

Appendices

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Appendix A

This appendix includes material from the investigation into framework reuse problems described in chapter 3 of this thesis.

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1 Experimental Materials

1.1. The Orrery practical exercises

52.428 Software Components, Architecture and Design

Aims:

The purpose of this set of exercises is to develop practical experience of learning and using a framework to create an application.

The application that will be created is a simple simulation of planetary motion. By the end of the exercises students should have created a system which allows planets to be added, positioned, removed and also allows gravity relationships to be modeled between planets (i.e. planet A orbits planet B).

This application is expected to be graphical in nature and will make use of the features provided by the Hot Draw application framework to achieve both it's graphical representation and capture user input.

Structure:

The coursework will be organized into six practical exercises. Each exercise will introduce a new aspect of the framework. This new aspect must first be understood before it can be instantiated into the application. The topics covered are outlined below.

1. Creating a Hot Draw application.
2. Constraining Figure behaviour.
3. Creating Tools and Handles.
4. Constraining Drawing Behaviour.
5. Animation.
6. Customised solution.

The coursework is a group activity, students are expected to form themselves into groups (of four) and work together to create a single system for submission.

One of the main goals of this task is to make students aware of the steep learning curve that is typical of most application frameworks. To this end students are

expected to encounter and are encouraged to discuss framework problems with other students and the class lectures via the class news group. classnews@cs.strath.ac.uk.

Assessment:

The work will be assessed via a group demonstration on the date of the deadline.

Each group will be asked to demonstrate their implementation of the six practical exercises. Marks will be awarded for each stage of the practical exercises that have been completed. Particular attention will be paid to the final exercise where students will be given the freedom to use the framework as they see fit.

The result of their creative efforts will be used to judge the students understanding of the Hot Draw framework. Students should also be prepared to answer questions about how Hot Draw has been used to implement the application's functionality.

In addition students should email their final implementations to classaddress@cs.strath.ac.uk. Submissions must be sent before 5.00pm on the date of the deadline.

Hints and Tips:

Learning and using an unfamiliar framework can be much more difficult than it would seem. The following suggests a few pointers to help you if you get stuck.

1. Look at documentation
2. Study examples
3. Make use of news group for problems and related discussion.
4. Think about reuse in the code you create, make it general.
5. Use design pattern knowledge where appropriate.

Practical 1: Creating a Hot Draw application

Aims:

The aim of this exercise is to illustrate the domain that the Hot Draw framework can be applied to and provide a first experience of framework programming by creating a simple application.

The application domain of the framework is best illustrated by careful examination of the example programs included with the framework.

The programs can be found in the *JHotDraw5.1\CH\ifa\draw\samples* directory with the corresponding source code in the *JHotDraw5.1\sources\CH\ifa\draw\samples* directory. There are four examples in all, with each one dealing in a different set of framework functionality. It is recommended that students spend some time running the examples and experimenting with the range of functionality on offer. This will present a comprehensive (although not complete) picture of what the framework can perform. The knowledge gained from doing this will become more relevant in subsequent practicals where many of the ideas presented here will be of use.

The first step towards creating our planet simulation will be to create a simple application that creates a default Hot Draw framework and adds an ellipse to the top right hand corner of its display (see **figure 1**).

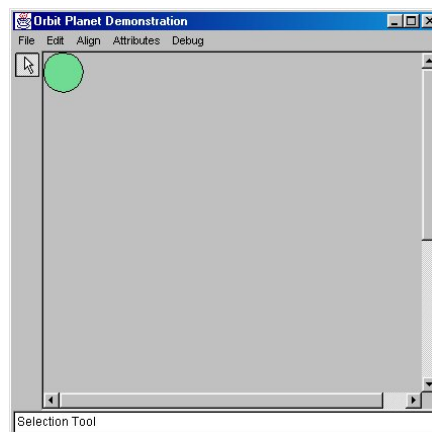


Figure 1: Default Hot Draw Application

Remember:

One of the main goals of this task is to make students aware of the steep learning curve that is typical of most application frameworks. To this end students are expected to encounter and are encouraged to discuss framework problems with other students and the class lectures via the class news group. classnews@cs.strath.ac.uk.

Sample Solution

```

/*
 * MainClass.java
 *
 * Created on 28 August 2000, 13:48
 */
package Prac1;

import CH.ifa.draw.application.*;
import java.awt.*;

/**
 * MainClass creates and runs the Hotdraw application
 * @author doug
 * @version 1.0
 */
public class MainClass extends Object {
    /** Creates new MainClass */
    public MainClass() {

    }

    /**
     * @param args the command line arguments
     */
    public static void main(String[] args) {
        //practical 1 code starts
        MyDrawApp window = new MyDrawApp("Orbit Planet Demonstration");
        window.open();
        //practical 1 code ends
    }
}
/*
 * MyDrawApp.java
 * Created on 28 August 2000, 14:05
 */
package Prac1;
import CH.ifa.draw.application.*;
import CH.ifa.draw.framework.*;
import CH.ifa.draw.standard.*;
import CH.ifa.draw.util.*;
import CH.ifa.draw.figures.*;
import java.awt.*;
import java.awt.event.*;

/**
 * My DrawApp represents the HotDraw application
 * @author doug
 */
public class MyDrawApp extends DrawApplication {
    /** Creates new MyDrawApp */
    public MyDrawApp() {
        super();
    }
    public MyDrawApp(String title) {
        super(title);
    }
    /** initialise the new drawing*/
    protected Drawing createDrawing() { //practical 1 code starts
        Point pOrigin = new Point(0, 0);
        Point pCorner = new Point(pOrigin.x + 40, pOrigin.y + 40);
        EllipseFigure ellipse = new EllipseFigure(pOrigin, pCorner);
        Drawing sDrawing = new StandardDrawing();
        sDrawing.add(ellipse);
        return sDrawing; //practical 1 code ends
    }
}

```

Practical 2: Constraining figure behaviour

Aims:

In the previous exercise it should have been noticed that the selection tool allowed an ellipse to be both repositioned and resized in the application. In terms of the simulation's requirements the resize behaviour is now considered inappropriate and the framework must be modified in order to prevent this behaviour from occurring (i.e. the ellipse can not be resized only positioned).

Additionally because the figure can no longer be resized the selection behaviour, which currently shows the resize handles, is no longer relevant and instead it is desired that a border be drawn around any shapes that are currently selected.

Remember:

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Sample Solution:

```

/*
 * MyDrawApp.java
 *
 * Created on 28 August 2000, 14:05
 */

package Prac2;

import CH.ifa.draw.application.*;
import CH.ifa.draw.framework.*;
import CH.ifa.draw.standard.*;
import CH.ifa.draw.util.*;
import CH.ifa.draw.figures.*;
import java.awt.*;
import java.awt.event.*;

/**
 * My DrawApp represents the HotDraw application
 *
 * @author doug
 * @version
 */
public class MyDrawApp extends DrawApplication {

    /** Creates new MyDrawApp */
    public MyDrawApp() {
        super();
    }

    public MyDrawApp(String title) {
        super(title);
    }

    /** initialise the new drawing*/
    protected Drawing createDrawing() {
        //practical 1 code starts
        Point pOrigin = new Point(0, 0);
        Point pCorner = new Point(pOrigin.x + 40, pOrigin.y + 40);
        //practical 2 code starts
        MyEllipseFigure ellipse = new MyEllipseFigure(pOrigin, pCorner);
        //practical 2 code starts
        Drawing sDrawing = new StandardDrawing();
        sDrawing.add(ellipse);
        return sDrawing;
        //practical 1 code ends
    }

    /** creates the systems drawingView*/
    //practical 2 code starts
    protected StandardDrawingView createDrawingView(){
        Dimension d = getDrawingViewSize();
        return new MyDrawingView(this, d.width, d.height);
    }
    //practical 2 code ends
}

/*
 * MyDrawingView.java
 *
 * Created on 30 August 2000, 14:30
 */

package Prac2;

import CH.ifa.draw.framework.*;
import CH.ifa.draw.standard.*;

```

```

import CH.ifa.draw.figures.*;
import java.awt.*;

/**
 * My Drawing View adds new selection behaviour to drawing View
 *
 * @author doug
 * @version
 */
public class MyDrawingView extends StandardDrawingView {

    /** Creates new MyDrawingView */
    public MyDrawingView(DrawingEditor editor, int width, int height) {
        super(editor, width, height);
    }

    /** drawAll draws all figures in drawing to view and additionally draws
     * all selected shapes with a border */
    //practical 2 code starts
    public void drawAll(Graphics g) {
        super.drawAll(g);
        FigureEnumeration k = selectionElements();
        while (k.hasMoreElements()) {
            Figure figure = k.nextFigure();
            DecoratorFigure decoratedFigure = new BorderDecorator(figure);
            decoratedFigure.draw(g);
        }
    }
    //practical 2 code ends
}

/*
 * MyEllipseFigure.java
 * Created on 30 August 2000, 14:48
 */
package Prac2;

import CH.ifa.draw.framework.*;
import CH.ifa.draw.standard.*;
import CH.ifa.draw.figures.*;
import java.awt.*;
import java.util.*;

```

```

/**
 * MyEllipseFigure creates an ellipse with a fixed size and no edit behaviour
 * @author doug
 */
public class MyEllipseFigure extends EllipseFigure {
    //practical 2 code starts
    public static final int DEFAULT_WIDTH = 40;
    public static final int DEFAULT_HEIGHT = 40;
    //practical 2 code ends

    /** Creates new MyEllipseFigure */
    public MyEllipseFigure() {
        super(new Point(0, 0), new Point(DEFAULT_WIDTH, DEFAULT_HEIGHT));
    }

    /** Creates new MyEllipseFigure */
    public MyEllipseFigure(Point origin, Point corner) {
        super(origin, corner);
    }

    /** basicDisplayBox ensures that size cannot be changed*/
    public void basicDisplayBox(Point origin, Point corner){ //practical 2 starts
        //need temp for unususal case where origin = corner therefore can't mutate corner
        //as it also mutates origin ie(creates a display box equal to one point)
        Point temp = new Point(origin.x + DEFAULT_WIDTH, origin.y + DEFAULT_HEIGHT);
        super.basicDisplayBox(origin, temp); //practical 2 code ends
    }

    /** handles returns an empty vector to prevent editing of Figure*/
    public Vector handles(){ //practical 2 code starts
        return new Vector(); //practical 2 code ends
    }
}

```

Practical 3: Creating Tools and Handles

Aims:

In this exercise it is desired that a 'create planet' tool is inserted in the application to replace the programmatically generated ellipse with the ability to create ellipses (of a fixed size) anywhere inside the application at a click of the mouse.

Also because this application is to be a planet simulation we require a more specific behaviour for the ellipses (which represent our planets). In particular we require that figures in this system have some concept of mass and the ability to get and set this quantity via an appropriate interface. It is expected that the mass of a figure is clearly visible in the application so some pertinent means of displaying this information is also required.

Finally the simulation requires that planets masses can be altered easily from within the application, so some means of direct manipulation of a figure's mass is required.

Remember:

One of the main goals of this task is to make students aware of the steep learning curve that is typical of most application frameworks. To this end students are expected to encounter and are encouraged to discuss framework problems with other students and the class lectures via the class news group. classnews@cs.strath.ac.uk.

Sample Solution:

```

/*
 * MassEllipseFigure.java
 *
 * Created on 07 September 2000, 08:16
 */

package Prac3;

import java.awt.*;
import java.util.*;
import CH.ifa.draw.figures.*;
import CH.ifa.draw.standard.*;

/**
 * MassEllispeFigure represents a fixed size ellipse with a mass and edit behaviour
 * to change that mass.
 * @author doug
 * @version
 */
public class MassEllipseFigure extends MyEllipseFigure implements MassFigure{
    //practical 3 code starts
    public static final int DEFAULT_MASS = 10;
    public static final double MINIMUM_MASS = 1;
    public static final double MAXIMUM_MASS = 100;
    private double mass;
    //practical 3 code ends

    /** Creates new MassEllipseFigure */
    public MassEllipseFigure() {
        super();
        mass = DEFAULT_MASS;
    }

    /** setMass sets the newMass provided it is in valid range*/
    //practical 3 code starts
    public void setMass(double newMass){
        if(newMass >= MINIMUM_MASS && newMass <= MAXIMUM_MASS){
            mass = newMass;
        }
    }
    //practical 3 code ends

    /** getMass returns the figures mass*/
    //practical 3 code starts
    public double getMass(){
        return mass;
    }
    //practical 3 code ends

    /** draw renders the Figure with mass displayed in its center*/
    //practical 3 code starts
    public void draw(Graphics g){
        super.draw(g);
        TextFigure textFig = new TextFigure();
        textFig.setText((new Double(mass)).toString());
        Rectangle rect = textFig.displayBox();
        textFig.displayBox(new Rectangle((center().x - rect.width/2),
                                         (center().y - rect.height/2),
                                         rect.width,
                                         rect.height));

        textFig.draw(g);
    }
    //practical 3 code ends

    /** handles returns vector of handles to provide edit behaviour to change
     the figures mass*/
    //practical 3 code starts
    public Vector handles(){
        Vector handles = new Vector();

```



```

        handles.addElement(new MyMassIncHandle(this, RelativeLocator.southEast()));
        handles.addElement(new MyMassDecHandle(this, RelativeLocator.southWest()));
        return handles;
    }
    //practical 3 code ends

    /** return the maximum allowable mass*/
    //practical 3 code starts
    public double getMaximumMass() {
        return MAXIMUM_MASS;
    }
    //practical 3 code ends

    /** return the minimum allowable mass*/
    //practical 3 code starts
    public double getMinimumMass() {
        return MINIMUM_MASS;
    }
    //practical 3 code ends
}

/*
 * MassFigure.java
 *
 * Created on 07 September 2000, 09:08
 */

package Prac3;

/**
 *
 * @author doug
 * @version
 */
public interface MassFigure {
    //practical 3 code starts

    /** setMass sets the newMass provided it is in valid range*/
    public void setMass(double newMass);

    /** getMass returns the figures mass*/
    public double getMass();

    /** return the maximum allowable mass*/
    public double getMaximumMass();

    /** return the minimum allowable mass*/
    public double getMinimumMass();

    //practical 3 code ends
}

/*
 * MyDrawApp.java
 *
 * Created on 28 August 2000, 14:05
 */

package Prac3;

import CH.ifa.draw.application.*;
import CH.ifa.draw.framework.*;
import CH.ifa.draw.standard.*;
import CH.ifa.draw.util.*;
import CH.ifa.draw.figures.*;
import java.awt.*;
import java.awt.event.*;

/**
 * My DrawApp represents the HotDraw application
 */

```

```

* @author  doug
* @version
*/
public class MyDrawApp extends DrawApplication {

    /** Creates new MyDrawApp */
    public MyDrawApp() {
        super();
    }

    public MyDrawApp(String title) {
        super(title);
    }

    /** initialise the new drawing*/
    protected Drawing createDrawing() {
        /**practical 1 code starts
        Point pOrigin = new Point(0, 0);
        Point pCorner = new Point(pOrigin.x + 40, pOrigin.y + 40);
        //practical 2 code starts
        MyEllipseFigure ellipse = new MyEllipseFigure(pOrigin, pCorner);
        //practical 2 code starts*/
        Drawing sDrawing = new StandardDrawing();
        //sDrawing.add(ellipse);
        return sDrawing;
        //practical 1 code ends
    }

    /** creates the systems drawingView*/
    //practical 2 code starts
    protected StandardDrawingView createDrawingView(){
        Dimension d = getDrawingViewSize();
        return new MyDrawingView(this, d.width, d.height);
    }
    //practical 2 code ends

    /** add tools to the palette*/
    //practical 3 code starts
    protected void createTools(Panel palette){
        super.createTools(palette); //adds selectionTool
        Tool tool = new CreationTool(view(), new MassEllipseFigure());
        palette.add(createToolButton(IMAGES+"ELLIPSE", "Create Planet Tool", tool));
    }
    //practical 3 code ends
}

/*
 * MyMassDecHandle.java
 *
 * Created on 11 September 2000, 10:19
 */

package Prac3;

import java.awt.*;
import CH.ifa.draw.framework.*;
import CH.ifa.draw.standard.*;

/**
 * MyMassDecHandle represents edit behaviour required to decrement a figures mass
 */
* @author  doug
* @version
*/
public class MyMassDecHandle extends LocatorHandle {

    //practical 3 code starts
    public static final int OFFSET = 1;
    //practical 3 code starts

    /** Creates new MyMassIncHandle */
    public MyMassDecHandle(Figure figure, Locator locate) {
        super(figure, locate);
    }

```

```

    }

    /** invokeStart alters figures mass if handle clicked on*/
    //practical 3 code starts
    public void invokeStart(int x, int y, DrawingView view){
        super.invokeStart(x, y, view);
        MassFigure massFig = (MassFigure)owner();
        massFig.setMass(massFig.getMass() - OFFSET);
    }
    //practical 3 code ends

    /** invokeStep alters figures mass if mouse dragged horizontally*/
    //practical 3 code starts
    public void invokeStep(int x, int y, int anchorX, int anchorY, DrawingView view){
        super.invokeStep(x, y, anchorX, anchorY, view);
        if(x != anchorX){
            int xOffset = Math.abs(x - anchorX);
            MassFigure massFig = (MassFigure)owner();
            massFig.setMass(massFig.getMass() - xOffset);
        }
    }
    //practical 3 code ends
}

/*
 * MyMassIncHandle.java
 *
 * Created on 11 September 2000, 10:19
 */

package Prac3;

import java.awt.*;
import CH.ifa.draw.framework.*;
import CH.ifa.draw.standard.*;

/**
 *
 * @author doug
 * @version
 */
public class MyMassIncHandle extends LocatorHandle {

    //practical 3 code starts
    public static final int OFFSET = 1;
    //practical 3 code starts

    /** Creates new MyMassIncHandle */
    public MyMassIncHandle(Figure figure, Locator locate) {
        super(figure, locate);
    }

    //practical 3 code starts
    public void invokeStart(int x, int y, DrawingView view){
        super.invokeStart(x, y, view);
        MassFigure massFig = (MassFigure)owner();
        massFig.setMass(massFig.getMass() + OFFSET);
    }
    //practical 3 code starts

    //practical 3 code starts
    public void invokeStep(int x, int y, int anchorX, int anchorY, DrawingView view){
        super.invokeStep(x, y, anchorX, anchorY, view);
        if(x != anchorX){
            int xOffset = Math.abs(x - anchorX);
            MassFigure massFig = (MassFigure)owner();
            massFig.setMass(massFig.getMass() + xOffset);
        }
    }
    //practical 3 code ends
}

```

Practical 4: Constraining drawing behaviour

Aims:

The aim of this exercise is to create the gravity behaviour in the application. The desired functionality is for the user to be able to construct graphical connections between the planets where each connection represents a gravitational field. The connections should be made via a tool and should clearly indicate what orbits what (i.e. so that it is clear to the user that planet A orbits planet B).

As a result of this new behaviour the current selected figure movement is inadequate. In the present system when a user selects a figure and drags it the figure moves independently of others in the drawing. It is now desired that figures that have other figures orbiting them move as a group (i.e. all orbiting figures are translated along with the orbited figure) while orbiting figures continue to move independently of others.

Remember:

One of the main goals of this task is to make students aware of the steep learning curve that is typical of most application frameworks. To this end students are expected to encounter and are encouraged to discuss framework problems with other students and the class lectures via the class news group. classnews@cs.strath.ac.uk.

Sample Solution:

```

/*
 * MyDrawApp.java
 *
 * Created on 28 August 2000, 14:05
 */

package Prac4;

import CH.ifa.draw.application.*;
import CH.ifa.draw.framework.*;
import CH.ifa.draw.standard.*;
import CH.ifa.draw.util.*;
import CH.ifa.draw.figures.*;
import java.awt.*;
import java.awt.event.*;

/**
 * My DrawApp represents the HotDraw application
 *
 * @author doug
 * @version
 */
public class MyDrawApp extends DrawApplication {

    /** Creates new MyDrawApp */
    public MyDrawApp() {
        super();
    }

    public MyDrawApp(String title) {
        super(title);
    }

    /** initialise the new drawing*/
    protected Drawing createDrawing() {
        /**practical 1 code starts
        Point pOrigin = new Point(0, 0);
        Point pCorner = new Point(pOrigin.x + 40, pOrigin.y + 40);
        //practical 2 code starts
        MyEllipseFigure ellipse = new MyEllipseFigure(pOrigin, pCorner);
        //practical 2 code starts*/
        Drawing sDrawing = new StandardDrawing();
        //sDrawing.add(ellipse);
        return sDrawing;
        //practical 1 code ends
    }

    /** creates the systems drawingView*/
    //practical 2 code starts
    protected StandardDrawingView createDrawingView(){
        Dimension d = getDrawingViewSize();
        return new MyDrawingView(this, d.width, d.height);
    }
    //practical 2 code ends

    /** adds tools to palette*/
    //practical 3 code starts
    protected void createTools(Palette palette){
        super.createTools(palette); //adds selectionTool
        Tool tool = new CreationTool(view(), new MassEllipseFigure());
        palette.add(createToolButton(IMAGES+"ELLIPSE", "Create Planet Tool", tool));
        //practical 4 code starts
        tool = new ConnectionTool(view(), new MyLineConnection());
        palette.add(createToolButton(IMAGES+"CONN", "Create Gravity Tool", tool));
        //practical 4 code ends
    }
    //practical 3 code ends
}

```

```

/*
 * MyLineConnection.java
 *
 * Created on 05 September 2000, 13:52
 */

package Prac4;

import CH.ifa.draw.figures.*;
import CH.ifa.draw.framework.*;
import java.awt.*;

/**
 * MyLineConnection represents the gravity relationship between two figures
 *
 * @author doug
 * @version
 */
public class MyLineConnection extends LineConnection {

    /** oldEnd remembers state of End figures previous position */
    private Point oldEnd;

    /** Creates new MyLineConnection */
    public MyLineConnection() {
        super();
        setStartDecoration(null);
        setEndDecoration(new ArrowTip());
        oldEnd = null;
    }

    /** figureChanged enforces the drag constraint where a orbiting Figure is free to
move
but an orbited figure must move its orbiters */
    //practical 4 code starts
    public void figureChanged(FigureChangeEvent e){
        if(oldEnd == null){ //ensures oldEnd is initialised
            oldEnd = endFigure().center();
            figureChanged(e);
        }

        super.figureChanged(e);
        Figure figure = e.getFigure();
        if(figure == endFigure()){
            int xOffset = endFigure().center().x - oldEnd.x;
            int yOffset = endFigure().center().y - oldEnd.y;
            startFigure().moveBy(xOffset,yOffset);
        }

        oldEnd = endFigure().center(); //update oldEnd position
    }
    //practical 4 code ends
}

```

Practical 5: Animation

Aims:

This practical aims to bring the simulator to life via animation. The desired functionality is that the tool palette will feature a button which toggles the animation on and off.

The animation is expected to describe a simple circular orbit of the planets which represents the static gravity constraints created in the previous exercise. Additional and more complicated behaviour could be attempted if time allows.

The animation must take each planets mass into account (so that heavier planets orbit faster than lighter ones).

Remember:

One of the main goals of this task is to make students aware of the steep learning curve that is typical of most application frameworks. To this end students are expected to encounter and are encouraged to discuss framework problems with other students and the class lectures via the class news group. classnews@cs.strath.ac.uk.

Sample Solution:

```

/*
 * MyDrawApp.java
 *
 * Created on 28 August 2000, 14:05
 */

package Prac5;

import CH.ifa.draw.samples.javadraw.Animator;
import CH.ifa.draw.application.*;
import CH.ifa.draw.framework.*;
import CH.ifa.draw.standard.*;
import CH.ifa.draw.util.*;
import CH.ifa.draw.figures.*;
import java.awt.*;
import java.awt.event.*;

/**
 * My DrawApp represents the HotDraw application
 *
 * @author doug
 * @version
 */
public class MyDrawApp extends DrawApplication {

    //practical 5 code starts
    private Animator fAnimator; //creates new thread for animation
    private Button fAnimationButton; //start/stopbutton for animation
    //practical 5 code ends

    /** Creates new MyDrawApp */
    public MyDrawApp() {
        super();
    }

    public MyDrawApp(String title) {
        super(title);
    }

    //practical 5 code starts
    public void destroy() {
        super.destroy();
        endAnimation();
    }
    //practical 5 code ends

    /** starts animation*/
    //practical 5 code starts
    public void startAnimation() {
        if (drawing() instanceof Animatable && fAnimator == null) {
            fAnimator = new Animator((Animatable)drawing(), view());
            fAnimator.start();
            fAnimationButton.setLabel("Stop");
        }
    }
    //practical 5 code ends

    /** stops animation*/
    //practical 5 code starts
    public void endAnimation() {
        if (fAnimator != null) {
            fAnimator.end();
            fAnimator = null;
            fAnimationButton.setLabel("Start");
        }
    }
    //practical 5 code ends

    /** toggles animation on or off*/

```



```

//practical 5 code starts
public void toggleAnimation() {
    if (fAnimator != null)
        endAnimation();
    else
        startAnimation();
}
//practical 5 code ends

/** initialise the new drawing*/
protected Drawing createDrawing() {
    /**practical 1 code starts
    Point pOrigin = new Point(0, 0);
    Point pCorner = new Point(pOrigin.x + 40, pOrigin.y + 40);
    //practical 2 code starts
    MyEllipseFigure ellipse = new MyEllipseFigure(pOrigin, pCorner);
    //practical 2 code starts
    Drawing sDrawing = new StandardDrawing();
    sDrawing.add(ellipse);
    return sDrawing;
    //practical 1 code ends*/
    //practical 5 code starts
    MyDrawing myDrawing = new MyDrawing();
    return myDrawing;
    //practical 5 code ends
}

/** creates the systems drawingView*/
//practical 2 code starts
protected StandardDrawingView createDrawingView(){
    Dimension d = getDrawingViewSize();
    return new MyDrawingView(this, d.width, d.height);
}
//practical 2 code ends

/** creates the systems toolPalette*/
//practical 5 code starts
protected Panel createToolPalette(){
    Panel panel = super.createToolPalette();
    fAnimationButton = new Button("Start");
    fAnimationButton.addActionListener(
        new ActionListener() {
            public void actionPerformed(ActionEvent event) {
                toggleAnimation();
            }
        }
    );
    panel.add(fAnimationButton);
    return panel;
}
//practical 5 code ends

/** add tools to the palette*/
//practical 3 code starts
protected void createTools(Panel palette){
    super.createTools(palette); //adds selectionTool
    Tool tool = new CreationTool(view(), new MassEllipseFigure());
    palette.add(createToolButton(IMAGES+"ELLIPSE", "Create Planet Tool", tool));
    //practical 4 code starts
    tool = new ConnectionTool(view(), new MyLineConnection());
    palette.add(createToolButton(IMAGES+"CONN", "Create Gravity Tool", tool));
    //practical 4 code ends
}
//practical 3 code ends
}

/*
 * MyDrawing.java
 *
 * Created on 06 September 2000, 09:23
 */

package Prac5;

```

```

import CH.ifa.draw.framework.*;
import CH.ifa.draw.standard.*;
import CH.ifa.draw.util.Animatable;
import java.util.*;

/**
 *
 * @author doug
 * @version
 */
public class MyDrawing extends StandardDrawing implements Animatable{

    //practical 5 starts
    public void animationStep() {
        Enumeration k = figures();
        while (k.hasMoreElements()){
            Figure fig = (Figure)k.nextElement();
            if(fig instanceof Animatable){
                Animatable anim = (Animatable)fig;
                anim.animationStep();
            }
        }
    }
    //practical 5 ends
}

/*
 * MyLineConnection.java
 *
 * Created on 05 September 2000, 13:52
 */

package Prac5;

import CH.ifa.draw.util.Animatable;
import CH.ifa.draw.figures.*;
import CH.ifa.draw.framework.*;
import java.awt.*;

/**
 * MyLineConnection represents the gravity relationship between two figures
 *
 * @author doug
 * @version
 */
public class MyLineConnection extends LineConnection implements Animatable {

    /** oldEnd remembers state of End figures previous position */
    private Point oldEnd;
    //practical 5 code starts
    private double alpha; //angle in degrees
    //practical 5 code ends

    /** Creates new MyLineConnection */
    public MyLineConnection() {
        super();
        setStartDecoration(null);
        setEndDecoration(new ArrowTip());
        oldEnd = null;
        alpha = 10;
    }

    /** figureChanged enforces the drag constraint where a orbiting Figure is free to
    move but an orbited figure must move its orbiters */
    //practical 4 code starts
    public void figureChanged(FigureChangeEvent e){
        if(oldEnd == null){ //ensures oldEnd is initialised
            oldEnd = endFigure().center();
            figureChanged(e);
        }
    }
}

```

```

        super.figureChanged(e);
        Figure figure = e.getFigure();
        if(figure == endFigure()){
            int xOffset = endFigure().center().x - oldEnd.x;
            int yOffset = endFigure().center().y - oldEnd.y;
            startFigure().moveBy(xOffset,yOffset);
        }

        oldEnd = endFigure().center(); //update oldEnd position
    }
    //practical 4 code ends

    //practical 5 code starts
    // guard concurrent access to display box
    public synchronized void basicMoveBy(int x, int y) {
        super.basicMoveBy(x, y);
    }
    //practical 5 code ends

    //practical 5 code starts
    public synchronized void basicDisplayBox(Point origin, Point corner) {
        super.basicDisplayBox(origin, corner);
    }
    //practical 5 code ends

    //practical 5 code starts
    public synchronized Rectangle displayBox() {
        return super.displayBox();
    }
    //practical 5 code ends

    /** rotates gravity constraints to move planets in animation*/
    //practical 5 code starts
    public void animationStep() {
        if(startFigure()!=null){ //can be null during lineconnection creation
            Point oStart = translate();
            Point newStart = rotate(oStart);
            int xOffset = (int)(newStart.getX() - oStart.getX());
            int yOffset = (int)(newStart.getY() - oStart.getY());

            startFigure().moveBy(xOffset, yOffset); //move orbiter
        }
    }
    //practical 5 code ends

    //calculates figures current position relative to origin for rotation
    //practical 5 code starts
    private Point translate(){
        Point origin = new Point();
        Point startPoint = startFigure().center();
        Point endPoint = endFigure().center();
        origin.setLocation( startPoint.getX() - endPoint.getX(),
                           startPoint.getY() - endPoint.getY());
        return origin;
    }
    //practical 5 code ends

    //calculates next point in the figures orbit
    //practical 5 code starts
    private Point rotate(Point position){
        double scaleFactor =
        (((MassFigure)startFigure()).getMass())/((MassFigure)startFigure()).getMaximumMass();
        double radAlpha = Math.toRadians(alpha*scaleFactor);
        double xValue = (position.getX() * Math.cos(radAlpha) - position.getY() *
Math.sin(radAlpha));
        double yValue = (position.getX() * Math.sin(radAlpha) + position.getY() *
Math.cos(radAlpha));
        Point point = new Point();
        point.setLocation(xValue, yValue);
        return point;
    } //practical 5 code ends
}

```

Practical 6: Customised solution

Aims:

The simulator is almost complete. It is felt that as you have now built up considerable domain knowledge about the potential applications of the Hot Draw framework. We want to take advantage of this knowledge by giving you the chance to customise the simulator in anyway you see fit.

The caveats that apply are as follows:

1. The alterations made must be of a reasonable size. (i.e. approximately same as practicals three, four or five)
2. The alteration must be worthwhile to the application. (in other words the change has got to make sense in the application domain).
3. The alteration must make considerable use of the framework.

Remember:

One of the main goals of this task is to make students aware of the steep learning curve that is typical of most application frameworks. To this end students are expected to encounter and are encouraged to discuss framework problems with other students and the class lectures via the class news group. classnews@cs.strath.ac.uk.

1.2. The project outlines

Project 1: Using the HotDraw Framework to Develop a Model Railway Simulation

(CES/CS 4th Year Honours) Dr Murray Wood, Computer Science

The aim of this project is to use the object-oriented framework called 'HotDraw' to create a model railway simulation (or similar e.g. racing car / Scaletrix, ...).

This project is suitable for a student interested in object-oriented design and large-scale Java programming. An interest in UML and Design Patterns would also be useful.

The HotDraw framework defines the overall software architecture – the classes and objects, their responsibilities, their collaborations and the threads of control – for a group of related graphical applications. The framework is then tailored to specific applications usually by composing and sub-classing framework classes. Basically the framework provides the building blocks, the task is to understand these and re-use them to construct the Railway application.

Previously HotDraw has been used to generate different drawing packages, pert chart editors, and network diagram editors. However it also supports some of the dynamic features necessary to build a model railway / racing car simulation.

The final report will document the resulting understanding of the framework architecture, as well as describing the design of your application. Evaluation will include consideration of the difficulties in understanding the HotDraw framework and how easy it is to generate a new application using the framework in contrast to starting from scratch.

The following paper gives an overview of HotDraw: R Johnson, Documenting Frameworks using Patterns, OOPSLA '92 Proceedings, SIGPLAN Notices, 27(10):63-76, Vancouver BC, October 1992.

See: <ftp://st.cs.uiuc.edu/pub/patterns/papers/documenting-frameworks.ps>

You can see HotDraw in action at: <http://www.rolemodelsoft.com/products/drawlets/demos.htm>

Frameworks and HotDraw in particular will be studied in the new 4th year Computer Science Class Software Architecture. The topic is also an area of active research in the Computer Science department. See: <http://www.cs.strath.ac.uk/~murray/EPsrcFrameworks.html>

Project 2: Using the HotDraw Framework to Develop Patterns Tutor ¹

(CS 4th Year Honours) Dr Murray Wood, Computer Science

The aim of this project is to use the object-oriented framework called 'HotDraw' to create an interactive tutorial on the Design Patterns Catalog.

This project is suitable for a student interested in Design Patterns, object-oriented design, large-scale Java programming and UML.

The HotDraw framework defines the overall software architecture – the classes and objects, their responsibilities, their collaborations and the threads of control – for a group of related graphical applications. The framework is then tailored to specific applications usually by composing and sub-classing framework classes. Basically the framework provides the building blocks, the task is to understand these and re-use them to construct the tutorial.

Previously HotDraw has been used to generate different drawing packages, pert chart editors, and network diagram editors. However it also supports many of the features necessary to create an interactive tutor. In particular it will be useful to include a facility to demonstrate the dynamic aspects of design patterns.

The final report will document the resulting understanding of the framework architecture, as well as describing the design of your application. Evaluation will include consideration of the difficulties in understanding the HotDraw framework and how easy it is to generate a new application using the framework in contrast to starting from scratch.

You can read about Design Patterns at: <http://www.enteract.com/~bradapp/docs/patterns-intro.html>

The following paper gives an overview of HotDraw: R Johnson, Documenting Frameworks using Patterns, OOPSLA '92 Proceedings, SIGPLAN Notices, 27(10):63-76, Vancouver BC, October 1992.

See: <ftp://st.cs.uiuc.edu/pub/patterns/papers/documenting-frameworks.ps>

You can see HotDraw in action at: <http://www.rolemodelsoft.com/products/drawlets/demos.htm>

¹ This project was modified to create a class diagramming tool with support for design patterns

Frameworks and HotDraw in particular will be studied in the new 4th year Computer Science Class Software Architecture. The topic is also an area of active research in the Computer Science department. See: <http://www.cs.strath.ac.uk/~murray/EPsrcFrameworks.html>

Project 3: Using the HotDraw Framework to Develop a Golf Course Design Tool

(CS 4th Year Honours) Dr Murray Wood, Computer Science

The aim of this project is to use the object-oriented framework called 'HotDraw' to create a tools that allows the design of golf courses.

This project is suitable for a student interested in object-oriented design and large-scale Java programming. An interest in UML and Design Patterns would also be useful.

The HotDraw framework defines the overall software architecture – the classes and objects, their responsibilities, their collaborations and the threads of control – for a group of related graphical applications. The framework is then tailored to specific applications usually by composing and sub-classing framework classes. Basically the framework provides the building blocks, the task is to understand these and re-use them to construct the tool.

Previously HotDraw has been used to generate different drawing packages, pert chart editors, and network diagram editors. It is anticipated that the tool would present a palette of golf hole features that would be combined to design individual holes.

The final report will document the resulting understanding of the framework architecture, as well as describing the design of your application. Evaluation will include consideration of the difficulties in understanding the HotDraw framework and how easy it is to generate a new application using the framework in contrast to starting from scratch.

The following paper gives an overview of HotDraw: R Johnson, Documenting Frameworks using Patterns, OOPSLA '92 Proceedings, SIGPLAN Notices, 27(10):63-76, Vancouver BC, October 1992.

See: <ftp://st.cs.uiuc.edu/pub/patterns/papers/documenting-frameworks.ps>

You can see HotDraw in action at: <http://www.rolemodelsoft.com/products/drawlets/demos.htm>

Frameworks and HotDraw in particular will be studied in the new 4th year Computer Science Class Software Architecture. The topic is also an area of active research in the Computer Science department. See: <http://www.cs.strath.ac.uk/~murray/EPsrcFrameworks.html>

1.3. Interview question guide

Interview Guide

*NB. After the first interview the questionnaire was modified slightly to include some additional questions. The additions are marked below with an asterisk *.*

Thank you for agreeing to this interview. Its purpose is to try and capture the experiences, thoughts and opinions that you have collected about framework use while working on your final year project.

I would ask you to answer the following questions as truthfully and thoroughly as possible. I assure you that this activity is unrelated to your final year project and your responses to this interview will not be used for/or against you in any way.

You should understand that the answers to these questions might form part of our future work however I assure you that in such a circumstance your identity will remain anonymous.

1. Please describe the application you are developing with the framework?
2. How does this application compare in size and complexity to other applications that you have previously worked on?
 - Have you any industrial experience of software development?
3. What kinds of applications do you believe this framework is suitable for?
 - How familiar are you with applications of this type?

*

4. Which classes do you consider to be the most important to your understanding of the framework?
 5. Describe the process by which you made your modifications to the framework. (High level / process)
 6. Is it important to keep your modifications consistent with the existing architecture?
 - How did you develop your understanding of the architecture?
 - Have you experienced any problems that could be attributed to you diverging from the architecture? (Example?)
 7. Have you experienced any problems or benefits from the 'inversion of control' phenomenon that exists in the framework?
 - Yes. Can you give any specific examples from your project?
 8. Were there any modifications that you could not achieve in the framework?
 - Yes. How did you resolve these?
 - Yes. Can you give any specific examples from your project?
 9. What aspects of learning to use the framework caused you the most difficulty?
 - Can you give a specific example from your project of this?
-
10. How did you locate/identify functionality in the framework?
 - Did you have problems locating functionality?
 - If appropriate could you give a specific example from your project?
 11. Have you sometimes identified several alternative ways to make a modification?
 - Yes. How did you decide between them?

- No. Did you look for more than one?
 - If appropriate could you give a specific example from your project?
12. Were you interested in understanding what the framework was doing as it was executed?
- How did you attempt to gain this understanding?

-
13. How do the inheritance hierarchies in the framework help or hinder your ability to:
- Locate where to make modifications to the framework.
 - Understand the functionality offered by the framework.
 - If appropriate could you give a specific example from your project?
14. In your opinion does the use of design patterns in the framework help you to understand:
- How to use a part of the framework.
 - What that part does in the framework. (sequence)
 - Why a part exists in the framework. (justification of)
15. How useful did you find the example applications in learning the framework /developing your project?
- When did you use them? (which ones)
 - What are the advantages/limitations of using examples in this manner
16. Were the architecture practicals and their solutions useful for your project?
- In what ways?
-

17. What kinds of documentation or tools did you find to be effective/ not effective when using the framework?
- *
18. What documentation or tools do you feel were useful in developing an understanding of the:
- Static structure of the framework?
 - Dynamic structure of the framework?
19. Are there areas you think the documentation failed to cover?
- What alternatives would you suggest to correct this shortcoming?
-

20. If you had to advise next years students on the best approach to learning the framework what would you tell them?
- *
21. If you were set the task of making a framework more accessible and easy to use how would you solve the problem?
22. Has there been anything that you have not been asked about that you feel is important and should be addressed?

That concludes the interview. Thank you, again, for your time.

1.4. Software Architecture Questionnaire

For those doing 52.440 Software Architecture - others please ignore (apologies)

We realise that we will not be flavour of the month with you just now but we would like to ask a real favour of you.

Last week a research paper was published in the main US Software Engineering journal (IEEE Trans. Software Engineering) by researchers investigating the challenges in understanding object-oriented frameworks. They based their work on a study of students using an object-oriented framework called ET++. We would like to take this opportunity to investigate, and perhaps respond to, some of their findings.

Also, as some of you may know, Doug's area of research is focused on the problems in using object oriented frameworks such as HotDraw.

The following is a very simple questionnaire. It should only take the order of 10 minutes to complete. We would be very grateful if you could use your experiences in the HotDraw practicals to complete this.

Please note: Responding to the following questionnaire is entirely at your own discretion its not part of the coursework and will not affect your course marks in any way.

If you have the time and the inclination please answer the questions below and return them to murray via email.

Thank you very much - we hope you have found the course a useful practical experience,
Marc, Murray and Doug.

Framework Experiences Questionnaire:

Q1) How difficult did you find understanding the following aspects of the HotDraw framework?

Please enter a number 1 to 5, where:

- 1 very easy
- 2 easy
- 3 moderate
- 4 hard
- 5 very hard

- 1.1 Understanding individual classes and their methods
- 1.2 Using abstract classes/interfaces
- 1.3 Mapping your solution to framework code
- 1.4 Understanding the structure of inheritance hierarchies and object compositions
- 1.5 Understanding design patterns
- 1.6 Understanding the dynamic structure of the framework
- 1.7 Choosing from alternative framework solution strategies
- 1.8 Understanding the HotDraw problem domain
- 1.9 Were there any other particularly challenging aspects of the framework practicals
(please specify)

Q2) How effective have you found the following in solving your problems during the practicals.

Please enter a number 1 to 5, where:

- 1 no use
- 2 barely useful
- 3 moderately useful

- 4 useful
- 5 very useful

2.1 Browsing JavaDoc files

2.2 Doug's Patterns Patterns for JHotDraw paper

2.3 Design pattern knowledge

2.4 Asking lecturer

2.5 Asking newsgroup

2.6 Asking other students

2.7 Studying existing examples

2.9 Previous practical solutions

2.10 Are there any other tools/techniques that you used and found particularly useful? (please specify)

2.11 Are there any other tools/techniques that you didn't actually use but that you THINK would be useful? (please specify)

Q3)

3.1 What were your main sources of problems during the early HotDraw practicals e.g. around Practical 4?

3.2 What were your main sources of problems during the later HotDraw practicals?

3.3. What were your key sources of help in the early HotDraw practicals?

3.4 What were your key sources of help in the later HotDraw practicals?

Q4) In the assessed practical please estimate how much time you spent in the following areas (answer in hours)

4.1 Stuck with no idea what to do

4.2 Stuck with no idea why something didn't work

4.3 Forming hypotheses of how a solution might work

4.4 Reading documentation

4.5 Reading the source code

4.6 Implementing changes

4.7 Testing

4.7 Other time consuming activities

(please specify)

If you have any further insights into the real challenges of using object-oriented frameworks please feel free to elaborate below:

*** Would you be prepared to spend 30 minutes (maximum) in a follow-up interview during January.

Yes/No

End of questionnaire:

Thank you very much for your co-operation

Marc, Murray and Doug

Merry Christmas - you have earned a break!

2 Data

2.1. The individual developer's logbook

The following notes record the thoughts and actions of the author as he attempted to create a Orrery application in JHotdraw.

NB – Initially the author intended to create a class diagram application (which was abandoned in favour of the Orrery application as the former was too complex for the time scale available). The first few pages of the log (up to the 28/8/00) describe thoughts on the original CAD project. This material has been included as it represents the developer's first exposure to the framework and captures the strategies used to gain that important initial familiarity.

19/7/00 Using 'Patterns for Oresklo'

Pattern 1 Structured drawing editors

① list atomic elements (each are implement figure)

class box.

method interconnect

inheritance interconnect

aggregation interconnect.

} should there be
one general
interconnect?

(+ To implement figure see pattern 2)

Text labels: class names

class attribs

class methods

interconnect name.

② list of tools.

Add class

Del class

Edit class

Add interconnect.

Del inter connect.

(+ To implement tool see pattern 6)

Pattern 2 Defining drawing elements3 options either subclass Figure, Abs. Figure or pre def ~~figure~~ figures

In this case go with pre defined as class box is essentially a fancy rectangle.

+ interconnects are types of line.

+ text is text.

(* may make sense to define add, hand interconnect of figure or complement it..) - does it?

(maybe for constraints)

Pattern 6 Tools

suggests use of palette to hold tools.

tools are not actions.

3 options subclass either Input Event handler, Canvas Tool or Construction tool

(advised to look at what's available in Canvas Tool first).

(no explanation
of three
given)how?
where do we
find it?

19/7/00.

* try to use HotDraw to create a tool for creating class interaction diag. (UML)

• need to define what constitutes C.A.D. ① its components

② their interconnections ③ constraints.

components represent classes hence require name, list of attrib, list of methods + associations

interconnections - use method invocation, inheritance, aggregation.

constraints - classes must have name, interconnections must join two ^{components} ~~classes~~ together.

- interconnections must have name
- classes cannot overlap
- method names must be fully qualified
- ① method invocation must join a method to a method.
- ② inheritance must join a class to a class
- ③ aggregation must join " " " "

could have two methods of construction.

① User controlled GUI editing - shows UI aspects of HD.

② Automated parsing of source file

- shows programmatic aspects of HD. (useful if time?)

③ need toolbar & options

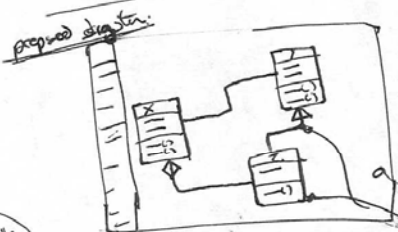
already have knowledge that HD has support for tool bars

- Add class.
- Del. class
- Edit.
- Add interconnect
- Del interconnect

(units of functionality captured from examples)

< mental schema > * need to think about program feature issues like formality + layout of CAD. should it provide automatic formality? < except trying to choose things during highlight HD.

< * DOES NOT MATTER ABOUT FUNCTIONALITY >



< In MVC does HD only comprise view? >

no? - it includes view + controller. it is an application.

< How do I turn HD into what I want? >

Draw Canvas containing figures editing via handles + tools (where constraints?)

No easy answer turn to draw. Patterns for Products

* every body has different

initial feeling was to design my own app (probably common sense)

20/7/00 - Hot Draw CAD Project.

* patterns don't explicitly describe role of Drawing Curves. (important because DC. is the container for the components.)

↳ Drawing object distinct from DC. - why is this not clear to start with.

* in order to understand how Drawing works I have to understand its api class 'sequence of Figures' - logically it seems clearer why a Drawing is a seq of figures instead of being a has a relationship.

* Seq of Figures manages collection of figures + Drawing extends to add size+style info

Drawing Curves extends Seq of Fig to add controller info (ie handles + selections).

→ what I want to do is get the framework running so that I can start customizing

* Patterns for building an unusually adaptable Java framework described something like this in it Fundamental Class Package - (has do I find Hot Draw FCP.)

↳ basic package in hierarchy?

* look at examples to see how they do it. - no complete examples found.

* decide to try add create my own main. - difficulties with packages (100% terms)

Success! - create JFrame + add SimpleDrawing Curves (from Basics package) with Drawing Curves component (from Advanced package)

2h later

* seems like it would be very difficult to use F/A in a considered like cycle approach

(ie how do you change when you are unsure as to what other classes do?)

* concerned about how to integrate my code with framework - should I create a class (CADEditor?) to encapsulate framework classes or just leave them in main?

* essentially important point is that Pattern S. got us here!

* cannot find Tool Palette - how it exists from example 'Simple Test Panel' - found it in rotametalsoft.awt - patterns make no mention of this object.

- basic tool palette created.

* following example I create panel with HD. properties I want then add them to Main Window. - (is this good MVC?) or okay?

21/7/00 - ~~finally~~ created initial shell of app following the example found yesterday (essentially adding HD stuff to a panel then adding it to frame) + other small touches.

24/7/00 Hot Draw CAD Project

* Noticed similarity between R. Johnson's 'Draw f/w org patterns' + Drawlets doc
need to investigate if others of this type exist (use of patterns is different to conventional applic.)

* has to create custom figure + has to create custom tools.

* doc suggests body + container hierarchy has do I find this? - Draw doc

L. suggests Shape tool.

- found rectangle tool in can. - rectangles?

* need figure defined first - so that can subclass tools. properly

ie class box - need name logical + physical

extend rectify.

ie class sy $(x, y, width, height)$
(component - lines, text boxes)

need draw with var.
class name, list of attribs, list of methods
(inter text separator).

width of box = widest text box + margins either side

height of box = sum of heights + top & bottom margins + margins for each separator + separator thickness.

position of first separator = $x = 0$
 $y = \text{top margin} + \text{name height} + \text{top separator margin}$

position of second separator = $x = 0$
 $y = (\text{pos of first}) + \text{bot. separator margin} + \text{sum of attrib heights} + \text{top separator margin}$

attribs = $x = \text{left margin}$
 $y = (\text{pos of first}) + \text{bot. separator}$

methods = $x = \text{left margin}$
 $y = (\text{pos of second}) + \text{bot. separator}$

const.
left margin
right margin
top margin
bottom margin
inter text space
(inter separator margin)

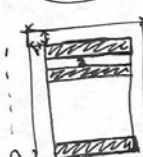
- line separator 1
- line separator 2
- list attributes
- list methods
- str. class name.

multi line text box

Cons. (list of steps).

create text box for each str.
width = widest str.

- get next item
 - create text box
 - position text box
 - add text box to collection.
- define point



attrib.
widest str.
left
right
up
down
its.
list of steps. text boxes.

25/7/00 Hot des CAD Project

* test box change position (set position) functionality is not obvious methods to translate(), set bounds(), set location() etc all seem possible very little diagnostic evidence avail to distinguish what the functionality actually is (poor Java doc comments).

set bounds certain link to move() in AbsFis. ^{now} need to understand location. what class does moveable location spans. - need to find correct class. (moveable location?)
- Draw point with test box. set location(). No turns out to be move()?

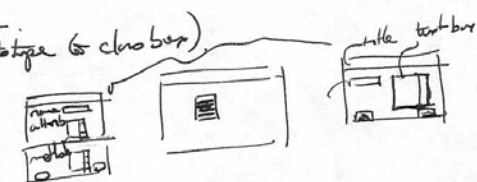
why isn't this info avail.

o need to know height of text label - bound straight away in class.
- why isn't text label a type of figure as opposed to AbsFig?

logically correct but not done in de

- need to look at possible for print interface.
- need to look at possible for multi line text box. (prototype for class box)

bird creation tool or multi line text box.
- basic figure()
- constructor?
- or shape tool.

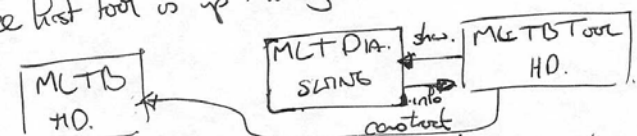


most of my current problems are graphical. why things

compare the single class involves with dot creating a straight line.

bird GUI for tool Java swing stuff.





















o Is it appropriate for a Tool obj to create COT obj? MVC
o Yes, once first tool is up + running - create CAD in RAT RDE to model s/s?



o null pointer exception - no idea where from - well probably from lack of curves obj in tool. solved - need to supply curves in interface

are am I doing any benefits here Hot des

2 prob. ① - buttons working on dialing (swing issue) {action listener interface} ② - null object not only {reg button with dialing}

26/7/00 ¹  ²  ³  ⁴  ⁵  ⁶  ⁷  ⁸  ⁹  ¹⁰  ¹¹  ¹²  ¹³  ¹⁴  ¹⁵  ¹⁶  ¹⁷  ¹⁸  ¹⁹  ²⁰  ²¹ ²² ²³ ²⁴ ²⁵ ²⁶ ²⁷ ²⁸ ²⁹ ³⁰ ³¹ ³² ³³ ³⁴ ³⁵ ³⁶ ³⁷ ³⁸ ³⁹ ⁴⁰ ⁴¹ ⁴² ⁴³ ⁴⁴ ⁴⁵ ⁴⁶ ⁴⁷ ⁴⁸ ⁴⁹ ⁵⁰ ⁵¹ ⁵² ⁵³ ⁵⁴ ⁵⁵ ⁵⁶ ⁵⁷ ⁵⁸ ⁵⁹ ⁶⁰ ⁶¹ ⁶² ⁶³ ⁶⁴ ⁶⁵ ⁶⁶ ⁶⁷ ⁶⁸ ⁶⁹ ⁷⁰ ⁷¹ ⁷² ⁷³ ⁷⁴ ⁷⁵ ⁷⁶ ⁷⁷ ⁷⁸ ⁷⁹ ⁸⁰ ⁸¹ ⁸² ⁸³ ⁸⁴ ⁸⁵ ⁸⁶ ⁸⁷ ⁸⁸ ⁸⁹ ⁹⁰ ⁹¹ ⁹² ⁹³ ⁹⁴ ⁹⁵ ⁹⁶ ⁹⁷ ⁹⁸ ⁹⁹ ¹⁰⁰ ¹⁰¹ ¹⁰² ¹⁰³ ¹⁰⁴ ¹⁰⁵ ¹⁰⁶ ¹⁰⁷ ¹⁰⁸ ¹⁰⁹ ¹¹⁰ ¹¹¹ ¹¹² ¹¹³ ¹¹⁴ ¹¹⁵ ¹¹⁶ ¹¹⁷ ¹¹⁸ ¹¹⁹ ¹²⁰ ¹²¹ ¹²² ¹²³ ¹²⁴ ¹²⁵ ¹²⁶ ¹²⁷ ¹²⁸ ¹²⁹ ¹³⁰ ¹³¹ ¹³² ¹³³ ¹³⁴ ¹³⁵ ¹³⁶ ¹³⁷ ¹³⁸ ¹³⁹ ¹⁴⁰ ¹⁴¹ ¹⁴² ¹⁴³ ¹⁴⁴ ¹⁴⁵ ¹⁴⁶ ¹⁴⁷ ¹⁴⁸ ¹⁴⁹ ¹⁵⁰ ¹⁵¹ ¹⁵² ¹⁵³ ¹⁵⁴ ¹⁵⁵ ¹⁵⁶ ¹⁵⁷ ¹⁵⁸ ¹⁵⁹ ¹⁶⁰ ¹⁶¹ ¹⁶² ¹⁶³ ¹⁶⁴ ¹⁶⁵ ¹⁶⁶ ¹⁶⁷ ¹⁶⁸ ¹⁶⁹ ¹⁷⁰ ¹⁷¹ ¹⁷² ¹⁷³ ¹⁷⁴ ¹⁷⁵ ¹⁷⁶ ¹⁷⁷ ¹⁷⁸ ¹⁷⁹ ¹⁸⁰ ¹⁸¹ ¹⁸² ¹⁸³ ¹⁸⁴ ¹⁸⁵ ¹⁸⁶ ¹⁸⁷ ¹⁸⁸ ¹⁸⁹ ¹⁹⁰ ¹⁹¹ ¹⁹² ¹⁹³ ¹⁹⁴ ¹⁹⁵ ¹⁹⁶ ¹⁹⁷ ¹⁹⁸ ¹⁹⁹ ²⁰⁰ ²⁰¹ ²⁰² ²⁰³ ²⁰⁴ ²⁰⁵ ²⁰⁶ ²⁰⁷ ²⁰⁸ ²⁰⁹ ²¹⁰ ²¹¹ ²¹² ²¹³ ²¹⁴ ²¹⁵ ²¹⁶ ²¹⁷ ²¹⁸ ²¹⁹ ²²⁰ ²²¹ ²²² ²²³ ²²⁴ ²²⁵ ²²⁶ ²²⁷ ²²⁸ ²²⁹ ²³⁰ ²³¹ ²³² ²³³ ²³⁴ ²³⁵ ²³⁶ ²³⁷ ²³⁸ ²³⁹ ²⁴⁰ ²⁴¹ ²⁴² ²⁴³ ²⁴⁴ ²⁴⁵ ²⁴⁶ ²⁴⁷ ²⁴⁸ ²⁴⁹ ²⁵⁰ ²⁵¹ ²⁵² ²⁵³ ²⁵⁴ ²⁵⁵ ²⁵⁶ ²⁵⁷

26/7/00 - Hot Java CAD Project

* want to set size of class boxes - need to understand figure hierarchy
 - could use cons. (ratio, width, height) / how do you use ~~size~~ bounding box.

• also has to make button not toggle.

* subclass rectangle tool - get this from body of the tool hierarchy via Pattern 6.

• want to understand how to click on existing elements (to add control labels to them)
 looking @ selection tool.

* edit behavior seems to be controlled by 'handles' (need to understand those now Jane doe).

handle size of box / want handle to be control / then listen for double click events (create text box).
 when mouse moves into it / release control when mouse moves out of it.

edit Tool?



Q. how does handle know what shapes it's interested in?
 (e has to use attach handles to figure)

* handles attach to curves

Simple drawing curves - a big class. * contains selections.

* contains high level to map figures & handles.

- looking at simple examples to try and get better understanding of relationship.

* Simple model panel - shows how to set up tool palette properly

it.

27/7/00

- cont. to read examples. (graph node applet is quite like what I want.)

Label holder?

Graph node - shows that figures implement three core handles. (edit Tool (x, y).)
 get handles ()
 rect shape / dist. rect shape / filled shape / dist. shape / dashed

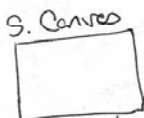
look for handles code - rectangle shape / dist. rect shape / filled shape / dist. shape / dashed

* heavy table marching all interactions & responsibilities.



• lines that I want
 • lines that other elements use

• where do I put
 what?



• mouse events

• current tool (state)

- mouseEntered() - component - what can I do comp?

- mouseExited()



• current state



• editing figure

fig. handle

① mouse moves into figure
 want figure to be selected

② mouse clicks inside figure
 want handle to create a new text box (positioned approp.).

③ text box automatically to go into
 edit mode + receive text events
 until [a] pressed or mouse
 clicked.

No understanding of
 why something has been done.

27/7/00

Not das CMS projectRolesPAINTABLE

- render itself

DRAWING

- sequence of figures
- serve itself.

FIGURES

- draw themselves in a style
- provide handles.
- use locators

DRAWING STYLE

- properties of representation.

DRAWING CANVAS

- pos event. {
- active tool
 - calls handles to draw themselves.

Tool

- create or manipulate figures.
- handle events

Handles

- draw themselves.
- use locators
- handle events.

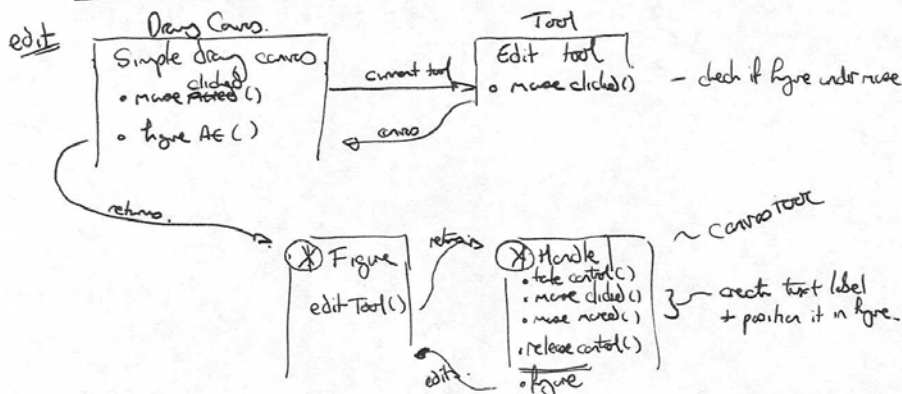
Locator

- specifies position.

POSSIBLE SEQ.

- ① create drawing
- ② select a tool
- ③ use tool on a canvas to create figure using drawing style. (at locator)
- ④ select figure to display handle (at locator)
- ⑤ select handle to edit figure

28/7/00 Hot days CAD project



* actual subclass of each class is important (ie handle doesn't feature mouse support until canvas handle etc.).

* coupling between classes can vary based on inheritance (ie Figure + handle share how to be close so that handle can edit specific things about figure) but Canvas + tool are only bound at a certain higher level of inheritance (ie both require mouse services + canvas needs access to figure.)

29/7/00

* trying to define behavior of overriding tool. 'TextRectangleTool'.

↳ actions required are difficult to specify but finally getting sense of predictability with this.

- requires knowledge of what super methods are currently doing - so that either you can prevent it, add to it or ensure it continues. (ie what is the behavior I want vs behavior getting).

resfigure

```

classDiagram
    class resfigure {
        resbasicfigure()
        set-properties()
    }
  
```

system not use resfigure as shown - not done.

change line. { have mouse into figure as trigger to take control + want to mouse click

↳ mouse out of figure as trigger to release control.

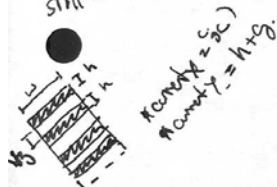
more interaction - not clear where line. lies need to experiment.

(figure.) where are handles likely in the system - not DC → tool → handle

seems (DC → handle / DC → tool)

(DC → tool → handle)

this might still be true but original idea was wrong (ie can get boxes to change color way (DC → tool → handle))



3/8/00

Hot Draw Gamma version

help @ Java Doc

①



②



③

Drawing change listener { listeners for drawing change

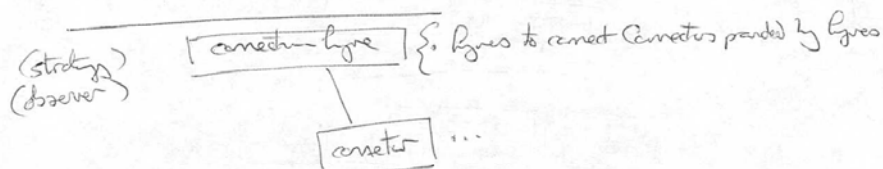
④

Figure change listener { listeners for fig changes

⑤

Figure Enumerator { traverses through figures. ?

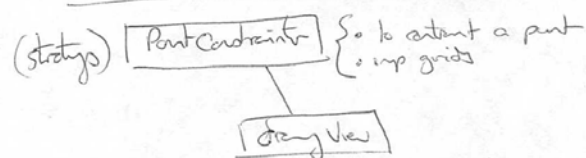
⑥



⑦

Locator (Strategy) { locates pos on figure

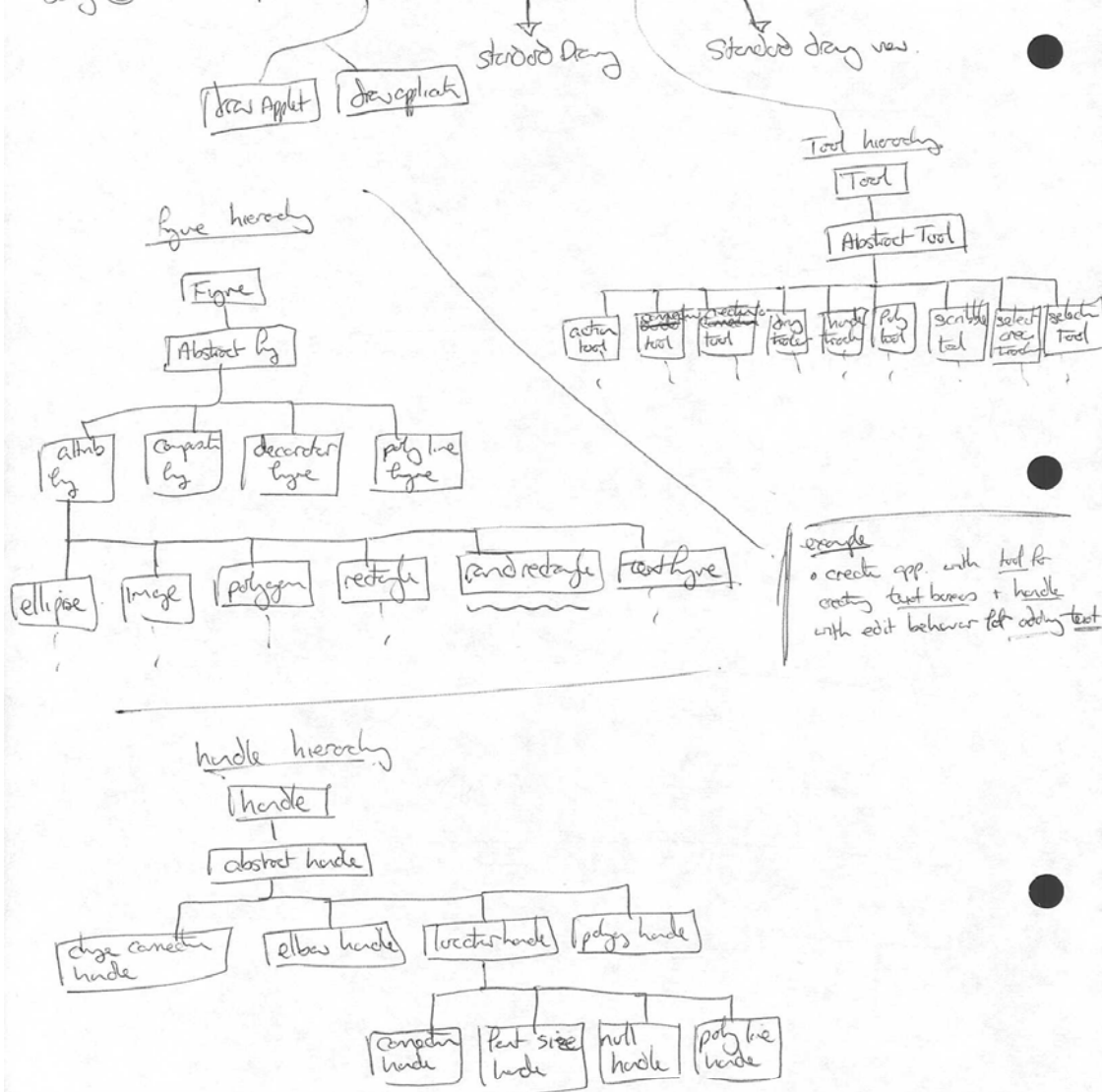
⑧



(Architecture Overview PP+97)

what is predefined? (40+) (package, cr. ifc., draw, standard)

using ② need imp for draw editor, draw, tool, draw view.



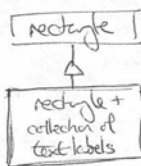
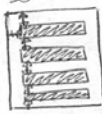
3/8/00

spec

create box contents (text + images layout of text + box so that filling is cheap)

maintained by

• if be general or provide



• layout (Plus layout)
• are box?

paint (draw box)

handles (+ read/write)
(constructors + list)

• (has do we attach text to figure?)

↳ text figure, connect (figure)

• tool / handle

• (has do I add new text strip to figure) (text connect text)

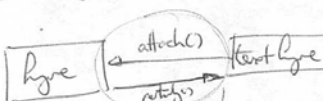
• (has do I create rectangle? (why is there no rect tool?)

↳ subclass. create tool. - (create Tool (OV, figure).)

• need to change behavior of rectangle to consider constant of contents

• need to change text behavior to prevent size change + allow edit change

POO



(figure) two speak issue

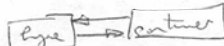
- ① - individual interaction (what about group of text)
- ② - has to contain figure having interaction

intro container box (some don't boundary)

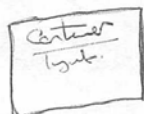
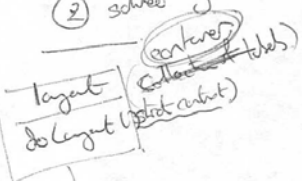


to hold text

re solves ① →



② solved by container check if fits inside rectangle + adjust if it doesn't



banding
• if not lines

(should container be a of text figure?)



7/8/00 Hot draw - Emma

text in box - key issue is should box have knowledge of contents + prevent size going too small or should edit code integrate to see if it can make box smaller.

But what about adding text to box (positioned aspect)



understand system.

add text to box.

connect text tool creates + units label to user specified value
calls text/hypr. connect (hypr) to attach it to hypr.
(we want to modify this to take into account an layout strategy)

extending
in spirit of
existing code
is here

hypr - don't want to specify rectangles might need to?

list of offset locators

connect ()
creates new locator
next position is
defined by strategy

drop box?



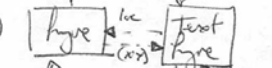
strategy

space text space (Pt, list of connectors)



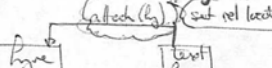
what is involved in attach?

my ideas observer



more(x,y) more(rel x,y)

what is involved in attach?



connectors?

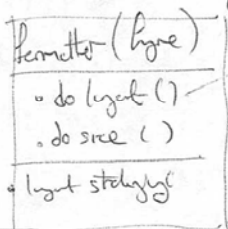
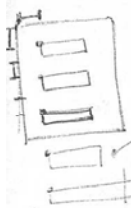
(to interconnect hyprs)

layout - overall problem is hypr composed with smaller hyprs + has to format them (ie space the connectors)

what interfaces
List of hyprs, bounding, strategy
(hypr) (shape) (?)

add new item
change size

attach layout tree
to connector



size

(space between layout)

strategy pattern

composition

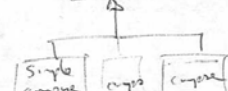
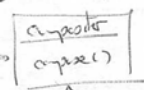
nodes

solids

rectangle

compos: compose()

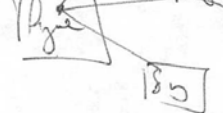
strategy pattern



compose (list of hyprs, bounding, flag size/layout)

Abstract hypr

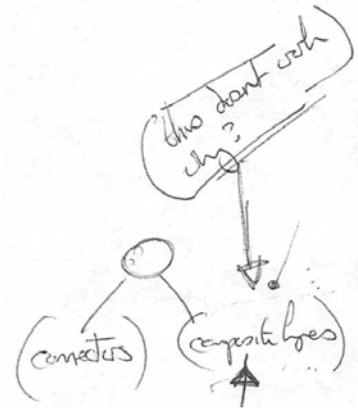
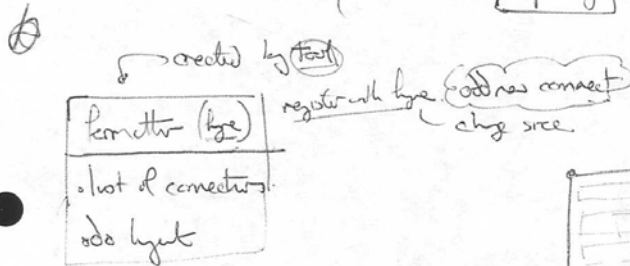
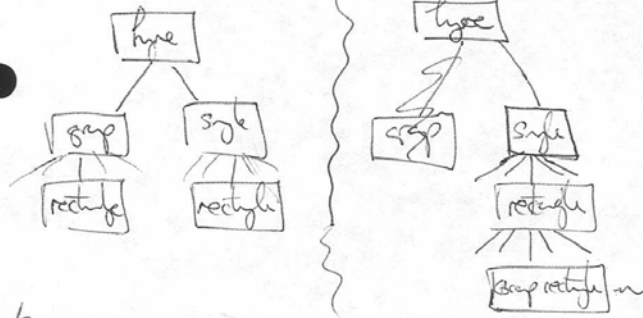
doesn't hold multiple hyprs
- interface implies that it does!



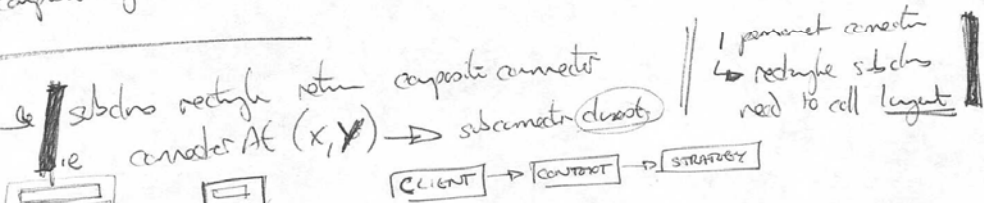
List of hyprs in listing hypr



7/8/08 need to subclass rectygl type - add multiple type still - is this best place to add?



subclass connector?
 composite type? ✓

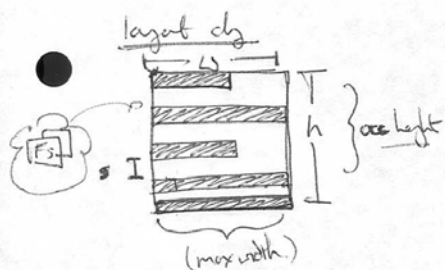


9/8/00 (subclass rectygl + add gap if type 2 it.)

(my want to refactor - ie has don't explicit rel. between gap & rect.)



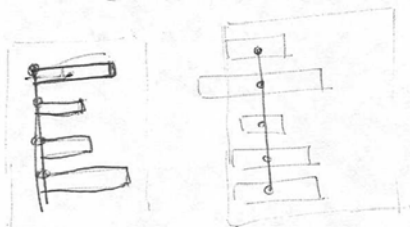
9/8/80. created gap width/height. (hybrid strategy pattern)



while (lines) do
 position of current X, Y.
 check width against maxwidth (if hyper update)
 add ~~line~~ height + inter space to acc height
 update current X, Y.

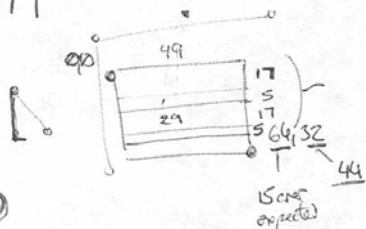
how do you set it two part?

(merely don't set loc it offsets from current loc) - ?

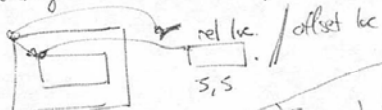


debugging
 is this dot normal debugging or ~~panic~~ behavior not clear?

10/16
 20,20 48
 17



seems like merely is doing change gap boxes with something that will move position relative.



Subdivide into horizontal re locators
 pages



X, Y



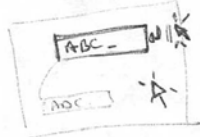
X1, Y1

11/4/ very combinatorial idea seen successful!

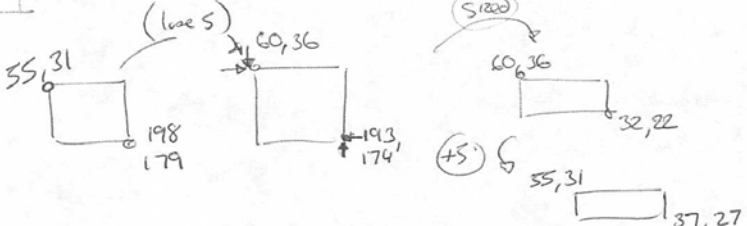
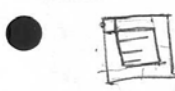
(merely was boundary problem)

other combinatorial clicked on

(local create things uses registers with it for completion
 Enter complete copies redist into figure (add) 3



3
 14
 24
 34



Printing sources/CH/ifa/draw/samples/pert/PertFigure.java at 10/08/00 14:18

```
/*
 * @(#)PertFigure.java 5.1
 */
```

```
package CH.ifa.draw.samples.pert;
```

```
import java.awt.*;
import java.util.*;
import java.io.*;
import CH.ifa.draw.framework.*;
import CH.ifa.draw.standard.*;
import CH.ifa.draw.figures.*;
import CH.ifa.draw.util.*;
```

```
public class PertFigure extends CompositeFigure {
```

```
    private static final int BORDER = 3;
    private Rectangle fDisplayBox;
    private Vector fPreTasks;
    private Vector fPostTasks;
```

```
    /*
     * Serialization support.
     */
```

```
    private static final long serialVersionUID = -7877776240236946511L;
    private int pertFigureSerializedDataVersion = 1;
```

```
    public PertFigure() {
        initialize();
    }
```

```
    public int start() {
        int start = 0;
        Enumeration i = fPreTasks.elements();
        while (i.hasMoreElements()) {
            PertFigure f = (PertFigure) i.nextElement();
            start = Math.max(start, f.end());
        }
        return start;
    }
```

```
    public int end() {
        return asInt(2);
    }
```

```
    public int duration() {
        return asInt(1);
    }
```

```
    public void setEnd(int value) {
        setInt(2, value);
    }
```

```
    public void addPreTask(PertFigure figure) {
        if (!fPreTasks.contains(figure)) {
            fPreTasks.addElement(figure);
        }
    }
```

```

        }
    }

    public void addPostTask(PertFigure figure) {
        if (!fPostTasks.contains(figure)) {
            fPostTasks.addElement(figure);
        }
    }

    public void removePreTask(PertFigure figure) {
        fPreTasks.removeElement(figure);
    }

    public void removePostTask(PertFigure figure) {
        fPostTasks.removeElement(figure);
    }

    private int asInt(int figureIndex) {
        NumberTextFigure t = (NumberTextFigure) figureAt(figureIndex);
        return t.getValue();
    }

    private String taskName() {
        TextFigure t = (TextFigure) figureAt(0);
        return t.getText();
    }

    private void setInt(int figureIndex, int value) {
        NumberTextFigure t = (NumberTextFigure) figureAt(figureIndex);
        t.setValue(value);
    }

    protected void basicMoveBy(int x, int y) {
        fDisplayBox.translate(x, y);
        super.basicMoveBy(x, y);
    }

    public Rectangle displayBox() {
        return new Rectangle(
            fDisplayBox.x,
            fDisplayBox.y,
            fDisplayBox.width,
            fDisplayBox.height);
    }

    public void basicDisplayBox(Point origin, Point corner) {
        fDisplayBox = new Rectangle(origin);
        fDisplayBox.add(corner);
        layout();
    }

    private void drawBorder(Graphics g) {
        super.draw(g);

        Rectangle r = displayBox();

        Figure f = figureAt(0);

```

```

Enumeration i = fPostTasks.elements();
while (i.hasMoreElements())
    ((PertFigure) i.nextElement()).updateDurations();
}

public void updateDurations() {
    int newEnd = start()+duration();
    if (newEnd != end()) {
        setEnd(newEnd);
        notifyPostTasks();
    }
}

public boolean hasCycle(Figure start) {
    if (start == this)
        return true;
    Enumeration i = fPreTasks.elements();
    while (i.hasMoreElements()) {
        if (((PertFigure) i.nextElement()).hasCycle(start))
            return true;
    }
    return false;
}

//-- store / load -----

public void write(StorableOutput dw) {
    super.write(dw);
    dw.writeInt(fDisplayBox.x);
    dw.writeInt(fDisplayBox.y);
    dw.writeInt(fDisplayBox.width);
    dw.writeInt(fDisplayBox.height);

    writeTasks(dw, fPreTasks);
    writeTasks(dw, fPostTasks);
}

public void writeTasks(StorableOutput dw, Vector v) {
    dw.writeInt(v.size());
    Enumeration i = v.elements();
    while (i.hasMoreElements())
        dw.writeStorable((Storable) i.nextElement());
}

public void read(StorableInput dr) throws IOException {
    super.read(dr);
    fDisplayBox = new Rectangle(
        dr.readInt(),
        dr.readInt(),
        dr.readInt(),
        dr.readInt());
    layout();
    fPreTasks = readTasks(dr);
    fPostTasks = readTasks(dr);
}

public Insets connectionInsets() {
    Rectangle r = fDisplayBox;
    int cx = r.width/2;
    int cy = r.height/2;
    return new Insets(cy, cx, cy, cx);
}

public Vector readTasks(StorableInput dr) throws IOException {
    int size = dr.readInt();
    Vector v = new Vector(size);
    for (int i=0; i<size; i++)
        v.addElement((Figure)dr.readStorable());
    return v;
}
}

```

```
Font f = new Font("Helvetica", Font.PLAIN, 12);
Font fb = new Font("Helvetica", Font.BOLD, 12);
```

```
TextFigure name = new TextFigure();
name.setFont(fb);
name.setText("Task");
//name.setAttribute("TextColor", Color.white);
add(name);
```

```
NumberTextFigure duration = new NumberTextFigure();
duration.setValue(0);
duration.setFont(fb);
add(duration);
```

```
NumberTextFigure end = new NumberTextFigure();
end.setValue(0);
end.setFont(f);
end.setReadOnly(true);
add(end);
```

```
private void layout() {
    Point partOrigin = new Point(fDisplayBox.x, fDisplayBox.y);
    partOrigin.translate(BORDER, BORDER);
    Dimension extent = new Dimension(0, 0);
```

```
FigureEnumeration k = figures();
while (k.hasMoreElements()) {
    Figure f = k.nextFigure();
```

```
        Dimension partExtent = f.size();
```

```
        Point corner = new Point(
            partOrigin.x+partExtent.width,
            partOrigin.y+partExtent.height);
```

```
        f.basicDisplayBox(partOrigin, corner);
```

```
        extent.width = Math.max(extent.width, partExtent.width);
        extent.height += partExtent.height;
        partOrigin.y += partExtent.height; + gap
```

```
    fDisplayBox.width = extent.width + 2*BORDER; kft right
    fDisplayBox.height = extent.height + 2*BORDER; to bottom
```

```
private boolean needsLayout() {
    Dimension extent = new Dimension(0, 0);
```

```
    FigureEnumeration k = figures();
    while (k.hasMoreElements()) {
        Figure f = k.nextFigure();
        extent.width = Math.max(extent.width, f.size().width);
    }
```

```
    int newExtent = extent.width + 2*BORDER;
    return newExtent != fDisplayBox.width;
```

```
public void update(FigureChangeEvent e) {
    if (e.getFigure() == figureAt(1)) // duration has changed
        updateDurations();
    if (needsLayout()) {
        layout();
        changed();
    }
}
```

```
public void figureChanged(FigureChangeEvent e) {
    update(e);
}
```

```
public void figureRemoved(FigureChangeEvent e) {
    update(e);
}
```

```
public void notifyPostTasks() {
```

10/8/00

Composite Figure

```

/*
 * @(#)PertFigure.java 5.1
 */

```

o Layout

o Border

o margin

```

package CH.ifa.draw.samples.pert;

```

```

import java.awt.*;
import java.util.*;
import java.io.*;
import CH.ifa.draw.framework.*;
import CH.ifa.draw.standard.*;
import CH.ifa.draw.figures.*;
import CH.ifa.draw.util.*;

```

```

public class PertFigure extends CompositeFigure {
    private static final int BORDER = 3;
    private Rectangle fDisplayBox;
    private Vector fPreTasks;
    private Vector fPostTasks;

    /**
     * Serialization support.
     */
    private static final long serialVersionUID = -7877776240236946511L;
    private int pertFigureSerializedDataVersion = 1;

    public PertFigure() {
        initialize();
    }

    public int start() {
        int start = 0;
        Enumeration i = fPreTasks.elements();
        while (i.hasMoreElements()) {
            PertFigure f = (PertFigure) i.nextElement();
            start = Math.max(start, f.end());
        }
        return start;
    }

    public int end() {
        return asInt(2);
    }

    public int duration() {
        return asInt(1);
    }

    public void setEnd(int value) {
        setInt(2, value);
    }

    public void addPreTask(PertFigure figure) {
        if (!fPreTasks.contains(figure)) {
            fPreTasks.addElement(figure);
        }
    }

    public void addPostTask(PertFigure figure) {
        if (!fPostTasks.contains(figure)) {
            fPostTasks.addElement(figure);
        }
    }

    public void removePreTask(PertFigure figure) {
        fPreTasks.removeElement(figure);
    }

    public void removePostTask(PertFigure figure) {
        fPostTasks.removeElement(figure);
    }

    private int asInt(int figureIndex) {

```

```

    NumberTextFigure t = (NumberTextFigure)figureAt(figureIndex);
    return t.getValue();
}

private String taskName() {
    TextFigure t = (TextFigure)figureAt(0);
    return t.getText();
}

private void setInt(int figureIndex, int value) {
    NumberTextFigure t = (NumberTextFigure)figureAt(figureIndex);
    t.setValue(value);
}

protected void basicMoveBy(int x, int y) {
    fDisplayBox.translate(x, y);
    super.basicMoveBy(x, y);
}

public Rectangle displayBox() {
    return new Rectangle(
        fDisplayBox.x,
        fDisplayBox.y,
        fDisplayBox.width,
        fDisplayBox.height);
}

public void basicDisplayBox(Point origin, Point corner) {
    fDisplayBox = new Rectangle(origin);
    fDisplayBox.add(corner);
    layout();
}

private void drawBorder(Graphics g) {
    super.draw(g);

    Rectangle r = displayBox();

    Figure f = figureAt(0);
    Rectangle rf = f.displayBox();
    g.setColor(Color.gray);
    g.drawLine(r.x, r.y+rf.height+2, r.x+r.width, r.y + rf.height+2);
    g.setColor(Color.white);
    g.drawLine(r.x, r.y+rf.height+3, r.x+r.width, r.y + rf.height+3);

    g.setColor(Color.white);
    g.drawLine(r.x, r.y, r.x, r.y + r.height);
    g.drawLine(r.x, r.y, r.x + r.width, r.y);
    g.setColor(Color.gray);
    g.drawLine(r.x + r.width, r.y, r.x + r.width, r.y + r.height);
    g.drawLine(r.x, r.y + r.height, r.x + r.width, r.y + r.height);
}

public void draw(Graphics g) {
    drawBorder(g);
    super.draw(g);
}

public Vector handles() {
    Vector handles = new Vector();
    handles.addElement(new NullHandle(this, RelativeLocator.northwest()));
    handles.addElement(new NullHandle(this, RelativeLocator.northEast()));
    handles.addElement(new NullHandle(this, RelativeLocator.southwest()));
    handles.addElement(new NullHandle(this, RelativeLocator.southEast()));
    handles.addElement(new ConnectionHandle(this, RelativeLocator.east(),
        new PertDependency()));
    return handles;
}

private void initialize() {
    fPostTasks = new Vector();
    fPreTasks = new Vector();
    fDisplayBox = new Rectangle(0, 0, 0, 0);
}

```


① 28

14.50

CLASSES USED

DRAW APPLICATION

Subclass DA. (My Draw App)

STANDARD DRAWING
ELLIPSE FIGUREOBSERVATIONS

spent 10 mins trying to get simple example
in JavaDoc to compile, thought problem was to do
with packages, turns out it was ^{that} example dependent
on your subclassing D.A.

overridden methods to turn off news last time setting
create new / create Tools to null behavior → spoiled h.o.
— seems like want to override create — methods look
at DA s/c for example.

— might not be possible seems as if can only add
creation not like any existing (not very flexible!) 15.23.

• create circle in middle of screen. (wonder create drag?)
then do you find centre of drag? (looky in drag JavaDoc)
Pt Abstract Figure. central() using!

• how do you add shape to position on drag? 3.44.
— no obvious add line. may need to set figure located.

< Location suggests that it works in conj with handles >
may not have to use built force method. (still want circle!)

Figure. Basic Dragging Box (Pt, Pt) B.57

turns out Abstr. Figure. central() returns (x, y) drag 4.11

+ dragging box does not. (0,0,100) — why + has can't find data

<→ display box is union of all figures >

Dragging View. get Size() — returns diameter of drag.
(no it returns 0.66) 4.21

DA. get dragging view size() not dimensions (600, 600)
still doesn't work: also need figure in centre of the line
(ie the window is reserved how do I do this?)

• Dragging view must have a size that DA uses to set default
window size with / check out create contents tomorrow 4.97

• changed mind that want 'circle in centre' of line (what happens with drag)
(what if set size to full screen?)
Where is this related? — DA or DV.

(N.B. some lines don't look for something and across something unexpected
(non-sensical) which makes you wonder what the this class is doing that
you don't know about (ie why should DV have a setEditor() method?)

then these knowledge up inheritance hierarchies + across components
did end up examples that explain the purpose (can then move line in app
if that's what require later).

② 29/9/00

13.10

② cont.

CLASSES USEDOBSERVATIONS

every line brought in for purpose - want one line
 if doc that tells how uses of methods + classes.
 (relate the problem with the solution so that intent
 of author can be understood)

* has do you know if line is not present.

set window size override defaultSize() in DA. 4:23
 (called by open() in DA)

default size() - sets window size 4:30
 get Drawing view size() - sets view size (needed for centre)

still not solⁿ

more through w/ doc?

③ 30/9/00

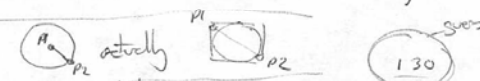
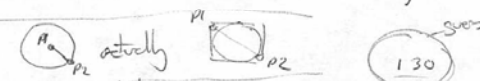
1.00

reconsidered req. line no longer require circle in middle
 (user should create + place where desired) - but still supposing
 has hard it was to try and achieve (was this actually the case?)

① price just get HD up + running? (took < 30 mins with lots of diff. techniques)

+ create ellipse on screen + check at examples

② alter select tool to prevent resize but keep movement

— and implies  actually 

does do I prevent resize ^{handles} → handles
 look in Ellipse class → no double handles. subclass ellipse?
 seems a bit extreme

what about using selection tool.

• selection tool create ^{Drag} Handle Tracker () methods what are those?
 • ^{Drag} Handle Tracker

Drag tracker seems to control movement behavior

(ie remove handle tracker + create tracker to dumb down selection tool.)

• look at code for selection tool - suggest create new subclass of handle
 tracker + override create - tracker added in selection tool

• look at code for H.tracker - suggest H.tracker is used when

handle already selected.

relevant

sel tool now down is pinned on to reselect re this is correct. better
 tools + handles in order to prevent resize after create handle tracker to
 return Abs tool.

• create My selection tool + need to insert in in place of sel tool

— MyDrawApp needs to override - create selection tool() ✓

apart from I ^{my approach}
 this back up my approach
 of changing the tool not the logic

2:27

SELECTION TOOL

ELLIPSE Fig

Dant.

CLASSES USED

addm? ODSOLUTIONS

② alter select tool to prevent resize but keep movement +
+ alter figures selection behavior to produce a border around figure + no handles

• need to alter figure return handles? - NO

• need to turn off part of selection tool which does them

• sometimes having a little knowledge of this is worse than having none!
(because many paths are available too easy)

• put bit does handles possibly - Absorbed. structure (?)

• only at s/c. ~~no~~ X

• NO structure based on functionality

handles are drawn in DV. draw handles (?) - draws correctly active

• do I want to subclass this - seems a bit too wide reaching

• with handle if we don't want figure to have handles we should

subclass it and remove them

• to set border around selected figure
look like DV. drawdl (or sub pt of) will have to be altered.
(if select in Elements → enumeration of selected.)

• subclass drawAll to do everything that it currently does
+ does all selected figures with border
(border decorator)

• need to create create Draw View (?) to supply new Draw V.

• redouble ellipse to move handles. - create handles?

Draw View
Border decorator.

perhaps
drawed by
+ has chat path

ELLIPSE FIGURE.

④ 31/8/00

1.00

③ add new planet creates a new instance of planet object currently
selected planet or new central planet if no planet selected.

or - could make all planet interact according to global gravity effect
which is better?

② First phase is undoubtedly to create a tool which creates planets
(need to tell students to remove prev. ellipse) + places them on screen
where ever we want. (change icon picture)

• need to create custom tool → based on existing tool? - no ellipse tool exists.
- create tool

• need to know where to custom 2 add new tool → DA. createTools()

need to look at DA code to figure out what to write. (only way to get

this knowledge is via example?)

• what would you have done with an example?

• create tool is allowing ellipses to be constructed - has dot limit
this?

creation tool

Tool Buffer

(needed
Java DrawApp
example)

120

126

9 cont.

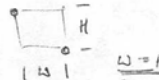
CLASSES USED

create test

OBSERVATIONS

- look at spec to discover problems
- add type to restrict it to circles ✓.

- looking @ ellipse type for clue on how to prevent ellipse behavior
- basic Dgty Bus (Pt, A)

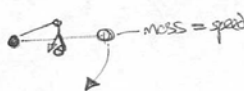


- this is primitive behavior so need to build links up hierarchy
- override basic dgt bus (1) so that is matters above relatively than also spec basic dgt bus to desc ellipse

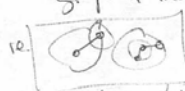
1.45

- second phase is to enhance add test to add planets to other planets orbits if a given planet is selected.
- (imply need to decide how orbits are to be implemented)

- might need to extend my ellipse → my planet. 1.53



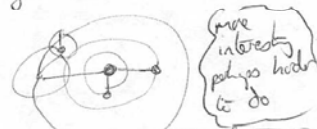
could do it so that the are groups of independent planets



or all together so that everything orbits largest is

not actually different from GUI point of view?

(no point in spec radius?)

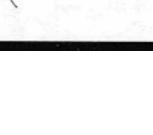
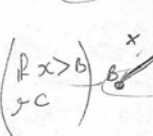
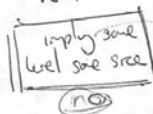


(forget to have size in part (c) so that planets are all uniform) 1.58
for the moment
adjusted basic Dgty Bus but req more click drag which is unideal. 2.02
want to click + add.

look at create test etc. not here only here to set ellipse new values to create. don't size initially

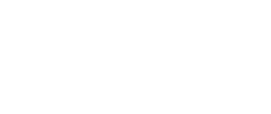
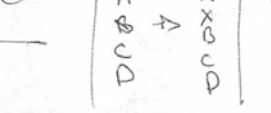
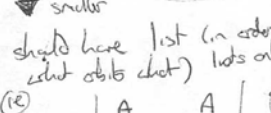
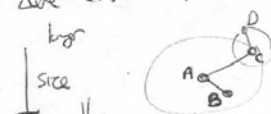
(don't seem to work) gotten around by basic dgt bus (Pt, A, Pt, A) 2.12

want to build up tree where looks orbit parents



what does shrink + h. look like?

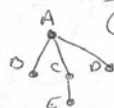
my ellipse



④ cont

CLASSES USED

||

OBSERVATIONS

(Int) orbits

A B C D

E

F

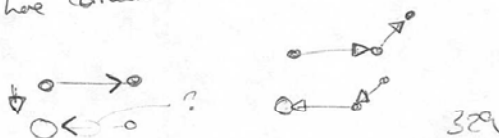
G

see back of
my sheet254
20

if planet bigger than next in line should orbit it
 else the new planet should orbit the next class it is smaller than.
 has do i create the behavior in files? - no idea
- want to use connectors

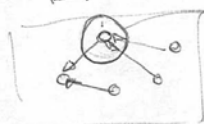
first want to get all figures.
 two lists are ordered size order of distance from pt
 don't need to rebuild everytime || do need to rebuild
 every time

create new connector from A to next + smallest
 need to have connector where connector is depend on
 size.



X

no matter size of X but still exists unless it is biggest
 planet in system



if this class become biggest
 notify system + recalc all
 connectors

(system
 list of planets + list of connectors)

B.43. end.

⑤ 4/9/00

CURSORS USED

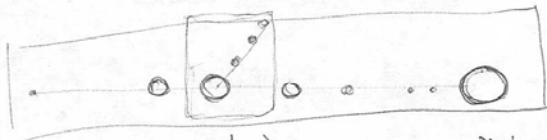
917.

OBSERVATIONS

- working on the orbiting hierarchy (has to add planets to it)
- when planet changes size it should be deleted & all connecting to it then added again at bigger size & what about descendants?



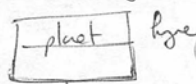
• behavior is too complex for patchwork



• build up some every add, del, or change
imply we want super structure not inside doses

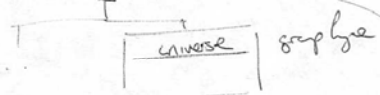
< to have planets orbiting sub planets try recursive approach >

part whole hierarchy - composite design pattern



lyre

external list of planets

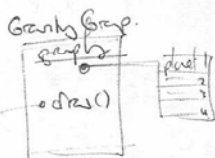


- when resize do we have to regenerate everything?
- possibly not - get away with at resize then think about it.

937

- think in lyres single ly / super lyre
- generate don't be specific to planet obj's. use lyre
- but - what special behavior do we need?

lyre / super lyre



if planet biggest then next in line should orbit it.
due to new planet should orbit the nearest class it is smaller than. (it's within the universe) (if head size then just growing)

946

- need to start with graph lyre / every add lyre generation has to make connections between planets - 'grow' the tree
- what about grants group using strategy for its generate obj's?

955

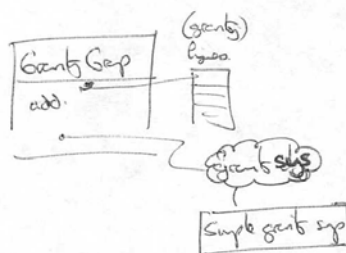
• graph boxes can't be connected - subclass?

⑤ cat

CLASSES USEDOBSERVATIONS

group by

now actually used this.



- looked at group by - is fine except for no connect behavior

- could use composition or abstract group which is best?

- add group by and sub class it. editing class. 10-10

implementing done

10-32

- small problems with dby

10-45

- cat attract plants outside group inside it plant size increases

- what happens when largest plant already has a sub group

can they be solved? does it matter?

- one possibility is to have freedom for students to develop their own dby more restrictive to better handle the mass of plant

- inside doGroup() need to know size of group that going to be size of (more general) but this implies that mass related to size - pot. membership problem

(shr? - get mass() - group by interface)

generic problem - has general should I make this? 11-03

one problem with interfaces is that you can't treat them as 'superclass' (ie group by has no methods no more)

- need to make connections between plants - has does this work 11-18

- 'connector by' is the line that joins connector byes together will be
- continuously adding connecting with current idea - has do
- delete does it? 11-47

(only add connector to res by)

- need to add group behavior to system 12-00
- (create simple group & set up)

connectors

connector by

⑤ cont

CLASSES USED

OBSERVATIONS

12.50

- add group to system implies naming the add ellipse tail ~~need~~
- need global universe obj. ~
- if have global root of hierarchy in drag subclass has will tail get a hold of it? can tail see drag nes() ~~drag()~~ ✓
- subclass correct tail?
 - don't know what to subclass here
 - overought rectify rect cell super
 - so it will add by the doing way
 - need to completely rename it but don't know what it already does (look @ s/c)
 - also what does rectify() do.

104

create tail

Beams

120

- simple + better way to do it - why not
- don't let our correct planets so they see hit
- - re change planet size wants to be co-effective }
- do it anyway - (but keep nes free)

(need to understand more about connections)
(particularly dynamic behavior)

way the connection to rect (in between layers)
(has do I get rect to connect this) - future action
need to customize the rect (set end style)

seems like previous has been made for this & deleted

(modifies
set end style of line NO

152

< leave connection ends to parent >

[I think I can change the line styles @ end of connections
but don't know how to do it.

203

* does need connection to maintain relative position when
moving rect of orbit.

210

Line Connection

X Line Description

6/5/9/00

CLASSICS CS40

line connector

OBSERVATIONS

150

3048

direct manipulation to create 'growing hills'

< want to show connectors in action >



(want this to be A orbits B) graphical depiction

also if B moves A moves with it
if A moves nothing happens to B

2009

• what do we have?

Hyes have connectors

connectors accept other connectors to make a connector

connections can be made inside by creating hyeconnectors

• connectors use 'observer' pattern to update themselves as hyes change

if we want to build constraints for those connections will need
access to start/end hyes.also need to know at some point what hyes have obiding hyes
(can this be done via listeners?)line connector has ref. to connectors
- start hye(1) end hye(1)

230

no domains needed to build if hye is connected + 2 def.

255

• trying to change hye changed method - used ~~connectors~~

need to use hye changed event params

works fine

• need to change graphics



400 -1

down line

• tried to instantiate poly line hye - could not
loaded & s/c found set attribute tells what
draws are end values (value is the rule)
(try this) set attribute ("Arrow.mech", value)

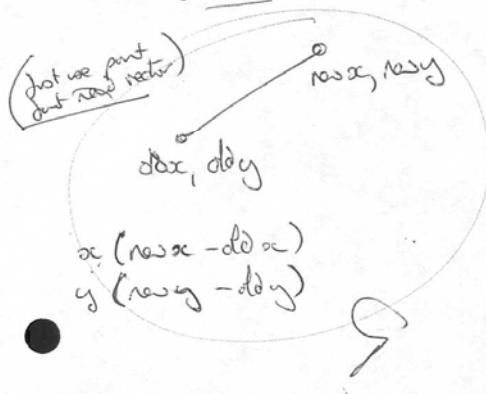
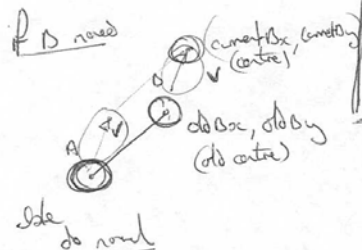
L10

ArrowTip?

• has at supply one of really set X direction (nd!)

• make cross layer

• no draw instructions as to what
connector parameters mean have to use
trial + errors



⑥

6/9/00

CLASSES OSCOOBSERVATIONS

913

⑤ crumcher of planets in orbit.

- completely new over - no idea where to start or even if hot does supports crumcher that I want.
- look for doc ^{presumably} _{byes} | ^{define order to} _{search}

looking for word crumcher somewhere - only guess- draw. which has Animatable interface 919crumcherStep()

no examples to illustrate this!

- presume add this to byes - does this show all it contains
- if true then could add it to the crumcher byes (so they know each and planet)

- found Java Draw App - supports crumcher
- seems exactly what I want.

(- knows that crumcher is applied to draw)

array by that is added

removed

replaced is wrapped in crumcher decorator

• no mention of Animatable decorator in draw.

- synchronized byes used in Animatable
- couldn't have thought of that on my own (probably really tricky issue).

940

- probably could use Animatable (if I need to) need to find example of use in program

• good when you had something existing something you had.

• going to cut + paste crumcher code from Java Draw App into MyDrawApp + use Animatable class (need to change draw)

- need subclass draw + add crumcherStep()
- need subclass MyAnimatable + add crumcherStep()

or could use crumcher decorator?

949

- DrawApp doesn't even bother to kill any any threads (you couldn't have thought of this)

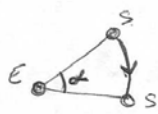
Animatable decorator
Animatable

⑥ out

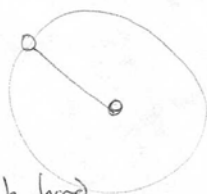
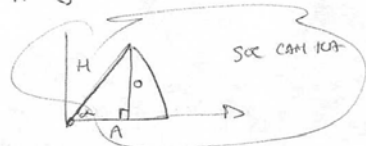
CLASSES USEDOBSERVATIONS

- add another degree line angle to py
- pretty straight lines actually. 1030
- need to insert res doing into application.
- create Prng C1

- ~~overweight~~ Myfire connects to add even behavior as returned per it has linkage to new eyes but
- need to figure out crime behavior. 1040


 $x'y'$ - apply circle (x,y,d)
 $\sin \theta \quad \cos \theta$

$$\begin{aligned} x' &= x \cdot \cos \theta - y \cdot \sin \theta \\ y' &= x \cdot \sin \theta + y \cdot \cos \theta \end{aligned}$$

by hand

$$\begin{aligned} x' &= x \cdot \cos \theta - y \cdot \sin \theta \\ y' &= x \cdot \sin \theta + y \cdot \cos \theta \end{aligned}$$

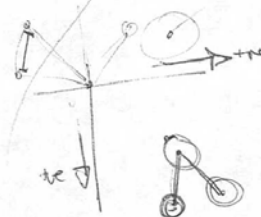
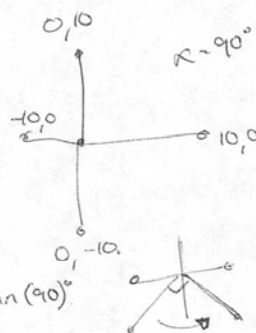
$$\begin{aligned} 0, 10 &\rightarrow 10, 0 \\ \rightarrow x' &= 0 \cdot \cos(90^\circ) - 10 \cdot \sin(90^\circ) \\ &= 0 - 10 \\ &= \underline{\underline{-10}} \end{aligned}$$

$$\begin{aligned} y' &= 0 \cdot \sin 90 + 10 \cdot \cos(90) \\ &= \underline{\underline{0}} \end{aligned}$$

 $\rightarrow (-10, 0)$

enclature
eqn with

$$\begin{aligned} x^2 + y^2 &= r^2 \\ x^2 + y^2 - r^2 &= 0 \end{aligned}$$



sketch all in not early - need to sky

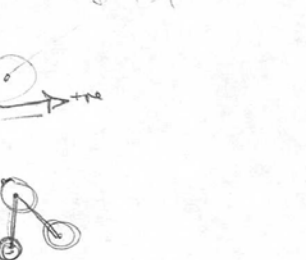
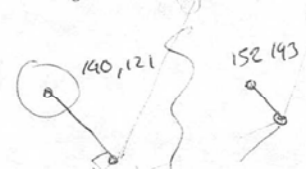
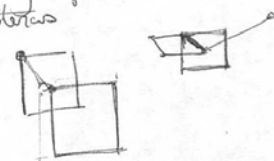
sketch for maths eqn

1119

1200

100

- problem appears to be mostly
- setting shape location is still a bit mysterious



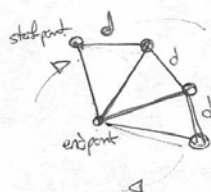
6 out

CLASSICS DUP

OBSERVATIONS

229

still not get rotation working!

if we can get this then
moreby (d) should work.

$$\text{start} - \text{end} = \text{Ostart}$$

for $(i=0, i < 360; ++)$ E

$$\text{new start} = \text{Ostart} \times \cos(\text{red } i) - \text{Ostart} \times \sin(\text{red } i)$$

$$\text{new start} = \text{Ostart} \times \sin(\text{red } i) + \text{Ostart} \times \cos(\text{red } i)$$

300
352

change of subject - move to practical 6

adding a size change handle

(not suitable - we move this in
a previous practical)

what if we add concept of mass + create animation
like planets orbit faster if heavier

∴ handle can adjust relative mass of obj (min - max)



could make mass an
interface
choose to subclass
handle

Mass ellipsoids
should I edit My ellipse type or subclass?
- subclass because it is singly more powerful?

+ mass var.
get/set mass
(+ add custom draw behavior
text label w/ mass.)

handle

(is there any
directly related)

First Size

check out design
patterns
encountered

handle

Adapter pattern

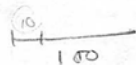
create view
percentage
locate mass on page

invoke step - detect movement w/ dec mass
when start/stop - draw/erase handle

⑦ 7/4/80 CLASSGS USND

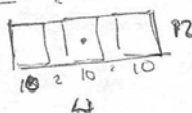
|| ASSUMPTIONS

- doing a handle
- has to be the most back into movement eqn (done need to)
- has to be correct at least for a line (again)
- could use connector (but can pull apart)
- let set display bar explicitly



$$\frac{10}{100} = \frac{1}{10} = 0.1\%$$

$$\frac{\text{SIZE}}{\text{MAX SIZE}} = (\text{percentage of size}) \times \text{need calc size (same 100. max)}$$



bar display has size
need to get width/height
and calc where x, y is

$$\frac{x}{\text{figure width}} = \text{percentage of size}$$

$$x = \text{width} \times (\text{percentage of size} \times \text{figure width})$$

$$\begin{aligned} \text{centre } x &= \frac{1}{2} \text{ width} \\ \text{centre } y &= \frac{1}{2} \text{ height} \end{aligned}$$

946

- need to add new line into application:

- not certain about ability to make line in heads
- interface specific & if type more ellipse line as this looks something but we need to treat it like this.
- should not move new code into new line interface
- don't want width of bar based on line (not good enough)

a percent

1028

2. doing the handle is hiding

• need to be able to handle the handle

1049

• handle is no big deal but have no edit
behaviour - trying to be

10.03

too similar
to example?

(decided to 'change' handle to be more like font test size example)

< can't get more step to be called >

< selection tool removed create handle toolbar >

(less)

1220

< need to change selection to the notice of new >

1138

fin.

body up with + suffix glasses / palette / title bar ✓
+ doing — loop or bad.
+ connect —

—

Line connector

handle connect (h_1, h_2)

if same = no! \rightarrow has not created

! (superduper pay by difference after get any bunch) !
error coming from (dup ellipse connector) ?

! solved geometry puffy problem

dup ellipse connector generates start / end point (!) in line connector

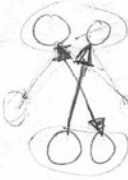
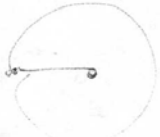
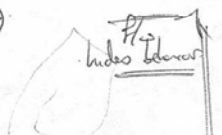
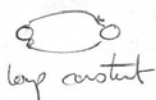
there are not perfect circles (round errors)
hence values translated are not right + rotation is corrupted.

Circle student large notes of large

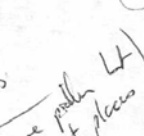
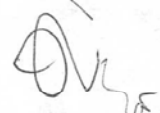
(Slo down big)
selection behavior

• simplest solution is to prevent loop
• does A have B as child?
(not answer that loop does have
but connects)
• could do it in Drang
but seems like my thing to do

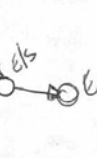
• find error in my implementation of line changed
• has do I connect both needs?
need to put line into selector?



class MySelector Tool
(is not redundant)

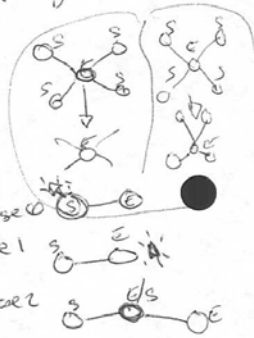


any circle that same path (L)
its used in different places



PE
PES

line
specially



11/09/00 CW.

what do you need to know about

Proc 1	CLASSES	METHODS
	MyDrawApp (Draw Application)	MyDrawApp ("...") open() createDraw()
	EllipseFigure	EllipseFigure (Pt, Pt)
	Draw	StandardDraw() add(Figure)

connecting between
figure and draw

Proc 2	CLASSES	METHODS
	MyDrawApp (Draw Application)	createDrawView() getDrawViewSize()
	MyEllipseFigure (EllipseFigure)	myellipseFigure (Pt, Pt) basicDisplayBox (Pt, Pt) handles()
	MyDrawView (StdDrawView)	mydrawView() — drawAll() selectionElements()
	DecoratorFigure	BorderDecorator (Figure) draw()

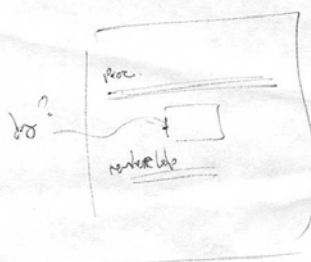
Less Basic.



Proc 3	CLASSES	METHODS
--------	---------	---------



high potential ideas

Aim
create plot sum my Methodsstructure
and arguments into 6 protocols.assessment
in lab done. Each system must be available 2hints + tips
study examples
make use of help books
be general.
use pattern knowledge also appropriate.

2.2. Project student interview data

NB Cross Case Analysis Data – data is collated by question to enable an easier comparison between the responses from each participant.

Question 1:

Subject A:

- DK:** So - just start with some simple questions right? I know roughly what you are doing but could you just describe the application that you are building in the framework?
- A:** *It's a class diagram editor particularly for U.M.L. class diagrams but its got the ability to take design patterns and insert them into diagrams and use them as part of a class diagram.*
- DK:** *Right so ... the developer creates, like, they say I will have a class doing this and a class doing that I want to have a class diagram then they could just pick and select and then the whole design pattern goes...*
- A:** What it is...
- DK:** At the same time?
- A:** *They just start drawing a class diagram as they would. Giving it names and attributes and then they have got a menu which has a list of patterns in it the user selects one of them and uses the toolbar button and clicks on the screen the design pattern appears there.*
- DK:** Just one operation ... you just click once and it puts the pattern in?
- A:** *Yeah ...you actually... if you want to edit it in any way you have to use a command to ungroup it ... it uses the group figure class to add it*
- DK:** So you can actually edit the design pattern?
- A:** You can because you can because you can change the names of the classes because it uses standard names like the decorator pattern has decorator, concrete decorator ... things like that.

Subject B:

- DK:** First thing, although I know what you are doing, just maybe for the benefit of the tape and everything, give a brief description in your own words about your application in the framework that you have developed?
- B:** Using the HotDraw framework to design and implement a Scalextric track editor, a simulation of a Scalextric editor. The brief for the project was to evaluate HotDraw in terms of how easy or difficult or otherwise it was to use. And would we have been better of just starting from scratch and writing all the code ourselves or is this a benefit starting off maybe on a halfway point using the existing code.
- DK:** Do you think you are seeing any benefits or do you think the other way would have been better?
- B:** I think it lies somewhere in between. There are obvious benefits to starting off with a piece of code like the HotDraw stuff that is there. You don't have to go and do absolutely everything yourself, in terms of drawing the figures and the rules on how figures work with each other and the application itself but yeah a constraint to the way in which HotDraw works. I'm trying to think of an example ... the way that the figures go together. You can create a new type of figure but extending one of the classes that is already there. For example the rectangle figure, when making sections of track and just extend that and change how it looks in terms of how you draw it but maybe in certain ways it didn't behave as I had wanted it to, in terms of how I wanted the track to behave. The first thing I tried to do was create a track class which extended the rectangle figure and then all the different types of tracks would just sort of change the implementation of the track class. Sort of, inherit from that but I was finding problems in terms of

passing information between the two tracks that were doing certain things with bits of track because it wasn't something that was a feature I could inherit from rectangle figure. It took a while to work out that I still couldn't understand now how I have solved this problem but with the interface. Err the track class was an interface, and all my track figures that I made – implemented the interface and extended rectangle figure and then I was able to do what I wanted to do and I'm not sure how exactly I solved that problem but this seems to work so...

Subject C:

DK:

I know roughly what you are doing but could you please maybe just describe the application you are developing with HotDraw?

C:

Well what I am trying to do is develop a golf course design tool, a sort of, application that will allow you to develop holes for golf courses. Just like - trying to match figures that are available in the HotDraw framework already or to – maybe things that are relevant to a golf course as in fairways, bunkers, greens, tees sort of things like that and having constraints on these figures so that you can manipulate it and the way you see... the user wants to manipulate the hole you can create it any which way that you want. And maybes trying to put in some extra operations as well that might be beneficial to the user. Distances and pars and stuff like that.

DK:

Is it just one hole or is it like a whole course?

C:

It's just a hole at a time. Even with what I am doing just now there is a lot of figures on the thing at the one time. And when you start dragging then redraw – the refresh s actually gets pretty slow just with one hole so I – trying to do eighteen I think that you would be.... [It would be too much]

Subject D:

DK:

I know what you are doing but could you please just describe in your own words the application that you are developing with this framework?

D:

The application that I am developing is a model railway simulation that involves animation within the application.

DK:

So what kind of things... you can build a track?

D:

It involves building a track, adding trains to the track. Simulating...

DK:

Various control aspects of that yeah? Okay.

Question 2:

Subject A:

DK:

How do you think that this application that you are developing compares in terms of size or complexity to other things you have done previously?

A:

Well its far larger than anything I've done before but ... is it not ... perhaps not that many classes maybe a dozen but that is because I'm using the framework but in terms of complexity it is far more complex than anything else I've ever written.

DK:

Have all your experiences been in academic contexts?

A:

Yeah, yeah.

Subject B:

- DK:** How would you say, this application compares in terms of size or maybe complexity to other applications that you have worked on previously?
- B:** Other applications in terms of stuff I've written in Java or like other things like HotDraw.
- DK:** Just... I mean in terms of any programming in general. Even outside of Java.
- B:** Just like software I've written for other classes of whatever.
- DK:** Yeah.
- B:** I think this is probably the most complex thing that I've had to do. I did a practical with Pete Barrie in his C class – last year and we had to do, it was like, serial communication that was in real time... what was the class called again... [I interrupt to ask if class was Embedded systems It wasn't] ...That was probably second. That was a fairly big one in terms of time scale normal practicals are just a week duration where as we had a fortnight to three weeks nearly for that one and that was probably relatively simple in comparison to what I'm doing just now [HotDraw].
- DK:** Have you had any industrial experience?
- B:** I had a job during the summer in an industrial placement I was writing C code there, for packet detection off a network.
- DK:** And how was that? Do you think that was a bigger problem than this or ...
- B:** Bigger than the example I gave from the C stuff and Pete Barrie's class. It was more indepth than that, it was a four month placement. And I spend at least two and a half to three months of that writing the code but it was also down to research on networks and IP protocol so there was a lot of stuff in there that I didn't know. But in terms of the actual, just writing the C code I don't think it was as in-depth or as complicated as what I am doing just now with the Java stuff.

Subject C:

- DK:** How do you think that this application, that you are developing, how do you think it compares in terms of size or maybe complexity to other applications that you have worked on previously?
- C:** It is an order... its 10 times bigger than most things I have ever come across in Java. I think it's the biggest Java program we have worked on and that is including the group project in third year and that was must have been about, I don't know, a few thousand lines of code it was. But in HotDraw there are so many classes and that's what makes it such a bigger kind of perspective than a normal program. I was writing bits of my report last thing yesterday and I just thought I would count the classes I can't remember the amount but it was over a hundred I think. [Unintelligible] You don't need to use them all, well I suppose you could use them all if you want to... I stopped at over a hundred classes. [DK suggests there is 197]
- DK:** Have you had any industrial experience? Outside the uni , software development?
- C:** No not really, no. Just basic web design I've done just HTML Java script but nothing... really related to...

Subject D:

- DK:** How does that compare in size, that application to other applications that you have worked on before?
- D:** It is probably the largest piece of work that I have ever done.
- DK:** In terms of complexity as well. Do you think it is as complicated or...
- D:** I'd say it is more complicated because I don't think I have done as much programming as that before.
- DK:** It's the scale yeah? [Agrees].
- DK:** Have you had any industrial experience before of software development?
- D:** Not as such no.

Question 3:**Subject A:**

- DK:** What sort of ... in a general level, what sort of applications do you think that the framework is best suited for?
- A:** Basically schematic diagrams, blueprints, any thing that doesn't require a great deal of graphic... err ... editing just basic line drawings bluep ... schematic diagrams basically.
- DK:** Just like you are doing? Do you think that there is quite a good fit then? [agrees]
- DK:** How familiar were you with those kinds of things before you came to this project?
- A:** I wouldn't say very, apart from class diagram editors like rose and together.
- DK:** You have used these then?
- A:** Yeah.

Subject B:

- DK:** Just a general question about how you perceive the framework. What kind of applications do you believe the framework is really suited towards?
- B:** Anything that requires drawing 2D images on the screen anything that can be derived from a drawing package such as the four projects that have been put forward for HotDraw.
- DK:** How do you think, two questions, firstly how do you think your project fits in – do you think it is a good match for HotDraw?
- B:** Yeah. Perhaps not necessarily the way I am doing it but what I am trying to do is well within HotDraws capability.
- DK:** The other thing, is how familiar were you with this kind of domain of applications before you used HotDraw?

- B:**
I wasn't
- DK:**
No experience what so ever?
- B:**
Nothing like frameworks or HotDraw, never before no. At least not to my knowledge!

Subject C:

- DK:**
What would you describe, if you were asked to describe the sort of applications that best fitted into HotDraw what would you describe them as?
- C:**
It's just like a default drawing editor. So there would be things like schematic diagrams and just things like basic kind of shape stuff nothing too complex but you can have shapes that have relationships with each other. So it would be, an easy example is something like a class diagram editor, or something like that. It is ideal for creating something like that. It would be just, kind of, schematic, kind of, drawing it wouldn't be anything too fancy.
- DK:**
How do you think your project fits in with that kind of environment?
- C:**
Yeah, It fits in quite well with what I'm doing. Its just there is so many possibilities open to you that in effect I could have a hundred buttons down the side but its kind of impractical to do that so you are saying right what am I going to restrict it to? But yeah there is a lot of predefined classes and stuff in HotDraw that I could use and I have used added to or composed my own from those ones but yeah it is pretty well suited.
- DK:**
You said at the start about the speed problems do you think that there is an issue there that perhaps it not, HotDraw is not well suited to large systems, large amounts of data or whatever?
- C:**
I am not sure whether it is a HotDraw problem or a Java problem. Because Java can be pretty slow. [Mentions J builder as example of Java performance]

Subject D:

- DK:**
What kind of applications do you think that this framework is best suited for? What is the general sort of range of applications that it covers?
- D:**
I'd say it's a good sort of diagramming tool, drawing editor but if you really looked into it you could probably adapt it to more [].
- DK:**
How familiar with that kind of category of thing prior to this. Did you have any experience...
- D:**
Well I've used diagramming tools like UML before.
- DK:**
Yeah. Okay actual sort of user experience.
- DK:**
How well do you think your application fits into that? Do you think it stretches it or its well within the domain?
- D:**
I'd say it stretches it. I'd say for me I thought it only used some of the aspects of the framework to do what I wanted to do.

Question 4:

Subject A:

N/A

Subject B:

DK:

What... In your own opinion... what do you think the, sort of, key classes are in terms of getting an understanding of HotDraw?

B:

Well Figure. And all the subclasses from that just to see the different ways they implement figures what you can do with them. Drawing and Drawing view and with drawings I've used probably Animatable as well because they sort of link the figures to the... its sort of, I think there is something in between the drawing and the figures. I think there are probably one or two others as well but...

Subject C:

DK:

What classes do you consider to be the most important the key classes to your understanding of the framework?

C:

The main ones are, would be figure, drawing, drawing view, tool, handle I think maybe those. Everything else comes from that.

Subject D:

DK:

Sort of what classes do you recognise or do you identify as being most important in your understanding of HotDraw?

D:

Most important class of mine was... Rectangle figure that was used extensively of all the objects that I used.

DK:

What other kind of classes were there? Key classes if you like.

D:

Key classes – handles, the drawing view, standard drawing.

Question 5:

Subject A:

DK:

When you are working with the framework what would you say your sort of process was, em, in terms of like ... when you approached the framework to do something what would be the sequence, at a sort of, high level that you would go through?

A:

Well the first task is to identify what it is I need to create and assuming that I've already had knowledge of Hotdraw, I know roughly where everything lies in Hotdraw, kind of thing different classes that I would need... so I would take the problem I have to solve, basically, and identify what kind of parts of Hotdraw fit in here and what parts or what do I have to extend to make it fit into the problem ...

DK:

Do you have an idea then ... when you are talking about you have identified the functionality that you want to add in have you sort of already designed a potential solution in your head?

A:

In the back of my mind yeah basically I've identified that these parts of the problem here need to be types of figures, extend hot draw figures I'd have to... parts of it ... the other part of it to extend the drawing area make changes to that. Because I know Hotdraw I can see when I am reading it that that part will go there and that part will go there.

DK:

Do you ever find times when maybe your doing something a little bit more obscure that uses a part of Hotdraw that you haven't looked at, has there been anything like that maybe more at the beginning of the project – when you were less familiar?

A:

There was yeah ... getting down to drawing views and drawings and draw application and particularly the tools as well I'd never, apart from creating a basic tool, I'd never done actually done anything with tool. With my project I had to go in and actually make quite a big change to the way it works.

Subject B:

DK:

What I would like you to do is try and describe at quite a high level the sort of process in which you made the modifications that you have made to the framework. How did you... you came to this framework didn't know it... what sort of stages, whenever you want to add something what did you do to add that thing?

B:

With the experience from the practicals during the class it would be a little bit of the figures so figures wasn't to difficult because we had done that, we had played about with that before but probably prior to that there was no knowledge at all the thing we are trying to manipulate of change to what, adapt it to what we wanted for example the figure the we could look at the source code for the figure class and or a particular subclass i.e. rectangle and see how it behaved or tried to work out where the implicit code was needed a sort of standard things like draw, draw frame draw border all that sort of thing. Handles – the thing that you'd go - we need that and we need that and that and that and we don't need that so we will just ignore it. But then put it into our own version so all the methods that we needed or wanted to change...

DK:

Did you find that that led to a... you maybe looked at one thing and then that would start to reference other things?

B:

That is where the problem came up. When you start to get half way through the hierarchy before you knew it you could be half a dozen classes down the line and you didn't know where you were and you would go back and say how on earth did I get here? And go back and start again try and track it.

Subject C:

DK:

Could you maybe go through and describe the process by which you made modifications to the framework. You had like a requirement "I want to do this...". How did you then turn that in to an actual implementation? What steps?

C:

I think... The first thing I did was... I already had a Java Draw Application there - the default example one but most of the things are available to you. And its just you start and you are trying to think right what figures will match to any one of these like maybe not even an exact match but similar to so I think right if I've got a green that I want to be this sort of shape then I can match to one or two instances of figures that would be available and from there say right just do a similar class to that or just subclass it and just restrict certain bits of it. I think that Ninety nine percent of the time there is a subclass, you are overriding methods just to make sure that you have the functionality that you wanted it to rather than creating a brand new figure. I don't think I have created any totally brand new figures mostly I have subclasses or there is few composite figures. The other classes were just figures inside figures. But I never created just a straight figure just implemented figure itself from the top I don't think I did that much.

DK:

Do you think you had the solution to the problem worked out before hand? Like obviously you have the problem first, would it be your opinion that you had solved that problem before you looked at HotDraw and said right what bits can I find to map into I've got my solution into the area that I would want to have say an object that does this and an object that does that what kind of thing can I find it that fits that or did you maybe just do it more what is available in HotDraw how can I make it into a solution. Was there maybe two different ways?

C:

Well I think probably the second way see what is available and seeing what I could modify to do what I wanted to do rather than thinking I have already got this...

Subject D:

DK:

This is quite a general question. Obviously when you had requirements to meet to make a railway simulator How did you approach that how – what was the process in which you made - turned your requirements into actual implementation. How did you use the framework in effect?

D:

Well, through the practical work through the classes involved with it I got a good understanding of the different aspects of the framework so I knew from there what to use.

DK:

So would you say then that – you had to add something in right? Would you have a sort of solution in your own head that was independent of the framework before you actually did it or would you sort of say 'oh I know the framework has support for this and this' lets use these in someway and make it work that way? Sort of two different ways perhaps of using it.

D:

I would probably say I used both methods. [At different times?] Both at different times. The track itself used a double linked list structure for it but for like connecting stuff and observing it I used the framework.

Question 6:

Subject A:

DK:

Do you think that it is important that when you are making these changes that you keep your application consistent with the framework architecture that is already there?

A:

I think it is yeah, because then it creates a ... there wont be Hotdraw and then there won't be something that's totally different that is quite obscure to what Hotdraw is about. And if you try and create all your classes and your structure in full with Hotdraw without trying to create any new classes nothing to do with Hotdraw or change Hotdraw in a particular way its important to try and keep it the same.

DK:

How do you think you developed this understanding of the architecture? I mean – this is maybe a hard question?

A:

It was just a case of learn as you go. With the practicals in software architecture it helps to learn certain parts of that and then those certain parts lead themselves to learning another part then they just expand from there. It starts from one and then builds out the way.

DK:

I guess you are being quite consistent with the architecture because you think it is important. Have you had any problems that you think might be because you have, sort of, diverged from the architecture? Maybe you have had to or something?

A:

No. I don't think so.

Subject B:

DK:

Do you think it is important when you are making modifications in your project to keep them consistent with the existing architecture of the framework?

B:

I think it would probably make sense. I mean somebody looking at my code once it is finished may well have an understanding of HotDraw or may not... but they start to get used to HotDraw and how it works and how the hierarchy and the classes work work in HotDraw and then they get to my code and they are like woah that is totally different and it might not be as easy for them to then follow what I'm trying to do in the code. Where as if it's the same as HotDraw then it is just an extension of HotDraw and it looks the same.

DK:

How do you think you developed your understanding of the architecture?

B:

I just played about with different classes tried to get used to how they all fitted together and what the methods referenced other classes... I think in terms of the practicals plenty in them about figures and animating and stuff and it was probably the best I could see so far way of going through it trying to get an understanding of it, because you just have to use so many things to manipulate the figures.

DK:

Do you think then that maybe the thing about the examples that was good was seeing a little bit at a time?

B:

Yeah. I mean to just come in and go right there is HotDraw I want you to get a planet simulation going! How do you do that - where do you start? At first it was difficult enough just trying to, for the first practical remove the handles from the figure have it start up a new empty application have an ellipse sitting there that was...

DK:

But now you would consider that quite easy?

B:

Yeah. Almost trivial. Where as beforehand it was where do you go to change this stuff?

DK:

Have you experienced any problems that you think could be attributed to you diverging from the architecture in anyway? If you could maybe give an example if you think you have?

B:

Can't think of any thing at the minute.

Subject C:

DK:

Do you think it is important to keep your modifications consistent with the existing architecture of HotDraw?

C:

Meaning?

DK:

Meaning... maybe for example HotDraw uses implicit invocation to do constraints maybe you might chose to do it explicitly?

C:

I was trying to follow the way that it was doing it for most of the classes I think. Because there you have got examples of how examples are actually done rather than maybe going about it a different way you can think well how did it do it and I would be trying to go along with that.

DK:

Did you have any maybe problems that you feel could have been caused by you going against the way that HotDraw tends to do things? Maybe you didn't realise that it did it a certain way and you had your own idea and you tried to do it and it was, it caused you problems. Did you have anything like that?

C:

I had a few things that were causing me problems. That was kind of going against the HotDraw but that was to do with just, like because HotDraw was all in AWT I was thinking of maybe changing bits here and there just to swing adding in other kind of components like that but that caused me all ... [kinds of problems] even though you could compile it and it would run it you would get funny side effects.

Subject D:

- DK:** How important do you think it is that you are consistent with the existing architecture that HotDraw promotes?
- D:** If you are consistent with the architecture then you shouldn't come across any problems.
- DK:** It's desirable anyway?
- D:** Yeah it would be.
- DK:** How do you think you developed that understanding? Do you think you developed that understanding?
- D:** I'd say for my type application it was hard to stick to the same style.
- DK:** Are there any problems from your project that you would identify as maybe because you had done something in a different style to HotDraw a different way of doing it you know that maybe caused a conflict in that sense?
- D:** Nothing that I can think of.

Question 7:

Subject A:

- DK:** You have probably heard, certainly it was in the newsgroup about the inversion of control in Hotdraw. Have you had any problems or have you experienced any benefits from that method of working ... that sort of organisation?
- A:** Don't think there were any problems ... benefits ... I don't think I could say definitely if there were any benefits without having done anything similar previously. Without really looking at it.

Subject B:

- DK:** You have probably heard a bit about the inversion of control, certainly it was in the newsgroup a little bit. Have you experienced any problems or benefit from the inversion of control that exists in the framework?
- B:** I am trying to think what the inversion of control means?
- DK:** It's the idea then – sorry - that the framework calls your code rather than you calling the framework. So you make your change and you plug it in and you have to know how the framework is going to use it in order to guarantee that the framework is going to use it correctly.
- B:** For example the framework would call animationStep that would call animatable? [I Confirm] Where as... As opposed to the inversion of control would be where I ... [would control the animation myself]. Well benefits from it would be err well I don't think I've particularly used it...
- DK:** If you have not been aware of it than that is okay
- B:**

I don't think I have. Well not intentionally anyway.

Subject C:

DK:

You have probably heard about the inversion of control phenomenon. Are you aware of what that is?

C:

No not really.

DK:

Okay. It was in the newsgroup anyway. It was this idea that frameworks - HotDraw - call your code rather than you, the conventional way of reusing software is that you inside your code have got like a loop and you will say and now I want to use that and I want it to... but its actually the other way around with HotDraw you create the bits and you plug it in and then HotDraw in some way uses it. Do you think that that kind of way of working; do you think that there is any benefits or problems from that perhaps?

C:

Well the problems [unintelligible] are just when things are being called. When is this actually being called who actually calls it. Who is actually making the decision to go this way rather than you saying specifically I want you to do this and this. It has just happened because something else is working that way.

DK:

Are there any ways in which you can find that out? Do you have any – what would you do in that situation? To solve that how would you... can you?

C:

You would maybe try and start from the level above and just thing right, well an example would be in figures like drawing is listening for figures changes it is like figure would just say I've changed and anything that is interested in that would change probably, would be notified of the change, so where is this actually called where does it goes once it is and you are trying to follow all the path that it takes and because like there are so many places interfaces and inheritance you are thinking right well he is using methods that haven't been declared here so they will have to be extended from either the previous method or inherited from another class so you are going back and back and back...[so you have to go up and down the hierarchy]

DK:

Are you actually looking at the source code level then? When this is happening to see the methods and stuff

C:

Yeah, Uh huh.

Subject D:

DK:

Have you heard of the inversion of control in the framework?

D:

No

DK:

Okay I'll give you a brief description. Basically all that that is, is it is this idea that when you make your changes to the framework you are not the controlling party of it. You are actually writing things and you are plugging them in to the framework and some other part of the framework calls them in some way and at some time. And you are not really aware of that. Do you think that that way of working presents any sort of benefits or any problems?

D:

I'd say it's a benefit because it gives you that type of abstraction so you only need to know what to use.

DK:

Do you think it's easy to identify. though where to plug things in?

D:

Ah no I think that's really difficult.

Question 8:

Subject A:

DK:

Have you ever found perhaps that you have identified a piece of Hotdraw that you know is what you want but when you try and change it or when you try and use it. The way that Hotdraw makes use of that is sort of odd, its sort of em. The dynamic aspect to it is what I'm trying to get to here – you want to use something but maybe its not available at the point where you want to use it, you never had anything like that?

A:

When I'm trying to use the patterns in the application they are saved initially as a file – just as a normal Hotdraw save file – you need to load them in some way, Hotdraw loads them as a standard drawing but I can't add a standard drawing to a standard drawing. At the point where I load it I had to go through and make a few changes to actually use what is saved and add it into the current drawing.

DK:

Has there been any modifications that you wanted to do but you couldn't get them to work?

A:

No I think I got all my modifications working.

Subject B:

DK:

Where there any modifications that you wanted to make but that you couldn't make in the framework?

B:

At first it looked as if it was going to be to actually solve the problem! I was trying to make a track figure out of a composite figure which just consisted of two line figures with the appropriate layout so it would look like two horizontal [parallel] lines. But I was having problems then connecting them together because I think there is something about composite figure that behaves differently to standard figure its just one figure like a rectangle figure or an ellipse figure, they all behave in a certain way but when you building them together into a composite figure I think it behaves somewhat differently and their were similar problems in the practicals as well when using composite figure I was thinking How on earth am I going to make these figures that I am creating and adding to the image look like pieces of track? So eventually I ended up with a rectangle figure which wasn't filled in or it was filled in the same colour as the background and the frame of it and instead of drawing the four lines top bottom left and right I just wanted a top and bottom and that would be it and that would give me my two parallel lines which is exactly what I am looking for and then in terms of making cars travel along that it was just a case of travelling along the outside edge of the figure. And that was that.

Subject C:

DK:

Were there any modifications that you wanted to make that you couldn't make? That you found too hard to make in the framework?

C:

I can't think of anything.

Subject D:

DK:

Were there any modifications that you couldn't achieve that you wanted to for this project?

D:

There was one when connecting two figures. If one was moved you would want the other figure to move with it and vice versa but it caused a stack overflow because of the multiple...

DK:

Yeah. So how did you actually solve that?

D:

I did it so that if pieces are connected you can [can't ?] move them then.

DK:

So you just prevented it then

Question 9:

Subject A:

DK:

What aspects of learning to use the framework caused you the most difficulty?

A:

I think the fact that the size of Hotdraw in the first place. I'm not familiar with working, comfortable with working, with that amount of classes before and also the fact that it is mostly interfaces and abstract classes. It is hard to learn to use them it is easier to learn to use concrete predefined classes and the fact that you can use them straight way and then go back and use the abstract classes to create different classes later on. It's the one thing I had no experience in before this.

Subject B:

DK:

At a general level what aspects of learning to use the framework caused you the most difficulty?

B:

Probably initially just trying to get my head around how everything was working. I hadn't done Java for a while so that was a sort of an initial problem I was struggling to remember how an earth Java worked. In terms of classes and the basic concepts in terms of classes and subclasses and inheritance that was that wasn't a problem but more specific stuff. And trying to pass information around like with the tracks trying to determine which track came next in terms of the structure of a complete circuit. I had a value that identified what type of track it was whether it was a corner or a straight piece or whatever and I could retrieve that value but that value alone wasn't enough for me to then make the car do what I wanted it to do in terms of, right its now a different piece of track so its got to animate in a different way. And never even thought to pass the figure itself, pass that piece of track itself as a variable effectively to it [until it was suggested to me].

Subject C:

DK:

Just a sort of general level question. What aspects of learning to use the framework do you think caused you the most difficulty?

C:

Probably were: where things were being called who was actually doing – who's actually in control sort of thing. Even finding out what sort of things that are available to you... to a class like there might not be all these methods are available unless you start digging deep and figure out where actually – what methods you can actually use in what different classes because there is so much inheritance and so many interfaces []

DK:

Do you think it was difficult sometimes to appreciate what methods did just by – you know you see them in the documentation and they have maybe got a wee explanation do you ever find that you misinterpreted that explanation first time round?

C:

Yeah. I think a few of them were like that. There were a few methods that are kind of similarly named and you are thinking well and the explanation maybe in the JavaDoc would be [vague?] what is the difference between these two and why - what does this method do different from that one does it and I think that sometimes that was... maybe it could have been better documented.

Subject D:**DK:**

Another sort of general question. What sort of aspects of learning to use the framework do you think caused you the most difficulty?

D:

Aspects? Trying to identify what you are using is quite hard.

Question 10:**Subject A:****DK:**

How did you identify functionality in the framework? Supposing you have got a problem and you know you are looking for something. How do you find it? How do you locate it?

A:

Well Hotdraw is pretty much laid out pretty well in terms of structure so that it make it easy to identify –

DK:

In terms of packages and so on?

A:

Yeah and it is quite obvious you have got anything you want to put or draw on the application is going to be a figure somewhere and the interface itself it comes from the draw application class and every main point in Hotdraw at some point has its own top level interface / abstract class so it is a case of if you want to do something you want to change it to something like a handle at some point then its going to be a subclass of that you interact with.

DK:

So at some level, you are looking at the top abstract things to see the kind of things it can do and then you look down at the detail to find a more refined version and then...

A:

Yeah.

DK:

Could you maybe sort of illustrate that with an example of ... in your project that you did? If you can, if you can't its okay.

A:

Every... the classes and the connections [unintelligible] were all... there are various types of connections in hot draw, it has at its top level line connection, I think it is, and it's a case of deciding what kind of connection I want and going down through the line connection hierarchy.

Subject B:**DK:**

How do you locate or identify functionality in the framework? When you want to add something and you know what you want to do. How do you then search for it?

B:

I think it depends on what it is I'm trying to do. If its something I've done before and I know roughly where about it occurs within the framework then it is pretty easy to go and find it. The majority of the things we have been adding to or changing (at least I have anyway) have either been in figure at some level or within drawing or drawing view so it is just a case of looking at standard drawing or standard drawing view and changing and looking for the methods in there. There was one in particular that took a while to find ... trying to remember what it is... think it was something to do with the... yep. If I removed a figure... in terms of the cars I had two cars within any application so if you add one increment a counter, when you add the next one increment a counter when the value goes to two then you can't add any more so that wasn't a problem Its just how you add the figure to a drawing that was okay but when you removed it I wanted to decrement the counter so that I could add it in again. But to do that I had to find where the remove figure method was and I thought I had found it in the same place where I had add figure within drawing but that wasn't it - it took me a while to search through and find where ever that was and I think that eventually it was about three or four classes away that I eventually found where the thing actually did right take this thing out the drawing to delete it from the screen you can't see it. And I had to sort of rewrite that.

Subject C:

- DK:** How did you identify – How did you locate functionality in the framework – you kind of just touched on it about how difficult it was to find things – How would you go about that?
- C:** Personally usually in J builder you can have numerous classes open at once very often you would find yourself with maybe twenty classes open at once just looking back and forth but in another window you have got explorer up looking through the package documentation as well and... That way.
- DK:** So would you start with say the package stuff, JavaDoc stuff and then go to the source code
- C:** Probably would but usually have them both open at the same time.
- DK:** So you have got that set up a sort of parallel between the two.

Subject D:

- DK:** The next question touches on that. How did you identify or locate things when you had to. What sort of – how did you know where to look and so on?
- D:** Basically trying to just trawl through the code. Read through it see where the flow of control is. [So you were actually looking at source code?] Yeah.
- DK:** Did you look at the JavaDoc?
- D:** Yip.
- DK:** As well? Did that, was that maybe... what did you...
- D:** I'd say it wasn't that helpful.
- DK:** It wasn't. Was it a starting point to go to the source code or did you just go to the source code straight away?
- D:** Probably just to see what the classes names were. [DK mumbling]

Question 11:

Subject A:

- DK:** When you are making a modification have you sometimes found that there is more than one way to do it?
- A:** Yep. Not perhaps two very large different ways of doing it but there was small ways going through different means of doing things. You could when, adding a figure, use composite figures or I could create a new class [subclass] yeah.
- DK:** How did you decide between them? I guess that might be specific to an individual example or whatever but...
- A:**

Basically whatever method had the least amount of changes to be made. If there was a top level class, a parent class, for both ways whatever one requires the least amount of change and already has the most amount of functionality that I need...

DK:

So the one that was closest...

A:

Closest match basically. Even if it didn't seem sensible so long as it was the closest match.

Subject B:

DK:

When you have been making modifications have you sometimes identified two separate ways or more than one way of doing the same thing?

B:

Yeah. In terms of well first off in terms of drawing the track actually making it look like a piece of track. And in terms of connecting the track together how you decide where a piece of track will go once you connect it to another piece of track so have got a half build circuit and you add a piece of track to it where is it going to go? Also how you decide which piece of track is the next one in the sequence or the circuit. I had an if statement with like four different tests in it if it was one thing the set the next one to the value of the next figure, other ones you would set it to... Sorry. It would either set its own next value to whatever the thing you just added it to or the one that you have just added it to its next value becomes the one you just added depending on certain checks but then I found that the other way of doing it would be to have a case statement with perhaps what is switching on the type of track. [I complain that I cant understand he expands...] In terms of can track A connect to track B so you can't connect a vertical straight to a horizontal straight for example where as you can connect a horizontal straight to another horizontal straight no problem provided that one end of it was empty or available to connect to. So the options I had was if this it can connect if this it could connect if that it could connect blah blah blah else cant connect so instead of having all these if statements you are using a switch on the value of the id for the track you are trying to add it to.

Subject C:

DK:

Have you sometimes identified several different ways to make a modification?

C:

Yeah you can decide... Well in separating the drawing from the view sort of thing you have got different ways you can go about doing the same sort of thing. You have got the option of whether you wanted to actually change the model or change the view. Yeah I think there were a few examples like that.

DK:

Can you think of anything specific in you project? [C asks for clarification] Having two options and having to choose one basically?

C:

The think that comes to mind was the flag, creating the flag that you had the choice of just like a rectangle figure then just redrawing what it looks like in the display box or going about it with a composite figure that consists of like a triangle figure and then just a line. I think the second way is how I would you know composite figure but that sort of opens it self as well just because it doesn't specify the layout so it was difficult just sort of laying out the figures so that it would draw it properly on the screen when you clicked the mouse. There were a few occasions that I thought I had done it and you would try it and place it somewhere then maybe drag it someplace else and it would just go up to top corner. I think I actually ended up looking at... was it Pert, the Pert application had an example of that and composite figure specified the layout for the figures inside that. I think I maybe used a good bit of that.

DK:

Do you think that in general there wasn't enough documentation for composite figures and how to go about them?

C:

I think it would have been better if there had been more examples even just like different layout that each specify the layout of figures because it was... Drawing itself was a composite figure and I never found that out until [DK agrees that this link is non obvious] I was thinking like drawing and you look at what methods has drawing got and maybes looking to extend composite figure [] because composite figure has got loads of methods and drawing has got all of these as well so there is a lot of stuff I never knew until you start to looking a bit deeper at it.

Subject D:

- DK:** Did you ever identify, sort of multiple approaches, multiple ways of solving the same problem?
- D:** No not really.
- DK:** Maybe to try and illustrate what I am meaning. Its things like in the practicals you had this whole implicit vs. explicit debate about how the planets connected. Anything like that come up in your project? No.
- D:** No. I can't think of anything.
- DK:** Did you ever look for more than one way of doing something?
- D:** Well obviously, aye.
- DK:** So maybe you found something that could work and then you kept looking - why was that was that just to make sure that you hadn't missed anything...
- D:** To see if there was a more simpler solution.
- DK:** How do you decide when to stop? [Pause] Is it just a sort of gut instinct?
- D:** I'd say if you have exhausted a few ideas then its probably time to stop.

Question 12:**Subject A:**

- DK:** Were you interested while you were developing in understanding the dynamic aspect of what the framework was doing while it was running its code?
- A:** Yeah I was. There is a lot of the framework that I haven't used so it is interesting how it all goes together. There is a lot of underlying classes that I would very bother touching but where are they being used
- DK:** Must be for some reason.
- A:** Yeah there must be a reason and it's a case of how they used in some way.
- DK:** Do you think that is quite a hard thing to get an insight into?
- A:** It is yeah, usually if they are very abstract or are a lot of interfaces, then it is hard to get those classes working even though the are actually doing something.
- DK:** Do you think it is hard when you see them – maybe you see them in JavaDoc and then you think – its hard to just appreciate why it should exist.
- A:** Yeah.
- DK:** And you maybe see a name and you think why would that even be there.
- A:** Yeah because perhaps maybe the subclass of that is very close to that top level class and then the point in changing it in the first place makes no real sense. Obviously for future development if you want to extend further - that's why its there but at the moment there is no good reason for it to be there.

Subject B:

- DK:** Where you interested in understanding what the framework was doing as it was executed? The sort of dynamic view of the framework. What that important to you?
- B:** ...Probably not no. If I wrote the code and it worked then that was me happy. If it did what I expected it to do.
- DK:** Did you ever find that you had to gain an insight like you tried to do something and it doesn't work and you can't account for why and then maybe you looked at it and you find that its something you know like a sequence of events that is happening or...
- B:** Yeah, it was like when I was trying to move the car I thought it was just going to be well add figure is in drawing which adds the figure so there is a remove figure within drawing surely that would just remove it but it didn't and it took me a while to work out why.
- DK:** I guess that is... when you were going through the process of detecting this class that did the remove, were you thinking in terms of this object is going to call this object and somebodies going to... did you find the path to it...
- B:** It was either through looking at what other classes the drawing inherited from or extended or even implemented, whatever, and following the hierarchy up that way and seeing what those super classes themselves inherited from trying to follow it through there or looking at the method in drawing itself and saying right that takes in a particular object and calls a method with a certain object and follow it that way through the methods.

Subject C:

- DK:** Were you interested in understanding what the framework was doing while it was running? The sort of dynamic behaviour in your project.
- C:** Well I suppose. For detecting mouse events and key events and just like detecting what is clicked and what is actually taking place when it is clicked. [And also what HotDraw does when it is clicked]
- DK:** How do you think you got all that understanding? Just back to the code or...
- C:** The software architecture practicals helped a wee bit. They helped gain a wee understanding slowly doing it bit by bit then the paper that you did that told you the main bits of like the HotDraw and just for certain things you look at certain areas sort of thing and that helped quite a wee bit.
- DK:** Do you think maybe that both of those things the examples you gave and the paper could have maybe covered other topics do you think? Do you think they covered all the important things that were there or do you think they missed out anything obvious?
- C:** *I think they covered just the kind of fundamental parts of it - to do with constraints, handles, animation. It never went into too much detail but it covered enough for me to understand what was the main components of the framework.*

Subject D:

- DK:** Were you interested or did you think it was important to understand the sort of dynamic aspects of this framework? What it was doing while it was running it code sort of thing?
- D:**

Don't think you really needed to. To be honest.

Question 13:

Subject A:

- DK:** How do the inheritance hierarchies in the framework help or hinder your ability to first of all locate where to make modifications? And you have maybe touched on that previously.
- A:** Yeah because you've got the - Hotdraw has its top level basic architecture and you can identify the point then it's a case of going to the next level and seeing if... which way you should be going.
- DK:** Do you find it hard to maybe appreciate when you are looking at each class what it actually does?
- A:** Individually its hard to figure out what each class alone does especially as you move closer to the top level once you get down to the actual concrete classes you've got...
- DK:** Did you find any problems down at the bottom though in as much as there is a lot of functionality, sort of, distributed in other classes on, you know, above it in the hierarchy.
- A:** If you have no idea what the top level classes do ... you can't just use the bottom classes on their own.
- DK:** So you are almost saying that you would always start at the top.
- A:** You should really start at the top because then ...if you start at the bottom you are missing the most [unintelligible] its just a class with a few methods where all the functionality is above it.
- DK:** The second part is do you think that or how do the inheritance hierarchies help or hinder your ability to understand the functionality offered, do they provide a ... I guess again that does come in to what you have answered.
- A:** If you start at the top and look at the whole hierarchy it help to understand if you were just looking at a part of it then you can't do it.

Subject B:

- DK:** *How do you feel the inheritance hierarchies help or hinder you in the framework? There are two parts to this... Okay first of all how do you think they help or hinder you to locate where to make modifications?*
- B:** It is not necessarily obvious just from either the names or the methods ... or the names of the methods or the names of the classes and it is sometimes you can get information from simply what a classes inherits from. And basically it is not a case of lets go looking a bit further up... you might find it that way perhaps a better way is the documentation doesn't lend itself to be very helpful either.
- DK:** The second part of that question is how do inheritance hierarchies help or hinder your ability to understand the functionality that each class offers?
- B:** It is well structured enough in that you can find something's. Something's are just obvious in where you are going to find it or where you should be looking like the hierarchy for figure – you have got an abstract figure and you have got a figure which is a sort of default application and then you have got all the different types of figure which implement that in their unique own way. And that pretty obvious as in where you are going from that but when you get to more sort of ... abstract is probably not the right word to use, but further up the application in terms of drawing and drawing view and those sort of things it gets a bit more complicated as to where the [unintelligible]

Subject C:

- DK:** How do you think inheritance hierarchies in the framework help or hinder your ability to locate where to make modifications?
- C:** They help you in the fact that there is so many methods available to you but they hinder you in the fact that you might not realise that at the start. You have to go into the abstract classes and interfaces and see what is actually there. Like the abstract figure and things like that would specify important methods you can't override and just read [] stuck to the figures.
- DK:** Do you think it was obvious when you had to add a new class where to put it in the hierarchy? Like it should definitely go subclass here or it should maybe go here. Is there any problem with that?
- C:** I think no I think it was okay quite. You kind of knew that if you can if you wanted just to go from abstract figure and add things to the methods or if you think there is a figure that does that for you. Ill subclass that rather than going straight from abstract.

Subject D:

- DK:** How do you think then, the inheritance hierarchies in the framework help or hinder your ability to locate where to make modifications?
- D:** Well inheritance hierarchies - make it easier because you just sort of look further up.
- DK:** Is it always easy then to say 'well I want to add this - here is where it should go. You can always say that?
- D:** Yeah. You could.
- DK:** What about understanding functionality when you were looking at the inheritance hierarchy and looking at a class how easy was it to understand what that class did?
- D:** I'd say it wasn't that easy I don't think there was enough documentation.
- DK:** So did you find that you had to search through a couple of classes in the hierarchy to get that knowledge?
- D:** Yeah.

Question 14:

Subject A:

- DK:** In your opinion does the use of design patterns in the framework - because Hotdraw has got a lot of design patterns - does that help you to understand how to use parts of the framework?
- A:** Parts yeah. If you are familiar with the pattern then yeah it does. There are a lot of patterns in Hotdraw that I really only know by name I've never studied. For the few patterns I know I can see how it all fits together - I know how the pattern works and I know why certain classes interact with other classes and then sub-classing others how it all works together.
- DK:** Yeah how about the converse, if you are not familiar with it?
- A:** If you are not familiar with it the patterns mean nothing to you. And it's just a case of trying to recognise the inheritance hierarchy on its own.
- DK:**

Do you think it can actually confuse you if you are not familiar with the pattern because they often decouple things?

A:

It can yeah particularly where you have got maybe the top level. The drawing view, the drawing and the draw application you have got three separate classes and they are all tied together in some way. You might think you have all these three parts why not have them together in some way it would make more sense.

DK:

Do you think that the design patterns also help you to appreciate what a part does? I.e. Its, sort of, sequence of interactions in the framework, the sort of, dynamic? Do you think it gives you an insight to the dynamics - knowing your design pattern, knowing how it collaborates with its classes?

A:

Well assuming you know the design pattern yeah then you... If you know the pattern well if you know the point of the pattern how it interacts then its going to help you with that part of the framework that the design pattern deals with but there is not much difference really between knowing the pattern and knowing that small part. It only helps you with that small part alone so you could know lots of small parts of it but you have still got to bring the whole thing together in the end.

DK:

Design patterns. Do you help to explain why a part might exist in the framework?

A:

Not for me no. Err...

DK:

It terms of maybe say the benefits or the limitations of a design pattern... err I have lost myself with that question [laughs] ... okay just ignore that it is not a very well worded one.

Subject B:

DK:

In your own opinion does the use of design patterns in the framework help you to understand how to use parts of the framework?

B:

Some of the obvious design patterns would suggest how to use the framework. Like the borderDecorator is probably a good example of the decorator pattern so they both sort of like the design pattern Decorator design pattern sort of tells you how to use the borderDecorator and border Decorator is a good example of how to use that design pattern. Its sort of hand in hand they help to explain each other.

DK:

Do you think ... How... did you were familiar with the decorator pattern before you saw it?

B:

We touched on it in the class before we saw it in HotDraw. So perhaps didn't understand it that much in the class but once I saw the HotDraw example it was a bit easier to appreciate it

DK:

Do you think if you found a design pattern that you weren't familiar with, how do you think if you weren't familiar with the design pattern at all do you still think that would help you. Would it confuse you?

B:

If it was an example from HotDraw and I understood how HotDraw was working but wasn't perhaps aware that it was a design pattern. So someone says 'there is a design pattern for you' oh I don't understand how that is working, but inside HotDraw how HotDraw would use it well I know how that part of HotDraw works. If I knew enough about HotDraw or the particular part of HotDraw that used the design pattern then it might help me to understand that new design pattern.

DK:

Do you think that design patterns help you to understand the dynamics of a part of the framework?

B:

Yeah I would say so. I think that design patterns in general help – if you can understand the design pattern just from a description of it without any formal example or hard code or anything then to apply that design pattern to the HotDraw framework you would find an example of that I think that would give you a good understanding of the framework. Or vice versa.

DK:

Do you think that design patterns can sometimes maybe justify why a part of the framework has been done that way. Maybe you see border decorator in hotdraw and you don't know about decorator and you

say why have they went and done that? But if you know the design pattern do you think it can make- can justify It can make you say I know why they have done that because...

B:

I think it probably... I think the whole idea of the design patterns from what the class was saying is that it is supposed to make things easier. It is supposed to make things easier to understand and interpret so that to create a framework such as HotDraw and just not use design patterns would seem rather silly considering that these design patterns exist to make things easier to make it easier for people to put classes together, have them sort of communicating, work together in a specific way to use a design pattern seems to make sense in that ... I don't know how global design patterns are but it is probably a universal sort of design standard maybe that everybody is going to understand so if you use design patterns that people are going to understand then it should be easier to understand the whole framework in itself.

Subject C:

DK:

In your opinion do you think the use of design patterns in the framework, because HotDraw has got a lot of design patterns in there, do you think that they helped you to understand how to use parts of that framework?

C:

Well no I think it was the other way around. HotDraw helped develop an understanding of patterns because some of the design patterns the theory [is quite abstract] how do you, do you have any examples of code on this And the HotDraw showed us the design patterns in use in kind of helped.

DK:

Do you think that design patterns help maybe to understand the dynamic aspects of parts of the framework? What sequence of events actually happened?

C:

Yeah. It does because the examples of the prototype pattern and stuff like that at runtime you are specifying what you want just like coding the instance from the button. When you sort of press the button so I suppose that helps.

DK:

The other part was: Do you think that design patterns help you to understand why something was included in the framework like the justification for doing it that way? I mean that in terms of design patterns have often have a motivation - the reason that you would use this design pattern is X and do you think that came across when you looked at the framework - that's why they did it because they needed to have flexibility here or anything?

C:

Well I suppose yeah that is basically it does help you to understand why for the particular patterns that are there but it does seem as if a teaching aid for design patterns sort of thing just this is why design patterns work, this design pattern should go here because it promotes good practice and so on.

DK:

Do you think it is important to have seen the design pattern previously? Do you think if you - presumably there are design patterns in there that you haven't seen before - do you think that that is harder to understand than if you had say read about them before?

C:

Well if you followed it and knew what it was doing. Then I suppose you would be okay but its would help to have that previous knowledge of the design pattern and why... the kind of theory behind it, before you come across it. Just even in the sense that this is an example of the composite or whatever design pattern you know why, you know the methods that should be there and you have got to go and look that up but you have got to understand the motivations and the collaborations.

Subject D:

DK:

In your opinion. Does the design patterns in the framework - 'cause the HotDraw thing has got lots of design patterns - do you think that they help you to understand how to use parts of the framework? Do you think they give you that knowledge?

D:

I think some did – like the observer pattern. That gave you an understanding of exactly what's actually going on.

DK:

That maybe touches on the next... it's the same sort of question right? Design patterns how do they help you to understand what a part does? The sequence that it goes through - do you think that they do that?

D:

Well design pattern gives you a description of what is happening rather than just code so...

DK:

And do you think it helps you to sort of understand the justification for why it was done that way. Why the designer decided to implement an observer pattern here or...

D:

Yeah. I think I agree with that.

Question 15:

Subject A:

DK:

How useful did you find the example applications?

A:

Very. There was a lot of things, particularly earlier on, that I was trying to do that a lot of the example applications helped with. Just even the structure of how the parts they change in the framework to make what they want work so a lot of that was very helpful.

DK:

When did you use them in terms of the ... did you use them early on...

A:

Mostly earlier on.

DK:

As you came through you rely less on them...

A:

Didn't really rely on them at all towards the end because they are in a way basic samples. They show certain parts of the framework and common parts of the framework which may change quite often but once you get further into the project it is a case of making changes to parts that won't change as often aren't including in the examples. Getting further back up the hierarchy to make changes.

DK:

What would you say would be the limitations of the examples? Maybe the advantages and limitations?

A:

The advantages are that they show the common features of Hotdraw and how to make certain changes and how the changes have to be made. The drawbacks are that they are quite basic in a way in that you usually only use what already exists in Hotdraw there are only perhaps two or three different things in the samples that they have sub-classed and made their own and made significant changes too and once you get past that point in your project ...

DK:

So would you say they are quite superficial? Sorry [I interrupt A.

A:

A part ... partly yeah.

DK:

Sorry I interrupted you actually.

A:

That alright I am done now.

DK:

Do you trust the examples?

A:

Yeah because I have used them. I used them quite a bit when I first learned Hotdraw and they work and there may be other ways of doing what they are doing but I trust the way they are doing it. I assume they are right.

DK:

It does. It seems a fair assumption. Yeah.

Subject B:

- DK:** How useful did you find the example applications such as the examples that were in the framework. You know PertChart and so on, how useful did you find them in terms of learning to use the framework?
- B:** I think the Pert example and the drawing application itself [JavaDrawApp] were the only two really that I had used I am trying to think what the other two were...
- DK:** There was nothing app and there was another one about connections but I can't remember the name of that either.
- B:** Certainly the Pert chart was used a lot. Mostly in terms of how do you make a tool create your figure put it into the drawing how do you connect things together how do you make...
- DK:** Did you maybe approach it with specific questions.
- B:** Yeah, yeah if there was something I particularly wanted to do I though well I know that does something similar to that or that does exactly that so I would go and look at that and see how it does it.
- DK:** When did you use them in terms of like the sort of time of your - during the course of your project?
- B:** I think it was pretty much as I was writing the code I got to a point where I don't know - how would I do this? And I was aware from those examples they did essentially look at it.
- DK:** So would you say it was spread out over the course of your development?
- B:** I wasn't like all at the start or at the end it was pretty much all the way through it.
- DK:** What do you think the advantages or limitations are of using examples are in that sort of way?
- B:** The advantages are probably that the code is already there for you to a certain extent it may be exactly what you are looking for or it may only be a part of what you are looking for so you take the bits you want saves you writing it or you take everything save you writing any code at all. Its just a cut and paste job reuse of code effectively and [justification for sw reuse] that would be the major advantage and the fact that it is there, on the assumption that it is there and the example is good and it works it could be enough for reference to say that's how that works and you can maybe learn from that and maybe that's how that particular function would work and ...
- DK:** So are you saying that in some way it acts as if this is the framework developer telling you how to use a specific part of the framework?
- B:** Yeah from their insight of the framework since they wrote it. The limitations of it - another advantage of it would be that it would help you to design your code to keep with the way the framework [architecture] so you are doing things the way they want you to do them. Or would expect you to do them. A potential disadvantage of it would be if you didn't understand it oh that does what I want it to do cut and paste and you don't know it would be too easy to or it cant be easy to just reuse the code blindly and then if something goes wrong you might have a problem and don't know what it is - it could be in the code you just copied thinking that it works but although it works it might not do exactly what you think it does. That could cause you problems because you wouldn't know where your error would be. Also then you are constrained to, if you stick to those examples that are there you are constraining yourself to writing your code the way the architecture of the framework exists already you don't have the freedom that you would have had normally if you had just wrote it yourself in your own way.
- DK:** So you couldn't then go beyond what the examples were showing you is that what you mean?
- B:** Well approximately yeah, If you stuck rigidly to the way that the examples did it you don't then have the same freedom that you would have had otherwise.

Subject C:**DK:**

How useful did you find the example applications, Pert chart and so on when you were learning the framework?

C:

Yeah, Pert application was good just for forcing relationships on figures and a good example of composite figure as well Pert figure is useful and JavaDraw was just good for showing you more or less all – not all but a good percentage of all the tools and all the figures that you can create with HotDraw. What kind of things are available or what kind of things you might consider using or changing or modifying.

DK:

When did you use them? When did you use examples? During... If you imagine your project when would you say would you say its all at one end, all at the start, all at the beginning [meant end] or spread out across the whole thing?

C:

I think it was all at the start. I think.

DK:

So you used them to get started and get an understanding and so on.

C:

I think that there is always something interesting look at its application and see how it uses it. Like extending DrawApplication I think that is where you kind of get your first [] even if you just create a [] like for me my golf course thing [] figures I would modify. With out modifying them gives you an understanding of how [] its to get.

DK:

How do you think the advantages or the limitations of using examples could be? Take say advantages first – what do you think the advantages are? That give you a head start...

C:

It shows you most stuff that is available to you how like examples of HotDraw in actual use and like forcing constraints and relationships between figures that are just drawn on the screen and the connection between them It does kind of get you off on a bit of head start rather than if you were just given Draw application to extend then you would think well I don't maybe...you would probably get there but it would take a while longer than if you had an example of something that extends draw application. Created in part already.

DK:

What do you think about limitations have you got any ideas?

C:

I suppose it doesn't cover everything I suppose if you had more examples you would cover most aspects of it which would be beneficial.

DK:

Do you think it is always easy to identify the bits of the examples that you want? Like do you think maybe there are lessons if you like hidden in the example that you can't see because there are other things going on? It is a lot of information to take in.?

C:

No. I thought okay for the stuff you were interested in you could find out how it went about doing it and even just ignore the stuff you are not interested in and pick out the stuff you were from the applications you have already made.

Subject D:**DK:**

How useful did you find the example applications. You know things like Pert chart and so on, when you were learning to use the framework?

D:

For the initial practicals it was pretty helpful but for the application I developing for my project there was not much.

- DK:** Why do you think that was?
- D:** If I just got a project and I didn't have that class and wasn't doing the practical work I'd find it difficult [ut]
- DK:** Do you think that it is only useful early on in a project? The use of examples to get you started or do you think its something that you would just refer to through out the project or maybe as you gained more experience.
- D:** *I think early on because there is so many different applications you could develop, there would be too many examples to cover every thing.*
- DK:** Have you any other thoughts on the advantages or limitations on using the examples?
- D:** Well advantages gives you a start point into the framework and what it is doing but maybe there could have been a bit help a bit more examples.
- DK:** Do you thing that they don't cover a complete set of what you might need to know?
- D:** Exactly. Yeah.

Question 16:

Subject A:

- DK:** *What about the architecture practicals? Again you mentioned this earlier but just to go back over it again were they useful?*
- A:** *Because that was the first.. that was the introduction basically to Hotdraw again becoming familiar to thier framework, again without them it would have been an a lot harder to in earlier to Hotdraw but if I was only doing the project if I had not done the software architecture class.*
- DK:** *What do you think was good about that?*
- A:** *It took you through the important parts of Hotdraw.*
- DK:** *Do you think there was a sort of sequence to it*
- A:** *There was a bit they - it starts with a key class the figures and then it starts to go from there the it starts to go back up the hierarchy slightly up to drawing views and drawings and then gets to the top, but it took you up the hierarchy and showed how certain parts interact and how they change.*
- DK:** Did you use the solutions to the practicals? Were they useful?
- A:** Only to see if there was a different way of doing my solution – quite often there was.
- DK:** Do you think the detail in the solutions that Murray produced were quite useful?
- A:** [unintelligible]
- DK:** Yeah. I think he had a textual description then the code and then he had alternative solutions.
- A:** The section on alternative solutions, giving alternative ways of doing it was helpful. It showed you that your way is not the only way.
- DK:** Do you think there is a danger that you find a solution that you tend to blank out other solutions?
- A:** They way I was doing it was I found my solution and then I looked at the given solution and I thought 'oh that way maybe seems better' and I had a tendency to go with the sample solution thinking that one

was slightly better rather than ... occasionally I stuck with my own... particularly towards the end when there was patterns [practicals?] in the assessed part and I stuck with my own to keep the feeling so that I know what I am doing but earlier on I was making changes to mine based on the sample solution.

Subject B:

DK:

You have hinted at them a little bit already but were the architecture practicals and their solutions helpful to you while you worked on your project?

B:

Very. Very.

DK:

In what ways do you think that?

B:

I think that HotDraw itself being a drawing application probably solely uses figures of one form or another anyway so there probably would be much else to use other than figures but there was just an awful lot that was in the practicals that I have to use on my project like removing the handles for example well that was in the practical... connecting two figures well that was in the practical... making one of those figures that is connected animate well that was in the practical its just, there is a awful lot from the practicals that I have got to use or a derivation of that that I want to use and so the practice we effectively got was those examples helped a lot in preparation for a large scale project.

DK:

Was there anything that you think that comes to mind if I ask Is there any changes that you wanted to make that you couldn't find an example that we haven't went over in the examples and that you would have no clue as to where to start with. Do you think that it covered everything?

B:

I think in terms of constraints at the drawing level for example I'm only allowed to put two cars in I cant put any more than that in. I don't think there was an example of that in the practicals you were free to add figures as and when you wanted it didn't matter. I've got a constraint that you can only connect certain types of figure together where as in the examples you can connect anything together.

DK:

And did you think that these things were hard to do?

B:

To stop certain figures like a horizontal track connecting to a vertical track that was[n't] particularly difficult it was just a case of identifying what each individual line connection was and through my decision of were they compatible or not set a flag and test the value of the flag when we were trying to connect them but to prevent more than two cars being put on the screen I had also the second one being a different colour from the first so when the first one appeared it would be red when we add the next one it would be blue if you delete the red one then add another car it would have to know to add it in as red so you need to know which car you have got at the time that was a bit more difficult I had a pretty good idea that it was going to be at the drawing level from what I had done in the assessed practical because I had done some work up at that level It was also suggested by one of the guys on the project that that was where to put constraints like that, so it sort of confirmed my initial instinct and it wasn't too difficult after that to work out exactly how to do it.

Subject C:

DK:

In a similar sort of way were the architecture practicals and their solutions useful to you?

C:

Yeah. They were good just introducing slowly to the framework without just throwing in do this and then do this and you have got to go and learn to see how they go and create an empty app, and create a ellipse on it and so it progressed from there and slowly the different bits even if you had a quick stab at it and you never got it properly the solution would come and you would think ah it seems pretty obvious looking at the solution remembering what you did in the previous one it was good that it was just extending the same sort of thing over and over again rather than saying right do this then forget that do sometime else it kept on going from the same example and all the rest.

DK:

Do you think that that helps the fact that maybe we focused on one topic at a time almost do you think it sort of split it up made it easier to learn than say an example in the framework? Because examples you see examples all as one thing that is the finished article where as we dissected an example and spread it out to you think that that is a better way to go or...

C:

I think it is better to keep going with the one example and keep extending it rather than getting fresh ones every time and starting from scratch every time its kind of building on your knowledge you have learned from the previous week.

Subject D:

DK:

Similar sort of thing but asking about the architecture practicals that we set, and also their solutions did you find them useful?

D:

Yeah very useful. It involved animation and connections so it was directly involved in my project.

DK:

How would you compare that to the normal examples in the framework do you think they were more useful less useful, the same.

D:

I think they were more useful because if you just get a demo you just look at it. Where as if you get a practical and try and you try and achieve something following through the code you are going to understand it a lot better.

DK:

You actually go through the process.

Question 17:

Subject A:

DK:

Moving on to tools and documentation what kind of documentation or tools did you find to be effective or not effective when using the framework. Take effective first. What sort of documentation did you get the most benefit from?

A:

I thought the Javadoc although there wasn't a great deal of detail it was helpful because it did show if I look at one class and I want to see how to change it in the Javadoc it gives me all the classes, its subclasses, its parent classes and usually the methods so I know how to go about making the changes without actually diving in and looking at the source code although Javadoc really wasn't documented enough - a lot of the methods just skim with no explanations what they do.

DK:

Did you use the source code at times to...

A:

Yeah there was a lot err some of the methods weren't obvious by their method [names?] they seemed obvious but there was a lot of methods with a similar kind of name and it was a case of going in looking at the source code to see what it does.

DK:

Sometimes did you get the feeling that the only way to get the real understanding was to go to the source code?

A:

It was yeah, because the lack of detail in the documentation. If there was more detail then perhaps not I could have stuck with the documentation alone but there was a lot of reading the source code.

DK:

Did you use the other types of documentation to see whatever ... there were design patterns which I think we have talked about, the U.M.L. diagram? Was that any use to you?

A:

I ... yeah I looked at that basically to see the top level then I had to go further down into the hierarchy to find what I want to do.

DK:

The paper? I know I wrote it but...

- A:** That was actually quite helpful because any papers that currently exist on Hotdraw are either written in small talk or are very abstract where as yours actually took what were important points at the time and actually explained them in a way that made sense to us.
- DK:** Do you think that then, as you became more experienced you moved beyond that level? That you didn't need to have these things?
- A:** I think that initially I learnt the parts of the framework I learnt it without documentation without having to go back to look at the source code all the time the fact there was all the papers meant I could go in and create what I needed to create.
- DK:** So you have got more of a model in your head at that point?
- A:** Yeah.
- DK:** Any tools? Did you use any tools? Things like, say, Rational rose or together?
- A:** No.
- DK:** Any documentation then that you would have thought was not effective? Design pattern literature for example?
- A:** I think that the design patterns... If you have come across a design pattern you are not familiar with and you want to know why it is there in Hotdraw then it is helpful but just to be able to... The design pattern documentation included with Hotdraw was just quite... a design pattern... err ... it does not really explain how it works with Hotdraw. It would be better if it gave... if it described the pattern in context with Hotdraw.

Subject B:

- DK:** What kinds of documentation or tools did you find to be effective or not effective while you were working on this framework?
- B:** The document that you gave us at the start that was probably the best so far it terms of documentation that we have used anyway within the project. The web based documentation on the classes and the methods [javaDoc] is not very good at all. You are looking for a specific method fair enough you can find a method from the index you can find what class it is in but in terms of the description as to how it behaves, what it does, how best to use it or how not to use it... that sort of stuff it is not very detailed. I don't know if that is its intention or other wise but it is not so... you would expect that that would be the bible effectively in terms of the framework and it is not that descriptive at all. I found that you go to a particular method and you find out where it is and then you just go and look up the source code for that class and you look at the comments in their and their all... their the same as what is in the javadoc is it- In some cases? [confirmed] At other points they were a bit more descriptive but the best thing to do was to look at it to see what it did just by looking at the code. Sort of reverse engineer it almost to work out what it did - sort of use it - play about with it until you got it to do what you wanted it to do. What other documentation...
- DK:** There was that wee UML diagram I don't know if you had looked at that?
- B:** No.
- DK:** Was there anything else?
- B:** I think the Java textbook which I've had since first year...
- DK:** What about tools? Did you use any tools?
- B:** I never bothered with the sort of project manager type tool that Murray gave us. I've heard various reports back on that I was quite content just to have numbered folders with...[details omitted] Each one was a incremental change over the previous one. And as best as I could I tried to have a readme file in

each folder say what problem this one had solved and what problems it had and then the next one identified the problems found and the problems solved for each one.

DK:

Any tools particularly towards identifying functionality and so on in the framework? Things like say rational rose or together J can generate a lot of material but you didn't use any of these? [shakes head]. Okay.

Subject C:

DK:

What kind of documentation or tools did you find to be effective or not effective maybe do effective first while you were using the framework? What sort of documentation and tools did you think were good?

C:

The JavaDoc was good. It could have been – if there was a wee bit more it could have been better but just using the JavaDoc and just having something like J builder open most classes open at once at just sitting flicking through them all.

DK:

What sort of frustrations do you think you had with JavaDoc? What sort of limitations if any does did it...

C:

It doesn't show you proper examples about any operation it tells you this is used for this and it returns this. I was thinking I want to see it actually working I want to see what its actually in use sort of thing. I suppose there is only so much it can do, it being embedded in the code.

DK:

Any tools did you use any tools?

C:

Trying to think... [no].

DK:

Any documentation that you thought was totally useless? Or relatively speaking useless not totally. There was other things like design patterns, UML diagram there was that paper thing that I wrote I don't know what else background papers about HotDraw the source code itself...

C:

Your paper was good, it was good for the general aspects of it and the UML diagram would be hard to draw the class diagram because you have so many classes so you are trying to keep it at a high level but because you keep a high level it some times doesn't really tell you much of what is going on so it is kind of a catch 22.

Subject D:

DK:

What kind of documentation or tools did you find to be effective or not effective when you went through your project?

D:

Well JavaDoc I don't think has enough detail. [] So that is a bit of a problem.

DK:

Do you think it's a bit inconsistent as well with its detail? You know sometimes you see a method and it can be quite well documented other times it seems...?

D:

I don't think they are well documented at all.

DK:

What about tools? Did you use any tools?

D:

No.

DK:

Any documentation that you thought was good? You had that, you have the design pattern literature, you had UML diagram...

D:

I'd say that the paper you wrote I thought that was em really helpful if we had that at the start it would have been a good help.

Question 18:

Subject A:

N/A

Subject B:

DK:

What documentation or tools do you feel would be useful in developing an understanding of the static structure and the dynamic structure? Two separate questions. The static being just if you like the inheritance hierarchies and things of that nature and the dynamic being things calling other things.

B:

I think in terms of the JavaDoc you can get a class hierarchy listing from that so that shows you what inherits from what and you can follow the inheritance hierarchy through that's pretty much alright just to see where every thing sort of fits together. In terms of how it works, how various methods use other classes use other methods or whatever... [subject forgets question. Question is restated] ... In terms of dynamic all I used was just the examples and just reading the source code so I don't think there was any specific tools in there.

Subject C:

DK:

Specific types of documentation right. What documentation or tools do you think were useful in developing an understanding of the static structure and the dynamic structure of the framework? Static being the sort of inheritance hierarchy and all that. Dynamic being who is calling what and creating what and why... would you say their was any documentation that stood out as being a good way to do that or do one or the other.

C:

I don't think so. I don't think there was anything really.

DK:

What about javaDoc in terms of the inheritance do you think you got an impression from that of the inheritance hierarchy?

C:

Yes. I suppose it does help you a bit because it does give you, a list of methods and a brief line that tells you what it extends and what it implements but only sometimes it will give you. I don't know if you have got this specified in the JavaDoc but like interfaces and like abstract classes and directly known subclasses like sometimes it says that it uses all these classes but it doesn't say that all the time. That's an abstract is there any examples of a concrete one and it doesn't tell you but there is. So you are just kind of hunting through it.

Subject D:

DK:

Similar sort of question but a bit more specific what documentation or tools do you feel were useful in developing an understanding of the static and the dynamic structure of the framework. Static being the inheritance hierarchy and things of that nature dynamic being the sequence of calls and creation.

D:

I'd say the practical work is probably the biggest help.

DK:
For both or for...

D:
I'd say for both.

Question 19:

Subject A:

DK:
Are there any areas that you think the documentation failed to cover?

A:
I think just there was no [unintelligible] it wasn't detailed enough. Low detailed particularly a thing of that size and certainly if you were new to frameworks, as we were, low detail just in the method descriptions or class descriptions.

DK:
Do you think there is any role for a larger, a more... overview of it?

A:
I think there is because you come up to the framework, you know roughly what the framework is for but you have got all these classes. You are given the top level class diagram and even then it takes time to figure out what is going on. A better... a decent overview of how it all goes together would be far better particularly for the beginner.

Subject B:

DK:
Were there any areas that you feel that the documentation failed to cover?

B:
Yeah. How it worked! Is that too vague... well in terms of how various methods behaved and what, just basically what they did.

DK:
Why each method was there? The purpose of each method?

B:
Yeah. What was it there for why was it necessary why did you need it I suppose that the standard two line comment prior to the method is enough to say this is what it does but it didn't sort of say why – how it did it or why it had to do that. In some cases knowing what a method did wasn't enough you had to know how it did it so you could – you needed that extra bit more detail.

Subject C:

DK:
Are there any areas that you think the documentation failed to cover? It just didn't address?

C:
I don't think so. I think yours was... I tell a lie, I tell a lie I was going to say yours was the only thing that talked about animation but there probably is something in java doc but I can't remember...

DK:
There is. There is only one reference in the JavaDoc and that's to the interface Animatable.

C:
So you have to implement these methods but it doesn't say how you are to go about it.

DK:
Yeah its very vague... the only insight I got from that is from the example the one you spoke about the big the paint one actually has animation and just by looking at the code for that's where my insights came from.

C:

Before I seen your paper the motion and the animation and how you go about it apart from looking at [the web?] I thought maybe I will just wait for Doug's paper to come out maybe he will have something interesting in it – something I can use.

DK:

I think that was one of the key benefits of that paper in terms of the time that it came out it was a wee bit late.

Subject D:

DK:

Were there any areas that you though the documentation had failed to cover? That you particularly wanted.

D:

Not sure no.

Question 20:

Subject A:

DK:

If you had to advise next years students – the folk that are going to follow on and be doing the same thing. If you had to advise them on the best approach to learning the framework, you know, given your experience what would you tell them to do?

A:

Doing the project or software architecture?

DK:

Just say software architecture.

A:

Basically follow through any examples you are given. Use the examples as a basis. Look at the source code because the documentation is probably not good enough and understand how. Start with perhaps one part, perhaps the figures, and then understand that and then perhaps work back up slightly, bring in maybe handles or tools, how they relate to figures and start just building your way out until you come to basically you have learnt the framework. But don't try and learn each individual part individually because the way it is designed the are all very separate and they are designed to be that way so basically learn one... learn how one or two relate to each other.

Subject B:

DK:

Okay the next two questions are a wee bit hypothetical questions you can just go wild on them or not. If you had to advise next years students on the best approach to learning the framework - next year doing architecture - right what would you tell them what advice would you give next years students? How to approach learning this framework?

B:

Drop the class straight away. Start off by, well the examples from the class in conjunction to the document you gave us because the document follows through the progression of the examples quite well so the first example was just drawing the application that all that is there. That was pretty much the first thing. They basically go hand in hand I don't know if that was the intention. It was certainly every thing you need for the examples is in that document you shouldn't really need to go anywhere else I don't think from what I can remember.

DK:

And do you think that that covers all the important parts of the framework or...misses anything?

B:

Most of the major parts the other the framework examples that are there like Pert example that pretty much covers everything that is there. The only thing that it doesn't cover is how to best use composite figures it as I say it could just be something to do with the code or the way I've written it I'm not sure but their does seem to be fundamental differences in how a figure behaves and how a composite figure behaves you can't change the colours or the fill colours of a composite figure in the same way that you

can as a standard rectangle figure or whatever. Yeah, Read the document and look at the source code for the examples and see how and just try and read it from there.

Subject C:

DK:

Okay a couple of hypothetical questions just to end here. So you can just say whatever you think. If you had to advise next years students on the best approach to take to learning the framework what would you tell them to do? That's just the students for the software architecture class.

C:

It would be just to go through maybe read up on patterns before you approach it but through the class practicals as well as you can and experiment just with maybe with the applications that are already there and just maybe experiment with it just take bits out and put stuff in and see what it does and increase you understanding.

Subject D:

DK:

Just the last couple of questions now, these are hypothetical questions so its just off the top of your head sort of thing. If you were to advise next year's students on the best approach to learning this framework – just in the architecture class – okay. What would you tell them, how would you tell them to go about learning this framework?

D:

I'd say as early on as possible try and develop a few applications yourself - get a few ideas and see if you can develop from them. And just pick apart the code and start reading through it and see what is actually happening.

DK:

Do you think that they should focus on certain key topic inside that or.

D:

Probably look at the key classes, especially at the start.

Question 21:

Subject A:

N/A

Subject B:

DK:

Same sort of question but a different perspective if you were set the task of making the framework more accessible and more easy to use what you do? How would you solve that problem?

B:

Take the stance that the person using it doesn't know anything about frameworks or design patterns or anything like what we did when we first took the class. So your documentation is going to be an idiots guide almost [make no assumptions] So that basically you document everything in terms of this is what it does this is how it does it this is why it does it or arguments perhaps as to why you would do it this way as opposed to an other way. Possibly even an alternative approach to it, like suggest in the documentation what the alternative approach might be. From what I have seen in HotDraw itself there is more than one way to do various different things. In some cases there is a multitude of different ways to do the same thing.

DK:

But at those point it should say you know you show also consider these other alternatives and stuff?

B:

Maybe sort of look at method X in class Y as opposed to a full description at that point when you go to that method the documentation for that method or that class would sort of reference back to that method as well as any other one. That way a newcomer has got the freedom to go about and say well I understand so I'm just going to use it or I understand that I'll see what the other one looks like oh don't know that forget it! Or oh that one I think is a bit better and they have got the freedom to choose that way themselves. It would make it more easy to navigate the framework itself and see... I think it would probably make it easier to go through the framework and get your head around the framework its self because there is a hell of a lot of classes in there certainly more than we have ever be [ut - encountered] with before.

Subject C:

DK:

Similar sort of question from a different perspective. If you were set the task of making a framework more accessible and more easy to use how would you do that how would you structure it? How would you solve that problem? Making it easier to use?

C:

You would probably have to. You would maybe have like for your paper that tells you the basic like kind of important bits then on top of that a kind of in-depth thing of what. [It is quite shallow that paper] It tells you things you need to know. [You don't want to overload at the start but something that is more thorough] Yeah if you have maybe both sort of thing that really says you do this with this because this and both the high level and the kind of in depth one. I don't know if you can do much with the javadoc maybe if there was extra documentation that wasn't in Java like a paper or web pages or something but because it is in the code it stretches everything out you just see miles and miles of code and think oh no – even thought three quarters of it might just be comments.

Subject D:

DK:

Similar question but from a different perspective. If you were set the task of making the framework more accessible and easier to use how would you address that, what would you do to make it easier for other people to use?

D:

I'd probably have a lot more documentation involved.

DK:

What kind, just JavaDoc or more through or...

D:

Probably JavaDoc but more through... more description [that is all real?].

Question 22:

Subject A:

DK:

Do you think that there is anything that you have not been asked about or anything that you feel is important or that you feel strongly about that you would like to comment on about Hotdraw?

A:

No.

DK:

Okay. Right. Thank you very much for your time.

Subject B:

DK:

Okay last question has there being anything that you have not been asked about that you feel is important, any burning issues, anything you want to get of your chest anything you want to say about how you used the framework?

B:

Err nothing that sticks out.

DK:

That fine. Right thank you very much that concludes the interview.

Subject C:

DK:

Okay last question then. Has there been anything that you have been expecting that you have not been asked about or that you feel is important that you feel you would like to address in terms of using frameworks problems with frameworks any thing that I have missed out that you would like to comment on?

C:

Not that I can think of.

DK:

Okay. That's fine that concludes the interview thank you again for your time.

Subject D:

DK:

Final question then. Has there been anything that you have not been asked about in this interview that you feel is important, or that you want to describe or talk about from your experiences of HotDraw that we haven't addressed?

D:

Probably... I don't know if this is the framework or this is a Java problem but I would say that it uses a lot of processing power up. It really slows down, the applications are really slow.

DK:

You are having performance problems?

D:

Yeah.

DK:

Do you think that that - It could be a Java problem that's true the other thing it could be like you said maybe there is a slight you were slightly stretching the envelope of what HotDraw could do. Do you think it is partly that as well?

D:

It could be.

DK:

Or how would you think perhaps that there may be a way in HotDraw that was more efficient and you just haven't found it?

D:

Possibly.

DK:

These are just could be, could be its not particularly very useful but... Okay well that concludes the interview right. Thank you very much for your time.

2.3. Postings from the Software architecture newsgroups

Subject: Border on drag
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

How would you draw the border on selection and remove it on deselection.
 I can sub class selection tool, and draw the border round an ellipse,
 but how to combine the two?

Subject: Re: Border on drag
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Its a bit early in the week to give away too much but try these hints.

- 1) Try and investigate the sequence of interactions behind a selection action. (i.e. when you select a figure what happens).
- 2) Consider the role of Drawing View in the above interaction.

Subject: Re: Border on drag
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
 > How would you draw the border on selection and remove it on deselection.
 > I can sub class selection tool, and draw the border round an ellipse,
 > but how to combine the two?
 >

Presumably it will involve the "Observer" pattern in someway - i.e. when the figure is deselected it should send a "changed" message to its observers (I would assume that the drawing, or drawingview would be good candidates for observers) - however I'm not quite sure how all of that fits together at the moment.

Subject: 'Inversion of control'?
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

'Inversion of control' is mentioned in all of the three frameworks papers recently distributed at the lectures, could you explain what this is?

Cheers,

Subject: Re: 'Inversion of control'?
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Inversion of control is where the framework takes responsibility for handling the main event loop of the application. In effect it calls your code rather than you calling it. Control is said to be inverted because the traditional sense of code reuse relies on the programmer explicitly calling methods in a class library (or similar) here the 'library' is calling you.

Consider last weeks HotDraw practical, the sample solution redefined the createDrawing() method in DrawApplication. However the user does not ever have to call this method the framework does it for you. Inversion of control.

Subject: Re: 'Inversion of control'?
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

This usually happens with the Template method, which is the circumstance that XXXX has just described. a.k.a. "The Hollywood Principle" (Don't call us, we'll call you).

Subject: A Figures' Attributes
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

I might be barking up the wrong tree here, but I have been looking through the methods within the "AttributeFigure" class in order to find out what types of attributes a Figure has. The documentation says that each type of AttributeFigure has at least two, namely FillColor & FrameColor, which you can access and change via the getAttribute() & SetAttribute() methods. Now the getAttribute method requires an Attribute's name, in order to manipulate it. However there doesn't appear to be a general Attributes type method for simply returning say, an enumeration of attributes or their names. Is there anyway of finding out what attributes a given figure has without having to resort to random tests?

The reason I'm following this particular line of enquiry is that I thought that there may be a "Resizable" attribute, which you could then simply remove or disable.

Subject: Re: A Figures' Attributes
 Newsgroups: strath.cs.ugrad.sw-architecture

If you remove the handles, you also remove the ability to re-size a figure.

This probably isn't what we are meant to do, but it works ;)

Subject: Re: A Figures' Attributes
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:
 >
 >
 > If you remove the handles, you also remove the ability to re-size a figure.
 >
 > This probably isn't what we are meant to do, but it works ;)
 >

Yeh I was thinking that. That was going to be my next question... There is a NullHandle class I notice, which presumably you could replace the current Handles with. So how do you remove and replace them? In fact, where are a given objects handles instantiated in the first place?

Subject: Re: A Figures' Attributes
 Newsgroups: strath.cs.ugrad.sw-architecture

The easiest way I found of removing the handles was to overwrite the handles() method so that it just returned an empty vector.

Subject: Re: A Figures' Attributes
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

I chose to inherit from the NullHandle class and override the draw method. A single instance of this new Handle class is contained in the Vector returned by the handles method of new class inheriting from EllipseFigure.

This doesn't really match xxxx tip, as the Template Method pattern is used for both parts of the practical. So what am I missing here?

Subject: Re: A Figures' Attributes
 Organization: University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:
 > I chose to inherit from the NullHandle class and override the draw

> method. A single instance of this new Handle class is contained in the
 > Vector returned by the handles method of new class inheriting from
 > EllipseFigure.
 >
 > This doesn't really match xxxx tip, as the Template Method pattern is
 > used for both parts of the practical. So what am I missing here?

xxxx tip relates to decorating the figure with a border.

The Decorator pattern is one approach to decorating Figures.

Usual problem arises of where to do this. We only want put a border on the figure when it is on the screen (in the user interface - the View) rather than change it permanently in the Model.

Subject: Hint for Practical 5

Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

A few people have had problems with practical 5.

A vague hint is that part of the practical can be implemented via one of the design patterns that you have already looked at. Hopefully if you try to match the problem to the patterns there is only one obvious candidate that will suggest itself.

Subject: NullHandle????

Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

has anyone noticed the NullHandle class? it provides a handle that doesn't change the figure. If we override the handle class, so that nothing is implemented, and use the implementation provided by null handle - would this work for one part of practical5?

Subject: Re: NullHandle????

Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
 > has anyone noticed the NullHandle class? it provides a handle that
 > doesn't change the figure. If we override the handle class, so that
 > nothing is implemented, and use the implementation provided by null
 > handle - would this work for one part of practical5?

It would certainly work, however you need not actually override the handle class itself, as the nullhandle class exists already. Why not look for where the handle class is actually used and try override that instead?

Subject: Re: NullHandle????

Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

.....i've found the BoxHandleKit....and i'm still looking.....

Subject: Functionality of Boxhandlekit class.

Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

This is sort of indirectly associated with the current practical. I have pretty much worked out how the practical may be solved, although it may not be the most elegant solution possible. But one thing that interests me about the way handles work is the status of the "BoxHandleKit" class. It doesn't appear to have a constructor, therefore I would assume it can't be instantiated, however it is used by the various concrete figure classes to create a default set of handles, using the line of code below:

.
 .

```
.
BoxHandleKit.addHandles(this, handles);
.
.
```

I would imagine this may be an example of the "factory" pattern, which isn't exactly an object itself, but which facilitates the creation of other objects (namely the various handles). I was just wondering how you can you make references to a class which doesn't appear to have been instantiated?

Subject: Re: Functionality of Boxhandlekit class.
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

```
>
> This is sort of indirectly associated with the current practical. I have
> pretty much worked out how the practical may be solved, although it may
> not be the most elegant solution possible. But one thing that interests
> me about the way handles work is the status of the "BoxHandleKit" class.
> It doesn't appear to have a constructor
```

Remember it has the default constructor given to it by the inheritance from Object. Maybe it doesn't require anything else? (Note: I haven't looked at it, so don't know! Its just a thought...)

Subject: Re: Functionality of Boxhandlekit class.
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

This type of class is referred to by Booch as a 'utility' class (if I remember correctly). The class is a collection of associated methods and provides a convient alternative to global functions.

Note the BoxHandleKit has no state. All you can do with this class is call it methods, and the methods can only work with objects that are passed as parameters (as the class has no state itself). As this is the case, all the methods can be made static. Therefore, any call on this class has the form UtilityClass.staticMethod(), so you never need to instatate the class, it justs waste cycles creating an object.

Another example could be a Sorter utility class -

```
class Sorter {
    static void quickSort(List l);
    static void shellSort(List l);
    static...
}

//...
List sortedList = Sorter.quickSort(aPreviouslyUnsortedList);
```

Subject: Practical 6
 Newsgroups: strath.cs.ugrad.sw-architecture

Having done Practical 6 I'm interested in one point, that the practical is titled "Creating Tools and Handles".

I created a tool (although I have a feeling it may not be the one that was in mind when the practical was set, based on where emphasis has been in the lectures ;), but haven't used handles at all, other than overriding the handles() method to get rid of the resize functionality.

I'm just interested in where it was orginally envisioned that they might be used. I'd imagine it /might/ be something to do with another way of setting the ellipse to a fixed size?

Also - a possible tip for anyone else doing the practical and thinking about how to represent planet mass easily. Since this tends to be an awfully big number when represented in kg, I set it so that the mass attribute was in terms of 1 Earth Mass (i.e. a mass of 5 = 5 x Earth's Mass). This gives you numbers which are much smaller and easier to display.

Subject: Re: Practical 6
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
 > Having done Practical 6 I'm interested in one point, that the practical is
 > titled "Creating Tools and Handles".
 >...
 > I'm just interested in where it was originally envisioned that they might be
 > used. I'd imagine it /might/ be something to do with another way of setting
 > the ellipse to a fixed size?
 >

Practical 6 states:

Finally it is required that the mass of the planets can be altered easily from within the application, so some means of direct manipulation of a figure's mass is required.

Subject: Re: Practical 6
 Newsgroups: strath.cs.ugrad.sw-architecture

: so some means of direct manipulation of a figure's mass is required.

Right, I'd taken direct manipulation in another way.

The way I've implemented the manipulation of a figure's mass is by creating a concrete ActionTool - you choose the tool, then click on the planet to change its mass.

I presume you are looking at some sort of handle that perhaps be dragged (like a slider) to adjust the planet's mass (whilst leaving the ellipse at a fixed size)? I'll have a look at this later on tonight.

Subject: Hints for Practical 6
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

It's very quiet on the news group this week, if people are having problems remember this is the best place to discuss issues, we can spend far more time on your problem here, others can contribute and in general a better quality answer **should** be produced than if you approach us during the practical (not that you shouldn't be doing that - do both!). As an aside if you are not having problems then you can still contribute to the group - why not raise issues about parts of Hot Draw for discussion or clarification doing so may help you in a future practical or even the exam.

Anyway, I'm assuming the lack of enthusiasm indicates that some of you are a bit stuck - here are some hints to get you started.

Think about the example XXXX gave about the prototype pattern in the lectures. Although that specific case is not useful is there anything similar which might help?

Also remember that for the direct manipulation of the figures mass we wish to see handles being used to control the interaction (The exact semantics of how a handle edits the figures mass can be defined in anyway you see fit). To understand how handles work you may need to trace the sequence of interactions from the user clicking the mouse in the DrawingView through to the appropriate message being sent to the Handle.

Finally its probably a good idea to browse the example programs for examples of figure creation and handle use.

Subject: Re: Hints for Practical 6
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

With respect to our project meeting last week, I was under the impression

that
we were required to use a text box of some description in order to
manipulate
the mass of the planets - as seen in the Pert Chart example.

Have I completely missed the point here or is this just another way of
doing what you wanted?

Subject: Re: Hints for Practical 6
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

The ellipse needs some way to define its initial mass, this can be done
via a text box or it can simply be inserted directly into the code.
Either way it happens during object creation after that all further
changes to mass should be made via the appropriate handles.

Subject: Pract 6
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Has the size to change when the mass changes ???

Are you looking for a tool to edit the mass or to edit in a text box.

Subject: Re: Pract 6
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
> Has the size to change when the mass changes ???

The exact behaviour of how a handle edits the figures mass can be
defined in
anyway you see fit. However I would point out the relationship you imply
between mass and size is a bit dubious. Would a foam sphere have the
same mass as an iron one (assuming the same size)?

>
> Are you looking for a tool to edit the mass or to edit in a text box.

neither, use a handle.

Subject: Pract 6 - Fixed Ellipse
Newsgroups: strath.cs.ugrad.sw-architecture

OK, I have managed to get a fixed ellipse working but I am sure that I
am doing it in a really bad way.

At the moment I have copied the entire EllipseFigure class, renamed it,
and modified one of the methods. I have tried to use inheritance but
since fDisplayBox is private, some of the methods won't inherit.

Can somebody hint me towards a different approach?

Cheers,

Subject: Re: Pract 6 - Fixed Ellipse
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

um..... dunno if this is right but we just removed the handles
like in the last practical, then made a new class for creating the shape
(inheriting from creationTool), and then overrode the mouse functions so
it created a clone of the shape when you clicked.

Subject: Re: Pract 6 - Fixed Ellipse
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>

> um..... dunno if this is right but we just removed the handles
 > like in the last practical, then made a new class for creating the shape
 > (inheriting from creationTool), and then overrode the mouse functions so
 > it created a clone of the shape when you clicked.
 >

Close, but not quite right!

First the figure should make use of new handles to edit the figures mass
 therefore the handles method should be returning them.

Secondly using Creation Tool is fine but you don't have to subclass it.
 If you pass the figure you want to create as an argument to Creation
 Tools constructor it will create that shape for you!

Subject: Re: Pract 6 - Fixed Ellipse
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

> Close, but not quite right!
 >
 > First the figure should make use of new handles to edit the figures mass
 > therefore the handles method should be returning them.

er... yeah still trying to do that. Have managed to use a handle to
 change the mass (by dragging the mouse while clicking it) but cannae
 display it anywhere apart from the dos window.

Subject: Re: Pract 6 - Fixed Ellipse
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

do you not have to subclass creation tool so that the size of the figure
 is constrained and that you only need to click the mouse to add a figure

Subject: Re: Pract 6 - Fixed Ellipse
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
 > do you not have to subclass creation tool so that the size of the figure
 > is constrained and that you only need to click the mouse to add a figure

No, the figure should be constrained by overriding the basicDisplayBox
 method. This should allow a mouse click to add a figure.

Subject: Re: Pract 6 - Fixed Ellipse
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

> At the moment I have copied the entire EllipseFigure class, renamed it,
 > and modified one of the methods. I have tried to use inheritance but
 > since fDisplayBox is private, some of the methods won't inherit.
 >

I'm not sure I follow what is going on here! Why are you copying
 EllipseFigure instead of subclassing?

To change the displayBox of a figure you should override
 basicDisplayBox() in the subclass of EllipseFigure.

Subject: Prac7 - Planets movement
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

At the moment I have a planet and all its moons moving as described in
 the practical but I am having a problem if you select more than planet
 (ie. a planet and it's moon). The planet will move as required but the
 moon will move twice the distance moved.

Is there a way to fix this problem from within the Figure class ?

Or a method to tell if an object is selected within the Figure class?

Subject: Re: Prac7 - Planets movement

Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
> At the moment I have a planet and all its moons moving as described in
> the practical but I am having a problem if you select more than planet
> (ie. a planet and it's moon). The planet will move as required but the
> moon will move twice the distance moved.
>
> Is there a way to fix this problem from within the Figure class ?
>

No. Or at least I don't think so, a lot depends on what you've implemented but the figure is only a part of this constraint and I think it more likely that something else is sending too many or the wrong kind of messages to the 'moon'.

> Or a method to tell if an object is selected within the Figure class?

Again no. HotDraw follows the MVC paradigm. This separates the applications into three parts model, view and controller. In HotDraw terms the figure is part of the model while selection behaviour and selection events are part of the view and controller respectively. Therefore figures wont directly know that they are selected, the Drawing view holds this information.

Subject: Re: Prac7 - Planets movement

Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

> At the moment I have a planet and all its moons moving as described in
> the practical but I am having a problem if you select more than planet
> (ie. a planet and it's moon). The planet will move as required but the
> moon will move twice the distance moved.
>
> Is there a way to fix this problem from within the Figure class ?
>
> Or a method to tell if an object is selected within the Figure class?
>
>

Could you maybe check if the other end has changed before moving it (inside the connection). You know by using the changed() method.

Subject: Re: Prac7 - Planets movement

Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

> wrote:
>
>> At the moment I have a planet and all its moons moving as described in
>> the practical but I am having a problem if you select more than planet
>> (ie. a planet and it's moon). The planet will move as required but the
>> moon will move twice the distance moved.
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>> Is there a way to fix this problem from within the Figure class ?
>>
>> Or a method to tell if an object is selected within the Figure class?
>>
>>
>
> Could you maybe check if the other end has changed before moving it
> (inside the connection). You know by using the changed() method.

>
>
>
>

Sorry that method won't do it you would have to check somehow if the other figure has changed aswell but atm I'm not sure how to do this.

Subject: Prac7 - Connection on a figure
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Hiya

Anyone any idea how to find out what connections a figure has?

Thank you

Subject: Re: Prac7 - Connection on a figure
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
> Anyone any idea how to find out what connections a figure has?
>

I don't know if you can determine a figures connections. Connections obviously use the Observer pattern to connect to figures. In effect this makes the connections anonymous to the figure, all it sees is the collection of FigureChangeListeners.

However if you're doing what I think you are doing then how about turning the question round? Can I find out what figures a connection has? If so, can I determine when those figures change? See if that helps!

Subject: Re: Prac7 - Connection on a figure
Newsgroups: strath.cs.ugrad.sw-architecture

That helps a lot I think I understand it now.

Thank you

wrote:

> wrote:
>>
>> Anyone any idea how to find out what connections a figure has?
>>
>
>
>
> I don't know if you can determine a figures connections. Connections
> obviously use the Observer pattern to connect to figures. In effect this
> makes the connections anonymous to the figure, all it sees is the
> collection of FigureChangeListeners.
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> However if you're doing what I think you are doing then how about
> turning the question round? Can I find out what figures a connection
> has? If so, can I determine when those figures change? See if that
> helps!
>
>

Subject: Prac 6 - Handles
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

I managed to get the composite figure up ok (mass is a little off centre though)
and i managed to get the handles in place that i wanted, but how do i define what the handles will actually do

ie I want one handle to increase the mass and the other to decrease it.

If this is totally obvious could someone please slap me silly

Do I simply extend the AbstractHandle.class?
How do I associate the handles with the mass value??

Subject: Re: Prac 6 - Handles
Organization: University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

> I managed to get the composite figure up ok (mass is a little off centre
> though)
> and i managed to get the handles in place that i wanted, but how do i
> define what the handles will actually do
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> ie I want one handle to increase the mass and the other to decrease it.
>
> If this is totally obvious could someone please slap me silly
>
> Do I simply extend the AbstractHandle.class?
> How do I associate the handles with the mass value??

See the solution which is on the Web now

Subject: Practical 6 Solution
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Was there any particular reason MassEllipseFigure inherited from
EllipseFigure, rather than CompositeFigure which I suspect a large
number of people done (correct me if im wrong though).

Subject: Re: Practical 6 Solution
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
> Was there any particular reason MassEllipseFigure inherited from
> EllipseFigure, rather than CompositeFigure which I suspect a large
> number of people done (correct me if im wrong though).
>

No, there is no particular reason other than not seeing it as a
possibility. I suspect that composite figure would actually make a better
solution - goes back to the idea of 'favouring composition over
inheritance'.

Subject: Re: Practical 6 Solution
Organization: University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

> Was there any particular reason MassEllipseFigure inherited from
> EllipseFigure, rather than CompositeFigure which I suspect a large
> number of people done (correct me if im wrong though).
>
>

Do you have a solution based on CompositeFigure that you could post to
the newsgroup? (CompositeFigure is an example of the Composite design
pattern - it would be very interesting if someone actually used this
pattern to solve Practical 6.)

One reason for inheriting from EllipseFigure is because
MassEllipseFigure is an EllipseFigure.

Subject: Re: Practical 6 Solution
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Name: PlanetFigure.java
PlanetFigure.java Type: Java File (Forte for Java)
(application/x-unknown-content-type-javafile)
Encoding: base64

Subject: Re: Practical 6 Solution
Organization: University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

> public class PlanetFigure extends CompositeFigure { ...

As far as I can tell xxxxx and xxxx and others have subclassed CompositeFigure because
PertFigure did. Following the samples is a sensible approach, especially when there is
little else to go by.

On the other hand the EllipseFigure already exists and it subclasses AttributeFigure, so
we have a choice of two classes to subclass (and there are more choices).

CompositeFigure follows the Composite design pattern, which we have not studied. This
pattern is used for building whole-part hierarchies, a structure where you are combining
collections of elements and individual elements e.g. a tree structure, but it is much
more general than that. It then allows the client to treat the structure as a single
Figure.

You could combine the TextFigure and the EllipseFigure as a very simple Composite - but I
don't think that is what any of you have done - please correct me if I am wrong. The test
is whether you are making use of the methods defined in the CompositeFigure interface -
add, remove, ...

An interesting question is whether PertFigure should really subclass Composite ... ?

Subject: Re: Practical 6 Solution
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

>You could combine the TextFigure and the EllipseFigure as a very simple Composite - but I
>don't think that is what any of you have done - please correct me if I am wrong. The test
>is whether you are making use of the methods defined in the CompositeFigure interface -
>add, remove, ...

I do use add, as does the pert sample figure.

Subject: Re: Practical 6 Solution
Organization: University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>>You could combine the TextFigure and the EllipseFigure as a very simple
> Composite - but I
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> wrong. The test
>>is whether you are making use of the methods defined in the
> CompositeFigure interface -
>>add, remove, ...
>
> I do use add, as does the pert sample figure.

Yep, apologies - I see that now:

```
private void initialise(){
```

```
fDisplayBox = new Rectangle(0, 0, 0, 0);

mass.setValue(10);
add(mass);

MyEllipseFigure planet = new MyEllipseFigure(new Point(fDisplayBox.x,
fDisplayBox.y),new Point(fDisplayBox.x+20, fDisplayBox.y+20));
add(planet);
}
```

This brings us back to the question of the relative merits of subclassing CompositeFigure v. AttributeFigure. Or whether you can simply use composition with CompositeFigure rather than inheritance ...

Hopefully, we'll look at this further later on.

Thanks,

Subject: Re: Practical 6 Solution
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

I had a composite figure aswell but was having a few problems with it.

do u have any issues with "copy & paste"-ing and how did u position the text box in the centre of the ellipse.

cheer for any help

Subject: Prac7
Newsgroups: strath.cs.ugrad.sw-architecture

Hi

I now have it moving all of its orbiters but I was just wondering if we should have it select (border) its orbiters aswell?

Thank You

Subject: Re: Prac7
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:
>
>
> I now have it moving all of its orbiters but I was just wondering if we
> should have it select (border) its orbiters aswell?
>

I assume you mean draw a single border around the entire selection? I don't think that would be a good idea because you want the selection to indicate only the object you are operating on.

Subject: Prac7 - What about...
Newsgroups: strath.cs.ugrad.sw-architecture

When you have 3 planets in a triangle effect.

I placed 3 planets with a connection from the first to the second, the second to the third and the third to the first then I tried to move any one of the planets and the program threw an exception.

I'm not quite sure why this occurs can anyone shed any light?

Thank you

Subject: Re: Prac7 - What about...
Organization: Department of Computer Science, University of Strathclyde

Newsgroups: strath.cs.ugrad.sw-architecture

You should check to see if you have an infinite loop?

You should prevent a circle being formed as it is impossible.

Subject: Re: Prac7 - What about...

Organization: Department of Computer Science, University of Strathclyde

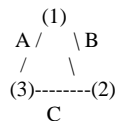
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
 > When you have 3 planets in a triangle effect.
 >
 > I placed 3 planets with a connection from the first to the second, the
 > second to the third and the third to the first then I tried to move any
 > one of the planets and the program threw an exception.
 >
 > I'm not quite sure why this occurs can anyone shed any light?
 >

Yeah, well, um.... I know why it happens but I haven't figured out how to fix it yet!

If anybody out there does come up with a correct answer then please post it here!



Excuse the diagram, but it will help in the following explanation.

Imagine a set of connections like the above where (1) orbits (2). (2) orbits (3) and (3) orbits (1). If the user tries to move 2 then the constraint to move all its orbiters kicks in and moves 1. 1 has been moved so it invokes the same constraint on its orbiters which moves 3 and in turn this moves 2 again

This is obviously an endless loop and eventually java's call stack overflows and execution halts.

Conceptually this kind of orbit behaviour should be possible (just imagine the triangle rotating) but can it be achieved with the constraints we have imposed on a planets movement?

Its an open question any ideas or solutions welcome!

Subject: Re: Prac7 - What about...

Organization: Department of Computer Science, University of Strathclyde

Newsgroups: strath.cs.ugrad.sw-architecture

The pert sample application detects circular references.

You could just make the three orbit another planet, of some mass but no size.

Subject: Re: Prac7 - What about...

Organization: Department of Computer Science, University of Strathclyde

Newsgroups: strath.cs.ugrad.sw-architecture

Hi

I'm not exactly sure how but I have managed to get it to move all three together without overflowing the stack.

Subject: Re: Prac7 - What about...

Organization: Department of Computer Science, University of Strathclyde

Newsgroups: strath.cs.ugrad.sw-architecture

Actually I just worked out why.

I have it testing to see if the orbiter is also selected and when it is it doesn't try to move it.

Therefore connection Planet A is selected and moved, this causes Planet B to move which causes Planet C to move which should cause Planet A to move but because planet A is selected it doesn't move it hence the loop stops because planet A only moves once.

Subject: Mass attribute.

Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Another pedantic one from me. I notice in the sample solution that xxxx creates a mass instance variable, which he directly manipulates in the code e.g. `textFig.setText((new Double(mass)).toString());`

Might it not be a more elegant solution to create mass as an attribute ala `AttributeFigure`, given that other attributes like colour & font (in the case of `TextFigure`) are stored in this way?

Subject: Re: Mass attribute.

Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

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> xxxx creates a mass instance variable, which he directly manipulates
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>
> Might it not be a more elegant solution to create mass as an attribute
> ala `AttributeFigure`, given that other attributes like colour & font (in
> the case of `TextFigure`) are stored in this way?

yep.

Subject: Re: Mass attribute.

Organization: University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

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> xxxx creates a mass instance variable, which he directly manipulates
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>
> Might it not be a more elegant solution to create mass as an attribute
> ala `AttributeFigure`, given that other attributes like colour & font (in
> the case of `TextFigure`) are stored in this way?

Does anyone have a solution based on this approach?

Subject: Re: Mass attribute.

Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

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> wrote:
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>> ala `AttributeFigure`, given that other attributes like colour & font (in
>> the case of `TextFigure`) are stored in this way?
>
> Does anyone have a solution based on this approach?
>
>

Aye, although it sort of makes more work that you would if you do it
Xxxx's way.

The AttributeFigure method "setAttribute()" takes in a string & and
object as arguments, which means that you have to use the class
Double...

Basically the only real difference from xxxx's is this line:

```
.
.
textFig.setText(getAttribute(ELLIPSE_MASS).toString());
.
```

where ELLIPSE_MASS is a constant string "ellipse mass". Another
consequence of using this is that it makes altering the mass a little
trickier, in that you have to fool about with instantiating more Double
objects to override the value of ELLIPSE_MASS, rather than simply adding
& subtracting primitives.

Subject: Prac6
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Can anyone tell me why im getting a null pointer exception when i create
anew ellipse figure.

I did have this working earlier but dont understand this error message.

this is where it occurs:

```
private void initialize()
{
    MyEllipseFigure planet = new MyEllipseFigure(new
    Point(fDisplayBox.x,
    fDisplayBox.y),
                                new
    Point(fDisplayBox.x+40,
    fDisplayBox.y+40));
```

This is in my composite PlanetFigure class where i make a new ellipse
figure.

Subject: Should planets overlap?
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

I notice that you can make the planets overlap, by dragging the orbiter
over the orbited. Maybe it might be an idea to prevent this from
happening (given that it causes the "gravity" to go a bit crazy).

I was thinking that you could could disregard within the drawing view,
you could disregard mousedrag events, if the drag would bring orbiters'
displaybox area within that of the orbited...

Subject: Re: Should planets overlap?
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

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> over the orbited. Maybe it might be an idea to prevent this from
> happening (given that it causes the "gravity" to go a bit crazy).
>
> I was thinking that you could could disregard within the drawing view,
> you could disregard mousedrag events, if the drag would bring orbiters'
> displaybox area within that of the orbited...
```

Sounds like a good idea feel free to give it a go!

Subject: Observer contrivance.
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

I get the feeling that as the last practical was contrived to employ using handles (a menu option would have done), that Practical 7 is contrived to employ the Observer pattern.

I have solved the practical by extending the Planet interface thus:

```
public interface Planet {
    int getMass();
    void setMass(int mass);
    String getName();
    void setName(String name);
    void addPlanet(Planet planet);
    void removePlanet(Planet planet);
    boolean isOrbited();
    HashSet getOrbitingPlanets();
}
```

The handleConnect and handleDisconnect methods in a subclassed LineConnection call the addPlanet and removePlanet methods respectively. A subclassed DrawingView's addToSelection method checks if a planet isOrbited(), and if so, adds its orbiting planets (avoiding circular references, of course) to the selection. Then when an orbited planet is moved, so are all its orbiting planets.

Is this an acceptable solution, or should it be more 'Observer-centric'?

Subject: Re: Observer contrivance.

Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

```
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> LineConnection call the addPlanet and removePlanet methods respectively.
> A subclassed DrawingView's addToSelection method checks if a planet
> isOrbited(), and if so, adds its orbiting planets (avoiding circular
> references, of course) to the selection. Then when an orbited planet is
> moved, so are all its orbiting planets.
>
> Is this an acceptable solution, or should it be more 'Observer-centric'?
```

Yes I think this is a good solution and no the practical was not contrived to employ the Observer pattern! Instead it was 'contrived' to introduce Connections and related components.

Subject: Grrrr...

Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

I get the impression that it is IMPOSSIBLE to (cleanly) solve practical seven using only Listeners - and a FLIMSY T-SHIRT is no reward for a wasted afternoon!

Here's is my (ridiculous) solution -

Employing a regular hash set in the move event class works fine for planets that have many orbits & 'orbitees' as long as only one planet is

selected and moved. The deal with the several planets being selected and dragged together, I has to intrduce the HashSetSingleton, but then this raises the dilemma of where to call the HashSetSingleton.clear() method - it can't be done in DrawingView.clearSelection() or something like 'if selection().size() == 0 then h.clear()' as both these methods seem to be called when planets are dragged. One option would be to introduce a 'clear selection tool' but this is such an awful route, that I'm not even going to bother!

```
public class OrbitedPlanetMoveEvent extends FigureChangeEvent {

    private HashSetSingleton notifiedPlanets;

    public int x = 0;
    public int y = 0;

    public OrbitedPlanetMoveEvent(Figure source, int dx, int dy) {
        super(source);
        x = dx;
        y = dy;
        notifiedPlanets = HashSetSingleton.instance();
    }

    public OrbitedPlanetMoveEvent(Figure source,
                                   int dx,
                                   int dy,
                                   HashSetSingleton alreadyNotifiedPlanets)
    {
        super(source);
        x = dx;
        y = dy;
        notifiedPlanets = alreadyNotifiedPlanets;
    }

    public boolean alreadyResponded(Planet planet) {
        return notifiedPlanets.contains(planet);
    }

    public HashSetSingleton getRespondedPlanets() {
        return notifiedPlanets;
    }

    public void clearRespondedPlanets() {
        notifiedPlanets.clear();
    }
}

public class HashSetSingleton {

    private HashSet hashSet = new HashSet();
    private static HashSetSingleton hashSetSingleton = new
    HashSetSingleton();

    protected HashSetSingleton() {
    }

    public static HashSetSingleton instance() {
        return hashSetSingleton;
    }

    public void add(Object o) {
        hashSet.add(o);
    }

    public void clear() {
        hashSet.clear();
    }

    public boolean contains(Object o) {
        return hashSet.contains(o);
    }
}
```

```

public class PlanetFigure extends EllipseFigure implements Planet,
FigureChangeListener {

    private int mass = 0;
    private String name = "";
    private int gravitationalFieldCount = 0;

    private Point getCorner(Point origin) {
        return new Point(origin.x + 100, origin.y + 100);
    }

    public PlanetFigure() {
    }

    public PlanetFigure(Point origin, Point corner) {
        super(origin, corner);
    }

    public void basicDisplayBox(Point origin, Point corner) {
        super.basicDisplayBox(origin, getCorner(origin));
    }

    public String getName() {
        return name;
    }

    public void setName(String name) {
        this.name = name;
    }

    public int getMass() {
        return mass;
    }

    public void setMass(int mass) {
        if (mass >= 0)
            this.mass = mass;
    }

    public void incrementGravitationalFieldCount() {
        ++gravitationalFieldCount;
    }

    public void decrementGravitationalFieldCount() {
        --gravitationalFieldCount;
    }

    public boolean isOrbited() {
        return gravitationalFieldCount > 0;
    }

    public void draw(Graphics g) {
        super.draw(g);
        TextFigure massText = new TextFigure();
        TextFigure gravFieldsText = new TextFigure();
        massText.setText("Mass: " + mass);
        gravFieldsText.setText("Grav. Fields: " + gravitationalFieldCount);
        Rectangle massRect = massText.displayBox();
        massText.displayBox(new Rectangle((center().x - massRect.width/2),
            (center().y - massRect.height),
            massRect.width,
            massRect.height));
        Rectangle gravRect = gravFieldsText.displayBox();
        gravFieldsText.displayBox(new Rectangle((center().x -
            gravRect.width/2),
            (center().y),
            gravRect.width,
            gravRect.height));
        massText.draw(g);
        gravFieldsText.draw(g);
    }
}

```

```

public Vector handles() {
    Vector v = new Vector();
    v.add(new IncreaseMassHandle(this, RelativeLocator.northEast()));
    v.add(new DecreaseMassHandle(this, RelativeLocator.southEast()));
    return v;
}

public void moveBy(int dx, int dy) {
    willChange();
    basicMoveBy(dx, dy);
    if (isOrbited()) {
        HashSetSingleton h = HashSetSingleton.instance();
        h.add(this);
        changed(new OrbitedPlanetMoveEvent(this, dx, dy, h));
    }
    else {
        changed();
    }
}

private void moveBy(int dx, int dy, HashSetSingleton
alreadyRepsondedPlanets) {
    if (!alreadyRepsondedPlanets.contains(this)) {
        alreadyRepsondedPlanets.add(this);
        willChange();
        basicMoveBy(dx, dy);
        if (isOrbited()) {
            alreadyRepsondedPlanets.add(this);
            changed(new OrbitedPlanetMoveEvent(this, dx, dy,
alreadyRepsondedPlanets));
        }
        else {
            changed();
        }
    }
}

public void changed(OrbitedPlanetMoveEvent e) {
    invalidate();
    FigureChangeListener l = listener();
    if (l != null) {
        l.figureChanged(e);
    }
}

public void figureInvalidated(FigureChangeEvent parm1) {
    //TODO: Implement this CH.ifa.draw.framework.FigureChangeListener
method
}

public void figureChanged(FigureChangeEvent e) {
    if (e instanceof OrbitedPlanetMoveEvent) {
        OrbitedPlanetMoveEvent event = (OrbitedPlanetMoveEvent);
        if (!event.alreadyResponded(this)) {
            moveBy(event.x, event.y, event.getRespondedPlanets());
        }
    }
}

public void figureRemoved(FigureChangeEvent parm1) {
    //TODO: Implement this CH.ifa.draw.framework.FigureChangeListener
method
}

public void figureRequestRemove(FigureChangeEvent parm1) {
    //TODO: Implement this CH.ifa.draw.framework.FigureChangeListener
method
}

public void figureRequestUpdate(FigureChangeEvent parm1) {
    //TODO: Implement this CH.ifa.draw.framework.FigureChangeListener
method
}

```

}

Subject: Re: Grrrr....
 Organization: University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

> I get the impression that it is IMPOSSIBLE to (cleanly) solve practical
 > seven using only Listeners - and a FLIMSY T-SHIRT is no reward for a
 > wasted afternoon!

Why is it students these days are so concerned about rewards?

I sure it wasn't wasted xxxxx. It will come in very useful in Practical 9!

Shy/Modest xxxxx has privately posted a solution based on the following:

All moves are identified by the starting planet and a sequence number.
 Before a planet moves, it will check that its last update did not start from the same planet, with the same sequence number.

I suspect it still doesn't deal with the problem you seem to have set yourself - selecting and simultaneously moving two planets which share a common moon.

Your efforts are appreciated and you will be rewarded,

Subject: centering 2 figures
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

I have taken the composite figure approach and added "MyEllipseFigure" to a "NumberedTextFigure" to create a "PlanetFigure".

The only problem i have is that i cannot align the centres of both figures.

I have been playing around with the layout method from the "Pert" example and also the center() method.

Has anyone else done it this way - if so can u help??

Cheers

Subject: Re: centering 2 figures
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

no need to reply, i've got it now, however I am still having trouble copying and pasting.

I can make a copy ok but the handles dont work on the copy and it has the same mass value as the original (ie not the default value - do i want this?)

Subject: Re: centering 2 figures
 Organization: University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

> no need to reply, i've got it now, however I am still having trouble
 > copying and pasting.
 >
 > I can make a copy ok but the handles dont work on the copy and it has
 > the same mass value as the original (ie not the default value - do i
 > want this?)

I would have thought that a copy SHOULD have the same mass as the original, not the default. The handles should work just the same on a copy though.

Subject: Re: centering 2 figures
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

That's what I thought, but xxxx's solution returns a copy with the default value (effectively a new one??).

I am still unsure as to why the handles cease to work though.

Subject: Practical 7 T-Shirts ...
 Organization: University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Well done to xxx for the following explanation. It neatly shows the difficulties that can arise when trying to trace program control based on event notification. Another high-quality T-shirt is on its way.

The behaviour bug in Practical 7 is actually down to something very simple, although the explanation is a little long-winded! The short answer is that it's down to a misplaced line, which results in a variable being overridden prematurely. The long answer is below:

The bug is due to the figureChanged() method in "MyLineConnection.java".

```
public void figureChanged(FigureChangeEvent e){
    if(oldEnd == null){           // ensures oldEnd is initialised

        oldEnd = endFigure().center();
        figureChanged(e);
    }

    // Let superclass handle connection update and drawing
    super.figureChanged(e);
    // Get the figure that changed
    Figure figure = e.getFigure();
    // If it is the ORBITED planet
    if(figure == endFigure()){
        // Get the distance moved
        int xOffset = endFigure().center().x - oldEnd.x;
        int yOffset = endFigure().center().y - oldEnd.y;
        // Move the ORBITING planet
        startFigure().moveBy(xOffset,yOffset);
    }

    oldEnd = endFigure().center();    // update oldEnd position <-- *
    This is the misplaced line *
}
```

The problem arises because the oldEnd point is overridden, even if the FigureChangeEvent did not originate from the end figure of the connector.

We have the links 2 -> 1, 3 -> 1, 3 -> 2 - stored in the vector of listeners

in that order.

When Planet one is moved the following sequence is initiated:

```
Planet 1 moves
2 -> 1 is notified, as end figure is planet 1, planet 2 is moved -
oldEnd is set to /moved center/ of planet 1
  _As planet 2 has changed, its listeners are all notified_
2 -> 1 is notified, end figure is not planet 2 - oldEnd is set to
/moved center/ of planet 1 (no change)
3 -> 1 is notified, end figure is not planet 2 - oldEnd is set to
/moved center/ of planet 1 <-- * This is where the problem occurs! *
3 -> 2 is notified, end figure is planet 2, planet 3 is moved -
oldEnd is set to /moved center/ of planet 2
  _As planet 3 has changed, its listeners are all notified_
2 -> 1 is notified, end figure is not planet 3 - oldEnd is set
to /moved center/ of planet 1 (no change)
```


3 -> 1 is notified, end figure is not planet 3 - oldEnd is set to /moved center/ of planet 1 (no change)
 3 -> 2 is notified, end figure is not planet 3 - oldEnd is set to /moved center/ of planet 2 (no change)
 3 -> 1 is notified, end figure is planet 1, planet 3 is moved by oldEnd - planet1 centre = 0, oldEnd is set to /moved center/ of planet 1
 Planet 3's listeners are still notified, as moveBy() has been called
 2 -> 1 is notified, end figure is not planet 3 - oldEnd is set to /moved center/ of planet 1 (no change)
 3 -> 1 is notified, end figure is not planet 3 - oldEnd is set to /moved center/ of planet 1 (no change)
 3 -> 2 is notified, end figure is not planet 3 - oldEnd is set to /moved center/ of planet 2 (no change)
 3 -> 2 is notified, end figure is not planet 1 - old End is set to /moved center/ of planet 2

Crucially, connection 3 -> 1's oldEnd gets overridden /before/ it is notified

of the move of planet 1 - therefore when it is notified of this move, the offset it calculates to move planet 3 by as a result of this equates to 0.

To solve the problem, all that has to be done is to move the oldEnd = ... code into the if statement, as follows:

```
public void figureChanged(FigureChangeEvent e){
    if(oldEnd == null){ // ensures oldEnd is initialised

        oldEnd = endFigure().center();
        figureChanged(e);
    }

    // Let superclass handle connection update and drawing
    super.figureChanged(e);
    // Get the figure that changed
    Figure figure = e.getFigure();
    // If it is the ORBITED planet
    if(figure == endFigure()){
        // Get the distance moved
        int xOffset = endFigure().center().x - oldEnd.x;
        int yOffset = endFigure().center().y - oldEnd.y;
        // Move the ORBITING planet
        startFigure().moveBy(xOffset,yOffset);

        oldEnd = endFigure().center(); // update oldEnd position <-- *
        Now moved within if statement *
    }
}
```

This means that the oldEnd is only overridden when the event is triggered by the end planet of the connection. In the above sequence, the connection 3 ->

1 will still have the original center of Planet 1 when it is notified of the

move, and will therefore be able to move correctly with respect to this change.

This problem does not occur when connecting the planets in the order 3 -> 1,

2 -> 1, 3 -> 2, as connection 3 -> 1 is notified of planet 1's changes prior

to connection 2 -> 1, and so connection 2 -> 1 does not get a chance to overwrite connection 3 -> 1's oldEnd before the required offsets are calculated.

Changing to code as shown above will make the behaviour stay constant whichever order the links are drawn in.

Subject: Practical 8
 Organization: University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

A hint from xxxx:

If you animate planets then you get problems trying to dis-ambiguate one from another. However if you animate the connections (as used in Practical 7 solution) then things are much simpler because each connection knows what end should be orbiting the other!

Subject: Re: Practical 8
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

ive got the animation going no problem , the only problem is how to make the planets move circularly instead of a type of diamond shape which i currently have, anybody got any hints.

Subject: Re: Practical 8
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

To draw circles change the animation behaviour for the animating figure to support these parametric equations (or similar).

$$x = x * \cos(A) - y * \sin(A)$$

$$y = x * \sin(A) + y * \cos(A)$$

Subject: Re: Practical 8
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Calculate x,y coordinates using Bresenham's algorithm from graphics last year?

Subject: Re: Practical 8
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Sorry, we CES folks didnt do graphics, so feel free to explain what u are talking about.

Subject: Re: Practical 8
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Its a way of finding the points on a circle, so calculate the points and move the planet to them all in turn.
A web search will find the algorithm.

Subject: Re: Practical 8
Newsgroups: strath.cs.ugrad.sw-architecture

I would imagine the best way to do this is to treat the center of the orbited planet as an origin, and then extend a vector from this origin to the relative center of the orbiting planet.

You can then use the (x,y) coordinates of this vector, and do all the standard rotation calculations.

Subject: Prac 8 Animation
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Sorry to seem a bit slow about this (only just got round to actually tackling this practical) - just to clarify ... I notice there SEEMS to be no readymade animatedfigure class, abstract or otherwise... however there is an animatable interface... so presumably we are expected to implement this interface, or am I just missing the appropriate concrete version?

Subject: Re: Prac 8 Animation
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Check out the last page of [the pattern lang.] document...

Subject: Replacement for the "square" handles

Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Okay, add this to your code for the coolest handles to alter the mass of the ellipse.

Simply add it you your handles code to replace the standard draw method for these. Two methods, one for the up handle, and one for the down handle.

```
/* Up handle */

public void draw(Graphics g) {
    Rectangle r = displayBox();

    int pointsX[] = {(int)(r.x),
                     (int)(r.x-(r.width/2)),
                     (int)(r.x+(r.width/2)),
                     (int)(r.x+(r.width*1.5)),
                     (int)(r.x+r.width),
                     (int)(r.x+r.width),
                     (int)(r.x)};

    int pointsY[] = {(int)(r.y),
                     (int)(r.y),
                     (int)(r.y-(r.height)),
                     (int)(r.y),
                     (int)(r.y),
                     (int)(r.y+r.height),
                     (int)(r.y+r.height)};

    g.setColor(Color.white);
    g.fillPolygon(pointsX,pointsY,7);
    g.setColor(Color.black);
    g.drawPolygon(pointsX,pointsY,7);
}

/* down handle */

public void draw(Graphics g) {
    Rectangle r = displayBox();
    int pointsX[] = {(int)(r.x),
                     (int)(r.x+r.width),
                     (int)(r.x+r.width),
                     (int)(r.x+(r.width*1.5)),
                     (int)(r.x+(r.width/2)),
                     (int)(r.x-(r.width/2)),
                     (int)(r.x)};

    int pointsY[] = {(int)((r.y)-r.height),
                     (int)((r.y)-r.height),
                     (int)((r.y+r.height)-r.height),
                     (int)((r.y+r.height)-r.height),
                     (int)((r.y+(r.height*2))-r.height),
                     (int)((r.y+r.height)-r.height),
                     (int)((r.y+r.height)-r.height)};

    g.setColor(Color.white);
    g.fillPolygon(pointsX,pointsY,7);
    g.setColor(Color.black);
    g.drawPolygon(pointsX,pointsY,7);
}
```

Subject: Animate Figure or Drawing ?

Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Is it the intent that by selecting the 'Animate' tool, that the selected planets are animated, or that the drawing is animated?

Subject: Re: Animate Figure or Drawing ?

Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
 > Is it the intent that by selecting the 'Animate' tool, that the selected
 > planets are animated, or that the drawing is animated?

According to xxxx's Paper, Drawing should be animated first, which then goes onto animate its collection of animatable figures individually.

If you look at the JavaDraw example, there is an "Animator" class which deals with the "difficult" bits of the animation... the draw app calls that, which then by proxy calls the drawing's AnimateStep() method.

Subject: Re: Animate Figure or Drawing ?
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
 > Is it the intent that by selecting the 'Animate' tool, that the selected
 > planets are animated, or that the drawing is animated?

The intent is for the whole drawing to animate.

Subject: Important practical8
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Xxxx brought the following to my attention:

I noticed that in your paper you say - "When Drawing is sub classed appropriately the framework will repeatedly call its animationStep method." I assume that appropriately means 'implements Animatable'. But when I do this, the framework makes no attempt whatsoever to call animationStep. Do I have to use an 'Animator', as in the javadraw example?

This is an important point that I have overlooked in my Patterns for JHotDraw paper. JavaDraw creates an Animator class which runs as a separate thread and calls the animationStep method. Without this (or something similar) the framework will not perform animation! I recommend that you import this class from the JavaDraw example.

Subject: Practical 8 Solution
 Organization: University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

The solution to Practical 8 is now on the web.

You can use today's practical to play around with it and seek any explanation needed.

We are, of course, still interested in any home-baked solutions. It is just that we have something else to occupy you with this weekend.

Subject: Re: Practical 8 Solution
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

and I wonder what that may be.... :o(

Subject: Elliptical Orbit
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

We've had the circular orbit, but does anybody know the formula for an elliptical orbit?

Subject: Re: Elliptical Orbit
 Newsgroups: strath.cs.ugrad.sw-architecture

Hi

You can simulate an elliptical orbit with the current simulation by having two planets with a third orbiting both of them this makes it move in an elliptical orbit around both of them (but make sure the mass is quite high). Other than that I'm not sure.

wrote:

> Weve had the circular orbit, but does anybody know the formula for an
> elliptical orbit?
>
>

Subject: Re: Elliptical Orbit
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
> Weve had the circular orbit, but does anybody know the formula for an
> elliptical orbit?
>
>

If you can find the general equation of an ellipse, thats really all you need. The thing to bear in mind is that the figure inside the ellipse will need to be at one of the foci of the ellipse rather than at its centre. Hope that helps!

Subject: Un-selectable Buttons
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Is there any way of making a button un-selectable after the action has been performed, i.e. once you have created one ellipse it is not possible to create another one since it is not possible to press the button.

Cheers

Subject: Re: Un-selectable Buttons
Organization: University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

> Is there any way of making a button un-selectable after the action has
> been performed, i.e. once you have created one ellipse it is not
> possible to create another one since it is not possible to press the
> button.

Have you tried using the Component method setEnabled:

```
public void setEnabled(boolean b)
```

Enables or disables this component, depending on the value of the parameter b. An enabled component can respond to user input and generate events. Components are enabled initially by default.

Subject: Re: Un-selectable Buttons
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

I have tried putting this method everywhere I can think of (my tool, application, and drawing classes) but nothing works, I think it makes most sense to put it in my tool class but I need some way of getting the component(the button). Is there any method to do this, if not how would I go about writing one.

Subject: figure animation...
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

i have been looking into animation of figures, with a view to making different figures animate in different ways. In order to animate a drawing, you must call animationStep(), and to enable each figure in that drawing to be animated, you define it a la Doug Kirk's last page.

I have tried to trace back to find where the default animationStep is for a figure, which presumably makes it rotate clockwise, but can't find it.

Does anyone have any ideas????

Cheers

Subject: Re: figure animation...
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
 ...
 >
 > I have tried to trace back to find where the default animationStep is
 > for a figure, which presumably makes it rotate clockwise, but can't find
 > it.
 >
 > Does anyone have any ideas????

animationStep is defined in the Animatable interface. Only figures that implement this interface will have an animationStep method. From memory, no figures in the Figure hierarchy implement Animatable therefore you won't find any default animation behaviour for a Figure!

Subject: Re: figure animation...
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

if no figure implements animatable, then how about drawings - what and where is the default animation for a drawing?

I would like to find out what possible methods of animation can be made, and how exactly to implement them, so i need some kind of template to look at.

hhhheeeelllpppp!!!!!!

Subject: Re: figure animation...
 Organization: University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

> if no figure implements animatable, then how about drawings - what and
 > where is the default animation for a drawing?
 >
 > I would like to find out what possible methods of animation can be made,
 > and how exactly to implement them, so i need some kind of template to
 > look at.
 >
 > hhhheeeelllpppp!!!!!!

The solution to practical 8 shows how this is done. There we animate the planets via the LineConnection class:

```
public class MyLineConnection extends LineConnection implements Animatable {

...
    public void animationStep() {
        if(startFigure()!=null){ //can be null during lineconnection
        creation
```

```

        Point oStart = translate();
        Point newStart = rotate(oStart);
        int xOffset = (int)(newStart.getX() - oStart.getX());
        int yOffset = (int)(newStart.getY() - oStart.getY());

        startFigure().moveBy(xOffset, yOffset); //move orbiter
    }
}
...
}

```

Any figure can be animated by implementing Animatable and defining an animationStep() method.

Subject: Drawing size
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Does anybody know how to find out the current size of the drawing?

Subject: Re: Drawing size
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
 > Does anybody know how to find out the current size of the drawing?

Drawing is a subclass of CompositeFigure so you could use displayBox() to get its size. However I believe that the default functionality of drawing is to return the minimum size rectangle that encloses the drawing so when it is empty it returns the rectangle (0,0,0,0). If you want something that gives the size of the drawing as it appears on screen you will need to look in DrawingView.

Subject: A few problems with getting a Drawing
 Newsgroups: strath.cs.ugrad.sw-architecture

Hi

I am trying to get the current drawing that a figure is on but the figure itself seems to have no knowledge of its own drawing.

HEEEELLLP :-)

Subject: Re: A few problems with getting a Drawing
 Organization: University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

> Hi
 >
 > I am trying to get the current drawing that a figure is on but the
 > figure itself seems to have no knowledge of its own drawing.

I suspect that this is part of the beauty of the Observer design pattern.

Figures only know of FigureChangeListeners which might be Drawings (almost certainly in the JHotDraw case).

You can probably get the drawing by casting the contents of the figure attribute fListener but that would be extremely naughty.

Subject: Re: A few problems with getting a Drawing
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Its OK I figured out another way to do the same thing. Same end result but the method has been turned around (looking at it from a different direction).

Subject: Re: A few problems with getting a Drawing
Newsgroups: strath.cs.ugrad.sw-architecture

Alternatively, you could be sneaky, and pass the Drawing View into the constructor of your Figure:

```
Tool tool = new CreationTool(view(), new MyAdaptedFigure(view()));
```

That way you can access the Drawing itself using the Drawing View's drawing() method.

Subject: Displaying box
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Is there a better way to redraw a figure than

```
displayBox(displayBox());
```

?

Subject: Re: Displaying box
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

```
>
> Is there a better way to redraw a figure than
>
> displayBox(displayBox());
>
> ?
```

I reckon that redrawing a figure should be done via the DrawingView. But this behaviour should already exist - modifying the figure invokes certain actions that result in the DrawingView being updated. Is this not the case? If not have a look at the redraw behaviour to see if you can figure out why not - it might lead you to an answer.

Subject: Re: Displaying box
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

it does redraw in most cases, but in one particular case it does not fully redraw. I don't know if this is a bug in hotdraw, or something else. I have looked into it but cannot find a solution apart from manually calling displayBox(displayBox()) at certain points.

wrote:

```
>
> wrote:
>>
>> Is there a better way to redraw a figure than
>>
>> displayBox(displayBox());
>>
>> ?
>
>,
>
> I reckon that redrawing a figure should be done via the DrawingView. But
> this behaviour should already exist - modifying the figure invokes
> certain actions that result in the DrawingView being updated. Is this
> not the case? If not have a look at the redraw behaviour to see if you
> can figure out why not - it might lead you to an answer.
>
```


>

Subject: Re: Displaying box
Newsgroups: strath.cs.ugrad.sw-architecture

: one particular case it does not fully redraw

Are you manipulating the display box of the Figure? If so, make sure you are calling willChange() prior to this, and changed() afterwards - not doing this can result in some nasty garbage left on screen.

Subject: Re: Displaying box
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Seemed to work with only changed() after it.

wrote:

>
>
>
> : one particular case it does not fully redraw
>
> Are you manipulating the display box of the Figure? If so, make sure you are
> calling willChange() prior to this, and changed() afterwards - not doing
> this can result in some nasty garbage left on screen.
>

Subject: Re: Displaying box
Newsgroups: strath.cs.ugrad.sw-architecture

: Seemed to work with only changed() after it

I found it necessary because I was shrinking the display box - and with only changed() it left garbage on the screen (increasing the display box caused no problems).

I presume (I haven't actually looked at the source for the methods ;) that willChange() stores a copy of the dimensions of the current display box, and this is then used to invalidate areas of the drawing after changed() is called.

Subject: Connections
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

Hello,

If I have two figures (ellipses) in a drawing, is it possible to create a connection between them automatically?

I would assume it is, but the process I'm going through to do it doesn't seem to work:

- Create a connection.
- Set the Start and End points for that connection to the relevant figures.
- Add the connection to the drawing.

I'm probably missing something obvious, but all help's appreciated.

Thanks,

Subject: Re: Connections
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
> If I have two figures (ellipses) in a drawing, is it possible to create
> a connection between them automatically?

> I would assume it is, but the process I'm going through to do it doesn't
 > seem to work:
 >
 > - Create a connection.
 > - Set the Start and End points for that connection to the relevant
 > figures.
 > - Add the connection to the drawing.
 >
 > I'm probably missing something obvious, but all help's appreciated.
 >

Doesn't seem to be a lot wrong here. One point is that when you say you
 are connecting the start and end points to relevant figures you are
 actually setting them to the figures connectors?

Other than that I can't see anything obvious - try comparing your code
 to the corresponding code in the examples (even though they use direct
 manipulation it still boils down to calling the same methods just in
 different places).

Subject: problem

Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Hello,

I was wanting to create a new version of the decorator so that I could
 decorate figures differently. Essentially all I want is in the
 borderDecorator class and all I want to change is the draw method. So I
 want the functionality of the borderDecorator but the draw method of its
 superclass - decoratorFigure. This made me think of the wrapper design
 pattern - i.e. hold a reference to the concrete BorderDecorator, and
 assign all the methods and variables to its values and extend the
 decoratorFigure and call super.draw(). This does not appear to work
 however. I am not allowed to access BorderDecorator. Anyone got any
 ideas.

cheers

Subject: Re: problem

Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
 > Hello,
 >
 > I was wanting to create a new version of the decorator so that I could
 > decorate figures differently. Essentially all I want is in the
 > borderDecorator class and all I want to change is the draw method. So I
 > want the functionality of the borderDecorator but the draw method of its
 > superclass - decoratorFigure. This made me think of the wrapper design
 > pattern - i.e. hold a reference to the concrete BorderDecorator, and
 > assign all the methods and variables to its values and extend the
 > decoratorFigure and call super.draw(). This does not appear to work
 > however. I am not allowed to access BorderDecorator. Anyone got any
 > ideas.
 >

Why do you need the functionality of BorderDecorator if you dont want
 the draw method? Or do mean that you want to draw a rectangle and then
 something else? Either way I think I would be easier to start with a
 fresh implementation of DecoratorFigure (remember that decorators can be
 nested).

Subject: Getting Position

Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Is there any way of finding a certain type of figure within a drawing
 without running through the enumeration of figures checking to see if
 they are an instance of what I am looking for. e.g. if I have an ellipse

figure and a rectangle figure can I directly get the instance of the ellipse figure.

Cheers

Subject: Re: Getting Position
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

wrote:

>
 > Is there any way of finding a certain type of figure within a drawing
 > without running through the enumeration of figures checking to see if
 > they are an instance of what I am looking for. e.g. if I have an ellipse
 > figure and a rectangle figure can I directly get the instance of the
 > ellipse figure.
 >

If you know a co-ordinate on the figure then you could use the
 Drawing.findFigure or Drawing.findFigureInside methods to get it.

Subject: Implicit Invocation problem !!!
 Newsgroups: strath.cs.ugrad.sw-architecture

Hi

I have a rather big problem. I decorate a planet using a tool I have created. The tool then registers the decorated planet as a drawing change listener. It then goes round all of the planets telling them about this newly decorated planet (so they can add it to a vector of decorated planets for later calculations that they need to do). When the drawing changes the decorated planet goes round all of the planets to see if any of them do not know about that decorated planet (i.e. handling the adding of a new planet to the drawing). If you add two planets in the following order- The one you are not going to decorate, then the one you are going to decorate - Then when you toggle off the decoration (the decoration tool peels off the decorator and tries to return it back to a normal planet, It also tells all the planets that it no longer exists - takes it out of the vector of decorated planets for each other planet - and removes it as a drawing change listener) it works fine. If you create the planets in the other order then decorate one of them it doesn't remove the decorated planet from the vector for the other planet. I think its to do with the order of the calls to the drawing change listener but I can't seem to be able to trace it.

Please Help

Subject: Re-Draw???
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Is there any way that you can get an ellipse to re-draw itself (i.e. force the framework to call the ellipses draw() method with the appropriate parameter)?

I know how to force a re-draw from the drawing view but need to be able to do this from the ellipse itself.

Cheers,

Subject: Re: Re-Draw???
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

surely it's just a matter of re-calling the 'basicDisplayBox' method.
 At least, when I had to redraw a shape I did this and it worked.....

Wrote:

>
 > Is there any way that you can get an ellipse to re-draw itself (i.e.
 > force the framework to call the ellipses draw() method with the

> appropriate parameter)?
 >
 > I know how to force a re-draw from the drawing view but need to be able
 > to do this from the ellipse itself.
 >
 > Cheers,
 >
 >

Subject: ICONS
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Does anyone know how to get ur own icons to appear on the tool bar.

I have redefined a path to point to my own gifs.

I have created gif1,2,and3 just like the icon appear in the "images"
 folder in HotDraw.

Problem:
 All functionality of the tool work (ie text appear, create figure,etcf),
 but u just cant see the icon in the toolbar...

PLEASE HELP!

Subject: Re: ICONS
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

I had the same problem.

To get it to work you have to take out the referece to the String IMAGES
 which is declared in DrawApplication and the String that contains the
 name of the image should read "/PLANET".

This is assuming the images are stored in the same directory and named
 PLANET1.gif, PLANET2.gif and PLANET3.gif. If you don't include the '/'
 it doesn't seem to find the images. If the gif's are in a folder called
 'images' you have to do the same thing, i.e. "/images/PLANET".

Hope this helps.

Subject: Re: ICONS
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Cheers xxxx, that was really beginning to bug me that was

Subject: Cannot override handles()
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Hello

I'm trying to create a handle on a Connection (that extends
 LineConnection). As was shown in the practical, it seems straightforward
 to do this with a Figure i.e. overriding the handles() method and adding
 your own handles in there.

However, when I try to do this with a Connection, I get:

```
MyLineConnection.java:227: The method Vector handles() declared in class
MyLine
onnection cannot override the method of the same signature declared in
class CH
ifa.draw.figures.LineConnection. They must have the same return type.
    public Vector handles() {
        ^
```

I'm probably just being a bit dim but if anyone can point me in the
 right direction its much appreciated.

Cheers,

Subject: Re: Cannot override handles()
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

You need to import java.util.Vector;

Subject: CompositeFigures
 Newsgroups: strath.cs.ugrad.sw-architecture

Does anybody know how to center figures within a composite figure? At the moment they all align to the left, but it would be better if they were centered.

Also, does anybody know how to change the connector position on a composite figure? At the moment it is on the outside of the composite figure, but I would like it to be on a figure within the composite figure.

Cheers,

Subject: Re: CompositeFigures
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

i've been messing about with composite figures, and have created the coordinates for the figure inside BasicDisplayBox. This allows the creation anywhere on the screen, but the problem with this, or at least in my coding, is that when you try and move the figure outwith the display box, the displaybox does not move and the figure cannot be seen outside this.

see if that works, and if you fix the other problem, or have any ideas, let me know.

Subject: Disabling tool panel
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Is there any way to disable the tools whenever the animation is running, such that u can only create new figures,etc once u press "STOP"??

Just a thought to try and tidy things up a bit, not essential seeing as how this thing is due in less than 2 days ;)

Subject: Can't create Ellipses
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Hello,

I am trying to create 2 ellipses simultaneously simply by clicking on the drawingView. Can anyone help me point to the right direction?

Cheers

Subject: Connectors
 Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

When trying to connect two planets automatically, how are able to pass in the two Figures that you are trying to connect. One of the points is a sationary point so it is always the same endPoint, but I can't seem to connect anything as the startFigure. I see that it is possible to pass in Connectors, but not Figures.

Any help would be appreciated!!!!

Subject: Re: Connectors

Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

I doubt this is the best way but there is a standard abstract implementation of connector. its called AbstractConnector.

i extended it but didn't override teh methods.

one of the constructors for connector takes in a figure as a parameter.

create the connector(yourFigure) then pass that along to connect the two.

Subject: DisplayBox???

Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

i have created a composite figure, but when i try to move the figure, the display box doesn't move with the figure. Does anyone have any ideas how to make sure that the two are always associated?

Subject: Re: DisplayBox???

Newsgroups: strath.cs.ugrad.sw-architecture

Well I think I had the same problem. Have you included a basicMoveBy method in your composite figure class that translates the displaybox when the figures are moved? You can find an example of it in the Pert sample.

Hope this helps,

wrote:

>

> i have created a composite figure, but when i try to move the figure,
 > the display box doesn't move with the figure. Does anyone have any ideas
 > how to make sure that the two are always associated?

Subject: gravity influencing speed

Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

I want to change the way that the simulation determines the speed of orbit.

i wonder in anyone knows the physics for working out the time for orbit when you have distance and the gravitational force (both masses + formula)

Subject: Re: gravity influencing speed

Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

the only equation i could find was a version of speed = distance/time but thats no good because i don't know speed or time.

Subject: Figure Connection

Organization: Department of Computer Science, University of Strathclyde
 Newsgroups: strath.cs.ugrad.sw-architecture

Does anyone have any ideas on how to stop two figures being allowed to be connected?

I am trying to use the canConnect() method from the LineConnection class and override it in MyLineConnection class but this does not seem to work.

Thi is the method from the LineConnection class:

```
public boolean canConnect(Figure start, Figure end){
    return true;
}
```

Thanks

Subject: Re: Figure Connection
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

over-ride canConnect in your connection figure

Subject: TextDecorator
Organization: Department of Computer Science, University of Strathclyde
Newsgroups: strath.cs.ugrad.sw-architecture

I am having problems changing the permanent display of the mass on a planet to a decorator for the text.

The TextDecorator takes in a figure and the mass of that figure as it's arguments and I have managed to get rid of any mistakes.

When I run the code it just doesn't display the mass when a planet is selected.

Has anybody else had similar problems, or know of a common mistake here? Even if I replace "mass" with a constant there is nothing displayed.

The code in the TextDecorator is the same as BorderDecorator apart from the draw() method which uses the code to display the text (below) instead of the code to draw a border.

Any ideas will be gratefully accepted

Ta

[illegible]

2.4. Student questionnaire responses

Questionnaire 1

Please see below for answers to the questionnaire:

```

>-----
>-----
>
>>Framework Experiences Questionnaire:
>-----
>-----
>
>
>
>Q1) How difficult did you find understanding the following aspects of
>the HotDraw framework?
>Please enter a number 1 to 5, where:
>1 very easy
>2 easy
>3 moderate
>4 hard
>4 very hard
>
>1.1 Understanding individual classes and their methods
>      3
>
>1.2 Using abstract classes/interfaces
>      2
>
>1.3 Mapping your solution to framework code
>      4
>
>1.4 Understanding the structure of inheritance hierarchies and object
>compositions
>      5
>
>1.5 Understanding design patterns
>      1
>
>1.6 Understanding the dynamic structure of the framework
>      4
>
>1.7 Choosing from alternative framework solution strategies
>      3
>
>1.8 Understanding the HotDraw problem domain
>      1
>
>1.9 Were there any other particularly challenging aspects of the
>framework practicals
>(please specify)
>
>
>
>Q2) How effective have you found the following in solving your problems
>during the practicals.
>Please enter a number 1 to 5, where:
>1 no use
>2 barely useful
>3 moderately useful
>4 useful
>5 very useful
>
>
>2.1 Browsing JavaDoc files
>      5
>
>2.2 Doug's Patterns Patterns for JHotDraw paper

```


> 3
>
>2.3 Design pattern knowledge
> 2
>
>2.4 Asking lecturer
> 3
>
>2.5 Asking newsgroup
> 4
>
>2.6 Asking other students
> 3
>
>2.7 Studying existing examples
> 5
>
>2.9 Previous practical solutions
> 5
>
>2.10 Are there any other tools/techniques that you used and found
>particularly useful?
>(please specify)
>
> Analyzing source code of the framework itself - 5
>
>2.11 Are there any other tools/techniques that you didn't actually use
>but that you THINK would be useful?
>(please specify)
>
>
>
>Q3)
>3.1 What were your main sources of problems during the early HotDraw
>practicals e.g. around Practical 4?
> Understanding how to integrate code with HotDraw
>
>3.2 What were your main sources of problems during the later HotDraw
>practicals?
> Side affects of the way I solved them e.g. when using the
> Observer pattern for moving a planet connected to another planet
> problems occurred as a result of not knowing the order in which
> each of the observers were notified.
>
>3.3. What were your key sources of help in the early HotDraw practicals?
> The javadoc documentation.
>
>
>3.4 What were your key sources of help in the later HotDraw practicals?
> The newsgroup and the lecturers.
>
>
>Q4) In the assessed practical please estimate how much time you spent in
>the following areas
>(answer in hours)
>
>4.1 Stuck with no idea what to do
> 0
>
>4.2 Stuck with no idea why something didn't work
> 1
>
>4.3 Forming hypotheses of how a solution might work
> 2
>
>4.4 Reading documentation
> 3
>
>4.5 Reading the source code
> 2
>
>4.6 Implementing changes
> 1

>
 >4.7 Testing
 > 1
 >
 >4.7 Other time consuming activities
 >(please specify)
 >
 >
 >
 >If you have any further insights into the real challenges of using
 >object-oriented frameworks please feel free to elaborate below:
 >
 >
 >
 >*** Would you be prepared to spend 30 minutes (maximum) in a follow-up
 >interview during January.
 >Yes / No
 >
 > Yes
 >-----
 >-----
 >
 >End of questionnaire:
 >Thank you very much for your co-operation
 >Marc, Murray and Doug
 >Merry Christmas - you have earned a break!

Questionnaire 2

 Framework Experiences Questionnaire:

Q1) How difficult did you find understanding the following aspects of
 the HotDraw framework?

Please enter a number 1 to 5, where:

- 1 very easy
- 2 easy
- 3 moderate
- 4 hard
- 5 very hard

1.1 Understanding individual classes and their methods
 3

1.2 Using abstract classes/interfaces
 3

1.3 Mapping your solution to framework code
 5

1.4 Understanding the structure of inheritance hierarchies and object
 compositions
 5

1.5 Understanding design patterns
 3

1.6 Understanding the dynamic structure of the framework
 5

1.7 Choosing from alternative framework solution strategies
 5

1.8 Understanding the HotDraw problem domain
 3

1.9 Were there any other particularly challenging aspects of the
 framework practicals
 (please specify)

Q2) How effective have you found the following in solving your problems during the practicals.

Please enter a number 1 to 5, where:

- 1 no use
- 2 barely useful
- 3 moderately useful
- 4 useful
- 5 very useful

2.1 Browsing JavaDoc files

4

2.2 Doug's Patterns Patterns for JHotDraw paper

5

2.3 Design pattern knowledge

3

2.4 Asking lecturer

4

2.5 Asking newsgroup

3

2.6 Asking other students

4

2.7 Studying existing examples

4

2.9 Previous practical solutions

5

2.10 Are there any other tools/techniques that you used and found particularly useful?
(please specify)

2.11 Are there any other tools/techniques that you didn't actually use but that you THINK would be useful?
(please specify)

I think that a class diagram showing the relationships between classes would be a great help. Although I realise this would be really difficult to do for HotDraw.

Q3)

3.1 What were your main sources of problems during the early HotDraw practicals e.g. around Practical 4?

I wrongly changed code in the HotDraw classes provided instead of manipulating the existing code by subclassing classes.
I struggled to grasp what was happening and where, due to the complex class hierarchy.
Just trying to understand a single class meant that I had to search through all the classes it inherited from and the interfaces that it implemented.

3.2 What were your main sources of problems during the later HotDraw practicals?

Did not try the later practicals as I found the earlier ones so difficult, but went through the given solutions.

3.3. What were your key sources of help in the early HotDraw practicals?

Lecture notes, Javadoc documentation, the examples provided with HotDraw e.g. PertApp.

3.4 What were your key sources of help in the later HotDraw practicals?

N/A

Q4) In the assessed practical please estimate how much time you spent in the following areas
(answer in hours)

4.1 Stuck with no idea what to do
1 hour.

4.2 Stuck with no idea why something didn't work

5 hours - tried to create two subclasses of MassEllipseFigure for two planets which had the same functionality apart from different size and mass values. Could only get the planets to appear with different sizes using this design approach as their mass value wrongly displayed defaults of 0.0. In the end, just created two classes the exact same as MassEllipseFigure but with different values for these two constants.

4.3 Forming hypotheses of how a solution might work

2hours.

4.4 Reading documentation

5 hours - constantly referred to this to get a high level overview of what functionality classes used and what classes they collaborated with.

4.5 Reading the source code

4 hours. Although I spent some time prior to attempting the assessed coursework reading the source code in the provided HotDraw classes and the practical solutions due to the fact I did not attempt the later practicals.

4.6 Implementing changes

10hours.

4.7 Testing

2hours.

4.7 Other time consuming activities
(please specify)

If you have any further insights into the real challenges of using object-oriented frameworks please feel free to elaborate below:

*** Would you be prepared to spend 30 minutes (maximum) in a follow-up interview during January.
No

End of questionnaire:

Questionnaire 3

----- Original Message -----

Subject: 52.440 Software Architecture

Date: Tue, 19 Dec 2000 17:04:39 +0000

From: murray@cs.strath.ac.uk

Reply-To: murray@cs.strath.ac.uk

Organization: University of Strathclyde

To: fourth-year@cs.strath.ac.uk

CC: doug@cs.strath.ac.uk, marc <marc@cs.strath.ac.uk>,murray
<murray@cs.strath.ac.uk>

For those doing 52.440 Software Architecture - others please ignore
(apologies)

We realise that we will not be flavour of the month with you just now
but we would like to ask a real favour of you.

Last week a research paper was published in the main US Software
Engineering journal (IEEE Trans. Software Engineering) by researchers
investigating the challenges in understanding object-oriented
frameworks. They based their work on a study of students using an
object-oriented framework called ET++. We would like to take this
opportunity to investigate, and perhaps respond to, some of their
findings.

Also, as some of you may know, Doug's area of research is focused on the
problems in using object oriented frameworks such as HotDraw.

The following is a very simple questionnaire. It should only take the
order of 10 minutes to complete. We would be very grateful if you could
use your experiences in the HotDraw practicals to complete this.

Please note: Responding to the following questionnaire is entirely at
your own discretion its not part of the coursework and will not affect
your course marks in any way.

If you have the time and the inclination please answer the questions
below and return them to murray via email.

Thank you very much - we hope you have found the course a useful
practical experience,
Marc, Murray and Doug.

Framework Experiences Questionnaire:

Q1) How difficult did you find understanding the following aspects of
the HotDraw framework?

Please enter a number 1 to 5, where:

- 1 very easy
- 2 easy
- 3 moderate
- 4 hard
- 4 very hard

1.1 Understanding individual classes and their methods
2

1.2 Using abstract classes/interfaces
2

1.3 Mapping your solution to framework code
4

1.4 Understanding the structure of inheritance hierarchies and object
compositions
2

1.5 Understanding design patterns
3

1.6 Understanding the dynamic structure of the framework
3

1.7 Choosing from alternative framework solution strategies

3

1.8 Understanding the HotDraw problem domain

2

1.9 Were there any other particularly challenging aspects of the framework practicals

(please specify)

It just involved looking at the classes in detail

Q2) How effective have you found the following in solving your problems during the practicals.

Please enter a number 1 to 5, where:

1 no use

2 barely useful

3 moderately useful

4 useful

5 very useful

2.1 Browsing JavaDoc files

2

2.2 Doug's Patterns Patterns for JHotDraw paper

4

2.3 Design pattern knowledge

3

2.4 Asking lecturer

4

2.5 Asking newsgroup

4

2.6 Asking other students

4

2.7 Studying existing examples

3

2.9 Previous practical solutions

4

2.10 Are there any other tools/techniques that you used and found particularly useful?

(please specify)

2.11 Are there any other tools/techniques that you didn't actually use but that you THINK would be useful?

(please specify)

Q3)

3.1 What were your main sources of problems during the early HotDraw practicals e.g. around Practical 4?

Becoming familiar with the classes available and how they worked together

3.2 What were your main sources of problems during the later HotDraw practicals?

3.3. What were your key sources of help in the early HotDraw practicals?

Lecture notes and discussing with other students

3.4 What were your key sources of help in the later HotDraw practicals?

NewsGroup and Douglas Kirk's paper

Q4) In the assessed practical please estimate how much time you spent in the following areas
(answer in hours)

4.1 Stuck with no idea what to do
1

4.2 Stuck with no idea why something didn't work
8

4.3 Forming hypotheses of how a solution might work
4

4.4 Reading documentation
3

4.5 Reading the source code
6

4.6 Implementing changes
4

4.7 Testing
4

4.7 Other time consuming activities
(please specify)

If you have any further insights into the real challenges of using object-oriented frameworks please feel free to elaborate below:

*** Would you be prepared to spend 30 minutes (maximum) in a follow-up interview during January.
Yes / No
yes

End of questionnaire:
Thank you very much for your co-operation
Marc, Murray and Doug
Merry Christmas - you have earned a break!

Questionnaire 4

Framework Experiences Questionnaire:

Q1) How difficult did you find understanding the following aspects of the HotDraw framework?

Please enter a number 1 to 5, where:

1 very easy

2 easy

3 moderate

4 hard

4 very hard

1.1 Understanding individual classes and their methods
3

1.2 Using abstract classes/interfaces
2

1.3 Mapping your solution to framework code

4

1.4 Understanding the structure of inheritance hierarchies and object compositions

4

1.5 Understanding design patterns

3

1.6 Understanding the dynamic structure of the framework

4

1.7 Choosing from alternative framework solution strategies

4

1.8 Understanding the HotDraw problem domain

2

1.9 Were there any other particularly challenging aspects of the framework practicals (please specify)

Discovering what functionality exists within the framework

Q2) How effective have you found the following in solving your problems during the practicals.

Please enter a number 1 to 5, where:

1 no use

2 barely useful

3 moderately useful

4 useful

5 very useful

2.1 Browsing JavaDoc files

2

2.2 Doug's Patterns Patterns for JHotDraw paper

2

2.3 Design pattern knowledge

3

2.4 Asking lecturer

3

2.5 Asking newsgroup

3

2.6 Asking other students

3

2.7 Studying existing examples

5

2.9 Previous practical solutions

5

2.10 Are there any other tools/techniques that you used and found particularly useful?

(please specify)

I reverse engineered a class diagram, but there are so many large packages, that it is too time consuming to scan every one.

2.11 Are there any other tools/techniques that you didn't actually use but that you THINK would be useful?

(please specify)

Q3)

3.1 What were your main sources of problems during the early HotDraw practicals e.g. around Practical 4?

Discovering what HotDraw features existed.

3.2 What were your main sources of problems during the later HotDraw practicals?

Having to fit into the implementation style of HotDraw, and working around constraints enforced by that style.

3.3. What were your key sources of help in the early HotDraw practicals?

Lectures & newsgroup.

3.4 What were your key sources of help in the later HotDraw practicals?

Sweat & perseverance.

Q4) In the assessed practical please estimate how much time you spent in the following areas

(answer in hours)

4.1 Stuck with no idea what to do

1

4.2 Stuck with no idea why something didn't work

3

4.3 Forming hypotheses of how a solution might work

3

4.4 Reading documentation

5

4.5 Reading the source code

10

4.6 Implementing changes

10

4.7 Testing

2

4.7 Other time consuming activities

(please specify)

Persuing fruitless avenues, that cant be implented due to fields not having the right access or no accessor methods, or some other contraint.

30

If you have any further insights into the real challenges of using object-oriented frameworks please feel free to elaborate below:

*** Would you be prepared to spend 30 minutes (maximum) in a follow-up interview during January.

Yes / No

No.

Questionnaire 5

murray@cs.strath.ac.uk wrote:

>

> For those doing 52.440 Software Architecture - others please ignore

> (apologies)

>

> We realise that we will not be flavour of the month with you just now

> but we would like to ask a real favour of you.

>

> Last week a research paper was published in the main US Software

> Engineering journal (IEEE Trans. Software Engineering) by researchers

> investigating the challenges in understanding object-oriented

> frameworks. They based their work on a study of students using an
> object-oriented framework called ET++. We would like to take this
> opportunity to investigate, and perhaps respond to, some of their
> findings.
>
> Also, as some of you may know, Doug's area of research is focused on the
> problems in using object oriented frameworks such as HotDraw.
>
> The following is a very simple questionnaire. It should only take the
> order of 10 minutes to complete. We would be very grateful if you could
> use your experiences in the HotDraw practicals to complete this.
>
> *****
>
> Please note: Responding to the following questionnaire is entirely at
> your own discretion its not part of the coursework and will not affect
> your course marks in any way.
> *****
>
> If you have the time and the inclination please answer the questions
> below and return them to murray via email.
>
> Thank you very much - we hope you have found the course a useful
> practical experience,
> Marc, Murray and Doug.
>
> -----
>
> Framework Experiences Questionnaire:
> -----
>
> Q1) How difficult did you find understanding the following aspects of
> the HotDraw framework?
> Please enter a number 1 to 5, where:
> 1 very easy
> 2 easy
> 3 moderate
> 4 hard
> 5 very hard
>
> 1.1 Understanding individual classes and their methods 3
>
> 1.2 Using abstract classes/interfaces 3
>
> 1.3 Mapping your solution to framework code 4
>
> 1.4 Understanding the structure of inheritance hierarchies and object
> compositions 4
>
> 1.5 Understanding design patterns 4
>
> 1.6 Understanding the dynamic structure of the framework 4
>
> 1.7 Choosing from alternative framework solution strategies 4
>
> 1.8 Understanding the HotDraw problem domain 3
>
> 1.9 Were there any other particularly challenging aspects of the
> framework practicals
> (please specify)
>
> Q2) How effective have you found the following in solving your problems
> during the practicals.
> Please enter a number 1 to 5, where:
> 1 no use
> 2 barely useful
> 3 moderately useful
> 4 useful
> 5 very useful
>
> 2.1 Browsing JavaDoc files 4
>
> 2.2 Doug's Patterns Patterns for JHotDraw paper 5

>
> 2.3 Design pattern knowledge 4
>
> 2.4 Asking lecturer 3
>
> 2.5 Asking newsgroup 3
>
> 2.6 Asking other students 3
>
> 2.7 Studying existing examples 3
>
> 2.9 Previous practical solutions 4
>
> 2.10 Are there any other tools/techniques that you used and found
> particularly useful?
> (please specify)
>
> 2.11 Are there any other tools/techniques that you didn't actually use
> but that you THINK would be useful? UML diagrams showing the overall structure but including most of the classes - not
just interfaces.
> (please specify)
>
> Q3)
> 3.1 What were your main sources of problems during the early HotDraw
> practicals e.g. around Practical 4? understanding HotDraw in general.
>
> 3.2 What were your main sources of problems during the later HotDraw
> practicals? discovering how to use HotDraw to accomplish the task.
>
> 3.3. What were your key sources of help in the early HotDraw practicals?
the examples supplies with HotDraw.
>
> 3.4 What were your key sources of help in the later HotDraw practicals?
as above and also the newsgroup so that I could see how other people
visualised the problem.
>
> Q4) In the assessed practical please estimate how much time you spent in
> the following areas
> (answer in hours)
>
> 4.1 Stuck with no idea what to do
2
>
> 4.2 Stuck with no idea why something didn't work
1
>
> 4.3 Forming hypotheses of how a solution might work
1
>
> 4.4 Reading documentation
1
>
> 4.5 Reading the source code
1
>
> 4.6 Implementing changes
<1
>
> 4.7 Testing
<1
>
> 4.7 Other time consuming activities
> (please specify)
keeping up with newsgroup!
>
> If you have any further insights into the real challenges of using
> object-oriented frameworks please feel free to elaborate below:
It seems to be the inversion of control that makes frameworks so
difficult to use well.
>
> *** Would you be prepared to spend 30 minutes (maximum) in a follow-up
> interview during January.
> Yes / No

Probably yes - but I don't know that much about frameworks! And it depends how the project is progressing!!

>
 > -----
 >
 > End of questionnaire:
 > Thank you very much for your co-operation
 > Marc, Murray and Doug
 > Merry Christmas - you have earned a break!

Questionnaire 6

> -----

 >
 > Framework Experiences Questionnaire:
 > -----

 >
 >
 >
 > Q1) How difficult did you find understanding the following aspects of
 > the HotDraw framework?
 > Please enter a number 1 to 5, where:
 > 1 very easy
 > 2 easy
 > 3 moderate
 > 4 hard
 > 4 very hard
 >
 > 1.1 Understanding individual classes and their methods
 2
 > 1.2 Using abstract classes/interfaces
 4
 > 1.3 Mapping your solution to framework code
 4
 > 1.4 Understanding the structure of inheritance hierarchies and object
 > compositions
 3
 > 1.5 Understanding design patterns
 4
 > 1.6 Understanding the dynamic structure of the framework
 4
 > 1.7 Choosing from alternative framework solution strategies
 4
 > 1.8 Understanding the HotDraw problem domain
 ?? Unclear question ??
 > 1.9 Were there any other particularly challenging aspects of the
 > framework practicals
 > (please specify)

Overcoming the massive learning curve was a major problem. It takes a good few hours to actually sit down and tackle each practical - time which I have

not had due to other classes and final year project. However, with the assessed practical exercise, I feel I now have a much better understanding of HotDraw as that forced me to look into things in greater depth.

>
 >
 > Q2) How effective have you found the following in solving your problems
 > during the practicals.
 > Please enter a number 1 to 5, where:
 > 1 no use
 > 2 barely useful
 > 3 moderately useful
 > 4 useful
 > 5 very useful
 >
 >
 > 2.1 Browsing JavaDoc files

5
 > 2.2 Doug's Patterns Patterns for JHotDraw paper

3
 > 2.3 Design pattern knowledge

2
 > 2.4 Asking lecturer

3
 > 2.5 Asking newsgroup

4 - not asking on the newsgroup but watching the comments of others.
 > 2.6 Asking other students

4
 > 2.7 Studying existing examples

3
 > 2.9 Previous practical solutions

5
 > 2.10 Are there any other tools/techniques that you used and found
 > particularly useful?
 > (please specify)

None

> 2.11 Are there any other tools/techniques that you didn't actually use
 > but that you THINK would be useful?
 > (please specify)

None

> Q3)
 > 3.1 What were your main sources of problems during the early HotDraw
 > practicals e.g. around Practical 4?

Actually trying to find out what class did what and what method did what.
 The actual solutions were not lengthy, code wise.

> 3.2 What were your main sources of problems during the later HotDraw
 > practicals?

Lack of time & the complexity of the later solutions

> 3.3. What were your key sources of help in the early HotDraw practicals?

Documentation & other students

> 3.4 What were your key sources of help in the later HotDraw practicals?

The sample solutions

> Q4) In the assessed practical please estimate how much time you spent in
> the following areas
> (answer in hours)

>
> 4.1 Stuck with no idea what to do

2

> 4.2 Stuck with no idea why something didn't work

4

> 4.3 Forming hypotheses of how a solution might work

1

> 4.4 Reading documentation

3

> 4.5 Reading the source code

4

> 4.6 Implementing changes

1.5

> 4.7 Testing

1.5

> 4.7 Other time consuming activities

> (please specify)

Report writing - 9 hours

>
>
> If you have any further insights into the real challenges of using
> object-oriented frameworks please feel free to elaborate below:

None

> *** Would you be prepared to spend 30 minutes (maximum) in a follow-up
> interview during January.
> Yes / No

No

>
> -----
> -----
>
> End of questionnaire:
> Thank you very much for your co-operation
> Marc, Murray and Doug
> Merry Christmas - you have earned a break!

and Merry Christmas to your good selves too!!

Questionnaire 7

murray@cs.strath.ac.uk wrote:

>
> For those doing 52.440 Software Architecture - others please ignore

> (apologies)
>
> We realise that we will not be flavour of the month with you just now
> but we would like to ask a real favour of you.
>
> Last week a research paper was published in the main US Software
> Engineering journal (IEEE Trans. Software Engineering) by researchers
> investigating the challenges in understanding object-oriented
> frameworks. They based their work on a study of students using an
> object-oriented framework called ET++. We would like to take this
> opportunity to investigate, and perhaps respond to, some of their
> findings.
>
> Also, as some of you may know, Doug's area of research is focused on the
> problems in using object oriented frameworks such as HotDraw.
>
> The following is a very simple questionnaire. It should only take the
> order of 10 minutes to complete. We would be very grateful if you could
> use your experiences in the HotDraw practicals to complete this.
>
> *****
>
> Please note: Responding to the following questionnaire is entirely at
> your own discretion its not part of the coursework and will not affect
> your course marks in any way.
> *****
>
> If you have the time and the inclination please answer the questions
> below and return them to murray via email.
>
> Thank you very much - we hope you have found the course a useful
> practical experience,
> Marc, Murray and Doug.
>
> -----
>
> Framework Experiences Questionnaire:
> -----
>
> Q1) How difficult did you find understanding the following aspects of
> the HotDraw framework?
> Please enter a number 1 to 5, where:
> 1 very easy
> 2 easy
> 3 moderate
> 4 hard
> 5 very hard
>
> 1.1 Understanding individual classes and their methods
2
>
> 1.2 Using abstract classes/interfaces
2
>
> 1.3 Mapping your solution to framework code
4
>
> 1.4 Understanding the structure of inheritance hierarchies and object
> compositions
3
>
> 1.5 Understanding design patterns
4

>
> 1.6 Understanding the dynamic structure of the framework

5

>
> 1.7 Choosing from alternative framework solution strategies

3

>
> 1.8 Understanding the HotDraw problem domain

2

>
> 1.9 Were there any other particularly challenging aspects of the
> framework practicals
> (please specify)

Yes, having to understand the observer pattern to do the second last
unassessed prac.

>
> Q2) How effective have you found the following in solving your problems
> during the practicals.
> Please enter a number 1 to 5, where:
> 1 no use
> 2 barely useful
> 3 moderately useful
> 4 useful
> 5 very useful
>
> 2.1 Browsing JavaDoc files

4

>
> 2.2 Doug's Patterns Patterns for JHotDraw paper

3

>
> 2.3 Design pattern knowledge

2

>
> 2.4 Asking lecturer

4

>
> 2.5 Asking newsgroup

3

>
> 2.6 Asking other students

4

>
> 2.7 Studying existing examples

5

>
> 2.9 Previous practical solutions

5

- >
- > 2.10 Are there any other tools/techniques that you used and found
- > particularly useful?
- > (please specify)

Browsing the source code of the framework classes

- >
- > 2.11 Are there any other tools/techniques that you didn't actually use
- > but that you THINK would be useful?
- > (please specify)

TogetherJ maybe.....

- >
- > Q3)
- > 3.1 What were your main sources of problems during the early HotDraw
- > practicals e.g. around Practical 4?

Understanding how the classes interacted, and where each of the methods was called from.

- >
- > 3.2 What were your main sources of problems during the later HotDraw
- > practicals?

sorting out bugs caused by the design patterns

- >
- > 3.3. What were your key sources of help in the early HotDraw practicals?

other examples & lecturers

- >
- > 3.4 What were your key sources of help in the later HotDraw practicals?

javadoc, examples, source code

- >
- > Q4) In the assessed practical please estimate how much time you spent in
- > the following areas
- > (answer in hours)
- >
- > 4.1 Stuck with no idea what to do

2

- >
- > 4.2 Stuck with no idea why something didn't work

1

- >
- > 4.3 Forming hypotheses of how a solution might work

1

- >
- > 4.4 Reading documentation

2

- >
- > 4.5 Reading the source code

2

- >
- > 4.6 Implementing changes

3

>
> 4.7 Testing

1

>
> 4.7 Other time consuming activities
> (please specify)

>
> If you have any further insights into the real challenges of using
> object-oriented frameworks please feel free to elaborate below:
>
> *** Would you be prepared to spend 30 minutes (maximum) in a follow-up
> interview during January.
> Yes
>
> -----
>
> End of questionnaire:
> Thank you very much for your co-operation
> Marc, Murray and Doug
> Merry Christmas - you have earned a break!

Questionnaire 8

> Q1) How difficult did you find understanding the following aspects of
> the HotDraw framework?
> Please enter a number 1 to 5, where:
> 1 very easy
> 2 easy
> 3 moderate
> 4 hard
> 4 very hard
>
> 1.1 Understanding individual classes and their methods

2
> 1.2 Using abstract classes/interfaces

3
> 1.3 Mapping your solution to framework code

1
> 1.4 Understanding the structure of inheritance hierarchies and object
> compositions
3

> 1.5 Understanding design patterns

4
> 1.6 Understanding the dynamic structure of the framework
4

> 1.7 Choosing from alternative framework solution strategies
4

> 1.8 Understanding the HotDraw problem domain
3

> 1.9 Were there any other particularly challenging aspects of the
> framework practicals
> (please specify)

> Q2) How effective have you found the following in solving your problems
> during the practicals.
> Please enter a number 1 to 5, where:

- > 1 no use
- > 2 barely useful
- > 3 moderately useful
- > 4 useful
- > 5 very useful
- >
- > 2.1 Browsing JavaDoc files

5

- > 2.2 Doug's Patterns Patterns for JHotDraw paper

5

- > 2.3 Design pattern knowledge

3

- > 2.4 Asking lecturer

3

- > 2.5 Asking newsgroup

5

- > 2.6 Asking other students

5

- > 2.7 Studying existing examples

5

- > 2.9 Previous practical solutions

4

- > 2.10 Are there any other tools/techniques that you used and found
- > particularly useful?
- > (please specify)

No

- > 2.11 Are there any other tools/techniques that you didn't actually use
- > but that you THINK would be useful?
- > (please specify)

No

- > Q3)
- > 3.1 What were your main sources of problems during the early HotDraw
- > practicals e.g. around Practical 4?

Not having enough background knowledge to HotDraw and what its components do.

- > 3.2 What were your main sources of problems during the later HotDraw
- > practicals?

Choosing one solution over others

- > 3.3. What were your key sources of help in the early HotDraw practicals?

HotDraw samples

Newsgroup

- > 3.4 What were your key sources of help in the later HotDraw practicals?

HotDraw samples

Newsgroup

Other students

> Q4) In the assessed practical please estimate how much time you spent in
 > the following areas
 > (answer in hours)
 >
 > 4.1 Stuck with no idea what to do
 3
 > 4.2 Stuck with no idea why something didn't work
 3
 > 4.3 Forming hypotheses of how a solution might work
 4
 > 4.4 Reading documentation
 1
 > 4.5 Reading the source code
 2
 > 4.6 Implementing changes
 2
 > 4.7 Testing
 1
 > 4.7 Other time consuming activities
 > (please specify)
 >
 > If you have any further insights into the real challenges of using
 > object-oriented frameworks please feel free to elaborate below:
 >
 > *** Would you be prepared to spend 30 minutes (maximum) in a follow-up
 > interview during January.
 > Yes / No
 No
 > -----
 >
 > End of questionnaire:
 > Thank you very much for your co-operation
 > Marc, Murray and Doug
 > Merry Christmas - you have earned a break!

Questionnaire 9

Answers in-line

> Framework Experiences Questionnaire:
 > -----

 >
 >
 >
 >
 > Q1) How difficult did you find understanding the following aspects of
 > the HotDraw framework?
 > Please enter a number 1 to 5, where:
 > 1 very easy
 > 2 easy
 > 3 moderate
 > 4 hard
 > 4 very hard

>
> 1.1 Understanding individual classes and their methods

1

> 1.2 Using abstract classes/interfaces

2

> 1.3 Mapping your solution to framework code

2

> 1.4 Understanding the structure of inheritance hierarchies and object
> compositions

3

> 1.5 Understanding design patterns

4

> 1.6 Understanding the dynamic structure of the framework

4

> 1.7 Choosing from alternative framework solution strategies

4

> 1.8 Understanding the HotDraw problem domain

4

> 1.9 Were there any other particularly challenging aspects of the
> framework practicals
> (please specify)

Most problems came from the number of classes involved in the framework and trying to understand how each class relate to the others. A class diagram, just with class name, not necessarily the methods, would have been extremely helpful, allowing you to actually see the hierarchy.

> Q2) How effective have you found the following in solving your problems
> during the practicals.

> Please enter a number 1 to 5, where:

> 1 no use

> 2 barely useful

> 3 moderately useful

> 4 useful

> 5 very useful

>

>

> 2.1 Browsing JavaDoc files

5

> 2.2 Doug's Patterns Patterns for JHotDraw paper

4

> 2.3 Design pattern knowledge

3

> 2.4 Asking lecturer

n/a

> 2.5 Asking newsgroup

n/a

> 2.6 Asking other students

2

> 2.7 Studying existing examples

4

> 2.9 Previous practical solutions

4

> 2.10 Are there any other tools/techniques that you used and found
> particularly useful?
> (please specify)

no

> 2.11 Are there any other tools/techniques that you didn't actually use
> but that you THINK would be useful?
> (please specify)

no

> Q3)
> 3.1 What were your main sources of problems during the early HotDraw
> practicals e.g. around Practical 4?

knowing what to sub-class

> 3.2 What were your main sources of problems during the later HotDraw
> practicals?

> 3.3. What were your key sources of help in the early HotDraw practicals?

trial and error approach, also asking friends

> 3.4 What were your key sources of help in the later HotDraw practicals?

javadoc and framework source code

> Q4) In the assessed practical please estimate how much time you spent in
> the following areas
> (answer in hours)

>

> 4.1 Stuck with no idea what to do

0 - 1 hours

> 4.2 Stuck with no idea why something didn't work

2 -3 hours

> 4.3 Forming hypotheses of how a solution might work

1 hour

> 4.4 Reading documentation

2 1/2 hours

> 4.5 Reading the source code

2 1/2 hours

> 4.6 Implementing changes

3 1/2 hours

> 4.7 Testing

not sure, ran in conjunction with coding

> 4.7 Other time consuming activities
> (please specify)

Trying, and failing, to create images for buttons, so that they looked as good as the ones provided, e.g star shape.

> If you have any further insights into the real challenges of using
> object-oriented frameworks please feel free to elaborate below:

One of the main problems/hassles I found was jumping back and forth around about 4 classes at once to try and work out how something worked.

> *** Would you be prepared to spend 30 minutes (maximum) in a follow-up
> interview during January.
> Yes / No

No

Questionnaire 10

murray@cs.strath.ac.uk wrote:

>
> For those doing 52.440 Software Architecture - others please ignore
> (apologies)
>
> We realise that we will not be flavour of the month with you just now
> but we would like to ask a real favour of you.
>
> Last week a research paper was published in the main US Software
> Engineering journal (IEEE Trans. Software Engineering) by researchers
> investigating the challenges in understanding object-oriented
> frameworks. They based their work on a study of students using an
> object-oriented framework called ET++. We would like to take this
> opportunity to investigate, and perhaps respond to, some of their
> findings.
>
> Also, as some of you may know, Doug's area of research is focused on the
> problems in using object oriented frameworks such as HotDraw.
>
> The following is a very simple questionnaire. It should only take the
> order of 10 minutes to complete. We would be very grateful if you could
> use your experiences in the HotDraw practicals to complete this.
>
> *****
>
> Please note: Responding to the following questionnaire is entirely at
> your own discretion its not part of the coursework and will not affect
> your course marks in any way.
> *****
>
> If you have the time and the inclination please answer the questions
> below and return them to murray via email.
>
> Thank you very much - we hope you have found the course a useful
> practical experience,
> Marc, Murray and Doug.
>
> -----
>
> Framework Experiences Questionnaire:
> -----
>
> Q1) How difficult did you find understanding the following aspects of
> the HotDraw framework?
> Please enter a number 1 to 5, where:
> 1 very easy

- > 2 easy
- > 3 moderate
- > 4 hard
- > 4 very hard
- >
- > 1.1 Understanding individual classes and their methods
- 3
- > 1.2 Using abstract classes/interfaces
- 2
- > 1.3 Mapping your solution to framework code
- 4
- > 1.4 Understanding the structure of inheritance hierarchies and object
- > compositions
- 3
- > 1.5 Understanding design patterns
- 4
- > 1.6 Understanding the dynamic structure of the framework
- 5
- > 1.7 Choosing from alternative framework solution strategies
- 4
- > 1.8 Understanding the HotDraw problem domain
- 4
- > 1.9 Were there any other particularly challenging aspects of the
- > framework practicals
- > (please specify)

Locating framework functionality

- > Q2) How effective have you found the following in solving your problems
- > during the practicals.
- > Please enter a number 1 to 5, where:
- > 1 no use
- > 2 barely useful
- > 3 moderately useful
- > 4 useful
- > 5 very useful
- >
- > 2.1 Browsing JavaDoc files
- 5
- > 2.2 Doug's Patterns Patterns for JHotDraw paper
- 3
- > 2.3 Design pattern knowledge
- 3
- > 2.4 Asking lecturer
- 3
- > 2.5 Asking newsgroup
- 4

> 2.6 Asking other students

4

> 2.7 Studying existing examples

4

> 2.9 Previous practical solutions

4

> 2.10 Are there any other tools/techniques that you used and found

> particularly useful?

> (please specify)

>

> 2.11 Are there any other tools/techniques that you didn't actually use

> but that you THINK would be useful?

> (please specify)

More extensive examples and documentation

> Q3)

> 3.1 What were your main sources of problems during the early HotDraw

> practicals e.g. around Practical 4?

>

> 3.2 What were your main sources of problems during the later HotDraw

> practicals?

Locating desired functionality and understanding the frameworks

operation

(who calls what when and why)

> 3.3. What were your key sources of help in the early HotDraw practicals?

Documentation

> 3.4 What were your key sources of help in the later HotDraw practicals?

>

> Q4) In the assessed practical please estimate how much time you spent in

> the following areas

> (answer in hours)

>

> 4.1 Stuck with no idea what to do

0

> 4.2 Stuck with no idea why something didn't work

2

> 4.3 Forming hypotheses of how a solution might work

3

> 4.4 Reading documentation

3

> 4.5 Reading the source code

1

> 4.6 Implementing changes

4

> 4.7 Testing

4

> 4.7 Other time consuming activities

> (please specify)

Questionnaire 11

Marc, Murray and Doug,

: We realise that we will not be flavour of the month with you just now

Ah well, at least its over and submitted now!

Below is my completed questionnaire. Hope it helps!

Framework Experiences Questionnaire:

Q1) How difficult did you find understanding the following aspects of the HotDraw framework?

Please enter a number 1 to 5, where:

1 very easy

2 easy

3 moderate

4 hard

5 very hard

1.1 Understanding individual classes and their methods

2

1.2 Using abstract classes/interfaces

3

1.3 Mapping your solution to framework code

4

1.4 Understanding the structure of inheritance hierarchies and object compositions

3

1.5 Understanding design patterns

3

1.6 Understanding the dynamic structure of the framework

2

1.7 Choosing from alternative framework solution strategies

2

1.8 Understanding the HotDraw problem domain

3

1.9 Were there any other particularly challenging aspects of the framework practicals
(please specify)

Q2) How effective have you found the following in solving your problems during the practicals.

Please enter a number 1 to 5, where:

1 no use

2 barely useful

3 moderately useful

4 useful

5 very useful

2.1 Browsing JavaDoc files

5

2.2 Doug's Patterns Patterns for JHotDraw paper

3

2.3 Design pattern knowledge

2

2.4 Asking lecturer

2

2.5 Asking newsgroup

3

2.6 Asking other students

3

2.7 Studying existing examples

5

2.9 Previous practical solutions

4

2.10 Are there any other tools/techniques that you used and found particularly useful?
(please specify)

Mainly just adapted existing classes to provide customised functionality.

2.11 Are there any other tools/techniques that you didn't actually use but that you THINK would be useful?
(please specify)

As I was using 3D in my extension, it might be useful to adapt the framework to build a package to handle 3d polygons and render them.

Q3)

3.1 What were your main sources of problems during the early HotDraw practicals e.g. around Practical 4?

Initial understanding of the framework and the underlying concepts.

3.2 What were your main sources of problems during the later HotDraw practicals?

Understanding requirements of practical (I felt at least one of the specifications was not clear enough, and my implementation was therefore different), choosing correct classes to modify.

3.3. What were your key sources of help in the early HotDraw practicals?

Samples included with HotDraw (i.e. NothingApp).

3.4 What were your key sources of help in the later HotDraw practicals?

JavaDoc of HotDraw classes.

Q4) In the assessed practical please estimate how much time you spent in the following areas
(answer in hours)

4.1 Stuck with no idea what to do

1

4.2 Stuck with no idea why something didn't work

4

4.3 Forming hypotheses of how a solution might work

4

4.4 Reading documentation

2

4.5 Reading the source code

1

4.6 Implementing changes

4

4.7 Testing

3

4.7 Other time consuming activities
(please specify)

3 - Researching best techniques

If you have any further insights into the real challenges of using object-oriented frameworks please feel free to elaborate below:

The main problem I found with using a framework was that any linear progression was not clearly laid out, causing potential problems - for instance in HotDraw a Figure is instantiated by its tool before the DrawingView is properly set up (even though it has been created), therefore trying to access certain elements on this causes an Exception. There were also a few cases where there was more than one way of solving a particular, and it was not clear which way would be better/more elegant.

*** Would you be prepared to spend 30 minutes (maximum) in a follow-up interview during January.

Yes / No

Yes

End of questionnaire

Questionnaire 12

Framework Experiences Questionnaire:

Q1) How difficult did you find understanding the following aspects of the HotDraw framework?

Please enter a number 1 to 5, where:

1 very easy

2 easy

3 moderate

4 hard

5 very hard

1.1 Understanding individual classes and their methods

2

1.2 Using abstract classes/interfaces

3

1.3 Mapping your solution to framework code

3

1.4 Understanding the structure of inheritance hierarchies and object compositions

2

1.5 Understanding design patterns

3

1.6 Understanding the dynamic structure of the framework

4

1.7 Choosing from alternative framework solution strategies

3

1.8 Understanding the HotDraw problem domain

2

1.9 Were there any other particularly challenging aspects of the framework practicals
(please specify)

Q2) How effective have you found the following in solving your problems during the practicals.

Please enter a number 1 to 5, where:

1 no use

2 barely useful

3 moderately useful

4 useful

5 very useful

2.1 Browsing JavaDoc files

4

2.2 Doug's Patterns Patterns for JHotDraw paper

4

2.3 Design pattern knowledge

3

2.4 Asking lecturer

4

2.5 Asking newsgroup

3

2.6 Asking other students

3

2.7 Studying existing examples

4

2.9 Previous practical solutions

5

2.10 Are there any other tools/techniques that you used and found particularly useful?
(please specify)

2.11 Are there any other tools/techniques that you didn't actually use but that you THINK would be useful?
(please specify)

Q3)

3.1 What were your main sources of problems during the early HotDraw practicals e.g. around Practical 4?
Understanding how far into the code hierarchy needed to be explored

3.2 What were your main sources of problems during the later HotDraw practicals?
understanding how to achieve the practical

3.3. What were your key sources of help in the early HotDraw practicals?
The samples in HotDraw

3.4 What were your key sources of help in the later HotDraw practicals?
Previous practical solutions

Q4) In the assessed practical please estimate how much time you spent in the following areas
(answer in hours)

4.1 Stuck with no idea what to do
2

4.2 Stuck with no idea why something didn't work
4

4.3 Forming hypotheses of how a solution might work
1

4.4 Reading documentation
2

4.5 Reading the source code
3

4.6 Implementing changes
4

4.7 Testing
1

4.7 Other time consuming activities
(please specify)

If you have any further insights into the real challenges of using object-oriented frameworks please feel free to elaborate below:

*** Would you be prepared to spend 30 minutes (maximum) in a follow-up interview during January.

Yes / No

yes

End of questionnaire:
 Thank you very much for your co-operation
 Marc, Murray and Doug
 Merry Christmas - you have earned a break!

Questionnaire 13

answers to questionnaire are embedded

murray@cs.strath.ac.uk wrote:

```
>
> For those doing 52.440 Software Architecture - others please ignore
> (apologies)
>
> We realise that we will not be flavour of the month with you just now
> but we would like to ask a real favour of you.
>
> Last week a research paper was published in the main US Software
> Engineering journal (IEEE Trans. Software Engineering) by researchers
> investigating the challenges in understanding object-oriented
> frameworks. They based their work on a study of students using an
> object-oriented framework called ET++. We would like to take this
> opportunity to investigate, and perhaps respond to, some of their
> findings.
>
> Also, as some of you may know, Doug's area of research is focused on the
> problems in using object oriented frameworks such as HotDraw.
>
> The following is a very simple questionnaire. It should only take the
> order of 10 minutes to complete. We would be very grateful if you could
> use your experiences in the HotDraw practicals to complete this.
>
> *****
>
> Please note: Responding to the following questionnaire is entirely at
> your own discretion its not part of the coursework and will not affect
> your course marks in any way.
> *****
>
> If you have the time and the inclination please answer the questions
> below and return them to murray via email.
>
> Thank you very much - we hope you have found the course a useful
> practical experience,
> Marc, Murray and Doug.
>
> -----
>
> Framework Experiences Questionnaire:
> -----
>
> Q1) How difficult did you find understanding the following aspects of
> the HotDraw framework?
> Please enter a number 1 to 5, where:
> 1 very easy
> 2 easy
> 3 moderate
> 4 hard
> 5 very hard
>
> 1.1 Understanding individual classes and their methods
2
>
> 1.2 Using abstract classes/interfaces
2
>
> 1.3 Mapping your solution to framework code
```

4

>
> 1.4 Understanding the structure of inheritance hierarchies and object
> compositions

4

>
> 1.5 Understanding design patterns

4

>
> 1.6 Understanding the dynamic structure of the framework

5

>
> 1.7 Choosing from alternative framework solution strategies

3

>
> 1.8 Understanding the HotDraw problem domain

1

>
> 1.9 Were there any other particularly challenging aspects of the
> framework practicals
> (please specify)

Practical 7 was the hardest. Using the observer pattern in order to
move the planets /line connections as one unit.

>
> Q2) How effective have you found the following in solving your problems
> during the practicals.
> Please enter a number 1 to 5, where:
> 1 no use
> 2 barely useful
> 3 moderately useful
> 4 useful
> 5 very useful
>
> 2.1 Browsing JavaDoc files

3

>
> 2.2 Doug's Patterns Patterns for JHotDraw paper

3

>
> 2.3 Design pattern knowledge

3

>
> 2.4 Asking lecturer

5

>
> 2.5 Asking newsgroup

3

>
> 2.6 Asking other students

5

>
> 2.7 Studying existing examples

5

>
> 2.9 Previous practical solutions

4

>
> 2.10 Are there any other tools/techniques that you used and found
> particularly useful?
> (please specify)

The source code being spilt into sub directories was usefull in locating the source code.

>
> 2.11 Are there any other tools/techniques that you didn't actually use
> but that you THINK would be useful?
> (please specify)

A proper class diagram, providing that it can split into reasonable chunks.

>
> Q3)
> 3.1 What were your main sources of problems during the early HotDraw
> practicals e.g. around Practical 4?

Felt overwhelmed, where do I begin. When I read one class I would end up going upstairs to its parents then across to another associated class, then to its child, then back to where I begun!! (didn't like the observer pattern in the beginning)

>
> 3.2 What were your main sources of problems during the later HotDraw
> practicals?

One of the biggest problems is basically how do interact with it

>
> 3.3. What were your key sources of help in the early HotDraw practicals?

The examples, could copy/adopt their techniques to my own problems.

>
> 3.4 What were your key sources of help in the later HotDraw practicals?

Basically scan the javadoc to find a method that had a name and rough description to something I wanted to do, then read the source code.

Attempted the net but most of the stuff there was on drawlets.

>
> Q4) In the assessed practical please estimate how much time you spent in
> the following areas
> (answer in hours)
>
> 4.1 Stuck with no idea what to do

1

>
> 4.2 Stuck with no idea why something didn't work

3

>
> 4.3 Forming hypotheses of how a solution might work

3

>
> 4.4 Reading documentation

2

>
> 4.5 Reading the source code

5

>
> 4.6 Implementing changes

5

>
> 4.7 Testing

3

>
> 4.7 Other time consuming activities
> (please specify)

2 hours searching to see if what I was doing was actually the correct way of doing it i.e. Trying to prevent myself re-writing functions that already exist.

>
> If you have any further insights into the real challenges of using
> object-oriented frameworks please feel free to elaborate below:
>
> *** Would you be prepared to spend 30 minutes (maximum) in a follow-up
> interview during January.
> Yes (Providing minimal revision is required)
>
> -----
>
> End of questionnaire:
> Thank you very much for your co-operation
> Marc, Murray and Doug
> Merry Christmas - you have earned a break!

Questionnaire 14

>
> Framework Experiences Questionnaire:
> -----
> -----
>
>
>
> Q1) How difficult did you find understanding the following aspects of
> the HotDraw framework?
> Please enter a number 1 to 5, where:
> 1 very easy
> 2 easy
> 3 moderate
> 4 hard
> 5 very hard
>
> 1.1 Understanding individual classes and their methods - 2
>

>
 > 1.2 Using abstract classes/interfaces - 3
 >
 >
 > 1.3 Mapping your solution to framework code - 4
 >
 >
 > 1.4 Understanding the structure of inheritance hierarchies and object
 > compositions - 5
 >
 >
 > 1.5 Understanding design patterns - 4
 >
 >
 > 1.6 Understanding the dynamic structure of the framework - 4
 >
 >
 > 1.7 Choosing from alternative framework solution strategies - 4
 >
 >
 > 1.8 Understanding the HotDraw problem domain - 3
 >
 >
 > 1.9 Were there any other particularly challenging aspects of the
 > framework practicals
 > (please specify)
 >
 >
 >
 > Q2) How effective have you found the following in solving your problems
 > during the practicals.
 > Please enter a number 1 to 5, where:
 > 1 no use
 > 2 barely useful
 > 3 moderately useful
 > 4 useful
 > 5 very useful
 >
 >
 > 2.1 Browsing JavaDoc files - 3
 >
 >
 > 2.2 Doug's Patterns Patterns for JHotDraw paper - 4
 >
 >
 > 2.3 Design pattern knowledge - 3
 >
 >
 > 2.4 Asking lecturer - N/A, not enough practical time
 >
 >
 > 2.5 Asking newsgroup - N/A
 >
 >
 > 2.6 Asking other students - 4
 >
 >
 > 2.7 Studying existing examples - 4
 >
 >
 > 2.9 Previous practical solutions - 5
 >
 >
 > 2.10 Are there any other tools/techniques that you used and found
 > particularly useful?
 > (please specify)
 >
 >
 > 2.11 Are there any other tools/techniques that you didn't actually use
 > but that you THINK would be useful?
 > (please specify)
 >
 > Big poster with all the entire hierarchy on the wall beside you

>
 > Q3)
 > 3.1 What were your main sources of problems during the early HotDraw
 > practicals e.g. around Practical 4?

Tracking down any actual implementation, figuring out what an interface was

>
 > 3.2 What were your main sources of problems during the later HotDraw
 > practicals?

Still tracking down implementation, understanding how things outwith
 `figure` worked

>
 > 3.3. What were your key sources of help in the early HotDraw practicals?
 >
 friends

>
 > 3.4 What were your key sources of help in the later HotDraw practicals?
 >
 friends, earlier examples and newsgroup postings with similar problems
 >
 > Q4) In the assessed practical please estimate how much time you spent in
 > the following areas
 > (answer in hours)

>
 > 4.1 Stuck with no idea what to do
 3
 >
 > 4.2 Stuck with no idea why something didn't work
 5
 >
 > 4.3 Forming hypotheses of how a solution might work
 2
 >
 > 4.4 Reading documentation
 1
 >
 > 4.5 Reading the source code
 2
 >
 > 4.6 Implementing changes
 2
 >
 > 4.7 Testing
 1
 >
 > 4.7 Other time consuming activities
 > (please specify)
 Trying to come up with something other than shading and making a sun
 >
 >
 > If you have any further insights into the real challenges of using
 > object-oriented frameworks please feel free to elaborate below:

Require total knowledge, far more time spent figuring out where to put
 implementation than actually doing the implementation itself. Probably the
 same with any major chunk of code though.

>
 >
 > *** Would you be prepared to spend 30 minutes (maximum) in a follow-up
 > interview during January.
 > Yes / xxNoxx
 >
 >
 > -----
 > -----
 >
 > End of questionnaire:

> Thank you very much for your co-operation
 > Marc, Murray and Doug
 > Merry Christmas - you have earned a break!
 >
 >

Questionnaire 15

Q1.1)5
 Q1.2)4
 Q1.3)4
 Q1.4)3
 Q1.5)2
 Q1.6)3
 Q1.7)4
 Q1.8)4
 Q1.9)Understanding some classes and methods (ambiguous naming)

 Q2.1)2
 Q2.2)3
 Q2.3)2
 Q2.4)2
 Q2.5)5
 Q2.6)5
 Q2.7)4
 Q2.9)5
 Q2.10)Plagerism.....no just kidding:)
 Q2.11)Using a different editor cause RealJ was honestly not very good...

 Q3.1)Reading classes that were extended, that were to extended...etc...
 a lot to take in.
 Q3.2)Differcultly on where to start!
 Q3.3)Newsgroups.
 Q3.4)The answer given in the end of the week.

 Q4)2 hours
 Q4.1)2 WHOLE DAYS!... maybe about 16 hours(this is for total number of
 things that were "suppose" to work.
 Q4.2)2 hours
 Q4.3)2 hours
 Q4.4)2 hours
 Q4.5)4-6 hours
 Q4.6)3 hours
 Q4.7)2 hours
 Q4.8) Report - Appox 6 hours

I personally think there should be much more documentation within the
 source code to explain each method. Somthimes it can be unclear what a
 method does and constantly switching betweeen the JavaDoc and the source
 code is a real pain in the arse. Reading undocumented code makes it one
 of the reasons why doing the practicals and hotdraw very difficult.

Interview - Nope sorry, i don't think i'll have the time next year..

Questionnaire 16

1.1 Understanding individual classes and their methods: 4

 1.2 Using abstract classes/interfaces: 4

 1.3 Mapping your solution to framework code:3

 1.4 Understanding the structure of inheritance hierarchies and object
 compositions:3

 1.5 Understanding design patterns:4

 1.6 Understanding the dynamic structure of the framework:5

1.7 Choosing from alternative framework solution strategies:5

1.8 Understanding the HotDraw problem domain:4

1.9 Were there any other particularly challenging aspects of the framework practicals: I found it most difficult to know where to make changes, ie what classes and methods to make the changes to.

2.1 Browsing JavaDoc files:5

2.2 Doug's Patterns Patterns for JHotDraw paper:5

2.3 Design pattern knowledge:3

2.4 Asking lecturer:3

2.5 Asking newsgroup:3

2.6 Asking other students:4

2.7 Studying existing examples:3

2.9 Previous practical solutions:5

2.10 Are there any other tools/techniques that you used and found particularly useful?: The best way I found to learn about frameworks was to spend ages looking at the code and changing small bits at a time to see what the effect was.

Q3)

3.1 What were your main sources of problems during the early HotDraw practicals e.g. around Practical 4?

The early [practicals were not as bad as the ones later one. Although I found it difficult to relate the design pattern to a specific problem. The examples in the Design Patterns book was still too complex. Easier examples may have helped me to relate the DP to the java code.

3.2 What were your main sources of problems during the later HotDraw practicals?

I had absolutely no idea how to do most of the practicals. I had a go at practicals 4 and 5, but after that I gave up inbeing ablr to do any of them. Looking at the solution there was just no way I would have ever thought of it.

3.3. What were your key sources of help in the early HotDraw practicals?

Looking at the lecture notes and design patterns book

3.4 What were your key sources of help in the later HotDraw practicals?

looking at the documentation provided by HotDraw and Doug Kirk's paper.

Q4) In the assessed practical please estimate how much time you spent in the following areas: around 80 hours in total to complete.

4.1 Stuck with no idea what to do

4 hours

4.2 Stuck with no idea why something didn't work

8 hours

4.3 Forming hypotheses of how a solution might work

4 hours

4.4 Reading documentation

8 hours

4.5 Reading the source code

12 hours

4.6 Implementing changes

12 hours

4.7 Testing

15 hours

4.7 Other time consuming activities
(please specify) Writing up report: 24 hours

If you have any further insights into the real challenges of using
object-oriented frameworks please feel free to elaborate below:

*** Would you be prepared to spend 30 minutes (maximum) in a follow-up
interview during January.
No

2.11 Are there any other tools/techniques that you didn't actually use
but that you **THINK** would be useful?
(please specify)

2.5. Student coursework submissions

Student coursework submissions could not be included for ethical reasons. See main body of thesis for some excerpts (Chapter 3).and problem list (below).

3 Analysis artefacts

3.1. List of problems collected from the data

Personal Experiences - CAD - Role Model

1. Most of my current problems are geographical – finding things.
2. Compare the hassle this involves [creating a text figure and getting it working properly] with just creating a JTextField.
3. Null pointer exception – no idea where from – well possibly from lack of canvas object in tool. Solved – need to supply canvas – hidden in inheritance!
4. Want to set size of class boxes – need to understand figure hierarchy – could use `cons(x,y,width,height)` / how to you use bounding box?
5. Its like having to solve a general s/w Eng. problem with the advantage of not having to write all the functional blocks but the disadvantage of having to translate your design schema into the frameworks structure (If the framework allows such conversion). This requires understanding the main roles and relationships in the framework, which is not easy.
6. Patterns don't explicitly describe the role of the Drawing Canvas (important because DC is the container for the components). Drawing object is distinct from DC – why is this not clear to start with!
7. In order to understand how Drawing works I have to understand its super class 'sequence of Figures' – logically it seems unclear why a drawing is a sequence of figures instead of being a has a relationship.
8. What I want to do is get the framework running so that I can start customising!
9. Look at examples to see how they do it – no complete examples [executable examples] found.
10. Cannot find ToolPalette – know it exists from example 'SimpleTestPanel' – (found it in `rolemodelsoft.awt`) – patterns make no mention of this object. [Next entry - basic tool palette created]
11. How to create custom figure and how to create custom tools - documentation [pattern lang.] suggests looking at the `canvasTool` hierarchy. How do I find this? - JavaDoc
12. TextBox change position (set position) functionality is not obvious. Methods to `translate()`, `setBounds()`, `setLocator()` ... etc all seem possible – very little diagnostic evidence available to distinguish what the functionality actually is. (Poor JavaDoc comments).
13. `setBounds()` contains link to `move()` in Abstract Figure. Now need to understand locator. What class does moveable locator super-class? - Need to find concrete class (movable locator) – Drawing point! With `textbox.setLocator()` < No turns out to be `move()`?
14. Why isn't TextLabel a type of Figure as opposed to an Abstract Figure?

15. Build GUI for tool using Java swing stuff [taken wrong approach here]
16. How does a Handle know what shapes its interested in? (I.e. how do you attach Handles to Figures)
17. Look for handles code [in the following:] – RectangleShape / AbstractRectangleShape / FilledShape / AbstractShape (getHandles()) / AbstractFigure (editTool()).
18. Where are handles fitting into the system - not DC > tool > handle seems more like DC > handle / DC > tool. This might still be true but original idea is now working (i.e. can get boxes to change colour using DC > tool > handle)
19. Having trouble visualising all interactions and responsibilities. [Start drawing diagrams and bullet lists of interactions]
20. {New Figure -> newBasicFigure(); setProperties()}. System must use new figure as shown – not obvious!
21. Mouse Interaction - Not clear where functionality lies need to experiment. [Search?]
22. Actual subclass of each class is important (i.e. handle doesn't have mouse support until CanvasHandle etc.)

Personal Experiences – CAD - Gamma

23. Extending in the spirit of the existing code is hard.
24. Debugging [text inside rectangle] is this just normal debugging or framework behaviour not clear [i.e. has the FW been misused]?
25. How do I create a rectangle? (Why is there no Rectangle tool?) – Subclass creation Tool?
26. Abstract Figure doesn't hold multiple figures – interface implies that it does!
27. Need to subclass rectangle figure to add multiple figure stuff – Is this the best place to add? [Addition made either as a descendent of RectangleFigure or decedent of GroupFigure]
28. MoveBy doesn't set location it offsets from current location.

Personal Experiences – Orbit – Gamma

29. Override methods to turn off menus first tried setting createMenu()/createTools() to null behaviour -> crashed HD! – Seems like I want to override createXXXX methods. Looking at D/A s/c for example! - Might not be possible seems that you can only add extra not take away – not very flexible.
30. Sometimes when looking for something come across something unexpected (nonsensical) which makes you wonder what else this class is doing that you don't know about (i.e. why should DV have a setEditor() method?).

31. Often chase knowledge up inheritance hierarchies and across compositions

32. Every function brought in for a purpose [don't always know why!]

33. How do you know if functionality is not present? [waste time searching]

34. Create circle in centre of screen – How do you find centre of drawing?

Look in drawing > wrong!

AbstractFigure.centre() ~ [appear to have assumed this will work without checking]

35. How do you add shape at a position on the drawing? No obvious add function may need to set figure locator

36. Locator [documentation?] suggests that it works in conjunction with handles [i.e. we don't want it]. Just have to use the brute force method > Figure.basicDisplayBox(Pt,Pt)

37. Turns out Abstract Figure returns (0,0) for drawing [maybe I thought basicDisplayBox() wasn't working because of this?] and displaybox also returns (0,0,0,0) – why is this and how can I find centre! (turns out that Drawing.display box is the union of all figures)

38. DrawingView.getSize() returns dimension of drawing > no it returns 0!!

39. DA.getDrawingViewSize() gets dimensions – still doesn't work [to find centre because of toolbar etc] also need figure in centre all the time (i.e. when window is resized)

40. How do I prevent resize > think handles. Look in Ellipse Figure > redefine handles. Subclass ellipse? Seems a bit extreme. What about changing selection tool?

41. SelectionTool creates Drag/Handle/Area Tracker() methods. What are these? DragTracker seems to control movement behaviour (i.e. remove handle tracker & area tracker to dumb down selection tool)

42. Looking at code for selection tool suggests creating a new subclass of handle tracker and override createHandleTracker method in selection tool

43. Create MySelectionTool and need to insert in place of selection tool. MydrawApp needs to override createSelectionTool() existence of this backs up my approach of changing the tool not the figure! [Wrong!]

44. Need to alter figure return handles [to turn handles off] – no! Need to turn off part of selection tool that draws them.

45. Part that draws handles is possibly AbstractTool.activate() – no! Handles are drawn in DV.drawHandles() – draws currently active handles. Do I want to subclass this – no! Seems a little bit too wide reaching.

46. Need to create custom tool > based on existing tool > DA.createTools(). Need to look at DA code to figure out what to write (only way to gain this knowledge is via an example?) (Needed JavaDrawApp example – what would you have done without an example?) [Didn't know how to use creation tool?]

47. Forgot to fix size in part A [?] so that planets are all uniform for the moment. Adjusted basicDisplayBox ok but required mouse click and drag [to create Figure], which is unnatural. I want the behaviour to be click to add. Look at creation tool source code not here – only have to

set ellipse constructor to create different size initially (doesn't seem to work). Problem caused by basicDisplayBox(Pt, Pt) – solved.

48. Need to make connections between planets – how does this work? Connection Figure is the line that joins connected figures together. Will be continuously adding connections with current idea [orbit algorithm] how do I delete old ones? ([Can] only [find] add connector for new figure)

49. Need to understand more about connections particularly dynamic behaviour

50. Try to change figure changed method ~ weird crashes. Need to use figure changed event parameter works okay.

51. Need to customise line creation (set end styles). (Seems like provision has been made for lots of different modifications). Need to change graphic (to single arrowhead). Tried to instantiate PolyLine figure could not get it to work. Looked at s/c found setAttribute which talks a lot about changing line end values. (Try this) > setAttribute("ArrowMode",value) – no! ArrowTip? Turns out simply to be a case of calling setXdecoration(null);

52. Make Arrow Longer. No clear instructions as to what constructor parameters mean – have to use trial and error [with ArrowTip & setXDecoration()]

53. Animation of planets in orbit. Completely new area – no idea where to start or even if HotDraw supports animation that I want. – Look at JavaDoc framework /figures. Looking for word animation somewhere – ambiguous. draw.util has Animatable interface – animationStep(). No examples to illustrate this! [couldn't find any examples first time around]

54. Need to figure out animation behaviour. Behaviour all in not working – need to debug! Look for maths equation. Problem appears to be MoveBy(). Setting the shape location is still a bit mysterious.

55. Drawing the handle is tricky. Need to add handle to figure overriding handles() looking @ s/c for text figure. Handle is now being drawn but have no edit behaviour – trying to fix.

56. can't get invoke step to be called. Selection Tool removed createHandleTracker – fixed now works

Student Interviews

Subject A:

57. DK:

How do you think that this application that you are developing compares in terms of size or complexity to other things you have done previously?

A:

Well its far larger than anything I've done before but ... is it not ... perhaps not that many classes maybe a dozen but that is because I'm using the framework but in terms of complexity it is far more complex than anything else I've ever written.

58. DK:

What aspects of learning to use the framework caused you the most difficulty?

A:

I think the fact that the size of Hotdraw in the first place. I'm not familiar with working, comfortable with working, with that amount of classes before and also the fact that it is mostly interfaces and abstract classes. It is hard to learn to use them it is easier to learn to use concrete predefined classes and the fact that you can use them straight way and then go back and use the abstract classes to create different classes later on. It's the one thing I had no experience in before this.

59. DK:

Were you interested while you were developing in understanding the dynamic aspect of what the framework was doing while it was running its code?

A:

Yeah I was. There is a lot of the framework that I haven't used so it is interesting how it all goes together. There is a lot of underlying classes that I would very [never?] bother touching but where are they being used

DK:

Must be for some reason.

A:

Yeah there must be a reason and it's a case of how they used in some way.

DK:

Do you think that is quite a hard thing to get an insight into?

A:

It is yeah, usually if they are very abstract or are a lot of interfaces, then it is hard to get those classes working even though they are actually doing something.

DK:

Do you think it is hard when you see them – maybe you see them in JavaDoc and then you think – its hard to just appreciate why it should exist.

A:

Yeah.

DK:

And you maybe see a name and you think why would that even be there.

A:

Yeah because perhaps maybe the subclass of that is very close to that top level class and then the point in changing it in the first place makes no real sense. Obviously for future development if you want to extend further - that's why its there but at the moment there is no good reason for it to be there.

60. DK:

Do you find it hard to maybe appreciate when you are looking at each class what it actually does?

A:

Individually its hard to figure out what each class alone does especially as you move closer to the top level once you get down to the actual concrete classes you've got...

DK:

Did you find any problems down at the bottom though in as much as there is a lot of functionality, sort of, distributed in other classes on, you know, above it in the hierarchy.

A:

If you have no idea what the top level classes do ... you can't just use the bottom classes on their own.

DK:

So you are almost saying that you would always start at the top.

61. DK:

Do you think it can actually confuse you if you are not familiar with the pattern because they often de-couple things?

A:

It can yeah particularly where you have got maybe the top level. The drawing view, the drawing and the draw application you have got three separate classes and they are all tied together in some way. You might think you have all these three parts why not have them together in some way it would make more sense.

62. DK:

Did you use the source code at times to...

A:

Yeah there was a lot err some of the methods weren't obvious by their method [names?] they seemed obvious but there was a lot of methods with a similar kind of name and it was a case of going in looking at the source code to see what it does.

DK:

Sometimes did you get the feeling that the only way to get the real understanding was to go to the source code?

A:

It was yeah, because the lack of detail in the documentation. If there was more detail then perhaps not I could have stuck with the documentation alone but there was a lot of reading the source code.

63. DK:

Are there any areas that you think the documentation failed to cover?

A:

I think just there was no [unintelligible] it wasn't detailed enough. Low detailed particularly a thing of that size and certainly if you were new to frameworks, as we were, low detail just in the method descriptions or class descriptions.

DK:

Do you think there is any role for a larger, a more... overview of it?

A:

I think there is because you come up to the framework, you know roughly what the framework is for but you have got all these classes. You are given the top level class diagram and even then it takes time to figure out what is going on. A better... a decent overview of how it all goes together would be far better particularly for the beginner.

Subject B:**64. B:**

I think this is probably the most complex thing that I've had to do. I did a practical with Pete Barrie in his C class – last year and we had to do, it was like, serial communication that was in real time... what was the class called again... [I interrupt to ask if class was Embedded systems It wasn't] ...That was probably second. That was a fairly big one in terms of time scale normal practicals are just a week duration where as we had a fortnight to three weeks nearly for that one and that was probably relatively simple in comparison to what I'm doing just now [HotDraw].

65. DK:

How do you think, two questions, firstly how do you think you project fits in – do you think it is a good match for HotDraw?

B:

Yeah. Perhaps not necessarily the way I am doing it but what I am trying to do is well within HotDraws capability.

66. DK:

Did you find that that led to a... you maybe looked at one thing and then that would start to reference other things?

B:

That is where the problem came up. When you start to get half way through the hierarchy before you knew it you could be half a dozen classes down the line and you didn't know where you were and you would go back and say how on earth did I get here? And go back and start again try and track it.

67. DK:

Do you think then that maybe the think about the examples that was good was seeing a little bit at a time?

B:

Yeah. I mean to just come in and go right there is HotDraw I want you to get a planet simulation going! How do you do that - where do you start? At first it was difficult enough just trying to, for the first practical remove the handles from the figure have it start up a new empty application have an ellipse sitting there that was...

DK:

But now you would consider that quite easy?

B:

Yeah. Almost trivial. Where as beforehand it was where do you go to change this stuff?

68. DK:

Where there any modifications that you wanted to make but that you couldn't make in the framework?

B:

At first it looked as if it was going to be to actually solve the problem! I was trying to make a track figure out of a composite figure which just consisted of two line figures with the appropriate layout so it would look like two horizontal [parallel] lines. But I was having problems then connecting them together because I think there is something about composite figure that behaves differently to standard figure its just one figure like a rectangle figure or an ellipse figure, they all behave in a certain way but when you building them together into a composite figure I think it behaves somewhat differently and their were similar problems in the practicals as well when using composite figure I was thinking How on earth am I going to make these figures that I am creating and adding to the image look like pieces of track? So eventually I ended up with a rectangle figure which wasn't filled in or it was filled in the same colour as the background and the frame of it and instead of drawing the four lines top bottom left and right I just wanted a top and bottom and that would be it and that would give me my two parallel lines which is exactly what I am looking for and then in terms of making cars travel along that it was just a case of travelling along the outside edge of the figure. And that was that.

69. DK:

At a general level what aspects of learning to use the framework caused you the most difficulty?

B:

Probably initially just trying to get my head around how everything was working. I hadn't done Java for a while so that was a sort of an initial problem I was struggling to remember how an earth Java worked. In terms of classes and the basic concepts in terms of classes and subclasses and inheritance that was that wasn't a problem but more specific stuff. And trying to pass information around like with the tracks trying to determine which track came next in terms of the structure of a complete circuit. I had a value that identified what type of track it was whether it was a corner or a straight piece or whatever and I could retrieve that value but that value alone wasn't enough for me to then make the car do what I wanted it to do in terms of, right its now a different piece of track so its got to animate in a different way. And never even thought to pass the figure itself, pass that piece of track itself as a variable effectively to it [until it was suggested to me].

70. DK:

How do you locate or identify functionality in the framework? When you want to add something and you know what you want to do. How do you then search for it?

B:

I think it depends on what it is I'm trying to do. If its something I've done before and I know roughly where about it occurs within the framework then it is pretty easy to go and find it. The majority of the things we have been adding to or changing (at least I have anyway) have either been in figure at some level or within drawing or drawing view so it is just a case of looking at standard drawing or standard drawing view and changing and looking for the methods in there. There was one in particular that took a while to find ... trying to remember what it is... think it was something to do with the... yep. If I removed a figure... in terms of the cars I had two cars within any application so if you add one increment a counter, when you add the next one increment a counter when the value goes to two then you can't add any more so that wasn't a problem Its just how you add the figure to a drawing that was okay but when you removed it I wanted to decrement the counter so that I could add it in again. But to do that I had to find where the remove figure method was and I thought I had found it in the same place where I had add figure within drawing but that wasn't it - it took me a while to search through and find where ever that was and I think that eventually it was about three or four classes away that I eventually found where the thing actually did right take this thing out the drawing to delete it from the screen you can't see it. And I had to sort of rewrite that.

71. DK:

Did you ever find that you had to gain an insight like you tried to do something and it doesn't work and you can't account for why and then maybe you looked at it and you find that its something you know like a sequence of events that is happening or...

B:

Yeah, it was like when I was trying to move the car I thought it was just going to be well add figure is in drawing which adds the figure so there is a remove figure within drawing surely that would just remove it but it didn't and it took me a while to work out why.

72. DK:

I guess that is... when you were going through the process of detecting this class that did the remove, were you thinking in terms of this object is going to call this object and somebody's going to... did you find the path to it...

B:

It was either through looking at what other classes the drawing inherited from or extended or even implemented, whatever, and following the hierarchy up that way and seeing what those super classes themselves inherited from trying to follow it through there or looking at the method in drawing itself and saying right that takes in a particular object and calls a method with a certain object and follow it that way through the methods.

73. **DK:**

How do you feel the inheritance hierarchies help or hinder you in the framework? There are two parts to this... Okay first of all how do you think they help or hinder you to locate where to make modifications?

B:

It is not necessarily obvious just from either the names or the methods ... or the names of the methods or the names of the classes and it is sometimes you can get information from simply what a classes inherits from. And basically it is not a case of lets go looking a bit further up... you might find it that way perhaps a better way is the documentation doesn't lend itself to be very helpful either.

DK:

The second part of that question is how do inheritance hierarchies help or hinder your ability to understand the functionality that each class offers?

B:

It is well structured enough in that you can find something's. Something's are just obvious in where you are going to find it or where you should be looking like the hierarchy for figure – you have got an abstract figure and you have got a figure which is a sort of default application and then you have got all the different types of figure which implement that in their unique own way. And that pretty obvious as in where you are going from that but when you get to more sort of ... abstract is probably not the right word to use, but further up the application in terms of drawing and drawing view and those sort of things it gets a bit more complicated as to where the [unintelligible]

74. **DK:**

And did you think that these things were hard to do?

B:

To stop certain figures like a horizontal track connecting to a vertical track that was[n't] particularly difficult it was just a case of identifying what each individual line connection was and through my decision of were they compatible or not set a flag and test the value of the flag when we were trying to connect them but to prevent more than two cars being put on the screen I had also the second one being a different colour from the first so when the first one appeared it would be red when we add the next one it would be blue if you delete the red one then add another car it would have to know to add it in as red so you need to know which car you have got at the time that was a bit more difficult I had a pretty good idea that it was going to be at the drawing level from what I had done in the assessed practical because I had done some work up at that level It was also suggested by one of the guys on the project that that was where to put constraints like that, so it sort of confirmed my initial instinct and it wasn't too difficult after that to work out exactly how to do it.

75. **DK:**

Why each method was there? The purpose of each method?

B:

Yeah. What was it there for why was it necessary why did you need it I suppose that the standard two line comment prior to the method is enough to say this is what it does but it didn't sort of say why – how it did it or why it had to do that. In some cases knowing what a

method did wasn't enough you had to know how it did it so you could – you needed that extra bit more detail.

Subject C:

76. DK:

How do you think that this application, that you are developing, how do you think it compares in terms of size or maybe complexity to other applications that you have worked on previously?

C:

It is an order... its 10 times bigger than most things I have ever come across in Java. I think it's the biggest Java program we have worked on and that is including the group project in third year and that was must have been about, I don't know, a few thousand lines of code it was. But in HotDraw there are so many classes and that's what makes it such a bigger kind of perspective than a normal program. I was writing bits of my report last thing yesterday and I just thought I would count the classes I can't remember the amount but it was over a hundred I think. [Unintelligible] You don't need to use them all, well I suppose you could use them all if you want to... I stopped at over a hundred classes. [DK suggests there is 197]

77. DK:

Did you have any maybe problems that you feel could have been caused by you going against the way that HotDraw tends to do things? Maybe you didn't realise that it did it a certain way and you had your own idea and you tried to do it and it was, it caused you problems. Did you have anything like that?

C:

I had a few things that were causing me problems. That was kind of going against the HotDraw but that was to do with just, like because HotDraw was all in AWT I was thinking of maybe changing bits here and there just to swing adding in other kind of components like that but that caused me all ... [kinds of problems] even though you could compile it and it would run it you would get funny side effects.

78. DK:

Okay. It was in the newsgroup anyway. It was this idea that frameworks - HotDraw - call your code rather than you, the conventional way of reusing software is that you inside your code have got like a loop and you will say and now I want to use that and I want it to... but its actually the other way around with HotDraw you create the bits and you plug it in and then HotDraw in some way uses it. Do you think that that kind of way of working; do you think that there is any benefits or problems from that perhaps?

C:

Well the problems [unintelligible] are just when things are being called. When is this actually being called who actually calls it. Who is actually making the decision to go this way rather than you saying specifically I want you to do this and this. It has just happened because something else is working that way.

79. DK:

Just a sort of general level question. What aspects of learning to use the framework do you think caused you the most difficulty?

C:

Probably were: where things were being called who was actually doing – who's actually in control sort of thing. Even finding out what sort of things that are available to you... to a class like there might not be all these methods are available unless you start digging deep and figure out where actually – what methods you can actually use in what different classes because there is so much inheritance and so many interfaces []

DK:

Do you think it was difficult sometimes to appreciate what methods did just by – you know you see them in the documentation and they have maybe got a wee explanation do you ever find that you misinterpreted that explanation first time round?

C:

Yeah. I think a few of them were like that. There were a few methods that are kind of similarly named and you are thinking well and the explanation maybe in the JavaDoc would be [vague?] what is the difference between these two and why - what does this method do different from that one does it and I think that sometimes that was... maybe it could have been better documented.

80. DK:

Can you think of anything specific in you project? [C asks for clarification] Having two options and having to choose one basically?

C:

The think that comes to mind was the flag, creating the flag that you had the choice of just like a rectangle figure then just redrawing what it looks like in the display box or going about it with a composite figure that consists of like a triangle figure and then just a line. I think the second way is how I would you know composite figure but that sort of opens it self as well just because it doesn't specify the layout so it was difficult just sort of laying out the figures so that it would draw it properly on the screen when you clicked the mouse. There were a few occasions that I thought I had done it and you would try it and place it somewhere then maybe drag it someplace else and it would just go up to top corner. I think I actually ended up looking at... was it Pert, the Pert application had an example of that and composite figure specified the layout for the figures inside that. I think I maybe used a good bit of that.

81. DK:

How do you think inheritance hierarchies in the framework help or hinder your ability to locate where to make modifications?

C:

They help you in the fact that there is so many methods available to you but they hinder you in the fact that you might not realise that at the start. You have to go into the abstract classes and interfaces and see what is actually there. Like the abstract figure and things like that would specify important methods you can't override and just read [] stuck to the figures.

82. DK:

There is. There is only one reference in the JavaDoc and that's to the interface Animatable.

C:

So you have to implement these methods but it doesn't say how you are to go about it.

Subject D:

83. DK:

In terms of complexity as well. Do you think it is as complicated or...

D:

I'd say it is more complicated because I don't think I have done as much programming as that before.

84. DK:

Do you think it's easy to identify, though where to plug things in?

D:

Ah no I think that's really difficult.

85. DK:

Were there any modifications that you couldn't achieve that you wanted to for this project?

D:

There was one when connecting two figures. If one was moved you would want the other figure to move with it and vice versa but it caused a stack overflow because of the multiple...

DK:

Yeah. So how did you actually solve that?

D:

I did it so that if pieces are connected you can [can't ?] move them then.

DK:

So you just prevented it then

86. DK:

Another sort of general question. What sort of aspects of learning to use the framework do you think caused you the most difficulty?

D:

Aspects? Trying to identify what you are using is quite hard.

87. DK:

What about understanding functionality when you were looking at the inheritance hierarchy and looking at a class how easy was it to understand what that class did?

D:

I'd say it wasn't that easy I don't think there was enough documentation.

DK:

So did you find that you had to search through a couple of classes in the hierarchy to get that knowledge?

D:

Yeah.

Newsgroup

88. I had a look at the example programs supplied with HotDraw and tried to decipher how all the classes link together. Let's take the Pert drawer for example, I cannot any linkage between the classes....any thoughts....I probably missed them though due to tiredness..... ;o)

89. How would you draw the border on selection and remove it on deselection. I can sub class selection tool, and draw the border round an ellipse, but how to combine the two?

90. Im having a bit of difficulty with this practical and wondering if i could get a little help before thursday. For drawing the box, Im over-riding SelectionTool, and in particular mouseDown() so

that when the figure is clicked the box is drawn. This bit works, however when trying to drag the figure, if I do something similar the rectangle flickers like mad.
Any help would be appreciated

Here is the mouseDown method [omitted]

91. Me and Brian got the ellipse to appear without the handles and it can still be moved but not resized and intended. But we are still having problems working out how to get a rectangle to appear instead of the handles whenever the ellipse is selected.

92. I might be barking up the wrong tree here, but I have been looking through the methods within the "AttributeFigure" class in order to find out what types of attributes a Figure has. The documentation says that each type of AttributeFigure has at least two, namely FillColor & FrameColor, which you can access and change via the getAttribute() & SetAttribute() methods. Now the getAttribute method requires an Attribute's name, in order to manipulate it. However there doesn't appear to be a general Attributes type method for simply returning say, an enumeration of attributes or their names. Is there anyway of finding out what attributes a given figure has without having to resort to random tests? The reason I'm following this particular line of enquiry is that I thought that there may be a "Resizable" attribute, which you could then simply remove or disable.

93. If you remove the handles, you also remove the ability to re-size a figure.
This probably isn't what we are meant to do, but it works ;)

94. wrote:

```
>
>
> If you remove the handles, you also remove the ability to re-size a figure.
> This probably isn't what we are meant to do, but it works ;)
>
```

Yeh I was thinking that. That was going to be my next question... There is a NullHandle class I notice, which presumably you could replace the current Handles with. So how do you remove and replace them? In fact, where are a given objects handles instantiated in the first place?

95. has anyone noticed the NullHandle class? it provides a handle that doesn't change the figure. If we override the handle class, so that nothing is implemented, and use the implementation provided by null handle - would this work for one part of practical5?

96. This is sort of indirectly associated with the current practical. I have pretty much worked out how the practical may be solved, although it may not be the most elegant solution possible. But one thing that interests me about the way handles work is the status of the "BoxHandleKit" class. It doesn't appear to have a constructor, therefore I would assume it can't be instantiated, however it is used by the various concrete figure classes to create a default set of handles, using the line of code below:

```
.
.
.
BoxHandleKit.addHandles(this, handles);
.
.
```

I would imagine this may be an example of the "factory" pattern, which isn't exactly an object itself, but which facilitates the creation of other objects (namely the various handles). I was just wondering how you can you make references to a class which doesn't appear to have been instantiated?

97. OK, I have managed to get a fixed ellipse working but I am sure that I am doing it in a really bad way. At the moment I have copied the entire EllipseFigure class, renamed it, and modified one of the methods. I have tried to use inheritance but since fDisplayBox is private, some of the methods won't inherit. Can somebody hint me towards a different approach?

98. um..... dunno if this is right but we just removed the handles like in the last practical, then made a new class for creating the shape (inheriting from creationTool), and then overrode the mouse functions so it created a clone of the shape when you clicked.

99. wrote:
 > do you not have to subclass creation tool so that the size of the figure is constrained and that you only need to click the mouse to add a figure?
 No, the figure should be constrained by overriding the basicDisplayBox method. This should allow a mouse click to add a figure.

100. At the moment I have a planet and all its moons moving as described in the practical but I am having a problem if you select more than planet (ie. a planet and it's moon). The planet will move as required but the moon will move twice the distance moved. Is there a way to fix this problem from within the Figure class? Or a method to tell if an object is selected within the Figure class?

101. Anyone any idea how to find out what connections a figure has?

102. I'm just wondering if anybody has had any success yet with the next practical. So far I've created a planetConnector tool that only lets you connect planets, and when you connect to its sets an orbiting attribute in Planet to true for one of them (the end figure of the connection). Also there is an arrowhead pointing to the orbiting planet. However I've reached an impasse about how to handle moving the orbiting planet when you move the orbited planet. I thought about using a figurechange event of some kind but I'm not sure.

103. I managed to get the composite figure up ok (mass is a little off centre though) and I managed to get the handles in place that I wanted, but how do I define what the handles will actually do i.e. I want one handle to increase the mass and the other to decrease it. If this is totally obvious could someone please slap me silly?

104. When you have 3 planets in a triangle effect. I placed 3 planets with a connection from the first to the second, the second to the third and the third to the first then I tried to move any one of the planets and the program threw an exception. I'm not quite sure why this occurs can anyone shed any light?

105. I had a composite figure as well but was having a few problems with it. do u have any issues with "copy & paste"-ing and how did u position the text box in the centre of the ellipse.

106. Can anyone tell me why I'm getting a null pointer exception when I create a new ellipse figure.

107. I did have this working earlier but don't understand this error message. this is where it occurs:

```
private void initialize()
{
    MyEllipseFigure planet = new MyEllipseFigure(new
        Point(fDisplayBox.x, fDisplayBox.y),
        new Point(fDisplayBox.x+40, fDisplayBox.y+40));
    ...
}
```

This is in my composite PlanetFigure class where i make a new ellipse figure.

108.I'm needing a few hints with this practical what i have got so far is

```
public class OrbitLine extends PolyLineFigure implements ConnectionFigure
```

Which is basically the same as LineConnection class. I can find the start figure and end figure of the connection using endFigure and startFigure methods but dont know how to determine when they are moved.

109.I'm having trouble making the handle manipulate the mass. Am i missing something major (like update the textbox in the drawview or something) or am i just missing a rweally obvious syntax error this is part of what i have already - any thoughts? In PlanetFigure Class...

```
public void incMass()
{
    if (mass.getValue() == 50)
        mass.setValue(50);
    else{
        int temp = mass.getValue();
        temp = temp+1;
        mass.setValue(temp);
    }
}
```

in IncMassHandle Class...

```
public IncMassHandle(Figure owner, Locator l)
{
    super(owner, l);
}

public void invokeEnd(int x,int y, int anchorX, int anchorY, DrawingView view)
{
    super.invokeEnd(x, y, anchorX, anchorY, view);
    PlanetFigure planet = (PlanetFigure)owner();
    planet.incMass();
}
```

110.I have taken the composite figure approach and added "MyEllipseFigure" to a "NumberedTextFigure" to create a "PlanetFigure". The only problem i have is that i canot align the centres of both figures. I have been playing around with the layout method from the "Pert" example and also the center() method. Has anyone else done it this way - if so can u help??

111.I've got the animation going no problem , the only problem is how to make the planets move circularly instead of a type of diamond shape which I currently have, anybody got any hints.

112.As part of my attempt at the assessment, I'm looking for a particular method , probably somewhere in AWT, that will give me the angle (in radians or degrees) between the X-Axis & a line bisecting a given point & the origin i.e. to find the angle(*).

```
o_____X
| \
| \
| \
| \
Y
```

I could derive it mathematically (calculate the length of the line, do O/H to get the sine of the angle then get the complement of the sine), but I was wondering if you knew offhand of a quick method where I just feed in the point & it returns the angle.

113. I have been looking everywhere to try to change the default colour of the ellipse from green to red. Do you know if this is possible and if so what class should I look at to do this?

114. Is there any way of making a button un-selectable after the action has been performed, i.e. once you have created one ellipse it is not possible to create another one since it is not possible to press the button.

115. Does anybody know how to find out the current size of the drawing?

116. If no figure implements animatable, then how about drawings - what and where is the default animation for a drawing? I would like to find out what possible methods of animation can be made, and how exactly to implement them, so I need some kind of template to look at.

117. I am trying to get the current drawing that a figure is on but the figure itself seems to have no knowledge of its own drawing.

118. Is there a better way to redraw a figure than `displayBox(displayBox());` ?

119. If I have two figures (ellipses) in a drawing, is it possible to create a connection between them automatically? I would assume it is, but the process I'm going through to do it doesn't seem to work:

- Create a connection.
- Set the Start and End points for that connection to the relevant figures.
- Add the connection to the drawing.

I'm probably missing something obvious, but all help's appreciated.

120. It does redraw in most cases, but in one particular case it does not fully redraw. I don't know if this is a bug in `hotdraw`, or something else. I have looked into it but cannot find a solution apart from manually calling `displayBox(displayBox())` at certain points.

121. A re-draw, apparently occurs automatically whenever something happens in the application (i.e. a figure is selected etc.). However, I need to force the framework into re-drawing either the selected figure or all figures (doesn't matter which).

122. I can't use either the `draw()` or `drawAll()` methods as they both take a `Graphics` parameter, which I don't have access to. Also, the `willChange()` and `changed()` methods are no use as I'm not actually moving the figures.

123. Is there any way of finding a certain type of figure within a drawing without running through the enumeration of figures checking to see if they are an instance of what I am looking for. e.g. if I have an ellipse figure and a rectangle figure can I directly get the instance of the ellipse figure.

124. I have a rather big problem. I decorate a planet using a tool I have created. The tool then registers the decorated planet as a drawing change listener. It then goes round all of the planets telling them about this newly decorated planet (so they can add it to a vector of decorated planets for later calculations that they need to do). When the drawing changes the decorated planet goes round all of the planets to see if any of them do not know about that decorated planet (i.e.

handling the adding of a new planet to the drawing). If you add two planets in the following order- The one you are not going to decorate, then the one you are going to decorate - Then when you toggle off the decoration (the decoration tool peels off the decorator and tries to return it back to a normal planet, It also tells all the planets that it no longer exists - takes it out of the vector of decorated planets for each other planet - and removes it as a drawing change listener) it works fine. If you create the planets in the other order then decorate one of them it doesn't remove the decorated planet from the vector for the other planet. I think its to do with the order of the calls to the drawing change listener but I can't seem to be able to trace it.

125. Another problem (well one of the ones from before). I want to add a sun figure and then connect it to all the planets who aren't a start connection for another planet. I have an idea of how to do it but theres a few problems I have extended the MyLineConnection so that the draw method doesn't do anything. My plan was to overwrite the add figure class in myDrawing so that each figure is checked through and connections added wherever they are needed but theres a couple of problems

- how do I know whether a figure has a connection (whether the connection is relevant or not, I can add isStartFigure(), isEndFigure() methods to the MyLineConnection class)

- How can I make a certain amount of connections at the same time (ie when I find that a connection has to be made can I just put new MyLineConnection????)

I think I am in the right direction but I don't know how to get this to work

126. Is there any way that you can get an ellipse to re-draw itself (i.e. force the framework to call the ellipses draw() method with the appropriate parameter)? I know how to force a re-draw from the drawing view but need to be able to do this from the ellipse itself.

127. Does anyone know how to get ur own icons to appear on the tool bar. I have redefined a path to point to my own gifs. I have created gif1,2,and3 just like the icon appear in the "images" folder in HotDraw.

Problem:

All functionality of the tool work (ie text appear, create figure,etcf), but u just cant see the icon in the toolbar...

128. I spoke to you in the lab on Fri about problems with re-sizing the ellipse using the handles from the previous practicals. Basically, In the MyMassIncHandle class, in the invokeStart method.... I try to get the co-ordinates of the current displayBox, then call the basicDisplayBox with the known values by:

```
Point corner = new Point();
Point origin = new Point();
Rectangle temp = displayBox();
```

```
origin.x = temp.x;
origin.y = temp.y;
corner.x = (origin.x + (temp.width));
corner.y = (origin.y + (temp.height));
```

```
massFig.basicDisplayBox(origin, corner);
```

Then in the basicDisplayBox function I try to change the size of the figure by a small amount by changing the co-ordinates of the corner point, but leaving the origin as it is...

```
Point temp = new Point(origin.x + (DEFAULT_WIDTH + (int)mass), origin.y
```

```
+ (DEFAULT_HEIGHT + (int)mass));
```

Problem I'm getting is that the figure is increasing in size, but it is jumping down the screen diagonally towards the bottom of the screen. I tried changing the way I was re-sizing by changing the point for the origin and that has reduced the jump, but it still moves down towards the right.

```
Point temp = new Point(corner.x - (DEFAULT_WIDTH + (int)mass), corner.y
- (DEFAULT_HEIGHT + (int)mass));
```

129. Another strange point is: When I drag the mouse to increase the mass (only the value for mass increases, as I've not changed the `invokeStep` method) but when I do a single click after dragging the mouse, it resizes without jumping)

130. I've been trying to get my planets connecting automatically all weekend but I just can't do it. I added two vectors to the `MassEllipseFigure` class, and these have to hold the start and end `LineConnection`'s, so that you can check if a planet needs to be linked to the sun. I then tried to overwrite the `add` method in `MyDrawing` and it was here that I never could work out how to add in a connection. Below is the code I tried to add. Note that this is just for adding in a planet that would connect directly to the sun.

```
public Figure add(Figure figure) {
    Figure figA = super.add(figure);
    if (figure instanceof MassEllipseFigure){
        //add link between figure and sun if sun is created
        Enumeration k = figures();
        while (k.hasMoreElements()){
            Figure sun = (Figure)k.nextElement();
            if (sun instanceof SunEllipseFigure){
                MyLineConnection sunCon = new MyLineConnection();
                Connector fStartConnector = findConnector((int)figure.center().getX(), (int)figure.center().getY(),
                figure);
                Connector fEndConnector = findConnector((int)sun.center().getX(), (int)sun.center().getY(), sun);
                sunCon.connectStart(fStartConnector);
                sunCon.connectEnd(fEndConnector);
                Figure figB = super.add(sunCon);

            } //end of if
        } //end of while
    } //end of if
    return figure;
} //end of add()
```

Anyway, it's not working and I don't know why. I don't think I have enough time to get it working but if you could point out why it's not working then that would be useful to put in my report instead of saying I can't understand why it's not working.

131. Does anybody know how to center figures within a composite figure? At the moment they all align to the left, but it would be better if they were centered.

132. Also, does anybody know how to change the connector position on a composite figure? At the moment it is on the outside of the composite figure, but I would like it to be on a figure within the composite figure.

133. Is there any way to disable the tools whenever the animation is running, such that you can only create new figures, etc. once you press "STOP"??

134.I have another problem, Can anyone tell me how to solve the following: I have a planet (P1) which is orbited by planet (P2). P2 is itself orbited by another planet (P3). //keeping up so far ;)// If P2 were to come into contact with my BlackHole then it is removed from the drawing. (no problem there) BUT, if P3 comes into contact with the BlackHole the it just sits there without being removed and P2 continues to orbit P1 as before?

135.I am trying to create 2 ellipses simultaneously simply by clicking on the drawingView. Can anyone help me point to the right direction?

136.I have created a composite figure, but when i try to move the figure, the display box doesn't move with the figure. Does anyone have any ideas how to make sure that the two are always associated?

137.i've been messing about with composite figures, and have created the coordinates for the figure inside BasicDisplayBox. This allows the creation anywhere on the screen, but the problem with this, or at least in my coding, is that when you try and move the figure outwith the display box, the displaybox does not move and the figure cannot be seen outside this.

138.Does anyone have any ideas on how to stop two figures being allowed to be connected?

139.I am trying to use the canConnect() method from the LineConnection class and override it in MyLineConnection class but this does not seem to work. This is the method from the LineConnection class:

```
public boolean canConnect(Figure start, Figure end){
    return true;
}
```

140.I am having problems changing the permanent display of the mass on a planet to a decorator for the text. The TextDecorator takes in a figure and the mass of that figure as it's arguments and I have managed to get rid of any mistakes. When I run the code it just doesn't display the mass when a planet is selected. Has anybody else had similar problems, or know of a common mistake here? Even if I replace "mass" with a costant there is nothing displayed. The code in the TextDecorator is the same as BorderDecorator apart from the draw() method which uses the code to display the text (below) instead of the code to draw a border.

```
TextFigure textFig = new TextFigure();
textFig.setText(new Double(mass).toString());
Rectangle rect = textFig.displayBox();
textFig.displayBox(new Rectangle((center().x - rect.width/2), (center().y - rect.height/2),
rect.width, rect.height));
textFig.draw(g);
```

Coursework Problems

141.In addition, I faced a somewhat unexpected problem. In executing my code, I found that the starting point never equalled the current point. The reason behind this was soon apparent: the points were based on different axes, as the origin is translated before the current point is found; and this was solved by translating the starting point.

142. Having done this another problem became apparent, whilst becoming red when a planet intercepts the link the CommsLink was not turning green again when the path was clear. This was because the planet causing the interruption was being used to reference the CommsLink. Therefore the link could be turned red, but after it had left the displayBox area of the planet there was no way to reference it to set it to green again, as HotDraw does not allow Figures to have any knowledge of attached connections.

143. In collision detection, it was necessary to check that a planet was not colliding with itself, as otherwise when every figure was fetched in turn to check for collisions, it would collide with itself and promptly remove itself from the screen.

144. Early on in the development, it was found that the asteroid did not always impact a planet or sun when it passes through it. This was due to the order in which I tried to test for an asteroid overlapping another object and was resolved through testing.

145. The sun did return to an ordinary planet but not all of the planets removed the sun from their registered lists. On closer inspection it was found that the sun was being registered twice with some planets (but not all planets). The reason for this was that the SunTool did not check to see if the sun was already registered with each of the planets before registering it.

146. The problem that I had with this extension was working out how to actually replace the original line connector with a reversing line connector. I realised that there was a replace figure method within the Drawing class and thought it would be a simple matter of creating a new instance of the reverse line connector and swapping it with the existing one, but this was not the case and I kept getting errors when trying to use the tool. I eventually realised that I had to copy all of the values from the existing connector including start point, end point, start figure, end figure and then set up the reverse line connector with these values. The new line connector could then replace the previous one without any problems.

147. To do this, I had to register the star with each planet that was connected to the sun, even if it wasn't connected directly. Originally, I did this by setting the star attribute of the planet to either the star it was connected to, or to the star of the planet that it was connected to. Unfortunately, this only worked when the planets were connected from the star first, as the attribute was only set when the connection was made. If it was done in an incorrect order the attribute of the figure would not have been set yet, therefore there would be nothing to copy. Also, when a figure was deleted, the planets connected via that figure would still have a reference to the star, and so would therefore be lit when there was no connection.

148. My task initially set, was the ability for a planet to rotate around another and increment its mass by one in relation to a full orbit. But the problem here arose that once the mass increased, the speed increased, in effect the planet never touched the same points as the previous journey round. The difficulty was to work out whether the planet had completed a full circle around the central planet. I undertook the task of calculating the gradient between itself and the central planet, but this still occurred in the same problem. As the same points were not being touched twice the gradient was not equal on the journey round.

149. Another problem that was encountered was that when the planet's gravitational direction was reversed the planet would get further and further away from the orbited planet. This was found to be the case when simply negating the values that are passed in as arguments to the moveBy method of the figure. This was eventually rectified by negating the angle instead of the x and y co-ordinates and this solved the respective problem.

150. The final problem that I had was, that I wanted the "orbiting" figure to begin to move in a straight line towards the centre of the Blackhole once it had moved too close. This would have been the alternative animationStep method for the Satellites and Planets but I was unable to calculate how

to move the figures in a straight line between two know points. Instead, when an “orbiting” figure gets too close to a Blackhole, it is move instantly to the centre of the Blackhole. Functionally this still works, however, it does not create the desired effect of a Planet (or Satellite), being sucked into a Blackhole in space.

151. I had planned to make the asteroids orbit the sun in an elliptical motion. This could not be done, as I was unable to find or calculate the required algorithm for this motion. Instead the asteroids ‘bounce’ around a 300x300 *box* in the drawing.

152. The main difficulty I encountered was trying to get the rocket to move in a straight line towards the connected planet. When the connected planet was orbiting another planet and the mass of the planet was increased to maximum the rocket could never land on the planet because it was moving too fast. As a result I added the speed attribute of the rocket so that it could be quick enough to land on the planet. This then produced another problem in that because the rocket was moving quicker it could actually overshoot passed the planet and then move erratically around it.

153. The next bug is one that seems to be more of a problem in my simulation than in the previous practicals. Because my starFigure is of a much larger size than the planets, it is possible to have a planet dependent on it that is within its boundaries, as shown in figure 5. As you can see, the connection goes the other way, as it is connected to the outer edge of the star. Beyond a certain point inside the star it stops rotating completely. I am not really sure why this occurs.

154. Another difficulty encountered involved the deletion of a sun completely from the drawing. The original design did not take this into account. It was obvious to me that the observer pattern could again be used. In this case the planets (MassEllipseFigure) implemented FigureChangeListener and when a sun was registered with the planet it would register itself as a FigureChangeListener. If the sun were removed the FigureChangeListener would be notified. All other notifications were ignored so that it only dealt with deletion of the sun. If it is notified of a sun's removal from a drawing it removes the sun from itself so that when the planet is drawn it will no longer calculate light from that sun.

155. As mentioned earlier, a problem exists when a planet increases it inevitably starts overlapping the central planet. To overcome this a constraint had to be used. Such a constraint had to make sure that the central planet is always visible.

156. When implementing the above design I encountered several difficulties whilst integrating it with HotDraw. The first problem encountered was what would happen when a new planet was added after another planet had been changed into a sun. The current design did not allow the new planet to display the light striking it. To solve this problem I used the observer pattern by making the SunDecorator class implement the DrawingChangeListener. Changes were made to the SunTool to make it register each new SunDecorator with the Drawing instance as a DrawingChangeListener. This meant that when a new planet was added each of the suns present in the simulation would be notified. Each sun would then check through each planet in the drawing to see if it has been registered with that planet. If it is not registered then it will register itself with the planet (it is expected that any planet that has not registered the sun is a newly added planet).

157. Another problem associated with this CompositeFigure class is understanding of how figures are stored and displayed. It is not very clear how to organise the figures, as the comments and documentation for this class tells the programmer that no methods for manipulating the figures are provided. After trying “playing around” with the class for a little while, it became apparent that the figures are organised by means of co-ordinates. I found that it is better to design the composite shape on paper, noting all the Points needed, before trying to implement the shape, as this can be very confusing to try and visualise how all the figures are going to fit together.

158. I discovered that the DisplayBox was not moving with the figure, which meant that if you had moved the shape to the bottom right hand side of the screen, in order to move it again, you had to position the mouse in the top left hand side of the screen, where the figure had initially been, and try and remotely move it from there. This is obviously unacceptable, and was rectified by moving the code dictating the layout of the figure, inside BasicDisplayBox(), and making all points dynamic rather than static. When static, they are always at the same position on the window, but by making all points an offset of the *origin* and *corner* points, (the mouse-clicked point, and mouse-released points), the shape is displayed at the correct position on the screen.

159. I had a few problems when trying to implement this extension. The main problem was the MassEllipseFigure within the composite figure not updating when the mass had been changed. It was only redrawing itself when I deselected the figure. I quickly realised that I would have to use the observer pattern to make sure that the changes were registered. To solve the problem, I simply had to add a willChange() method call before the mass was set and changed() call after the mass had been set to let the figure know that it should be updated.

160. *Garbage left on screen when display box shrunk* – If the willChange() and changed() methods on a figure are omitted when the display box is being shrunk, artefacts are displaying on the drawing.

161. It can be seen that there was a problem with the drawing of the planet. In order to actually display the planet on the screen, a display rectangle has to be set up. All figures are then drawn inside this rectangle. The ellipse is not drawn properly as the size of the display rectangle is too small. [use of composite]

162. However, the way my program works is that as soon as it has some kind of connection to a star, it automatically must have light shining on it. Unfortunately, when I implemented this, the star/planet attribute in MassEllipseFigure was set, but it wasn't fully updating i.e. it was producing inconsistent graphics (see left side of Figure 3). This display error only lasted until the figure was updated again, i.e. when something moved in front of it, or it was clicked or moved. By process of elimination, I proved that this was only happening when a connection was made, and that it was not being told to update. I assumed that it must be that this function was not alerting the drawing, which was listening to the figure, to the fact that it had changed, and therefore it was not being fully updated.

163. There was an initial difficulty with the giving each asteroid a random weight upon creation. This was a problem as each asteroid in the program is cloned from another, using a shallow copy, meaning each asteroid has the same mass, although the mass is random each time you start the program. This was solved by making asteroid extend Cloneable and overriding clone() in the method. This meant that each asteroid then had a uniquely random weight when it was added to the simulation.

164. I do have one major weakness in my application. If you decorate a figure with earthquake decorator it will vibrate when the animation is turned on. This works fine unless you then put a radiation decorator on top of the earthquake decorator. If you do this you will no longer have any earthquake animation. So if you want to create a figure that is both earthquake and radiation decorated then you must do the radiation decoration first.

165. Another problem I found which was with the prototype pattern. When creating a MassEllipse Figure, the constructor was only getting called once throughout the program. And essentially this instance was being cloned each time a new figure is created. This caused problems when trying to create Figures of different functionality (i.e. with different mass). The only way to achieve this was to create a new Creation Tool. In essence the functionality to change the mass was left for the user to decide at run time.

166. *Figures get added to toolbar before view is started* – As the toolbar uses the Prototype design pattern, a cloned copy of a figure is added to this at initialisation. This happens prior to the architecture setting up the DrawingView – which prevents figures from accessing details such as the view dimensions on construction.

167. A further problem I had, was when I set the Moon to its proportionate mass ratio value to Earth in real life, i.e. 1.0, the Moon remained stationary, i.e. it failed to rotate. I soon located the origin of this bug though. The *MyLineConnection* class has a method called *rotate(Point position)* which calls a method named *scaleFactor*. This method meant that using a minimum mass value of 1 and a maximum mass value of 100 for the Moon planet, then a very small number is going to be generated from this *scaleFactor* method, namely 1/100 which is 0.01. Thus, I corrected this fault by changing the Moons maximum mass value to 20 so that a bigger number is produced by the *scaleFactor* method, resulting in the Moon now rotating around Earth.

168. One of the main problems was with reference to increasing the size of the planet using handles for incrementation. The specific problem was that when the user clicked on the handle to increase the size, the size would increase but the position of the ellipse would also move slightly in a diagonal direction. A significant amount of time was spent trying to debug this problem, in particular trying to find out why the origin point was being shifted. Also investigated were a number of different ways of specifying the new dimensions of the display box to show an increase in size. Another avenue that was explored was finding the centre of the shape each time and having a function to re-adjust the position of the planet.

169. A problem was identified within the existing code for the animation of the gravity connection, namely that a Planet of mass 0.3 or less doesn't orbit the planet it is connected to, as the *scaleFactor* calculated is too low to move it.

170. It revolves around the calculation of the DisplayBox for the figure. What happens now is that when you move a newly-created figure, you seem to make the DisplayBox the size of the whole window. This means that once a figure has been created, and placed, it cannot be re-selected, and only de-selected when a new figure is added

171. Some of HotDraw's menus supplied by DrawApplication aren't really appropriate for the simulation, but it wasn't clear how to disable them. Overriding the methods to add entries is mentioned in the documentation but not how to remove entries. Overriding them with empty methods causes exceptions to be thrown in the frameworks classes and a crash, so the menus were left in place.

172. The next problem concerned where to do the detection of the overlapping figures. It was fairly intuitive to do this within the animationStep method in MyDrawing and it was decided that it should be placed straight after the animation of the first figure to check if the figure overlaps any other.

173. There is one more small problem with when I try to connect two planets using the route connection, I get a null pointer exception, although it still functions properly in that the connection does not occur. I did work out what the problem was but I couldn't think of a way to fix it. The problem occurs because I have set up the route connection figure and the rocket figure so that a rocket can only be connected to one planet at a time. When the connection is removed I set the rocket figure Boolean *canConnect* to true so that it may be used in another connection. However, the method this occurs in is called whenever two figures have tried to be connected, but are unsuccessful and so will result in the Boolean trying to be set but there is no reference to a rocket figure class.

174. *Figures having access to Drawing/DrawingView* – Figures do not by default have any access to either the Drawing or the DrawingView in which they are contained. This prevents them from

accessing information such as the size of the drawing. However, it is possible to overcome this problem by passing the view into the constructor of a figure, which can then store and access this as required.

175. While attempting to keep the system free of explicit references to particular objects, the number of Enumeration traversals that build up for mildly complex operations is quite ridiculous, and would cause an obvious slow down in the system if there were more than a few objects on the screen. This is especially true if the operations in question take place for every animation step.

176. I found it almost impossible when developing the simulator to treat new entities such as planets and gravitational fields abstractly as Figure objects. Setting and getting new attributes can be performed easily using the `setAttribute` and `getAttribute` methods of Figure, but most of time new behaviour also had to be introduced. In order to employ this new behaviour I had to cast Figures and manipulate them as their explicit type as the Figure interface cannot be extended. This means that the generality of treating everything as Figures, and the benefits inherent in that approach, are lost.

177. Clearly, I found the comprehension of interaction between the numerous classes extremely difficult, and moreover, establishing the flow of control within the programs was complex to track. The “inverted control” structure present within HotDraw meant that the framework is in control, and subsequently understanding what happens when control is passed over to the framework is a tricky task.

178. However there was no way of forcing the handles to be re-drawn from outwith the framework. For example if the mass was being displayed and the user selected the distance button, the display in the middle of the selected figure would reflect the change, but when the user attempted to manipulate the attributes value, the displayed distance value would remain the same, while the ‘hidden’ mass attribute would be undergoing change ‘behind the scenes’.

179. The main problem that I encountered was if I had a figure being “orbited”, which was itself “orbiting” another figure (as in the diagram below). If the planet in the middle (of the diagram) hit the Blackhole then it was deleted as expected along with the two associated lineConnections. The difficulty was, that if the last figure in the chain (in this case the Satellite) was to hit the Blackhole, it would stick to it and not be deleted, leaving the middle planet to continue orbiting but it was still connected to the Satellite.

180. One drawback with the use of this style of coding is that the style and layout of the framework can at first be difficult to grasp.

181. The difficulties encountered in the planet simulation practical included detecting what figures are in contact with other figures. Once it was realised that `StandardDrawing` extended `CompositeFigure` it was soon deduced how to detect the occurrence of overlapping figures as `CompositeFigure` provided many methods to accommodate this. This is an example of the number of levels of inheritance hiding the methods that are actually available to the object and this is only found when the hierarchy is carefully traversed.

182. There were a few problems I encountered during this assignment. After choosing to implement a composite shape, I had to discover how the `CompositeFigure` class worked. It became apparent that the fact that `CompositeFigure` extends `AbstractFigure` and not `AttributeFigure` can cause problems, with some methods which would be very useful, not being available to us.

183. The main difficulty when designing the solution was caused by the magnitude of the HotDraw framework. The depth of the hierarchy, meant that in order to understand what was required for the solution’s implementation, classes at 3, sometimes 4, different levels of the hierarchy needed

to be studied. The fact that one of the main difficulties in using a framework is the time needed to develop an understanding was highlighted during this study.

184. So I changed the co-ordinates of the bottom right hand corner of the box accordingly in `MyMassIncHandle` and `MyMassDecHandle` and then called `basicDisplayBox(origin, newCorner)`. I also had to add null methods with the same parameters and return types to the interface `MassFigure`. This did not work however and for a while I could not understand why. Then I noticed that the method `basicDisplayBox(Point, Point)` had been overridden in `MassEllipseFigure`. This method now set the display box at a default value so that no matter how much I changed the height and width of the object the display box would remain constant and therefore so would the figure.

185. It was discovered that the mass and size of a planet changed according to how the handles were manipulated. For example, if the incremental handle was clicked once and only once, then the planet size would increase by one value. However, if the incremental handle was clicked and the mouse button was held while the mouse was dragged very quickly, it was discovered that the mass value would increase very quickly while the size of the planet would only increase by a small amount. This leads to an inconsistent mass value to planet size ratio. Figure 5 highlights the problem.

186. Somewhat predictably, this led to another problem. The `CommsLink` was changing from green to red and back again, but erratically. On further investigation it became apparent that this problem involved the `displayBox` of the `CommsLink`. It had been assumed that the `displayBox` of a `Connection` figure was a `Rectangle` that encased the line neatly along its edges, whilst its actual nature can be seen in Fig. 2 below.

187. Another major difficulty I experienced was finding the starting point of the Moon planet. The reason why I had problems is due to the fact that the variable representing this feature changed continually as the Moon moved around Earth, whereas I wanted it to hold its initial value and remain unchanged. This problem resided in my code in the `figureChanged(FigureChangeEvent e)` method where I simply had the same code for my new `oldStart` variable as the existing `oldStop` variable. However, this was solved by only having the line `oldStart = startFigure().center();` once, to initialise the variable, and therefore not update it as the figure's location changes.

188. There were a number of problems with this approach that were gradually worked through. Firstly, the `findFigure` function returned only the first Figure it found working from the back of the Drawing forward. This meant that if a Planet had for example, a `GravityLink` directly on top of it, then a `CommsLink` on top of that, the `GravityLink` was returned as the found figure, and a block was not detected as it should have been. This was overcome by writing a function `findFigures`, to return an Enumeration of all those objects overlapping a particular `displayBox`.

189. It was shortly after the completion of this code that I discovered the `intersectsLine` function, part of the `Rectangle2D` class of the `java.awt` package. Although the code developed functioned correctly, to reimplement an innate facility like this was admittedly pretty stupid. (The code is included in the `unusedLineCode.java` file for the sake of completeness).

190. Another obstacle in using `JHotDraw` effectively was finding out what was there already. For example, I initially developed my own decorator class – completely oblivious to `DecoratorFigure`. Reverse engineering a class diagram in `Together` helped a little, but as the framework is large, it can be wearisome scanning over all the packages. Almost all discovery was conducted by using the Windows 'Find...' utility and searching on keywords.

191. There are a very large number of classes, subclasses and interfaces that are at your disposal and it is often difficult to find the one you want.

192. A general problem that was encountered was the time required searching through classes in HotDraw to find the relevant code sections for specific functionality. Although that aspect of the development process is a direct result of the high learning curve required for developing an application in a new framework environment

193. A significant amount of time was spent searching where the capabilities to add colour came from. This was discovered to be in the class AttributeFigure where colour is mentioned in the draw function.

194. When setting colours for various figures, it wasn't easy to determine which attributes a figure supported, i.e. setting the colour of a connector would be done by setting its FrameColor attribute, while a planet's colour is set by FrameColor and FillColor attributes, while text figures use TextColor.

195. Initially, to hide connectors, they were set to the background colour. However, they were still visible if they crossed text or figures. It may be possible to use HotDraw to set them as being not visible but the same effect can be achieved by overriding the draw method with an empty method. [?]

196. HotDraw did not produce the desired results with the Drawing classes method findFigure so the originally described method for finding any figures blocking the light did not work correctly. The method returned the figure on top at the coordinates given. This caused a problem when a MyLineConnection figure also existed between the planet and the sun. MyLineConnection figures are normally placed on top of other figures so when a connection exists the blocking planet is not returned from the method instead the connection is returned. The solution was to use each figures containsPoint(int x, int y) method. This meant that, for each point being tested on the line between the sun's centre and the planet's centre, each figure in the drawing would be tested using this method to see if it is blocking the light. This new method solved the problem but reduced the performance of the simulation.

197. I was also unable to work out how to change the position of the connector on the composite figure so that it was always attached to the MassEllipseFigure rather than the border of the composite figure.

198. The colour and text of the Ellipse instances were created by overriding the method draw in the EllipseFigure class. Colour was achieved by using the advanced Java colouring method by casting Graphics g to g2 instance. The text was created by a TextFigure object and adding that object to the centre of the Ellipse instance.

199. In attempting to use a CompositeFigure to hold a planet plus text fields, it was realised that connectors would track the rectangular edge of the composite. It may be possible to set the connector to follow the edge of an internal figure, but instead a solution not using composite figures was found.

200. An initial minor difficulty is concerned with the icons and how you use your own icons for toolbar buttons. HotDraw makes use of three images to represent up, down and selected states of buttons (toggle buttons unavailable in JDK 1.1, which the original framework was developed on). Although it is very simple to create three images for another figure, I was unable to ascertain how to include these into the program. This was solved in part with help from the course newsgroup, where a number of people had expressed difficulties with these icons.

3.3. List of Clusters

NB The clusters contain more detail than discussed in the thesis. This information although potentially useful for documentation was ignored in favour of the courser more abstract groupings.

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Appendix B

This appendix includes documentation material created during this thesis for the JHotDraw Framework.

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3 Micro architecture documentation.....	403

1 Pattern Language 1

Patterns for JHotDraw

Douglas Kirk

Department of Computer Science

University of Strathclyde

Livingstone Tower

Glasgow G1 1XH, Scotland

Tel: +44 (0)141 548 3622

Email: doug@cs.strath.ac.uk

This work is based heavily on the work of R. Johnson in his seminal 1992 paper "Documenting Frameworks using Patterns". This work merely attempts to adapt the concepts presented there into a format suitable for the Eggenschwiler & Gamma implementation of HotDraw.

JHotDraw Patterns

Semantic Graphic Editors

Defining Drawing
Elements

Changing drawing
element attributes

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Tools

Making new kinds of
handles

Making new Menus

Constraints

Creating Animation

Semantic Graphic Editors

HotDraw is a framework for structured drawing editors. It can be used to build editors for specialised two-dimensional drawings such as schematic diagrams, blueprints, music, or program designs. The elements of these drawings can have constraints between them, they can react to commands by the user, and they can be animated.

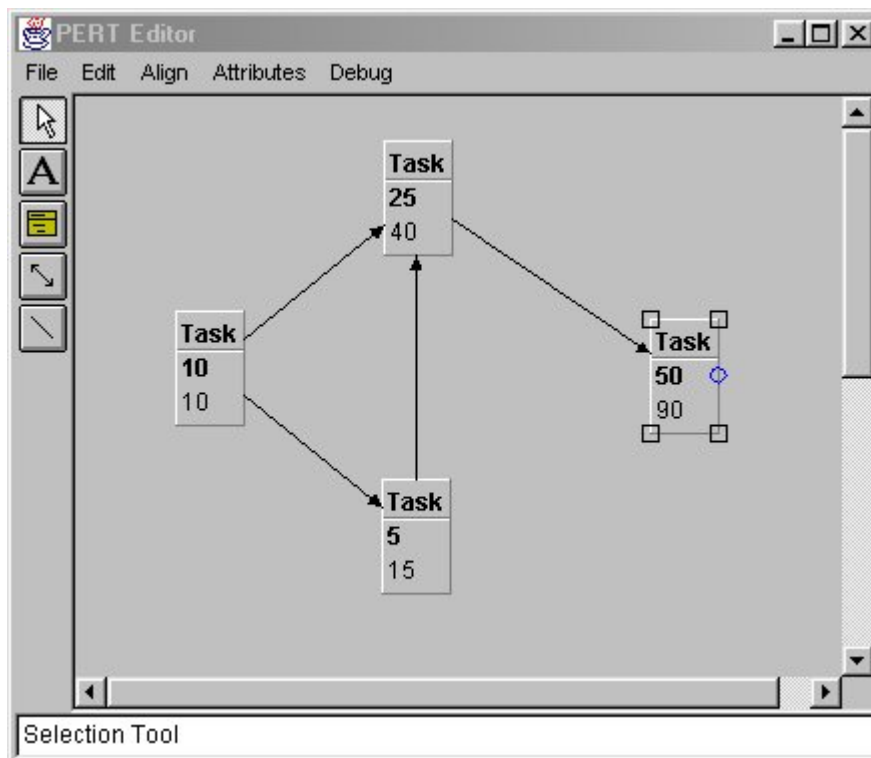


Figure 1: Pert chart editor

Figure 1 shows a PERT chart editor created using HotDraw. This example shows the fundamental aspects of a HotDraw application. The top of the figure holds the menu bar. The default bar is created with File, Edit, Align, Attributes and a Debug menu. Each menu contains familiar functionality i.e. the File menu allows the user to load and save diagrams etc. The menu bar is fully customisable, existing menus can be removed or edited and additional ones created to suit the needs of specific applications.

On the left hand side of the application is the Tool Palette. This defines the set of actions a user can perform with the application. In this example the palette contains a selection tool, a text editing tool, a PERT event creation tool, a PERT connection tool and a straight-line tool. By default this palette is configured with only a selection tool, but the framework does contain a collection of predefined tools to choose from and application specific tools can be created if required.

At the bottom of the application lies the status bar. This displays the current state that the system is in. In the above example the bar informs us that the selection tool is currently active. The status bar can be altered to return information specific to your application.

The largest part of the application is taken up by the Drawing View. This view provides a representation of the underlying application model. In the case of HotDraw the model is an object called Drawing (which is similar in function to its real world equivalent)

The shapes on the Drawing View are Figures in this case rectangles, text and lines. Figures are used to represent the discrete components in a diagram. Again the framework is pre-supplied with many commonly required figures and the developer has the opportunity to define new ones for their application.

The figure on the right hand side of the application is the currently selected shape and the little squares and the circle that are visible on it are called Handles. Handles show that a shape is selected and also provide editing functionality. The set of handles that are defined for each figure is customisable, the number of them, position and shape of them can all be changed and most importantly the behaviour defined for each one can be altered. Handles can be used to change a figure's size, colour, and shape ... any attribute of the figure can be edited this way.

The final elements shown on this diagram are constraints between figures. In this example the lines that connect the PERT events together represent constraints (although constraints do not have to be visible) and in this case they ensure that the duration of every event takes into account the duration of every preceding event in the graph.

HotDraw is designed around a direct manipulation paradigm. This places certain obligations on the developer. Where possible the application should adopt the direct manipulation approach. A user will manipulate an element of a drawing by using the mouse to select it then operate upon it. i.e. clicking on a PERT event in the above application will select it, causing its handles to display. The user may then drag the circular handle with the mouse and a new connecting line will appear. If the user positions the end of this line over another PERT event before releasing the mouse button then a connection between the two events will be made (and the constraints between then enforced).

Drawing editors created with HotDraw can assume several forms. Most commonly they are created as stand alone classes by sub classing `DrawApplication`, alternatively the application can be created as an applet (a simple application designed to run in a web browser) by sub classing `DrawApplet`.

A stand-alone application can be created via the following code:

```

Main(){
    DrawApplication drawApp = new DrawApplication();
    DrawApp.open();
}

```

This creates a default application that is initialised with a single tool and the standard menu configuration.

To design a drawing editor using HotDraw, first list the atomic elements of the diagram. Each one will be a subclass of Figure. Decide whether the drawing needs to be animated. List the tools that will be in the palette and make a subclass of DrawApplication with a `createTools(Palette)` method that creates and adds all the applications tools to the supplied Palette.

- **To create a subclass of Figure, see [Defining drawing Elements](#).**
 - **To animate a drawing, see [Creating Animation](#).**
 - **To put a tool on the palette, see [Making new kinds of Tools](#).**
-

Defining Drawing Elements

There are an infinite variety of primitive figures that can be included in a drawing. Thus, there needs to be a way to make new figures for each application.

Each kind of drawing element is a subclass of Figure. In HotDraw there are four strategies to figure creation. The relative strengths and weaknesses of each are explained below.

1. **Use existing classes:** HotDraw is supplied with default implementations for many common figures, such as EllipseFigure, RectangleFigure, and LineFigure. These may be reused ‘as is’ in new applications, this saves developers the time and effort required to create such elements themselves but reduces the knowledge the developer has about how that figure is implemented (important in efficiency and robustness arguments).
2. **Subclass existing classes:** Often the default implementations of Figure are ‘almost but not quite’ what is required by an application. In such circumstances it makes sense to customise the existing figure to fit the applications needs. This saves time compared with starting from scratch and provides insight into the organisation of that figure but sub classing will increase the number of classes in the system and carries the responsibility of ensuring that the original intent of that inheritance hierarchy is maintained.
3. **Composition:** An alternative to sub classing, composition can be used in situations where the new functionality required can be created by arranging several pre existing figures together. e.g. A text label could be defined as a rectangle with a text object inside. To facilitate this kind of creation HotDraw provides a subclass of Figure called CompositeFigure that essentially acts as a collection of figures. Composition frees the developer from class details, can reuse existing tools and allows dynamic configuration (new arrangements of figures can be constructed while the program runs). Against it, composition doesn’t provide as much freedom as sub classing (it can only compose what is available) and it can be difficult to debug due to its dynamic nature.
4. **Custom figure:** The ultimate amount of creative freedom comes from sub classing Figure or AbstractFigure. The choice of which class to choose depends on which is closest to the needs of the application. If the required Figure is very unusual then it may be required to subclass from Figure, but this should be avoided where possible due to the large number of abstract methods that require a definition. Instead it’s much more usual to subclass AbstractFigure which only requires four methods to be defined, basicMoveBy, basicDisplayBox, displayBox, and handles. This approach provides almost total control over how a figure is implemented however it comes at the cost of requiring an understanding of how the interface of Figure is used by the HotDraw framework.

Each drawing element in a HotDraw application is a subclass of Figure. Figures can be used directly or customised by sub classing or composition. In extreme cases a custom figure may be created by sub classing from the Figure class directly.

- **To let the user change the attributes of a figure, see [Changing drawing element attributes](#).**
 - **To enforce constraints between different figures, see [Constraints](#).**
-

Changing drawing element attributes

There are at least three ways to edit a figure's attributes: with a handle, via the menu bar, or with a special tool. Each technique is appropriate in different cases.

Editing a figure implies that it has been selected or is selected as a side effect of the editing process. This is important because the developer must ensure that all the edit methods below are only activated when the capability to perform that function exists. (There is no point trying to edit text on a figure with no text).

1. **Handles:** All figures have a handles method that returns a vector of handles for that figure. Handles support the direct manipulation paradigm in HotDraw therefore they are best suited to coarse-grained tasks such as editing a Figure's size, shape or position. By default Abstract Figure returns a handle (for resizing) on each corner of the shapes display box. It is common for subclasses to maintain this behaviour and to add to it appropriately.
2. **Tools:** Although more frequently used to create figures, tools can be used to add new attributes to existing figures. They are well suited to more precise tasks i.e. editing text, where handles would be difficult to use.
3. **Menus:** These can be very similar to tools, often the menu structure will mirror the tool palette. They are preferable for selection oriented events such as choosing the active fill colour or changing fonts.

Although many edit tasks may favour use of one of the above strategies over the others it is equally true that most edit operations can be achieved by any or all three of these techniques. i.e editing a figures colour can be done via a handle, a tool or a menu. The developer should select the approach that is correct for their application.

List the attributes of a drawing element that you want to edit. For each attribute, decide whether to edit it with a handle, an operation from the menu, or a tool, and either update the handles method in a subclass of Figure or override the createMenu or createTool methods of DrawApplication.

- **To make new kinds of handles, see Making new kinds of Handles.**
 - **To make new kinds of tools, see Making new kinds of Tools.**
-

Making new kinds of Tools

Tools represent the modes of interaction between a user interface and a drawing. Selecting a tool from the palette lets the user manipulate figures, create new figures, or perform operations upon a figure or the entire drawing. An important part of designing an editor using HotDraw is to design the set of tools that will exist on the palette.

The createTools method in DrawApplication is passed an AWT panel as a parameter and instantiates the panel with icons for all the tools in use by the application. By default createTools only creates a SelectionTool but it is easily overridden to return all the tools required by an application. HotDraw provides support for many different types of tools there are at least three distinct categories each of which are explained below:

1. **Creation Tools:** The most common of these are Creation Tools. Initially creation would appear to require a great number of tools, one for every type of figure but in actual fact there is only one called CreationTool. This is a very valuable tool because it can be parameterised to create any predefined type of figure. In other words CreationTool can be customised via its constructor to become a tool that creates ellipse figures or a tool that creates rectangle figures, etc. Any predefined Figure can be created this way. CreationTool saves the developer the effort of having to write independent but very similar tools for each type of figure that an application wishes to create.
2. **Connection Tools:** Defined in an identical manner to CreationTool except that it specifically creates connections between figures. Instead of having separate tools for each type of connector this single class provides a mechanism that can create any kind of connection.
3. **ActionTools:** Aside from creation and connection, tools can also be used to perform application specific actions. The Action Tool subclass provides a starting point for tools that wish to operate in this manner. This tool provides an action method that is invoked upon a mouse down event. Subclasses can override the action method to provide custom behaviour for the tool.

The createTools method of DrawApplication defines the tools that will be on the palette by returning an AWT panel that contains all the tools. Tools are typically defined as either creation, connection or action tools and there are appropriate subclasses to customise for each.

Making new kinds of handles

Handles vary in behaviour. Sometimes handles change the size of a figure, sometimes they change its colour, and sometimes they create new lines. In general, one could imagine pressing on a handle performing any kind of operation. Moreover, handles can be attached to any part of a figure, and they move when the figure moves.

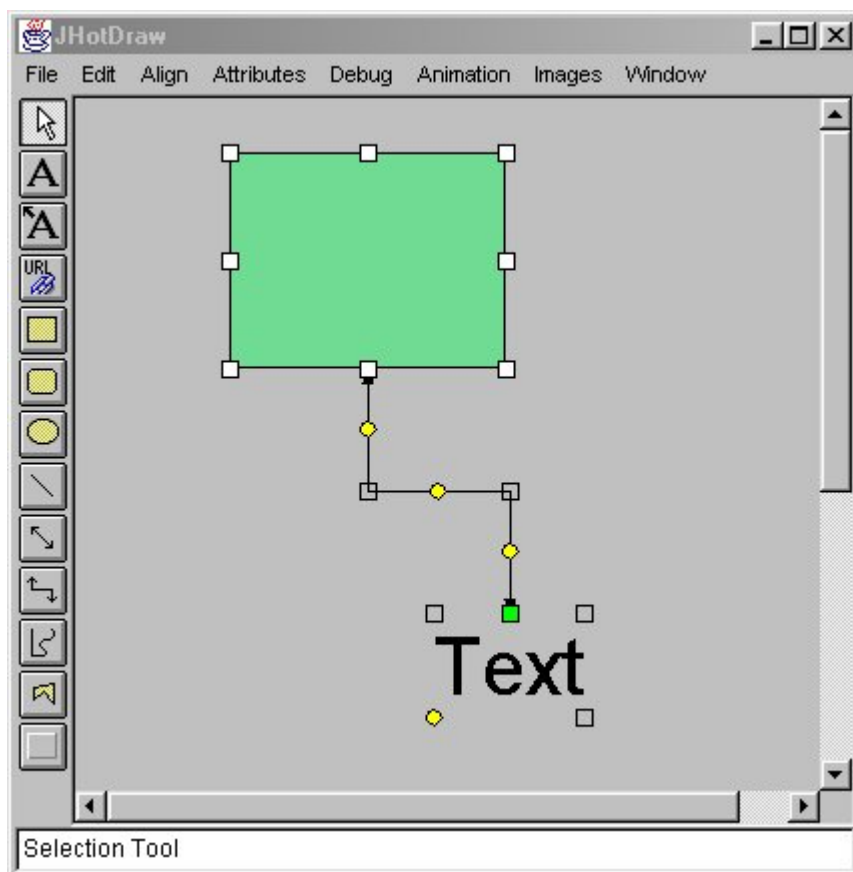


Figure 2: Handles on three figures

Figure 2 shows some of the different kinds of handles in HotDraw. It has three figures in it and they have all been selected to display their handles. The first thing to notice is that handles can have different appearances, in the above diagram there are four distinct styles of handle, an empty rectangle, a white rectangle, a green rectangle and a yellow circle. The different appearances can be used to denote different behaviours i.e. in this example the empty rectangles are null handles and perform no action other than to show selection. The white rectangles are the default handles in HotDraw and provide resize functionality. The green rectangle in the top middle of the TextFigure allows the connector to be disconnected from the figure. Finally the yellow dots provide custom behaviour specific to a figure i.e. on the ElbowConnector they allow each segment of the connector to be repositioned independently while on the TextFigure the single yellow dot changes the font size of the text.

The Handle interface in HotDraw defines the important behaviours a handle must implement. Commonly developers will subclass AbstractHandle (which implements the handle interface) to provide the required functionality. To change a handle's appearance the draw method has to be overridden. The handle can have any appearance the application requires but it should be remembered that it is good practice to keep the functionality of handles consistent with their behaviour through out

an application. Positioning of a handle on a figure can be altered by sub classing the locate method. This method returns a point around which the handle will be centred. Often handles are required to be positioned at precise locations on a figure. In such circumstances the RelativeLocator class can be used inside the locate method to provide a simple way to discover the position of the centre or corner of the figure that is required.

The main behaviour of a handle is defined in three methods. They are invokeStart, invokeStep and invokeEnd. Each of these methods are called by a user initiated event, invokeStart is called whenever the user clicks the mouse down on a handle, invokeStep when ever a user drags a handle and invokeEnd when ever the user releases the mouse button. Every interaction with a handle will therefore invoke a sequence of method calls where invokeStart is called at the beginning of the interaction invokeStep optionally may be called in the middle and invokeEnd will be called when the interaction is over. This granularity across the interaction allows the developer greater control over the behaviour. i.e. if the handle has to respond to a mouse click then the behaviour has to go in either the start or end methods (step will not be called on a mouse click). Further the developer can decide whether they want the behaviour to occur as soon as the button goes down or wait until the button is released.

Several different types of handle are already predefined in HotDraw, they include ChangeConnectionHandle, ElbowHandle, LocatorHandle, and PolygonHandle. It should be noted however that because handles tend to be very specific to their intended application opportunities for reuse are quite rare. Therefore developers should expected to have to write their own handles either by implementing the Handle interface or by sub classing AbstractHandle.

Handles are used to implement the direct manipulation paradigm in HotDraw. They are iconic representations that exist on the Figure and define some form of edit behaviour. There are three methods that define the behaviour of a Handle invokeStart, invokeStep and invokeEnd.

Making new Menus

Menus contain specific categories of functionality. Menus may be used to support file operations, edit operations etc. Sometimes the default menus created by HotDraw are too general and they either allow functionality that the application shouldn't have or overlook functionality that is required. It is therefore important to be able to customise the menus in an application.

Menus are defined in the DrawApplication class. By default HotDraw predefines a menu structure with the following menus: files, edit, debug, alignment, arrow, colour and font size. These menus can be removed or added to as appropriate in the application. More over DrawApplication defines separate create methods for each of the above menus. This does two things, first it defines this set of menus as the standard set for this domain i.e. you don't have to use them but you probably will. Second it also allows these menus to be very easily altered because all the relevant information is localised into a single method. When adding menus developers should be aware of this structure and seek to mimic it in their extensions.

Creating the menu bar occurs in the createMenu method. This method is very simple thanks to the above design. First it creates a menu bar and then it calls each create method in turn to add that menu to the menu bar, customisation is easily achieved by omitting unrequired menus and adding in method calls to your own create methods.

The framework also defines the CommandMenu class. This class is used inside new create methods to add menu items to the menu. It allows subclasses to define what action is taken when the user selects it and also provides methods for the DrawApplication to set its enabled state depending on the state of the drawing (not all menu items are available all the time). Finally menus can be recursive so its quite possible to have a menu item that leads to a further menu.

Menus are defined in their own create method, this allows them to be easily changed and simplifies the createMenu method which only has to select which create methods to call.

Constraints

Often an attribute of one figure is a function of the attributes of other figures. For example, in the PERT chart editor of Figure 1, the duration for an event is the maximum of the ending dates of all the events that precede it, i.e. that have a connection to it. As another example, the endpoints of the lines connecting PERTevents depend on the locations of the events. Handles also depend on the figure to which they are attached.

HotDraw has a standard way of keeping track of dependencies between Figures. Objects (even other figures) that are interested in the state of a Figure implement the `FigureChangeListener` interface. Each Figure has a collection of such listeners (usually empty), and the `addFigureChangeListener` and `removeFigureChangeListener` methods in Figure update this collection. Whenever a figure changes state it will iterate through the collection of listening objects and inform each of them about the state change. The listener can then perform its own action to ensure that a constraint is upheld.

The `FigureChangeListener` describes several different methods that may be invoked upon a state change. The `figureChanged` method is the most general informing the listener that some part of the figure has changed state. Typically the listener requires more information than this in order to act. To provide this information a `FigureChangedEvent` object is passed to the listener as a parameter to the method. The Event contains a reference to the figure that the listener can use to determine if the part of the figure that it is interested in has changed. In a similar manner the `FigureChangeListener` can also send `figureInvalidated`, `figureRemoved`, `figureRequestRemove`, and `figureRequestUpdate` messages to the listener allowing it some granularity in choosing which change events to react to.

The framework provides a set of classes that implement the `FigureChangeListener` interface. The root of these classes is the interface `ConnectionFigure`. This and its subclasses are used to enforce binary constraints between Figures in a Drawing. For example the class `LineConnection` is used to connect two figures with a line. This class first registers itself with both figures. It interrogates them via the `connectAt` method to get connection points for the start and the end of the line and draws itself. Now if either of the figures move the line is notified and it can request that the figure send a new connection point. Further if a figure is deleted then the line will be notified and can delete itself (a connection is not allowed to be open).

Constraints are always binary i.e. one thing always depends upon another.

Creating Animation

Constraints, handles and tools let a drawing react to a user. Animation gives a drawing a life of its own. Animation requires a controlling object to direct all the figures in a drawing.

Animation is provided in HotDraw by making a subclass of Drawing that implements the Animatable interface. This interface defines one method animationStep that is called to render a single frame of animation. When Drawing is sub classed appropriately the framework will repeatedly call its animationStep method. This allows animationStep to perform incremental updates to the state of the drawing which, because of their frequency appear to the user as animation.

This type of animation requires that each figure in the drawing has some rules to govern how it is updated on each new frame. At the crudest level this can be performed directly inside Drawing where animationStep directly specifies how each figure should move. This is acceptable when we want all figures to be animated in the same way but when different subclasses of figure require individual behaviour this approach does not work very well.

An alternative is for each animating figure in a drawing to implement their own animationStep method. These methods are not called directly by the framework, instead they rely on animationStep in drawing to call them. The advantage of this approach is that it allows animation behaviour to be easily specialised in different classes. This can allow a drawing to feature some shapes that animate and some that don't and have those that are animating act differently according to their type.

Independent figure animation can be invoked from the following code:

```
public void animationStep() {
    Enumeration k = figures();

    while (k.hasMoreElements()){
        Figure fig = (Figure)k.nextElement();
        if(fig instanceof Animatable){
            Animatable anim = (Animatable)fig;
            anim.animationStep();
        }
    }
}
```

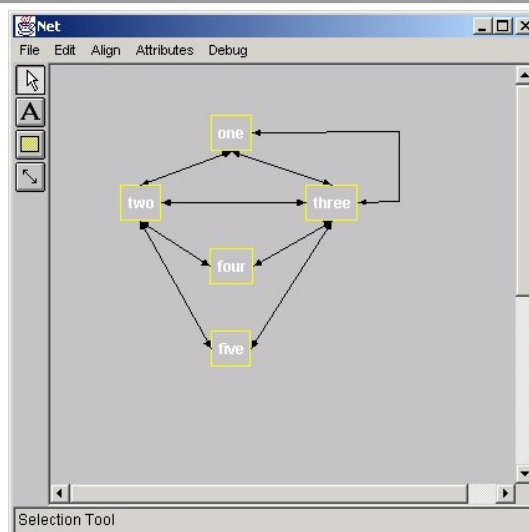
Often it is desirable to have control over animation behaviour so that the user can start or stop it as appropriate. Unfortunately HotDraw does not provide explicit support for such an operation, developers wishing to create such an effect must create it for themselves.

Animate a drawing by making a subclass for it that defines the animationStep method to perform the next step in the animation. Animate a figure by defining a further animationStep method for it. Use this method to create specific animation behaviour for that figure, then call it from the drawing's animationStep method.

2 Pattern language 2

JHotDraw Pattern Language

JHotDraw Domain Overview



A example JHotDraw application

JHotDraw is a framework for the creation of drawing editors. It provides support for a range of programs from simple paint package style editors to more complex programs that have rules about how their elements can be used and altered (e.g. a UML diagramming tool). The framework provides support for the creation of geometric and user defined shapes, editing those shapes, creating behavioural constraints in the editor and animation.

The applications created by JHotDraw are not 'bitmapped' (or rasterised) paint programs. They maintain a collection of shapes that are separate from each other and can be manipulated as separate entities (unless explicitly grouped together). The Drawing class is responsible for keeping track of which shapes have been added to the drawing. To increase its flexibility JHotDraw follows the principals of the MVC design pattern by separating its model (data) from its view (appearance). The Drawing can be thought of as the model as it contains the current state of the application, a separate class called DrawingView represents the drawing's appearance in the application's GUI.

Applications in JHotDraw are defined by the DrawApplication class. This class is responsible for the creation of the graphical user interface (GUI) and for controlling access to the main elements of a JHotDraw application. In JHotDraw all applications are comprised of a drawing; an associated drawing view, a set of drawing shapes and at least one tool.

- To create your application see [[Customising DrawApplication](#)]

The shapes that make up a drawing are represented by the concept of Figures in JHotDraw. Figures are defined as rectangular areas of a drawing but are free to define the visual area inside that rectangle (i.e. the bit the user sees) as they wish. JHotDraw comes presupplied with many comonly used figures but it is possible for developers to create custom figures for use in their own applications.

- To reuse existing figures in your application see [[Identifying Existing Figures](#)]
- To modify existing figures for your application see [[Modifying Existing Figures](#)]
- To compose existing figures together see [[Creating Composite Figures](#)]

Most applications in JHotDraw will require mechanisms for creating and editing the figures that make up a drawing. Figure creation is usually performed with a tool (a button that, when selected, alters the behaviour of the mouse). Editing figures is largely dependant on the type of figure and the set of attributes it allows to be altered. By default most figures allow their size and position to be changed, some allow their colours (outline and fill) to be changed and a few will support more esoteric options such as text editing etc. Editing behaviour is usually limited to the current selection on a drawing

- To create construction tools for figures see [[Using CreationTool](#)]

There are three main ways to define editing behaviour in JHotDraw, using handles (small icons that appear on the selected figure in the drawing), ActionTools (a special type of tool) or menus. In many cases these different mechanisms can be used interchangeably but occasionally the unique benefits and limitations of each approach have to be considered to create suitable edit functionality for an application.

- To create handles to edit figure attributes see [[Creating Handles](#)]
- To create tools to edit figure attributes see [[Using ActionTools](#)]
- To create menus to edit figure attributes see [[Creating Custom Menus](#)]

Constraints are used to impose limits on an application's behavior and are useful when creating applications that require specific relationships between their elements (example constraints include, controlling where figures can be positioned, which of their attributes can be altered, connecting two figures together, etc).

In JHotDraw there are a number of ways in which constraints may be modelled. Constraints can be local to a class of Figure (for example to force the figure to be a certain size or stay in a given position). Or constraints can be applied to subclasses of the Drawing (for constraints that affect groups of figures). Finally it is possible to create connections between figures in the drawing. These are represented on the Drawing by a special type of figure called a ConnectionFigure.

- To create constraints on figures and drawings see [[Modifying Existing Figures](#)] (**NB the standard implementation of drawing is a subclass of Figure**)
- To create connections between figures see [[Creating ConnectionFigures](#)]

All the different elements mentioned above (i.e. Figures, Handles etc) need to be positioned on the drawing. This can be done by specifying absolute coordinates for that element's position or by using Locators, special classes that can be used to describe positions relative to other elements in the drawing (for example a Locator could be used to create a handle in the centre of a figure).

- To use Locators in your application see [[Using Locators](#)]

JHotDraw also supports simple animation capabilities at both the drawing and figure levels of the application.

- To create animation in your application see [[Creating Animation](#)]

JHotDraw Pattern Language

Adding Buttons to the Toolbar



A toolbar displaying a range of different tools

Tools are displayed as buttons on the toolbar that usually runs down the left hand side of the application window. The buttons on the toolbar can represent tools to create new figures, create new connections or to edit figure attributes. There can only be one tool active at all times.

- To find out how to create tools to create figures see [\[Using CreationTool\]](#)
- To find out how to create tools to connect figure together see [\[Using ConnectionTool\]](#)
- To create tools that edit figure attributes see [\[Using ActionTool\]](#)

The DrawApplication class creates the toolbar and it initialises the toolbar with one tool (the selection tool). Sub-classes of DrawApplication can add additional tools by overriding the **createTools(Palette)** method and creating a new ToolButton to add to the Palette (the toolbar). ToolButtons represent tools on the toolbar. When they are selected the current tool in the DrawApplication is replaced with the tool for the selected button.



A ToolButton

- How to create a ToolButton on the palette (createTools(Palette) overrides createTools(Palette) in DrawApplication) (NB **IMAGES** is a static member of DrawApplication that specifies the path to the images directory)

```
protected void createTools(Palette palette){
    super.createTools(palette);
```

```

        ... define other tools here
        CreationTool ellipseTool = new CreationTool(view(),
new EllipseFigure()); //for example
        ToolButton ellipseButton = new ToolButton(this,
IMAGES+"ELLIPSE", "Ellipse Tool", ellipseTool);
        palette.add(ellipseButton);
    }

```

ToolButtons require an image to create a button. JHotDraw comes with several predefined images (JHotDraw5.1/CH/ifa/draw/images). Each of the predefined images are 24 X 24 pixels in size and in the GIF file format. A ToolButton requires three separate images for each state that it can be in; available, pressed and selected. There is a naming scheme for the filenames of each image. They should all begin with the same identifier then end in a number (e.g. the SelectionTool images are saved as SEL1.gif, SEL2.gif and SEL3.gif for the available, pressed and selected states respectively).



Three states of a ToolButton

- For more information on how the toolbar changes state see [[Customising Selection Behaviour](#)]

Although it is possible to remove the toolbar completely from applications created with the framework caution must be taken as other parts of the framework rely on the existence of a current tool and unless steps are taken to supply one the application will not function correctly.

JHotDraw Pattern Language

Creating Animation

JHotDraw provides support for a simple form of animation where figures can be moved around the drawing following simple rules.

Animation is provided in JHotDraw by making a subclass of Drawing that implements the Animatable interface. This interface defines one method **animationStep()** that is called to render each frame of the animation. This allows **animationStep()** to perform incremental updates to the state of the drawing which if they occur frequently enough appear as animation.

This form of animation requires that each figure in the drawing has some rules to govern how it is updated on each new frame. This can be preformed directly inside Drawing where **animationStep()** specifies a transformation for every figure in the drawing. This is acceptable when all figures are to be animated uniformly but precludes different subclasses from exhibiting different behaviour.

An alternative approach is to implement the Animatable interface for each animating figure in an application. These figures may then define the **animationStep()** as they wish. The Drawing's role in this scenario is to implement an **animationStep()** method that enumerates through the collection of figures calling each animatable figure's **animationStep()** method.

- How to create Drawing's **animationStep()** when animating individual figures

```
public void animationStep() {
    Enumeration k = figures();
    while (k.hasMoreElements()){
        Figure fig = (Figure)k.nextElement();
        if(fig instanceof Animatable){
            Animatable anim = (Animatable)fig;
            anim.animationStep();
        }
    }
}
```

Animation only works if the drawing is changed in very quick intervals JHotDraw does not provide any default mechanism to repeatedly call the animation method so this functionality much be created manually. The example program JavaDraw (JHotDraw5.1/CH/ifa/draw/samples/javadraw) creates a class Animator that spawns a seperate thread to call **animationStep()** at regular intervals, developers wishing to create animation should reuse this class where possible in their systems (insert **import CH.ifa.draw.samples.javadraw.Animator** at the top of a class to reference Animator).

JHotDraw Pattern Language

Creating Composite Figures

CompositeFigures are collections of existing figures organised together into a single figure. In JHotDraw this functionality is represented in the abstract CompositeFigure class and its subclass GroupFigure.



An example of a composite figure

When creating a custom composite figure there are several issues to consider; Selecting which classes are going to be composed, positioning those classes in the composite and finally defining how the composite will react to movement and resize events?

- For further information on the Figure inheritance hierarchy see [\[The Figure hierarchy\]](#)
- To reuse existing figures in your composite see [\[Identifying Existing Figures\]](#)

Figures can be added to a composite by calling its **add(Figure)** method. When adding figures to a composite each figure's position relative to the others has to be defined before composing them together (see example below for details). When figures overlap in a composite it is also important to add the figures in a back to front ordering (i.e. the figure at the back of the composite should be added first).

The GroupFigure class provides a default implementation of composite functionality; it provides support for moving the composite around the drawing but prevents resize behaviour.

- how to create a composite figure (example creates composite figure shown above)

```
...
TriangleFigure triangle1 = new TriangleFigure(new Point(0,0), new Point(20,20));
TriangleFigure triangle2 = new TriangleFigure(new Point(20,0), new Point(40,20));

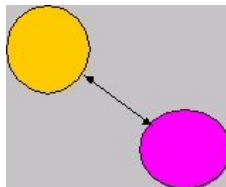
GroupFigure group = new GroupFigure();

group.add(triangle1);
group.add(triangle2);
//GroupFigure group can now be added to the drawing or used to create a tool
...
```

- To create construction tools for figures see [\[Using CreationTool\]](#)

JHotDraw Pattern Language

Creating ConnectionFigures



A ConnectionFigure connecting two ellipse figures

ConnectionFigures are used to create connections between figures in JHotDraw. Connections are typically visual elements although this behaviour may be turned off if required. Constraints are modelled in the framework by the ConnectionFigure interface and its two specialisations LineConnection and ElbowConnection.

- For more information about ConnectionFigure and its subclasses see [[The Connection hierarchy](#)]

The connection between the connected figures and the ConnectionFigure is made via an implementation of the observer design pattern. The figures act as observable classes while the connection acts as the observer. The default behaviour for this relationship is to update the connection in response to changes in the connected figures (maintaining the connection as the figures are repositioned in the drawing). Figures can refuse to take part in connections by overriding the figures **canConnect()** method to return false.

The ConnectionFigure interface is an extension of the FigureChangeListener interface. The FigureChangeListener interface describes several different methods that may be invoked upon a state change. The **figureChanged(FigureChangedEvent)** method that is sent when a figure changes state is the most general and is the most commonly used by connections. Other messages that the interface can react to include: **figureInvalidated(FigureChangedEvent)**, **figureRemoved(FigureChangedEvent)**, **figureRequestRemove(FigureChangedEvent)**, and **figureRequestUpdate(FigureChangedEvent)**.

The FigureChangeListener interface can be overridden in any subclass of ConnectionFigure to customise the constraint behaviour.

Connections are not strictly speaking made between figures but are actually made between Connectors. Connectors exist on figures and define how connections will appear on the figure.

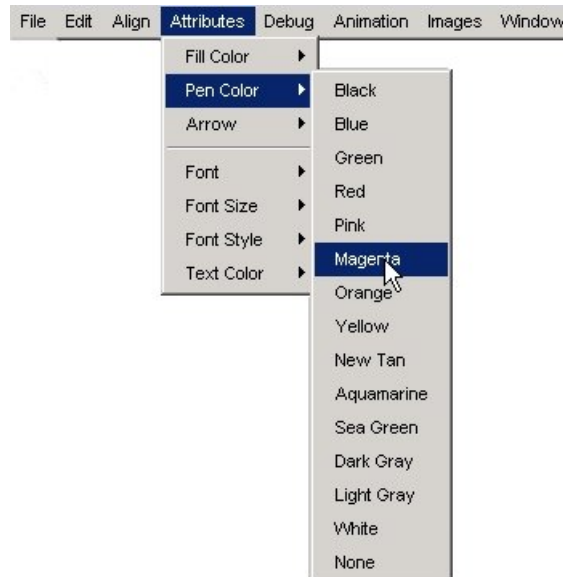
- For more information about connectors see [[Using Connectors](#)]

Connections between figures can be created by passing the figures' connectors into the ConnectionFigure's **connectStart(Connector)** and **connectEnd(connector)** methods. A more common approach is to create a tool to create connections in the application.

- To create a connection tool see [[Using Connection Tool](#)]

JHotDraw Pattern Language

Creating Custom Menus



A menu in JHotDraw

Menus reside on the menu bar that exists at the top of the application window. Menus are comprised of menu items and sets of items are generally grouped by functionality. In JHotDraw the default menu bar contains menus for file, edit, align, attributes and debug operations.

The DrawApplication class defines the application's menus. Subclasses may alter, remove (with caution) or add menus (and their menu items) to reflect the requirements of the application. Menus and menu items and the menu bar are constructed using Java's standard AWT components (Menu, MenuItem and MenuBar).

DrawApplication uses the factory method design pattern to localise menu creation into separate methods (i.e. to create the 'New' menu item on the File menu the code below is used). The same technique should be used when creating new menus in an application.

- How to create menus in your application (example from DrawApplication)

(NB The behaviour of the menu item is encapsulated in the ActionListener class (which in this case calls the DrawApplications **promptNew()** method and the menu that is returned by the **createFileMenu()** method is added to the MenuBar in the **createMenus()** method).

```
protected Menu createFileMenu() {
    Menu menu = new Menu("File");
    MenuItem mi = new MenuItem("New", new MenuShortcut('n'));

    mi.addActionListener( new ActionListener() { public void
actionPerformed(ActionEvent event) { promptNew(); } } );
    menu.add(mi);
}
```

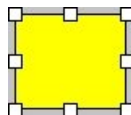
```
    ... above is repeated for all other menu items on the file menu  
} // end of createFileMenu()
```

Some menus are context sensitive and should only be activated when the correct type of figure has been selected. In such a case changes to the selection behaviour must be made to ensure that that menu (or menu item) only becomes available at the correct times. (This is the reason why caution must be used when removing menu items as the selection behaviour assumes certain menus exist when setting which menus are active)

- For more information on changing selection behaviour see [[Customising Selection Behaviour](#)]

JHotDraw Pattern Language

Creating Handles



A selected figure displaying resize handles

Direct manipulation of figures on a drawing is achieved through the use of Handles. The `AbstractHandle` class implements the `Handle` interface and provides default behaviour for all handles in the framework.

- For further information about the Handle hierarchy see [The Handle Hierarchy](#)

JHotDraw predefines several types of handle; they include `ChangeConnectionHandle`, `ElbowHandle`, `LocatorHandle` and `PolygonHandle`. It should be noted that because Handles tend to be specific to the figure they were created for, opportunities of reuse across different types of figure are rare. Therefore developers should expect to have to write their own handles either by sub-classing `AbstractHandle` or one of the above classes.

To add a handle to a figure the figures `handles()` method must be overridden. This method is called by other parts of the framework to draw the selected figures handles on the `DrawingView`.

Resize handles are often required for figures in JHotDraw applications therefore the framework provide a utility class (`BoxHandleKit`) which simplifies adding resize handles to a figure

- How to add handles to a figure (example from `GroupFigure`)

```
public Vector handles() {
    Vector handles = new Vector();
    handles.addElement(new GroupHandle(this, RelativeLocator.northWest()));
    handles.addElement(new GroupHandle(this, RelativeLocator.northEast()));
    handles.addElement(new GroupHandle(this, RelativeLocator.southWest()));
    handles.addElement(new GroupHandle(this, RelativeLocator.southEast()));
    return handles;
}
```

- How to add handles to a figure (using `BoxHandleKit`)

```
public Vector handles() {
    Vector handles = new Vector();
    BoxHandleKit.addHandles(this, handles);
    return handles;
}
```

When creating custom handles the dynamic behaviour of a handle has to be understood. Handles define three important methods. `invokeStart()`, `invokeStep()` and `invokeEnd()`. These methods are called when the mouse is respectively clicked, dragged and released on top of a handle. Every interaction with a handle will therefore follow a sequence where `invokeStart` will be called, `invokeStep` may be called (if the mouse is dragged) and `invokeEnd` will be called when the interaction ends. This granularity across the interaction allows the developer to control how the handle responds to the user input.

The appearance of a handle can also be altered. This might be appropriate to indicate the action the handle will perform or the current state the handle is in. To change a handles appearance override its **draw(Graphics)** method.

To create handles at a position on a figure the **locate()** method should be redefined. This method returns a point around which the Handle will be centred.

- For more information on positioning Handles see [[Using Locators](#)]

JHotDraw Pattern Language

Customising DrawApplication

DrawApplication is responsible for the creation of the graphical user interface (GUI) and for controlling access to the main elements of a JHotDraw application.

DrawApplication is the initialisation point for the framework. it defines a method **open()**, that initialises all the framework components and combines them together to create the application. The **open()** method is an obvious target for customisation in applications however the method should not be overridden directly (as the developer would then have the onus of initialising JHotDraw correctly). Instead the **open()** method implements the template design pattern, where **open()** is the template and methods such as **createTools()** and **createDrawing()** provide hooks that developers may override in thier own subclasses.

- How to initialise a default application

```
import CH.ifa.draw.application.DrawApplication;

public class MainClass{
    public static void main(String[] args){
        DrawApplication drawApp = new DrawApplication("Application title");
        drawApp.open();
    }
}
```

DrawApplication is also responsible for setting up the applications GUI.

- For more information on customising the GUI see [[Customising the GUI](#)]

Applications can also be animated.

- To add animation functionality see [[Creating Animation](#)]
-

JHotDraw Pattern Language

Customising Selection Behaviour

Selection is the action of identifying figures in the drawing. When a figure is selected in JHotDraw (via the selection tool) only those operations that are applicable should be displayed in the user interface (i.e. there is no point trying to edit text on a figure with no text!).

The `DrawingView` is responsible for maintaining the current selection. It has methods to add figures to and remove figures from the selection etc. When these events occur they trigger a sequence interaction to update the state of the GUI.

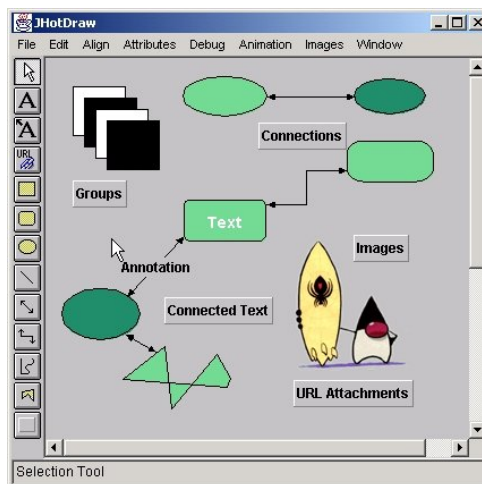
The major action that occurs on a change of selection is the invocation of the `DrawApplication`'s **`selectionChanged()`** method this checks specific menus to determine which of their menu items will be executable on the figures in the current selection. If the menu item can work then it is enabled if it cannot then it is disabled.

Tools are responsible for their own checks to ensure that they are operating on a valid figure, handles on the other hand are always okay because they are displayed as a consequence of figure selection (in fact they are used to indicate selection).

JHotDraw Pattern Language

Customising the GUI

The graphical user interface (GUI) of JHotDraw is defined within the DrawApplication class. Many parts of this GUIs appearance and behaviour can be customised to suit specific applications.



The JHotDraw Application GUI

The above image shows an example of a JHotDraw application. It illustrates the various parts that comprise the interface to a JHotDraw application the menu bar, the tool bar and the status bar.

Menu bar: The menu bar runs along the top of the window just below the title bar. It contains menus for file, edit, align, attributes and debug operations. The menu bar is customisable, elements can be added to the menus, some elements can be removed and the behaviours of existing elements can be changed as required by the application.

- For more information on customising the menubar see [\[Creating Custom Menus\]](#)

Tool bar: The tool bar runs down the left-hand side of the window. The tool bar contains icons for the different kinds of tools available to the application. By default the framework offers the selection tool but as the example above shows it is possible to add other tools to create elements or to edit parts of the drawing.

- For more information on customising the toolbar see [\[Adding Buttons to the Toolbar\]](#)

Status bar: The status bar is the white area running along the bottom of the window. It displays information about the current state of the application (i.e. currently selected tool). This is customisable to display specific information about an application. The `showStatus(String)` method in DrawApplication can be used to pass status information to the status bar

JHotDraw Pattern Language

Identifying Existing Figures

The Figure hierarchy defines the common graphical elements that can be added to a JHotDraw Application. At its root the interface Figure defines the common operations that a figure can be asked to perform. The direct descendant of Figure is AbstractFigure which defines much of the default behaviour of Figures in JHotDraw.

- For further information on the Figure inheritance hierarchy see [[The Figure hierarchy](#)]

The Figures that are available for immediate reuse in JHotDraw applications are defined in two subclasses of AbstractFigure. AttributeFigure contains the majority with subclasses for all the common geometrical figures (i.e. rectangles, ellipses, polygons etc) while PolyLineFigure contains one class, LineFigure that represents lines on the drawing.

All figures in JHotDraw are defined as rectangular areas within which a visual element that represents the Figure is displayed. The rectangular area is called the figure's display box and it is used to set the size and the position of a figure on the Drawing. Figures can have other attributes as well and the developer should familiarise themselves with AbstractFigure and AttributeFigure where many common attributes and behaviours are defined.

The example applications provided with JHotDraw showcase many of the Figures available for reuse in other applications. The application JavaDraw (JHotDraw5.1/CH/ifa/draw/samples/javadraw) provides a particularly good example of the types of figure available. Developers interested in reusing existing figures should run this application to observe the appearance and behaviour available for each figure.

- To create construction tools for figures see [[Using CreationTool](#)]
-

JHotDraw Pattern Language

Modifying Existing Figures

The framework comes presupplied with many different types of Figure. Often developers will find that predefined figures deliver only part of the functionality required for their application. In such circumstances figures can be subclassed to defined the required behaviour.

- For further information on the Figure inheritance hierarchy see [[The Figure hierarchy](#)]

It is important to develop a good understanding of a Figures behaviour before subclassing to identify which methods will have to be overridden and what extra methods will have to be added to create the new figure.

When creating a new subclass remember to maintain the naming convention of ending the class name with **Figure**.

- To create construction tools for figures see [[Using CreationTool](#)]
-

JHotDraw Pattern Language

Using Action Tool

Tools are commonly used for creation and connection events but it is also possible to use them to edit figure attributes. The abstract `ActionTool` class provides a starting point for tools that wish to operate in this manner.

- For information about the tool hierarchy see [\[The Tool Hierarchy\]](#)

The JavaDraw example program (JHotDraw5.1/CH/ifa/draw/samples/JavaDraw) contains an example of an `ActionTool`. `BorderTool` creates a border around any figure that is clicked on when the tool is active.

`ActionTool` provides the **`action(Figure)`** method that when defined in a subclass, performs its action whenever the tool is applied to a figure (i.e. the mouse is clicked on it).

`ActionTools` are represented by buttons on the `ToolBar`.

- To add an `ActionTool` to the toolbar follow [\[Adding Buttons to the Toolbar\]](#)

JHotDraw Pattern Language

Using ConnectionTool

The most common way to create `ConnectionFigure`s on a drawing is to create a tool in the application. JHotDraw uses a class called `ConnectionTool` to create tools that can be used to instantiate any kind of `ConnectionFigure`.

- For information about the tool hierarchy see [\[The Tool Hierarchy\]](#)

`ConnectionTool` is an implementation of the Prototype design pattern. `ConnectionTool` can be parameterised to create any kind of `ConnectionFigure`. To create the tool call the `ConnectionTool` constructor and pass into it an instance (the prototype) of the type of `ConnectionFigure` you want to create. For example:

- How to create a tool using `ConnectionTool` (**`createTools(Palette)`** overrides **`createTools(Palette)`** in `DrawApplication`)

```
protected void createTools(Palette){
    super.createTools(Palette);
    ... define other tools here
    ConnectionTool connectionTool = new connectionTool(new LineConnection());
    //add a button to the toolbar that represents the tool
}
```

Tools are represented in the applications GUI as a button.

- To create buttons on the tool bar follow [\[Adding Buttons to the ToolBar\]](#)

The `ConnectionTool` automatically provides the behaviour for setting the end points of a connection (i.e. when the tool is selected, using the mouse click on a figure to start the connection then drag the mouse to another figure to end the connection).

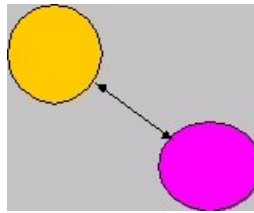
JHotDraw Pattern Language

Using Connectors

Connectors are algorithms that are used by ConnectionFigures to decide where the point of attachment for the connection should be placed. JHotDraw comes pre supplied with several different types of connector. The Connector interface is implemented by AbstractConnector which in turn is extended by ChopBoxConnector, LocatorConnector and ShortestDistanceConnector.

- For more information on the types of connector available see [\[The Connector hierarchy\]](#)

To illustrate the role a connector plays consider an EllipseFigure on a drawing connected to another figure. To make the connection appear to link the two figures together the line must be drawn from the perimeter of one figure to the perimeter of the other. This implies that a ConnectionFigure knows where the edges of both figures lie. However JHotDraw considers figures to be rectangular areas containing a visual representation of the shape this precludes the connection from identifying the edge of the shape inside the figure (it can only see the figures rectangle). To overcome this problem JHotDraw introduces the concept of Connectors. The ChopBoxConnector and its subclasses ChopEllipseConnector, ChopPolygonConnector and PolyLineConnector can be used to define the points that lie on the perimeter of the figure. ConnectionFigures attached to the Figure can query its connector to determine the figures actual perimeter.



A connection between ellipses showing the use of connectors

Connectors belong to Figures and can be obtained by calling a figures `connectorAt(int,int)` method. This method will return the connector that covers the point defined by the two integers in the parameter list. Figures can contain several different types of connector (covering different areas of the figure) but typically they contain only one.

Figures can be prevented from taking part in connections by overriding the `canConnect()` method and making it return false.

Connectors can be defined visually by using the ConnectionHandle class to create a Handle for connections.

- To find out how to create handles on figures see [\[Creating Handles\]](#)

JHotDraw Pattern Language

Using CreationTool

The most common way to add figures to a drawing is to create a tool in the application. JHotDraw uses a class called `CreationTool` to create tools that can be used to instantiate any kind of figure.

- For information about the tool hierarchy see [\[The Tool Hierarchy\]](#)

`CreationTool` is an implementation of the Prototype design pattern. `CreationTool` can be parameterised to create any kind of Figure. To create the tool call the `CreationTool` constructor and pass into it an instance (the prototype) of the type of Figure you want to create. For example:

- How to create a tool using `CreationTool` (`createTools(Panel palette)` overrides `createTools(Panel palette)` in `DrawApplication`)

```
protected void createTools(Panel palette){
    super.createTools(palette);
    ... define other tools here
    CreationTool creationTool = new CreationTool(new
EllipseFigure());
    //add a button to the toolbar that represents the tool
}
```

Tools are represented in the applications GUI as a button.

- To create buttons on the tool bar follow [\[Adding Buttons to the ToolBar\]](#)

The `CreationTool` automatically provides the behaviour for creating the size of the new figure (i.e. when the tool is selected, using the mouse click to place the figure then drag to determine its width and height).

JHotDraw Pattern Language

Using Locators

Locators are used to represent positions on figures. They are useful for defining where handles or connectors should be placed on a figure.

- To find out how to create handles on figures see [\[Creating Handles\]](#)
- To find out more about connectors see [\[Using Connectors\]](#)

The Locator interface is implemented by AbstractLocator which in turn defines two subclasses, OffsetLocator and RelativeLocator.

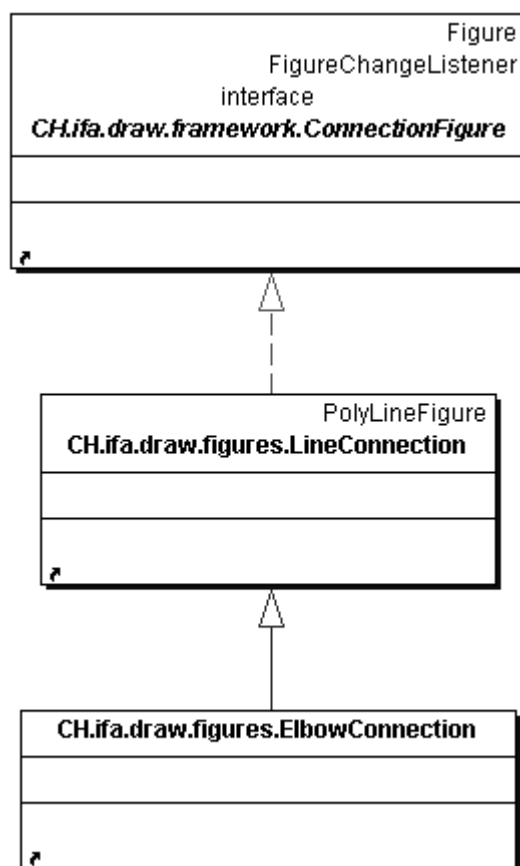
- For more information about the Locator hierarchy see [\[The Locator hierarchy\]](#)

Relative Locator is used to represent positions relative to a figures boundary. Positions are specified as percentages of the figure (i.e. 50% along and 50% down will locate the centre of the figure). Relative Locator comes with a set of convenient static methods that specify the ‘compass points’ on a figure (i.e. **northWest**() specifies the top left hand corner of a figure etc.)

Offset Locator is used to specify a position relative to another locator. They are often used in conjunction with relative locators for example; to specify a point a few pixels off of the centre of a figure.

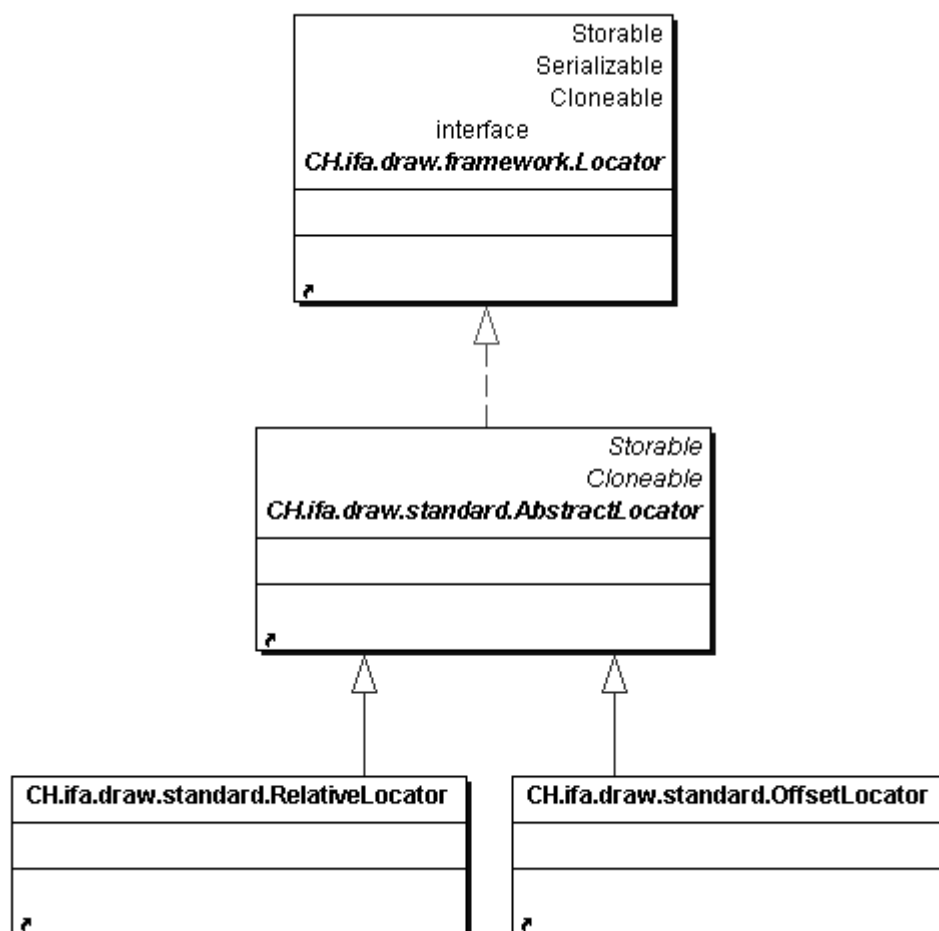
JHotDraw Pattern Language

The Connection Hierarchy



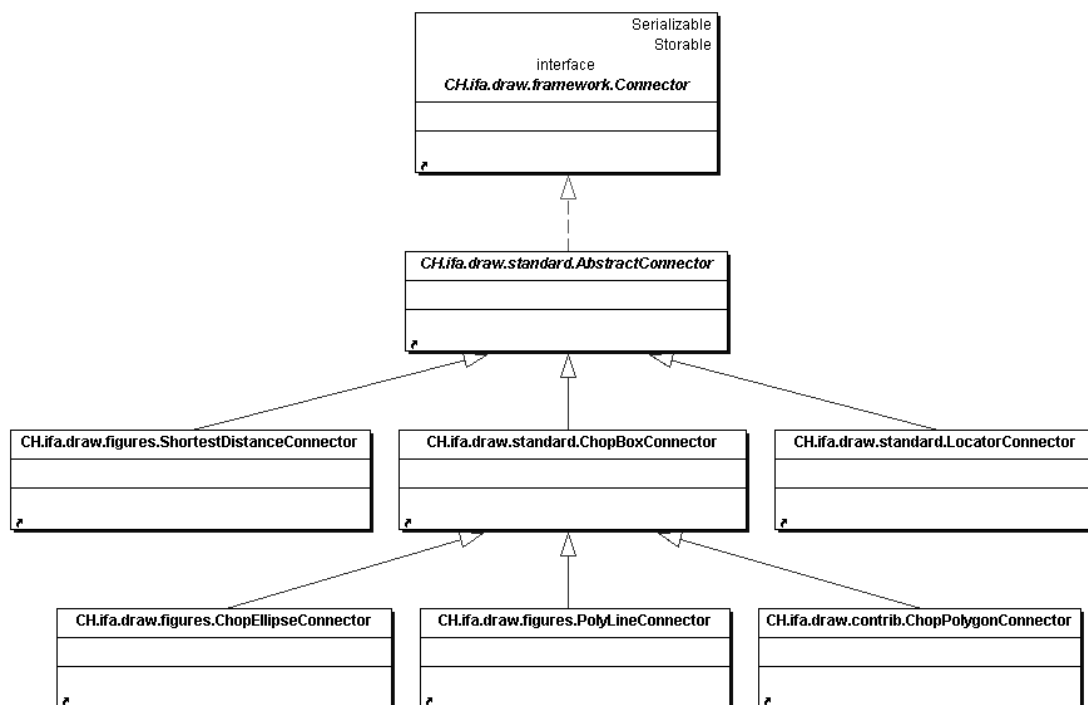
JHotDraw Pattern Language

The Locator Hierarchy



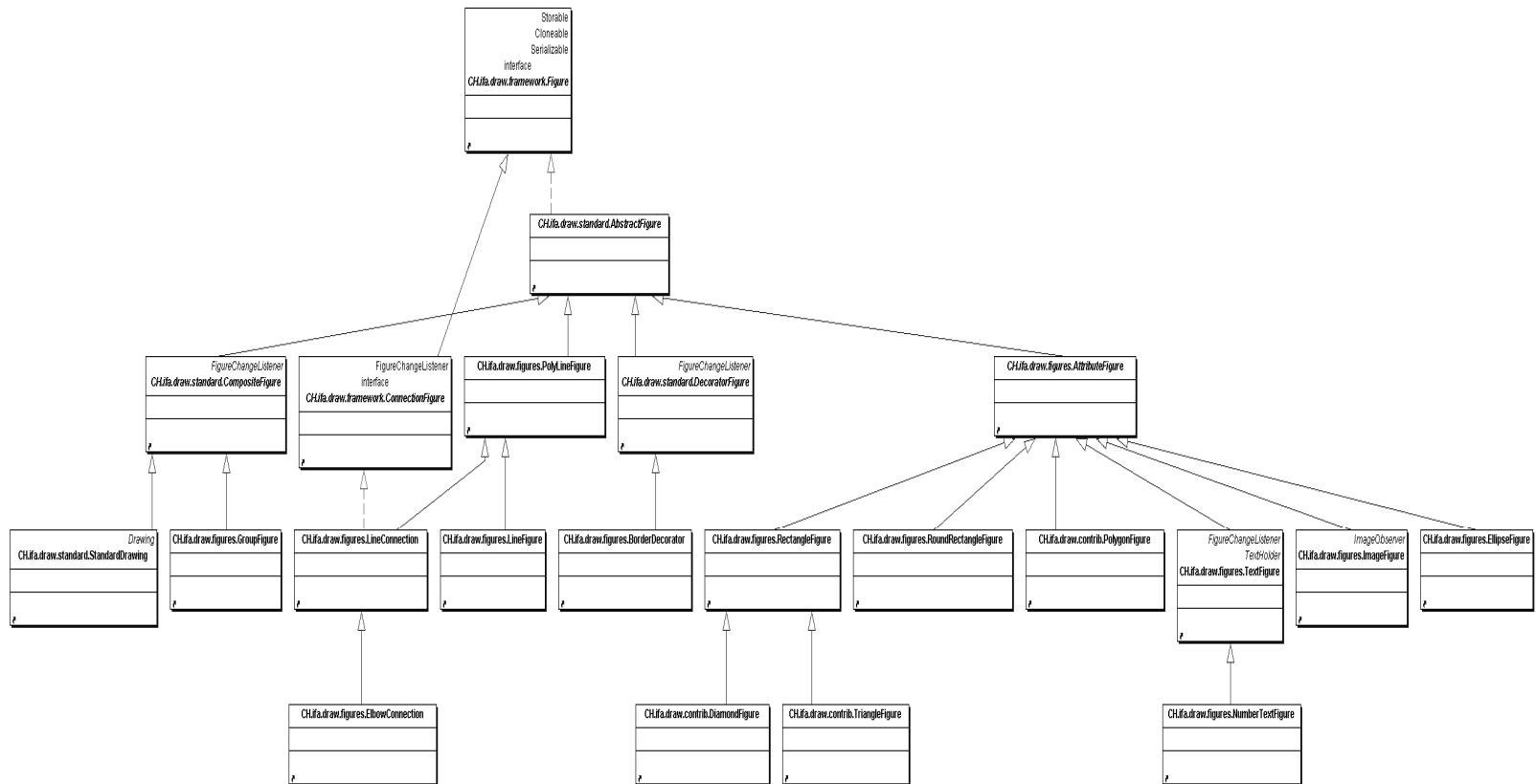
JHotDraw Pattern Language

The Connector Hierarchy



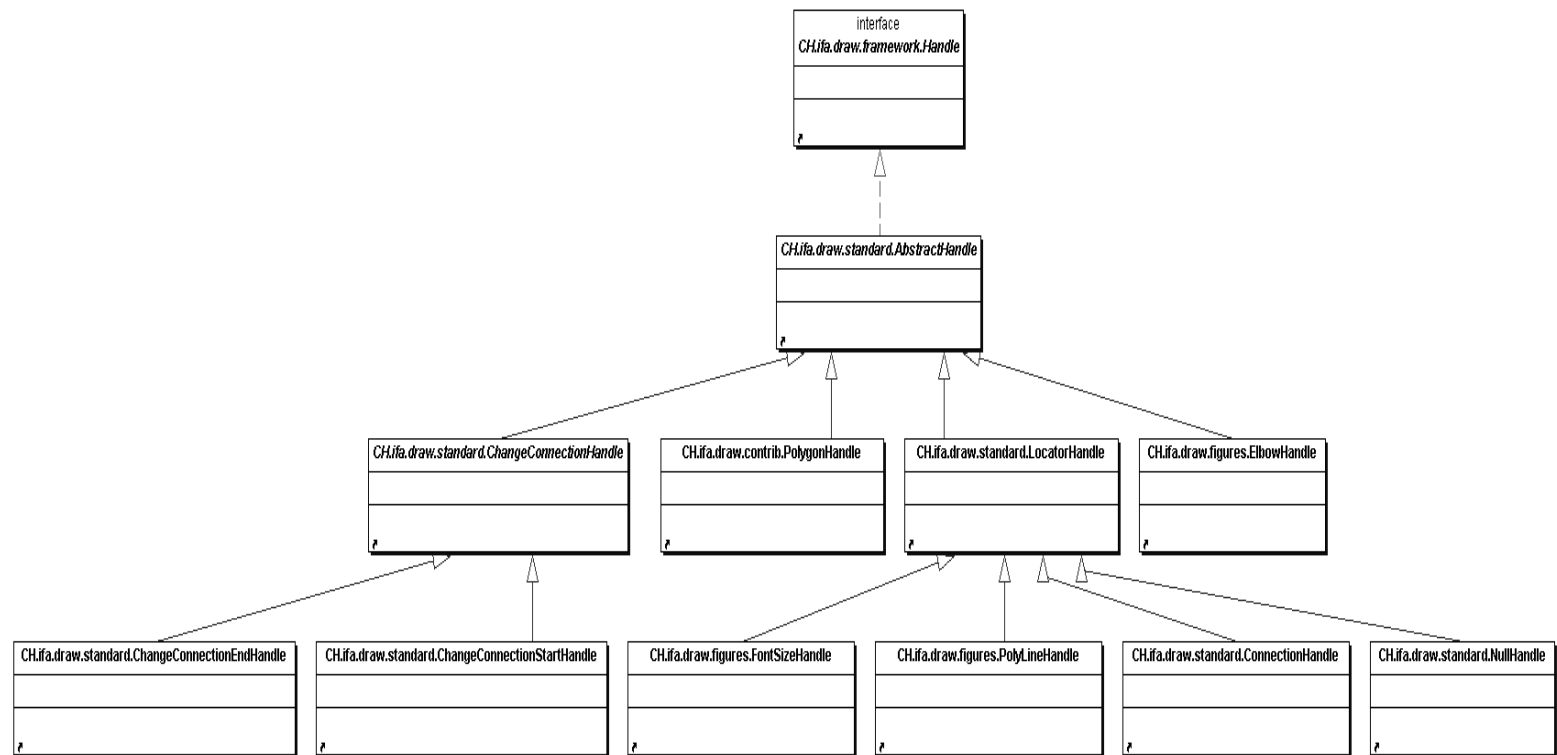
JHotDraw Pattern Language

The Figure Hierarchy



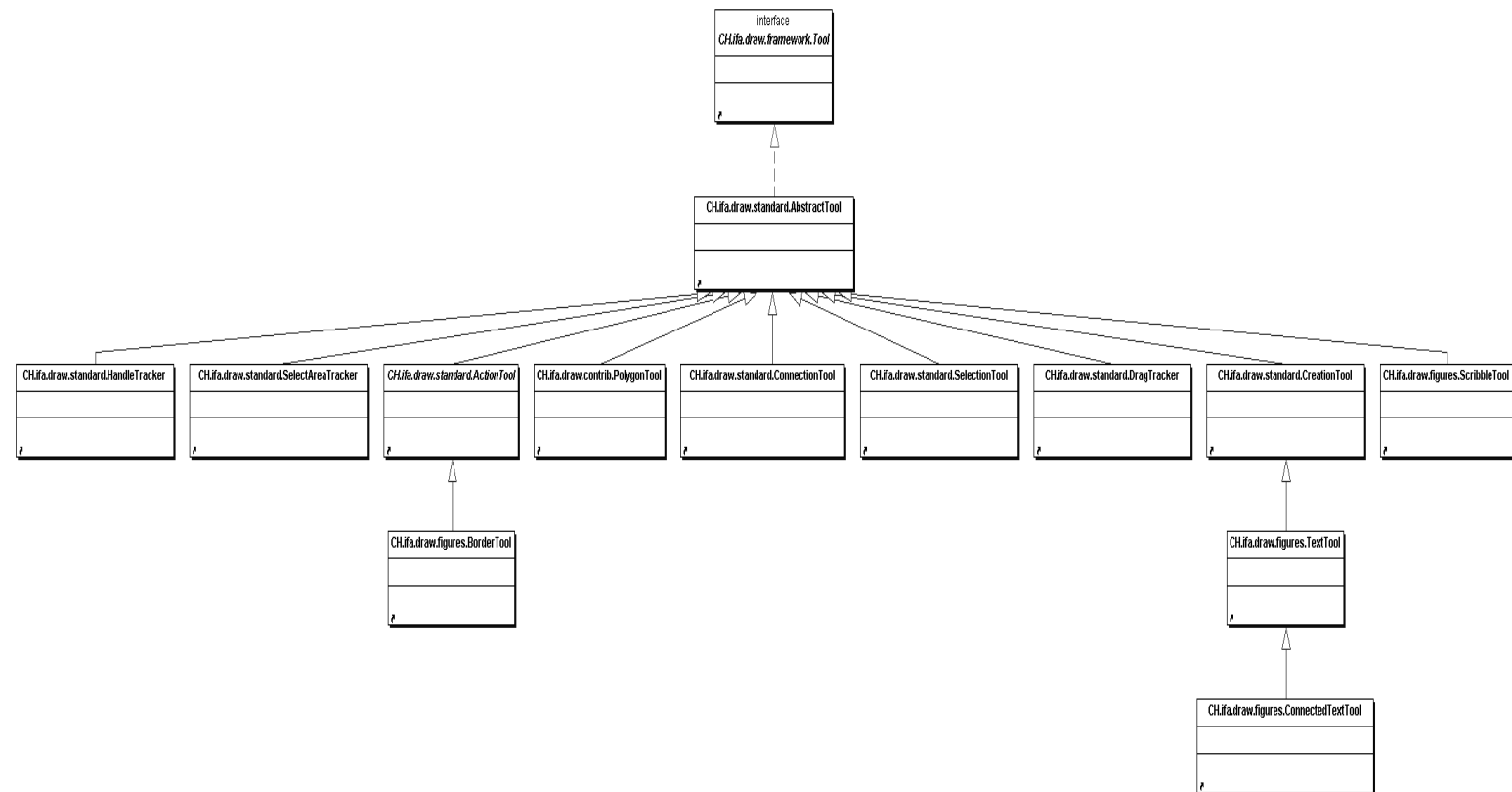
JHotDraw Pattern Language

The Handle Hierarchy



JHotDraw Pattern Language

The Tool Hierarchy



3 Micro architecture documentation

Micro Architectures

<u>Command</u>	<u>Hierarchy</u>
<u>ConnectionFigure</u>	<u>Hierarchy</u>
<u>Connector</u>	<u>Hierarchy</u>
<u>Drawing</u>	<u>Hierarchy</u>
<u>DrawingChangeListener</u>	<u>Hierarchy</u>
<u>DrawingEditor</u>	<u>Hierarchy</u>
<u>DrawingView</u>	<u>Hierarchy</u>
<u>Figure</u>	<u>Hierarchy</u>
<u>FigureChangeListener</u>	<u>Hierarchy</u>
<u>FigureEnumeration</u>	<u>Hierarchy</u>
<u>Handle</u>	<u>Hierarchy</u>
<u>LineDecoration</u>	<u>Hierarchy</u>
<u>Locator</u>	<u>Hierarchy</u>
<u>Painter</u>	<u>Hierarchy</u>
<u>PaletteListener</u>	<u>Hierarchy</u>
<u>PointConstrainer</u>	<u>Hierarchy</u>
<u>Storable</u>	<u>Hierarchy</u>
<u>TextHolder</u>	<u>Hierarchy</u>
<u>Tool</u>	<u>Hierarchy</u>

<i>Command</i>
+void execute() +boolean isExecutable() +String name()

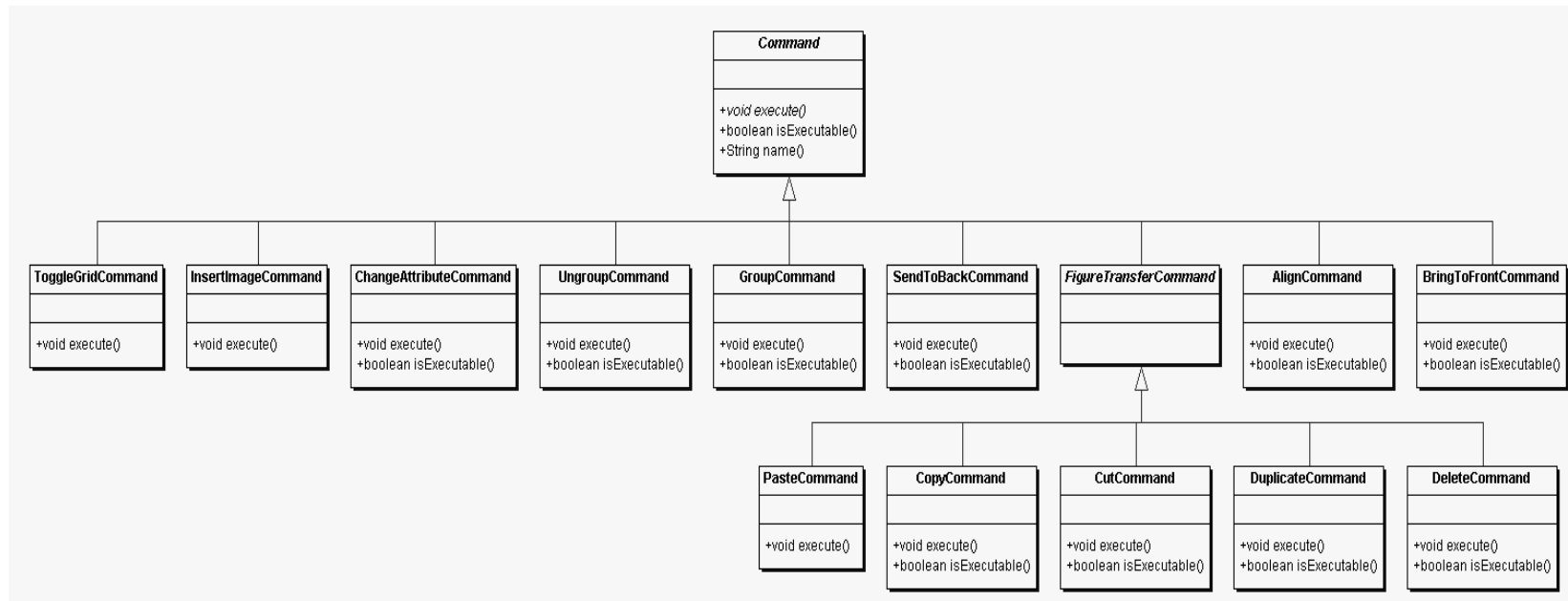
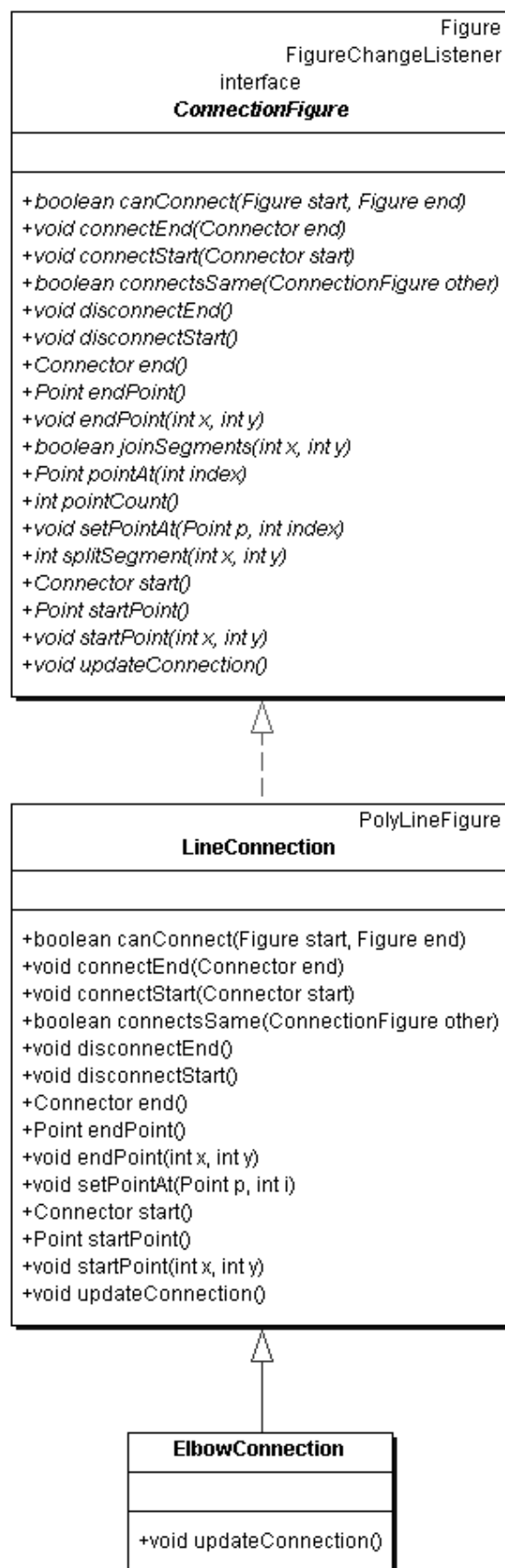
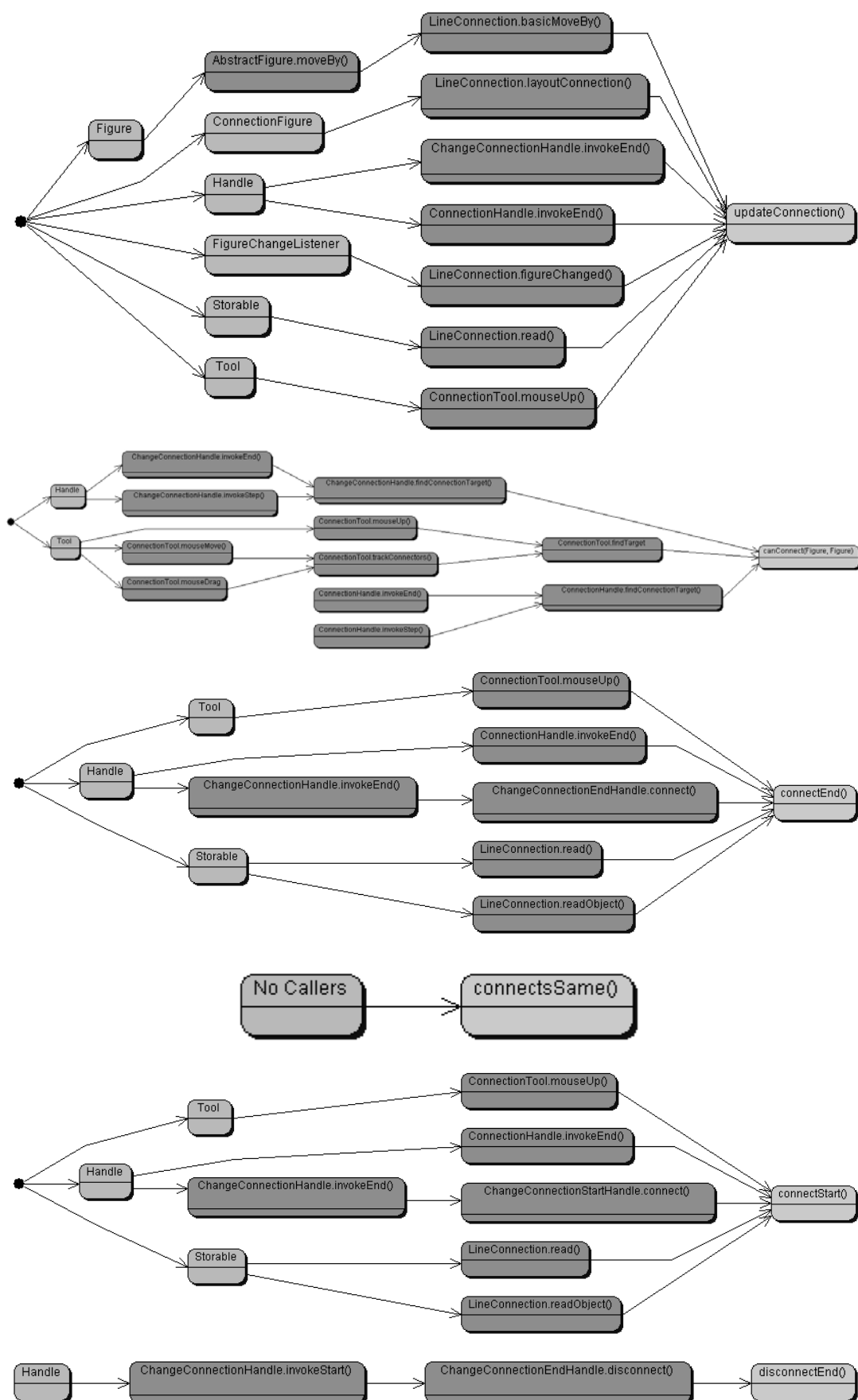
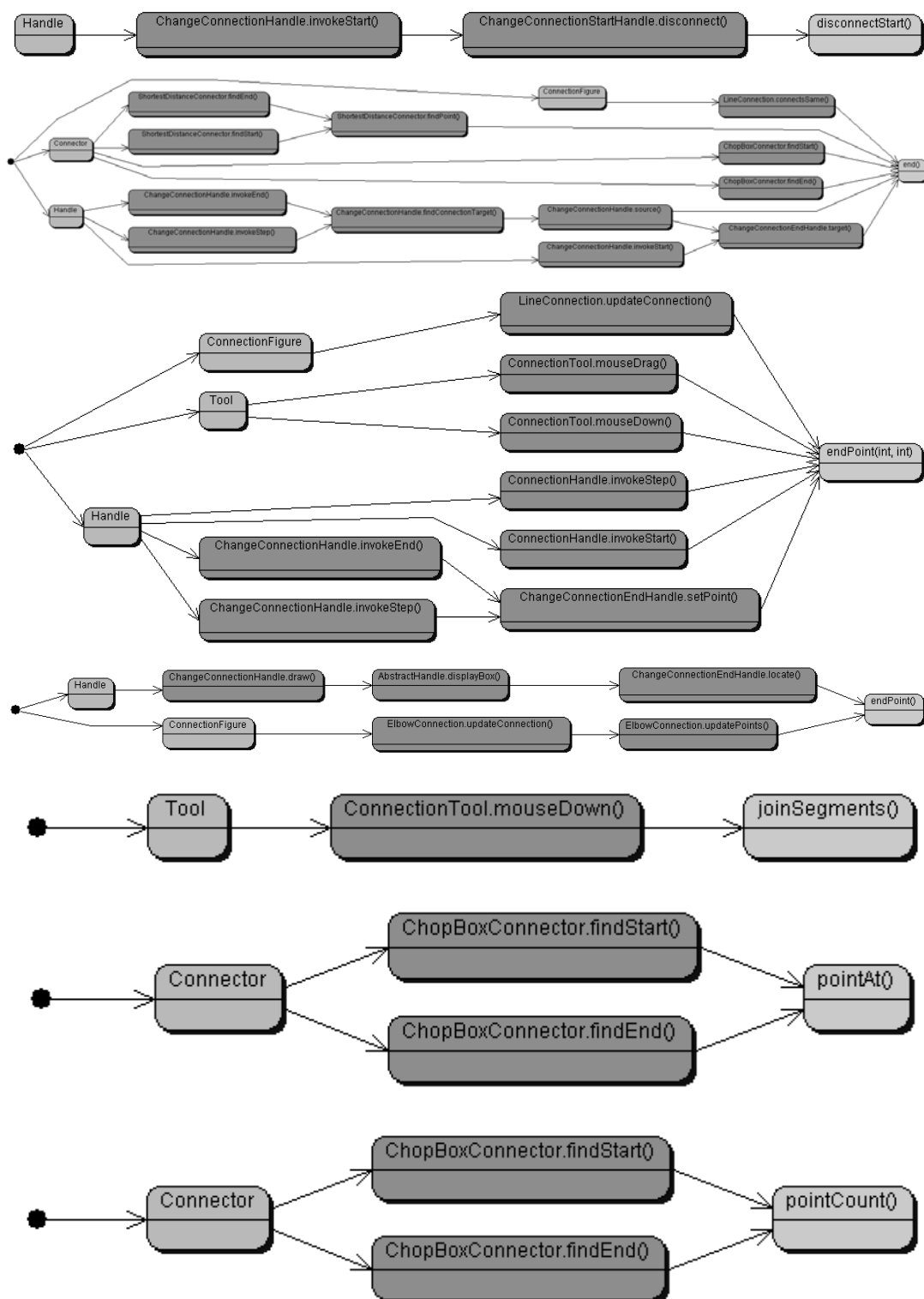
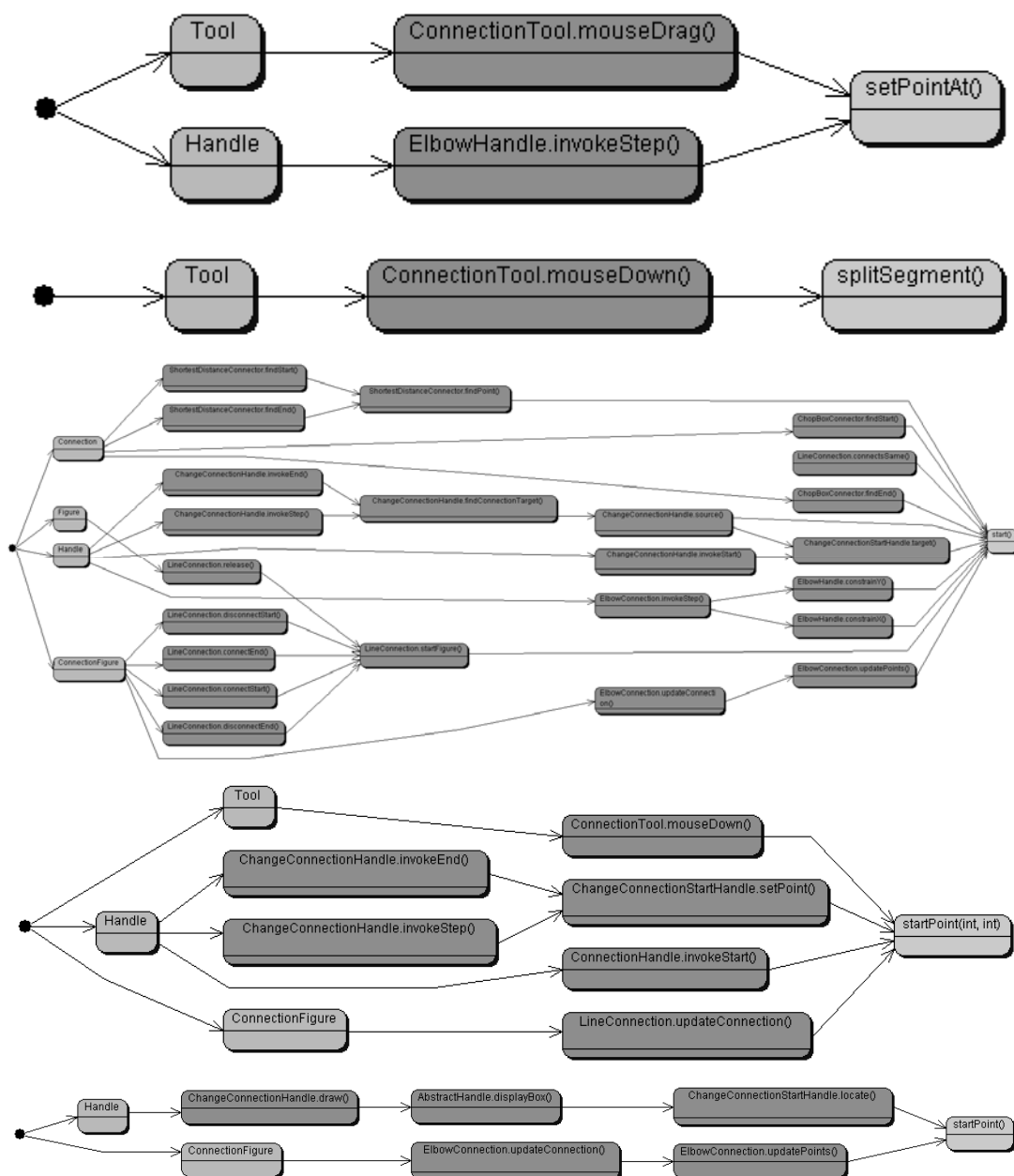


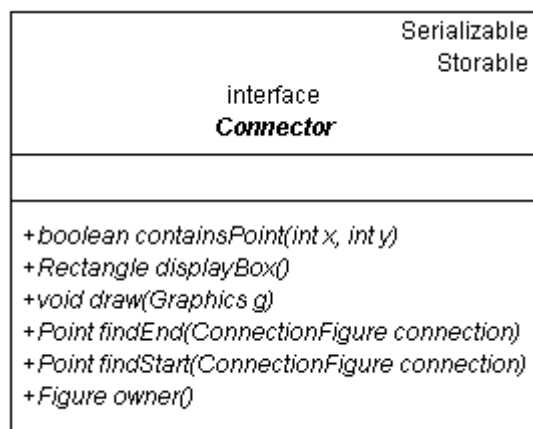
Figure FigureChangeListener interface ConnectionFigure
<pre> +boolean canConnect(Figure start, Figure end) +void connectEnd(Connector end) +void connectStart(Connector start) +boolean connectsSame(ConnectionFigure other) +void disconnectEnd() +void disconnectStart() +Connector end() +Point endPoint() +void endPoint(int x, int y) +boolean joinSegments(int x, int y) +Point pointAt(int index) +int pointCount() +void setPointAt(Point p, int index) +int splitSegment(int x, int y) +Connector start() +Point startPoint() +void startPoint(int x, int y) +void updateConnection() </pre>

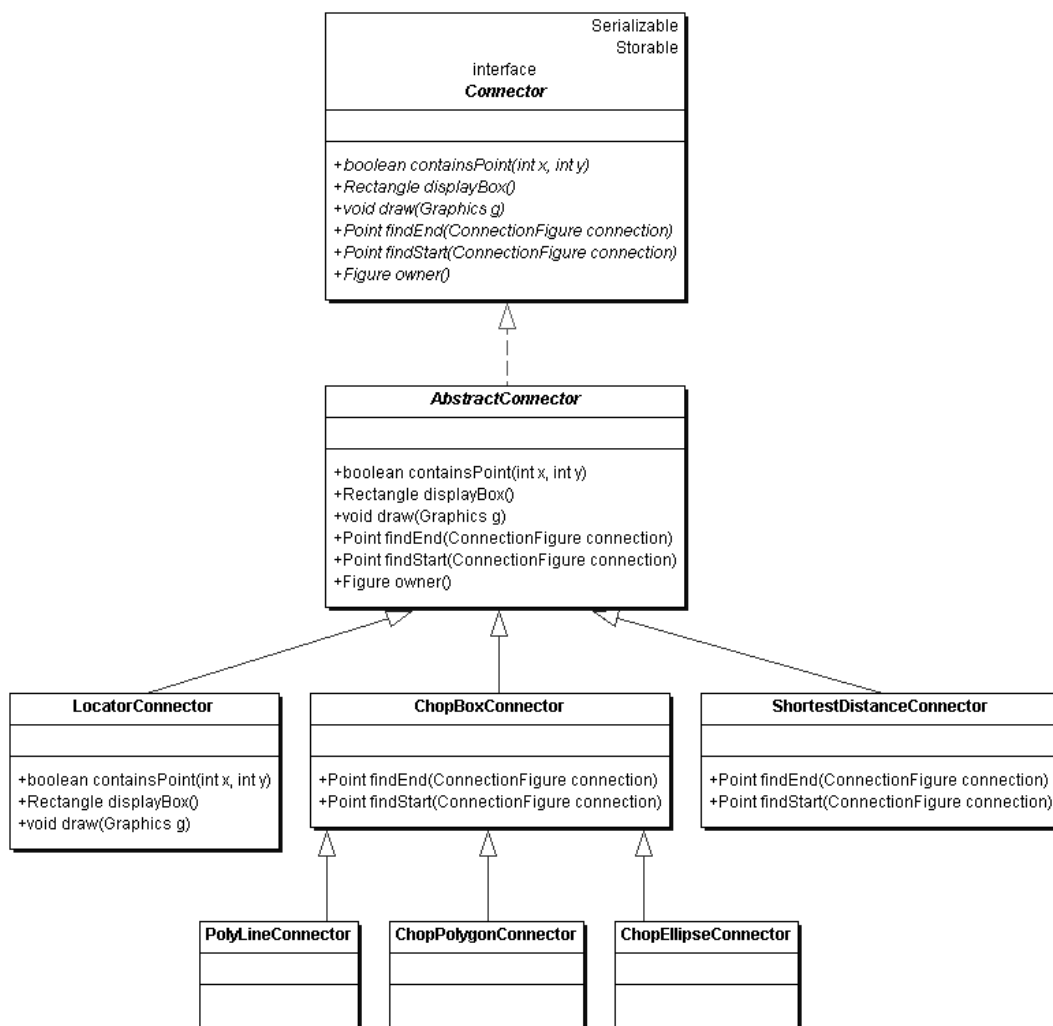


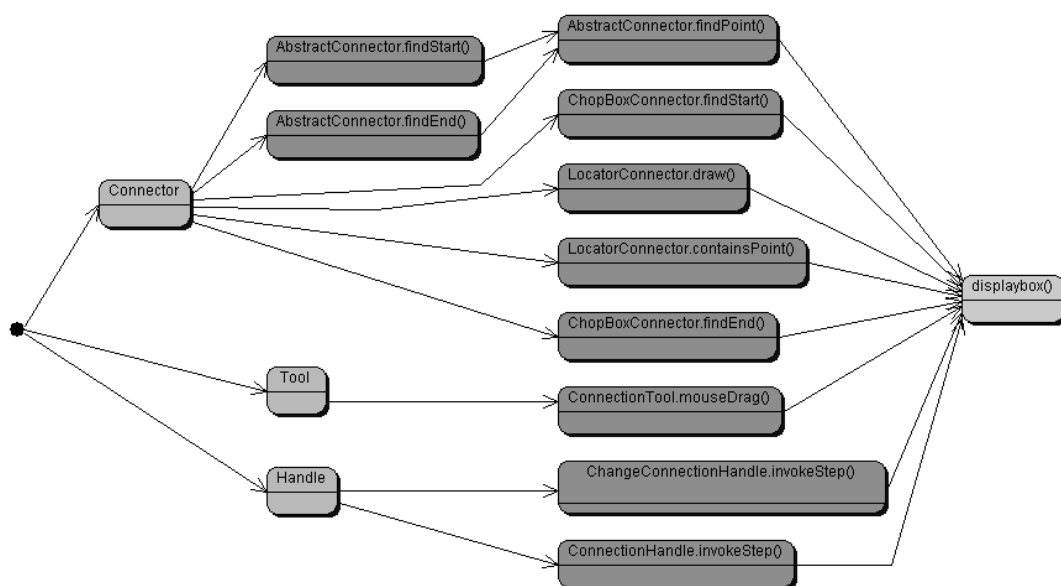
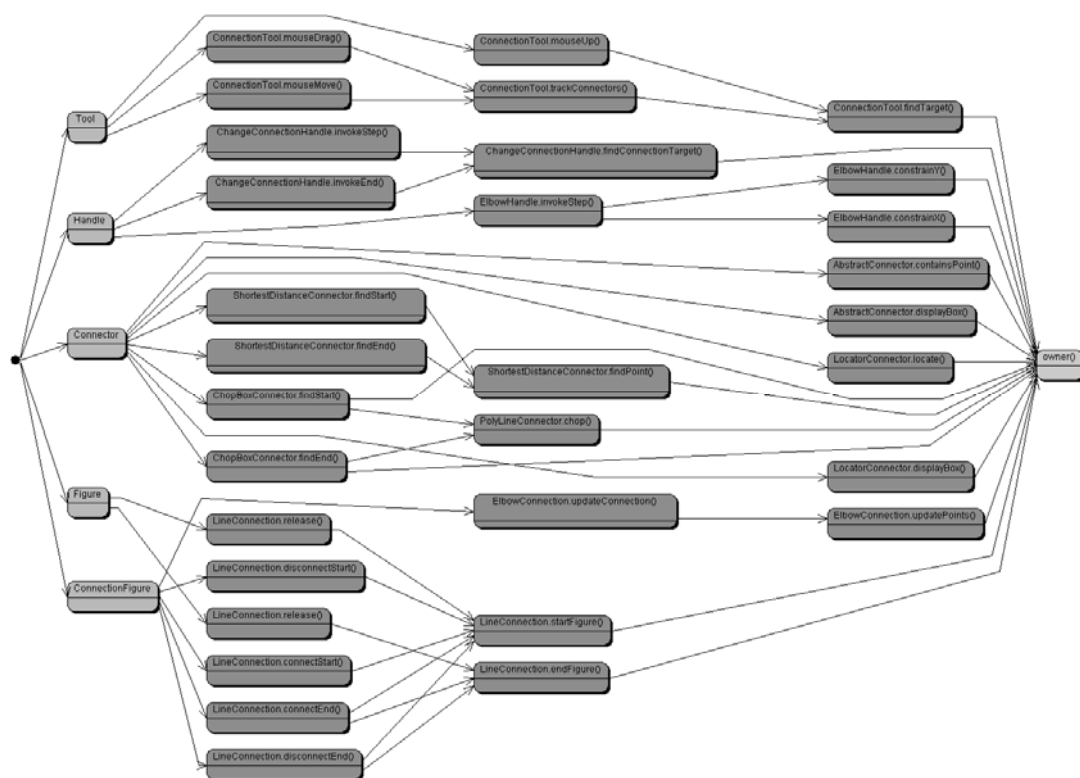


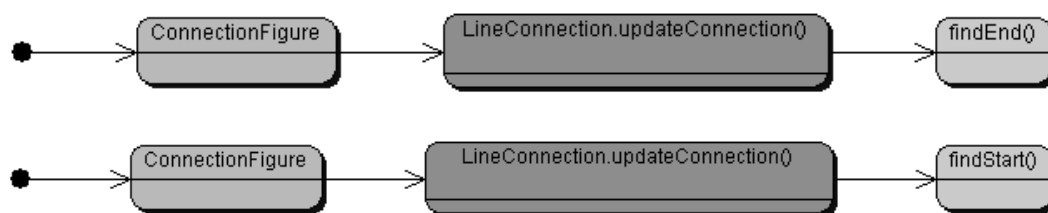




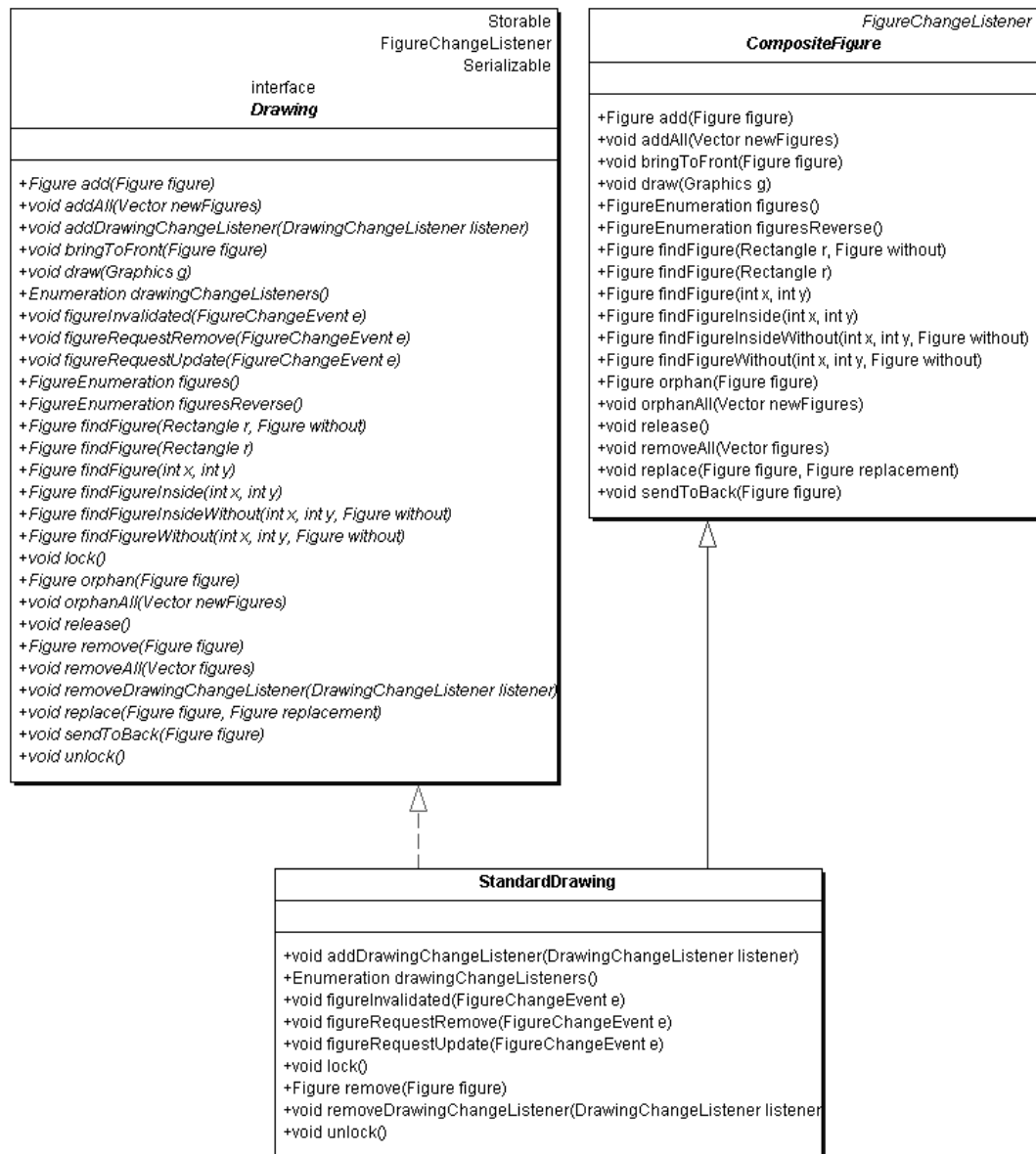


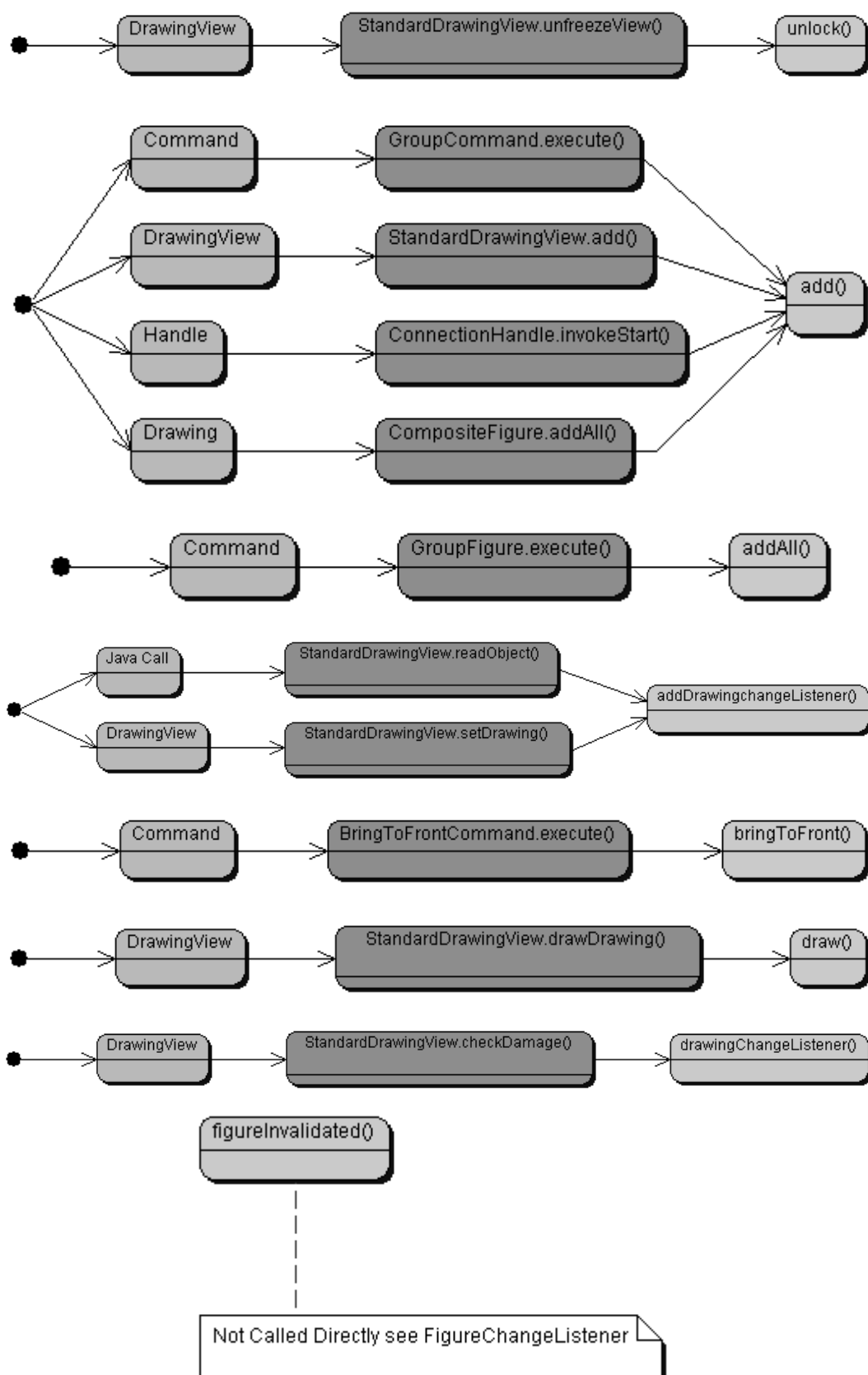


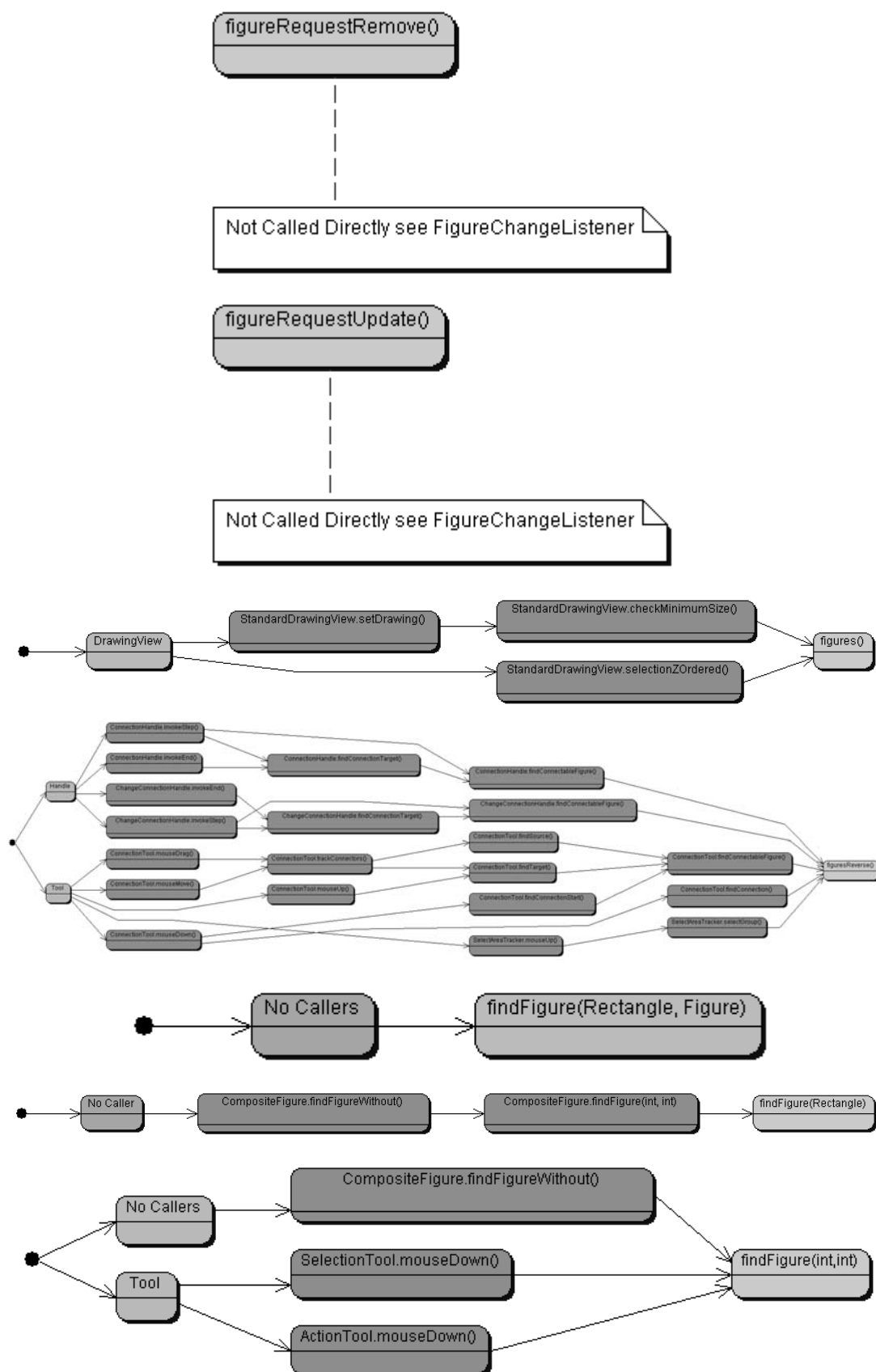


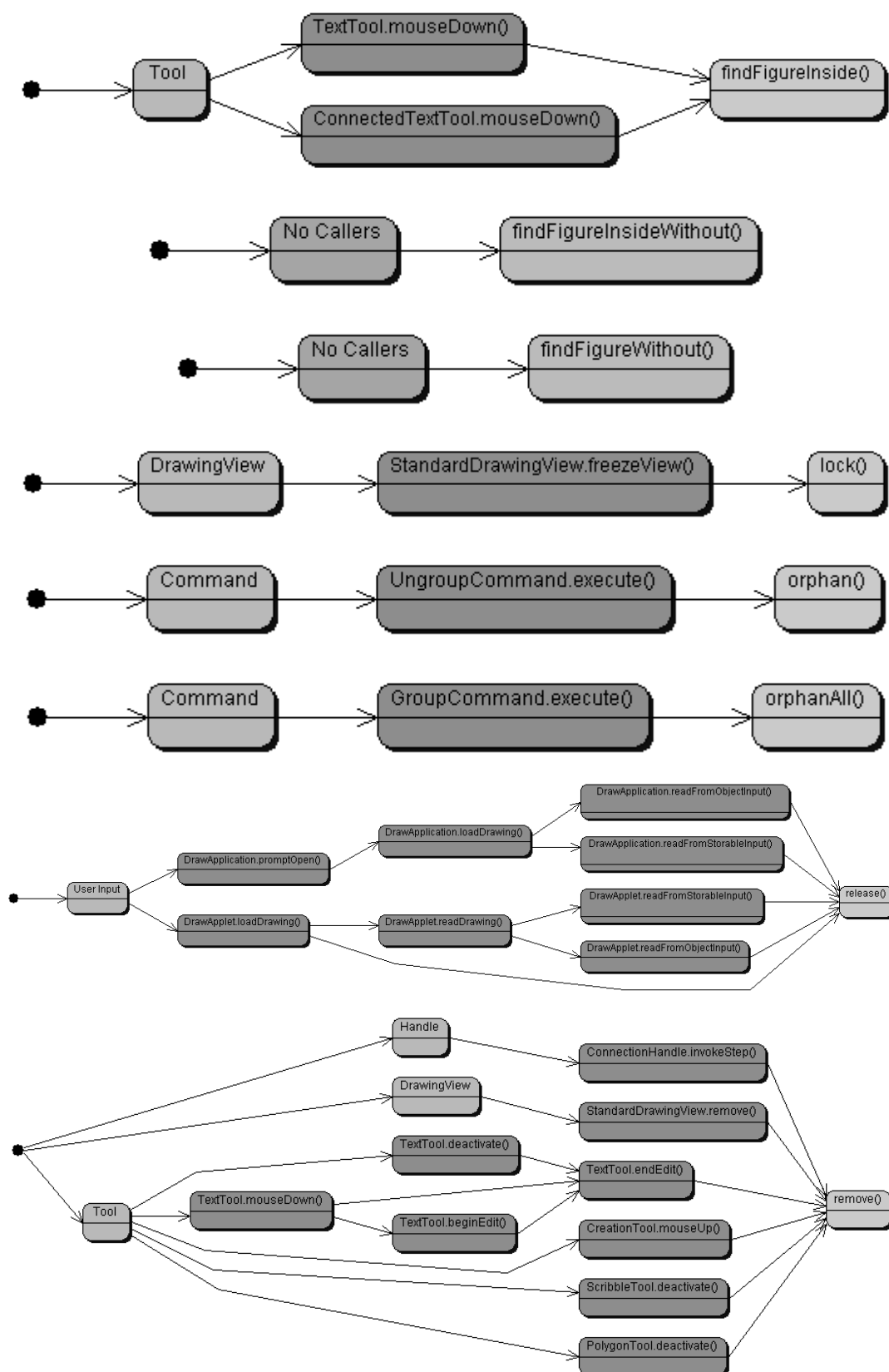


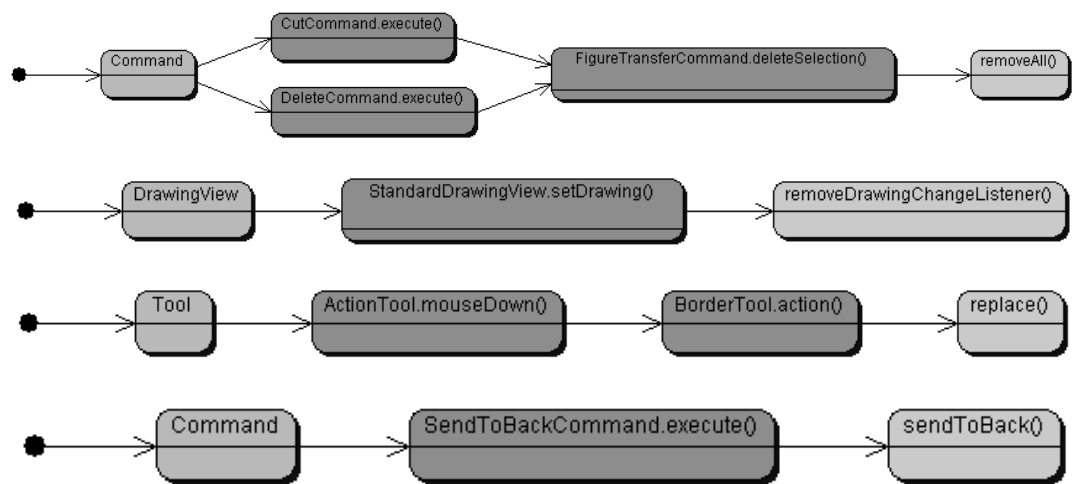
<div> <div>Storable</div> <div>FigureChangeListener</div> <div>Serializable</div> </div> <div> <div>interface</div> <div>Drawing</div> </div>
<div> <div>+Figure add(Figure figure)</div> <div>+void addAll(Vector newFigures)</div> <div>+void addDrawingChangeListener(DrawingChangeListener listener)</div> <div>+void bringToFront(Figure figure)</div> <div>+void draw(Graphics g)</div> <div>+Enumeration drawingChangeListeners()</div> <div>+void figureInvalidated(FigureChangeEvent e)</div> <div>+void figureRequestRemove(FigureChangeEvent e)</div> <div>+void figureRequestUpdate(FigureChangeEvent e)</div> <div>+FigureEnumeration figures()</div> <div>+FigureEnumeration figuresReverse()</div> <div>+Figure findFigure(Rectangle r, Figure without)</div> <div>+Figure findFigure(Rectangle r)</div> <div>+Figure findFigure(int x, int y)</div> <div>+Figure findFigureInside(int x, int y)</div> <div>+Figure findFigureInsideWithout(int x, int y, Figure without)</div> <div>+Figure findFigureWithout(int x, int y, Figure without)</div> <div>+void lock()</div> <div>+Figure orphan(Figure figure)</div> <div>+void orphanAll(Vector newFigures)</div> <div>+void release()</div> <div>+Figure remove(Figure figure)</div> <div>+void removeAll(Vector figures)</div> <div>+void removeDrawingChangeListener(DrawingChangeListener listener)</div> <div>+void replace(Figure figure, Figure replacement)</div> <div>+void sendToBack(Figure figure)</div> <div>+void unlock()</div> </div>



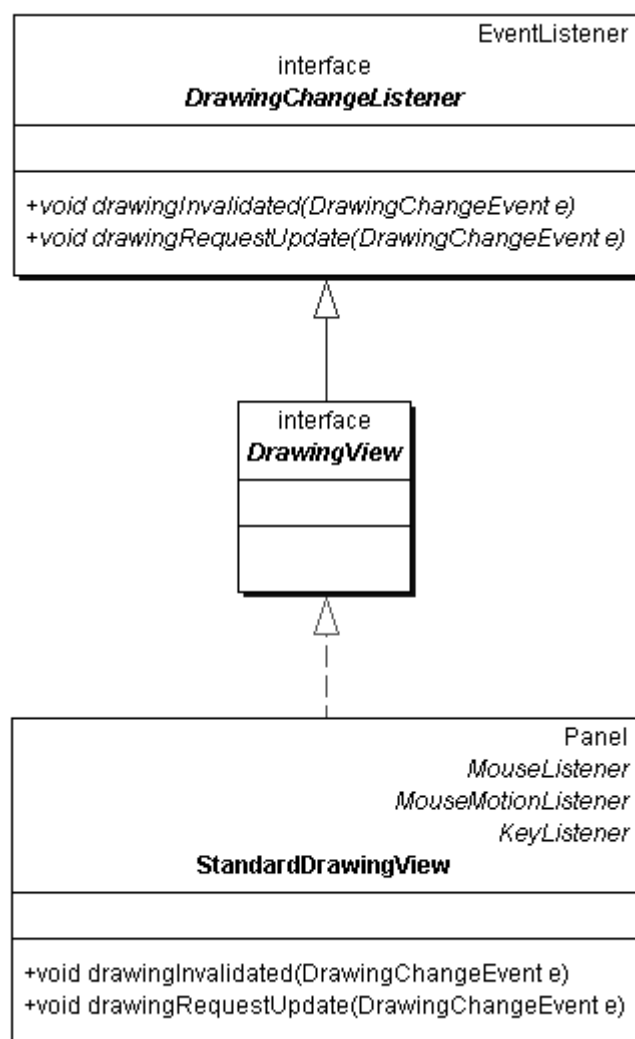


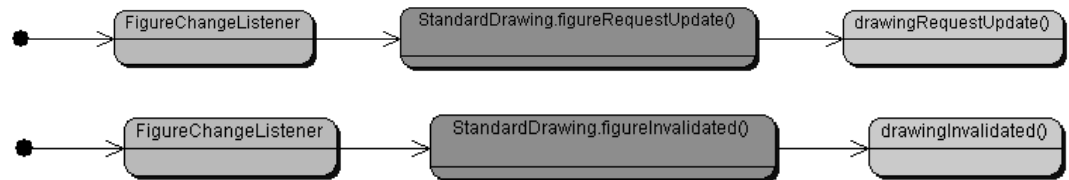




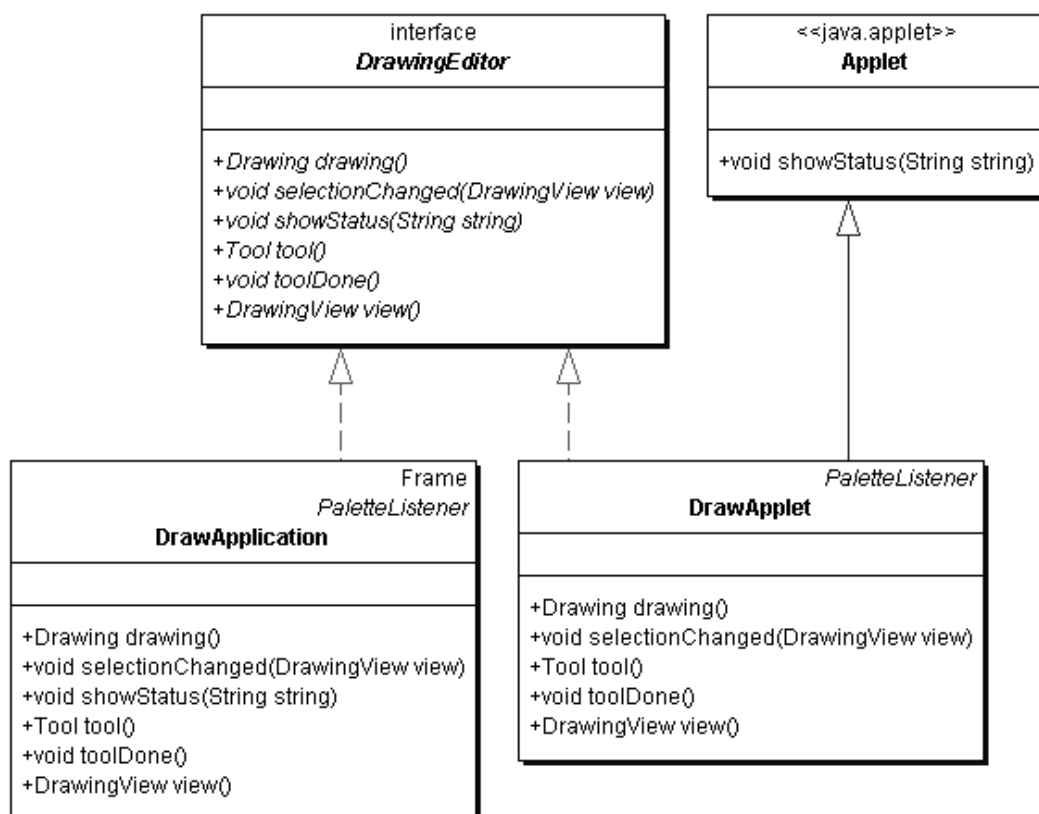


EventListener
interface <i>DrawingChangeListener</i>
+void <i>drawingInvalidated</i> (DrawingChangeEvent e) +void <i>drawingRequestUpdate</i> (DrawingChangeEvent e)

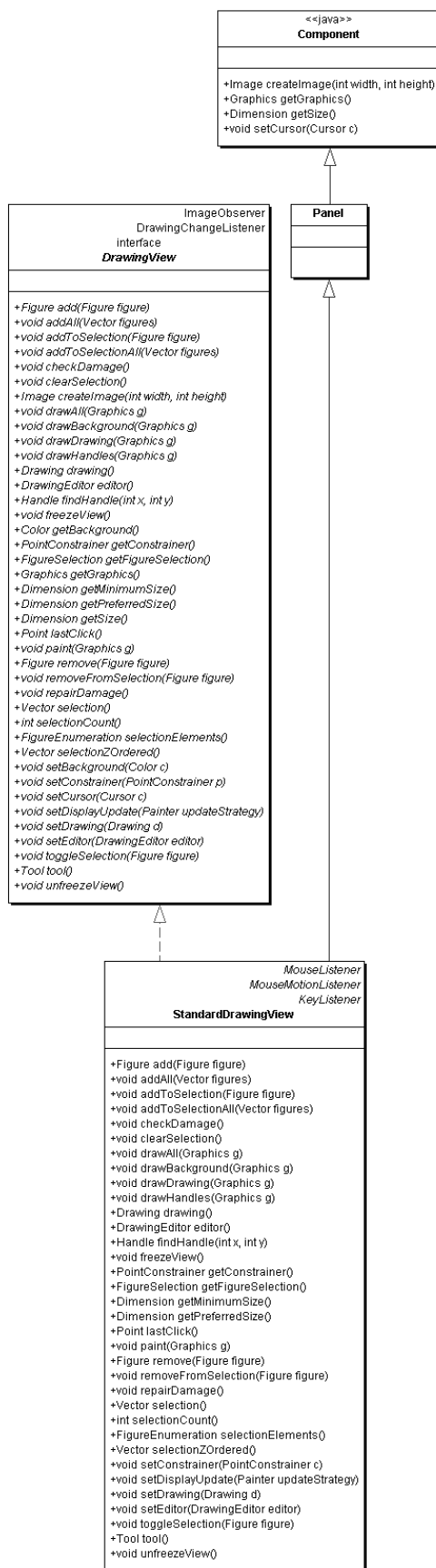


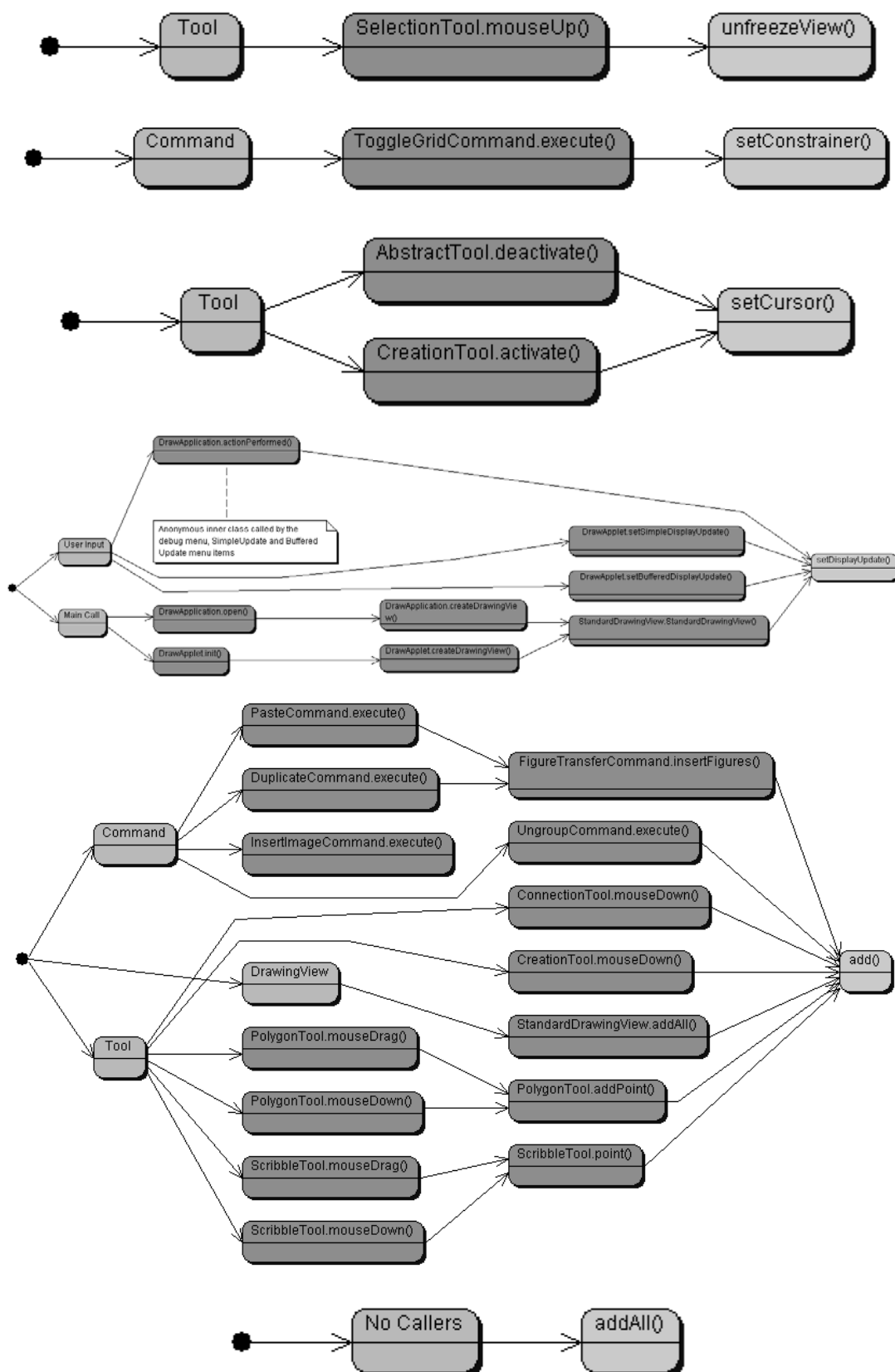


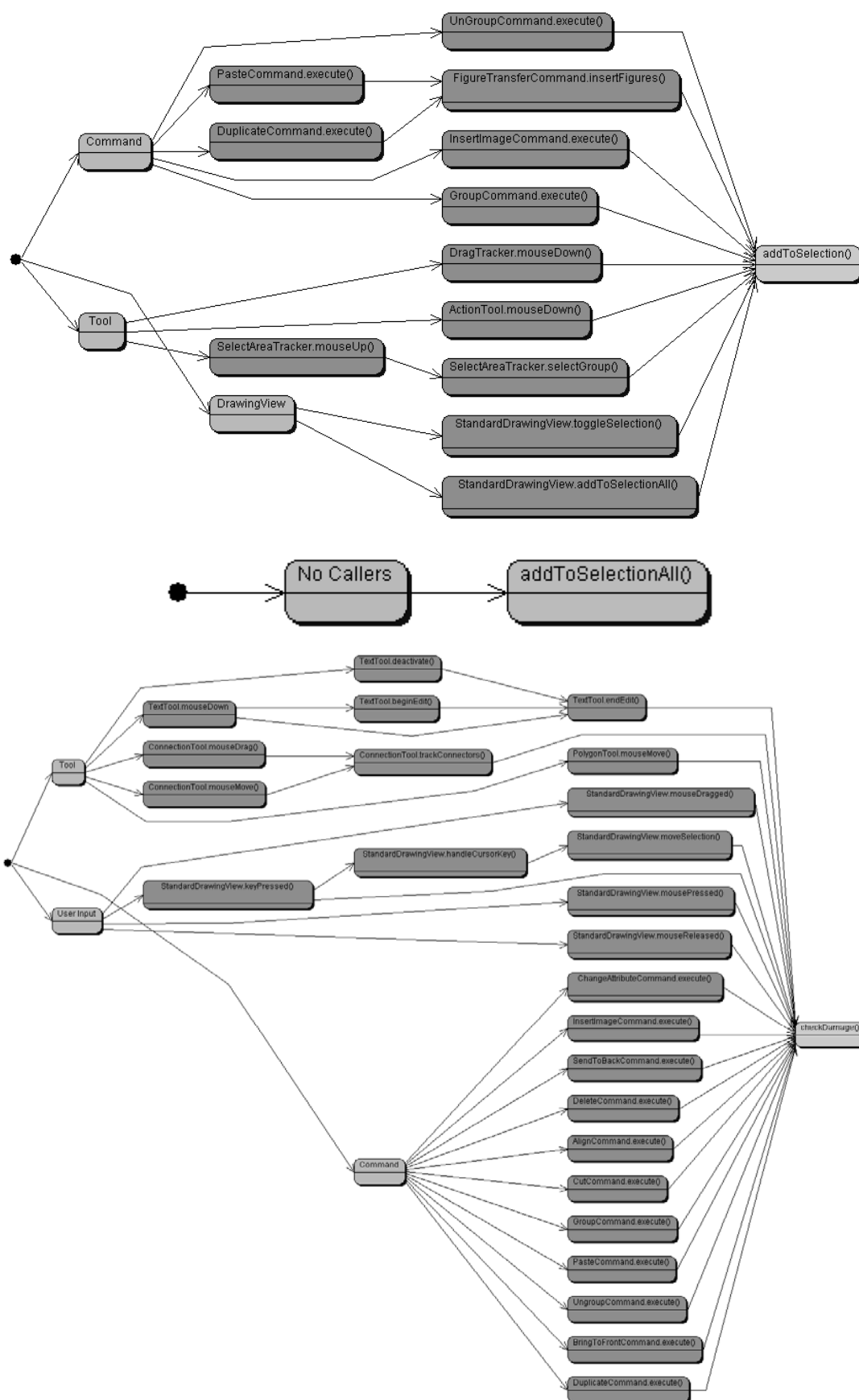
interface <i>DrawingEditor</i>
+ <i>Drawing</i> drawing() +void selectionChanged(<i>DrawingView</i> view) +void showStatus(<i>String</i> string) + <i>Tool</i> tool() +void toolDone() + <i>DrawingView</i> view()

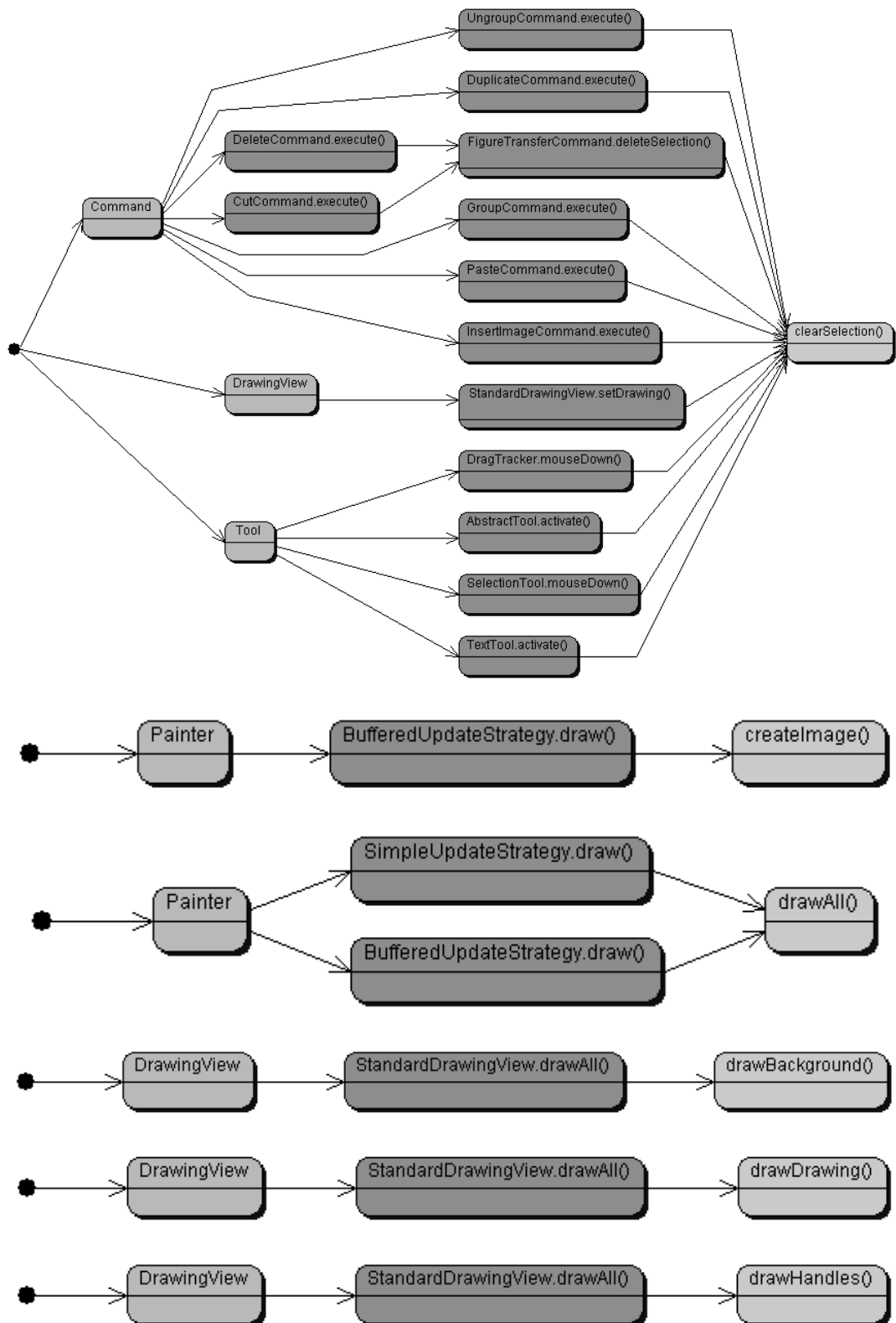


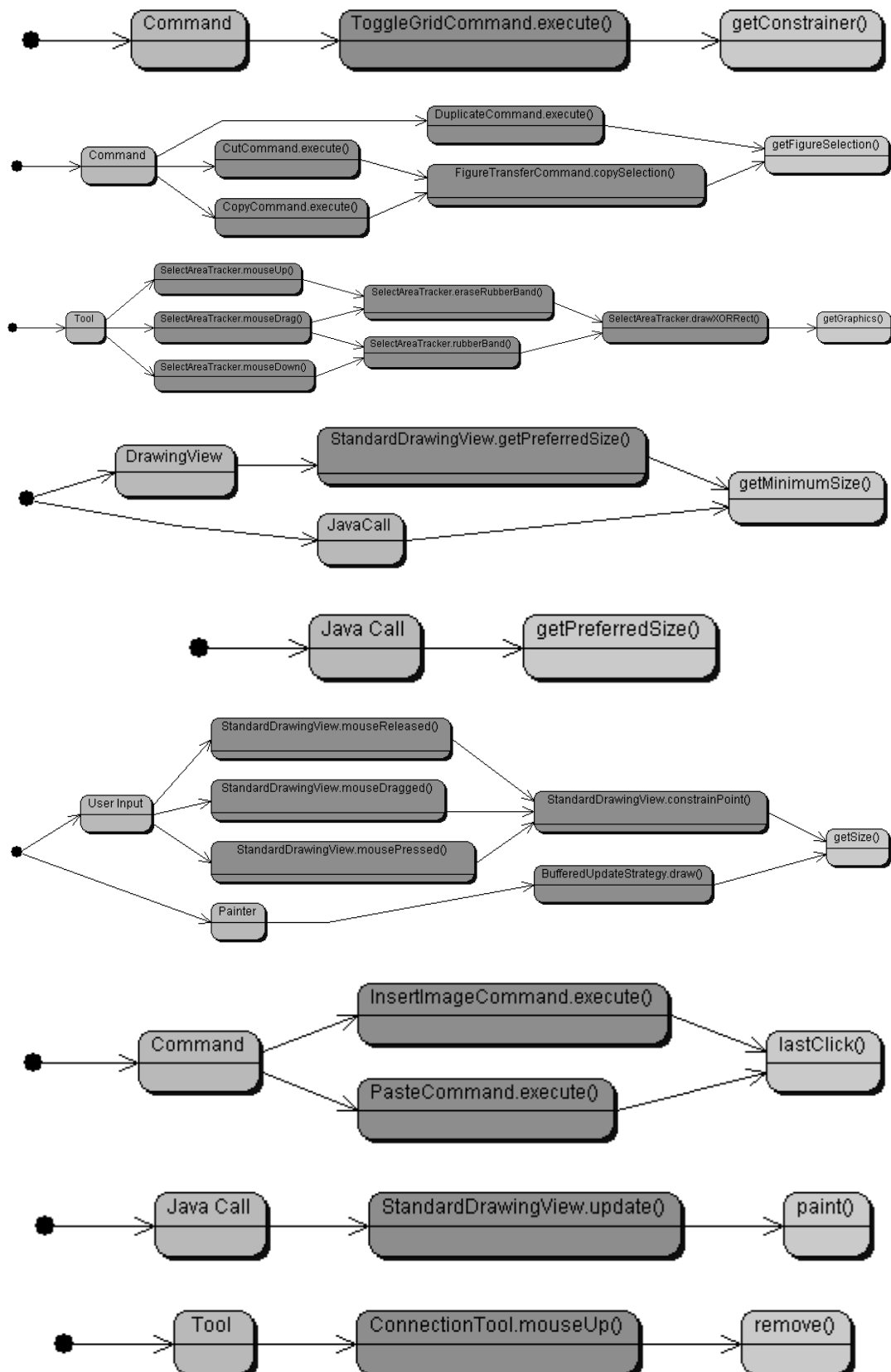
ImageObserver DrawingChangeListener interface <i>DrawingView</i>
<pre> +Figure add(Figure figure) +void addAll(Vector figures) +void addToSelection(Figure figure) +void addToSelectionAll(Vector figures) +void checkDamage() +void clearSelection() +Image createImage(int width, int height) +void drawAll(Graphics g) +void drawBackground(Graphics g) +void drawDrawing(Graphics g) +void drawHandles(Graphics g) +Drawing drawing() +DrawingEditor editor() +Handle findHandle(int x, int y) +void freezeView() +Color getBackground() +PointConstrainer getConstrainer() +FigureSelection getFigureSelection() +Graphics getGraphics() +Dimension getMinimumSize() +Dimension getPreferredSize() +Dimension getSize() +Point lastClick() +void paint(Graphics g) +Figure remove(Figure figure) +void removeFromSelection(Figure figure) +void repairDamage() +Vector selection() +int selectionCount() +FigureEnumeration selectionElements() +Vector selectionZOrdered() +void setBackground(Color c) +void setConstrainer(PointConstrainer p) +void setCursor(Cursor c) +void setDisplayUpdate(Painter updateStrategy) +void setDrawing(Drawing d) +void setEditor(DrawingEditor editor) +void toggleSelection(Figure figure) +Tool tool() +void unfreezeView() </pre>

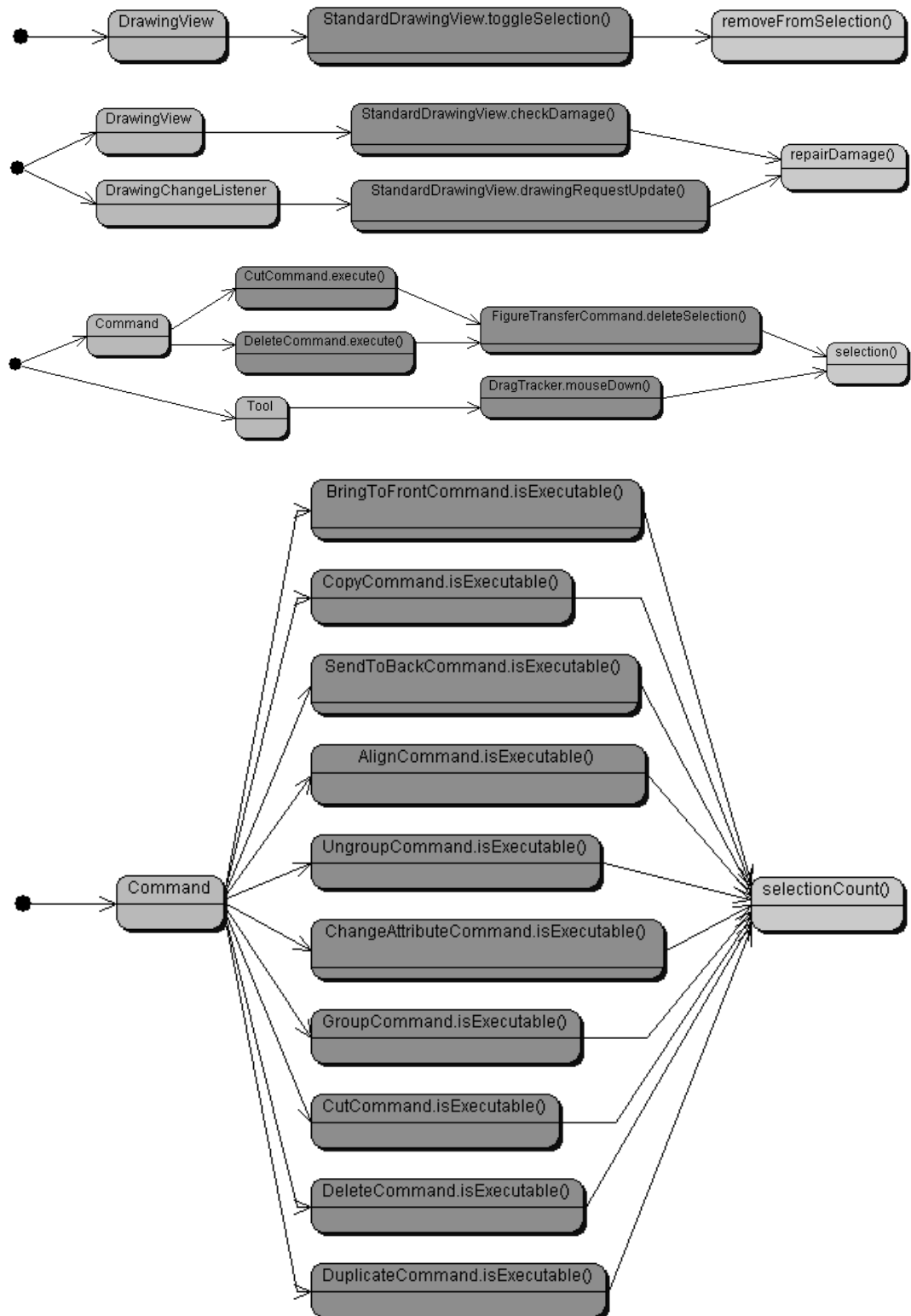


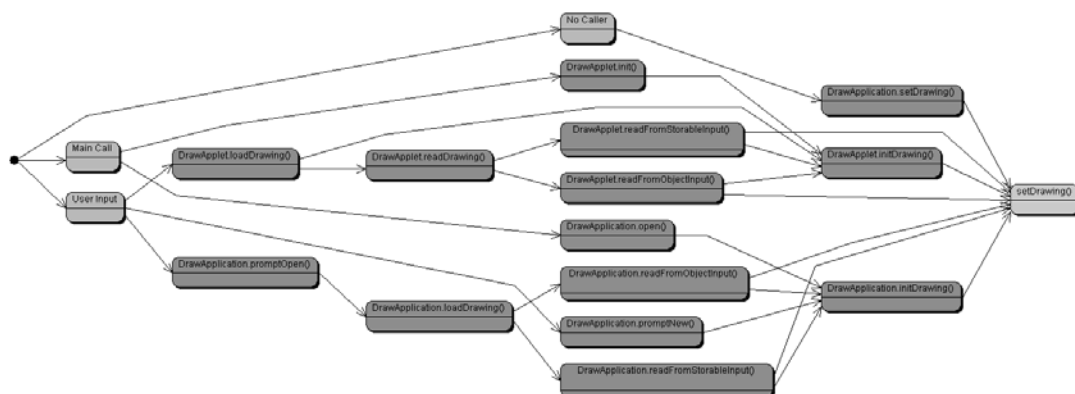
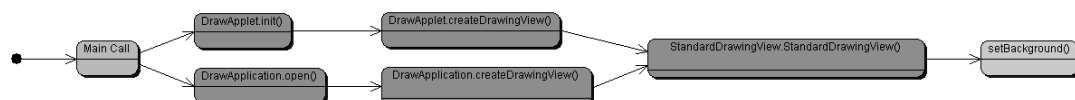
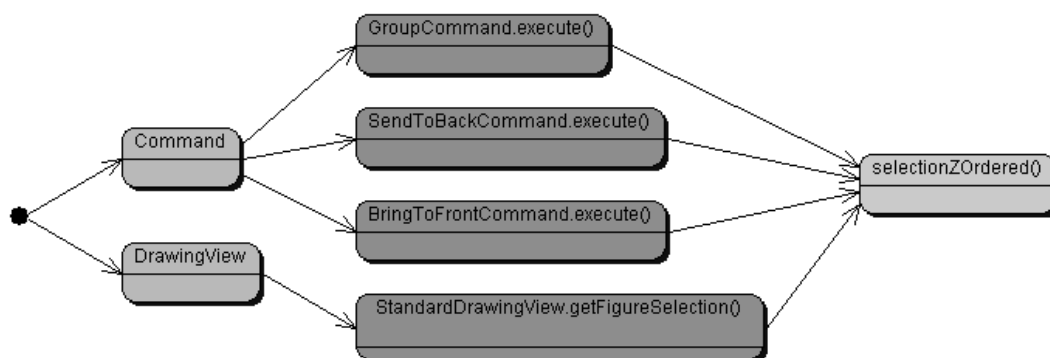
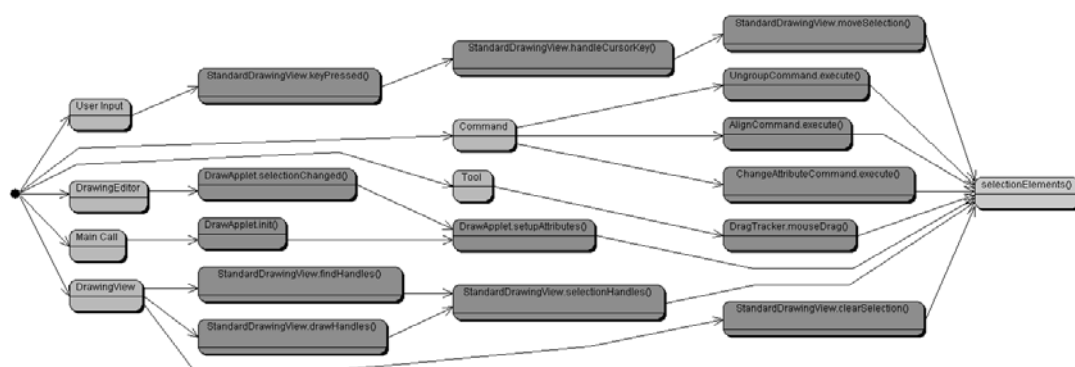


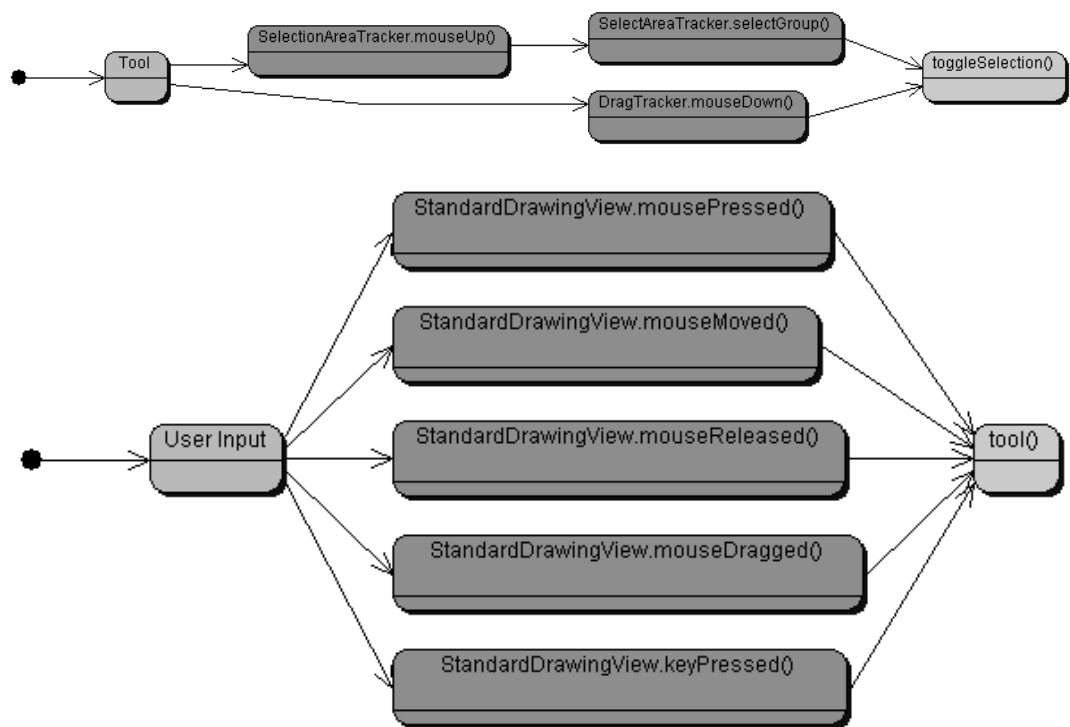




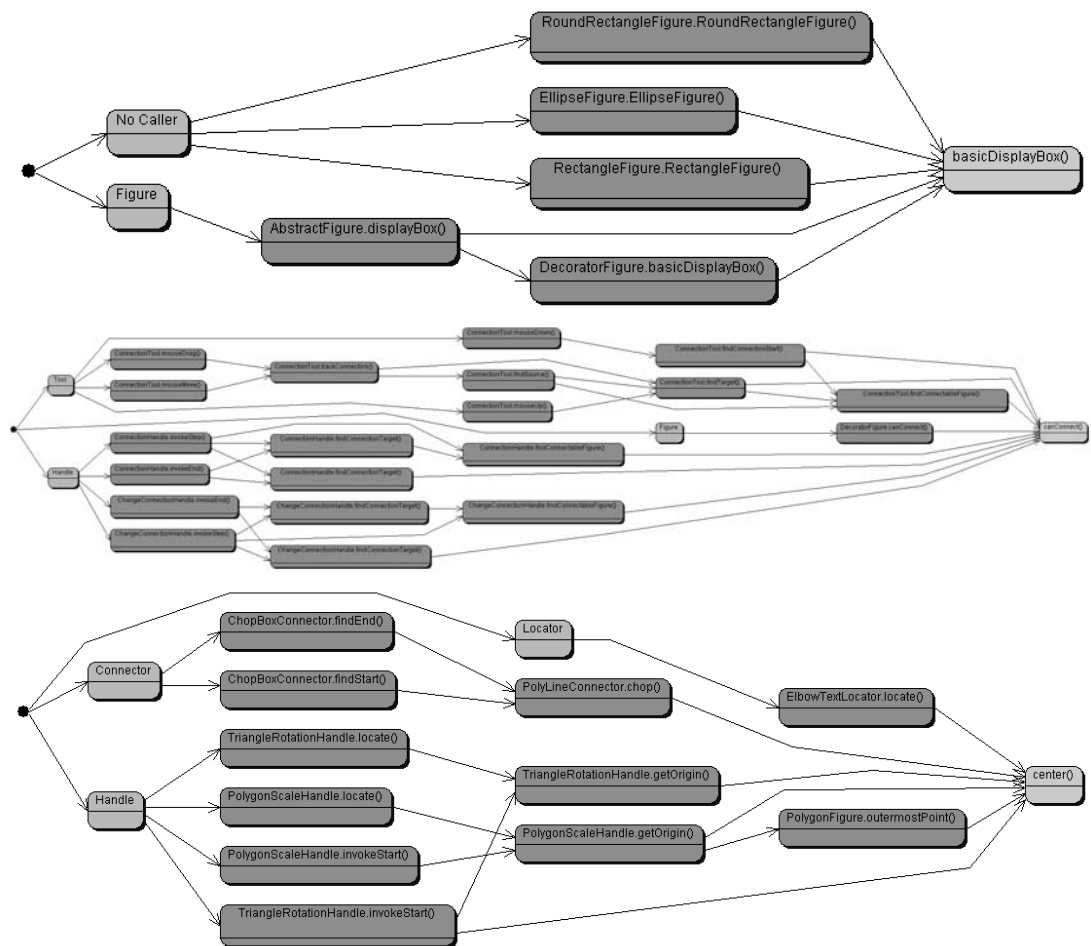


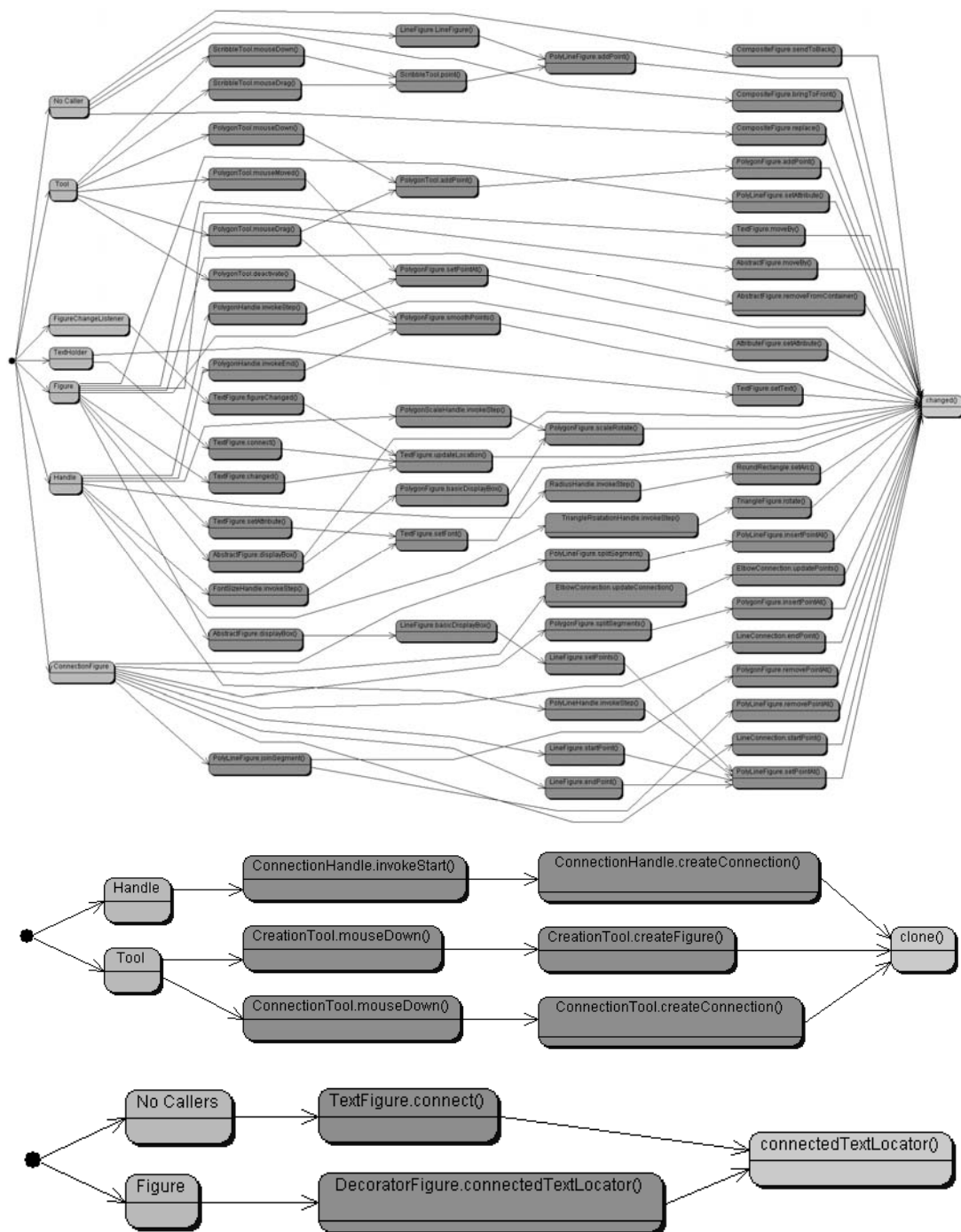


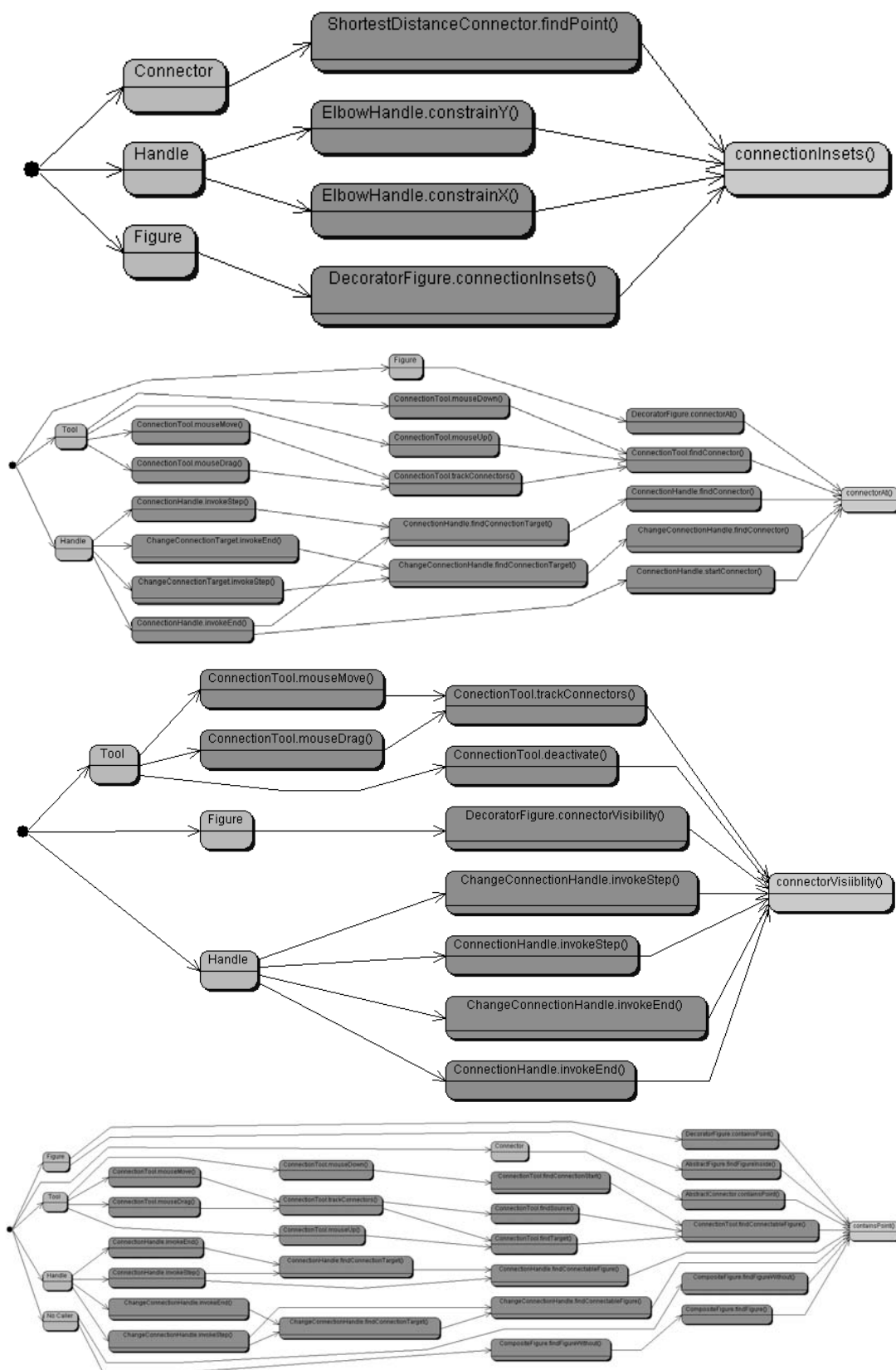


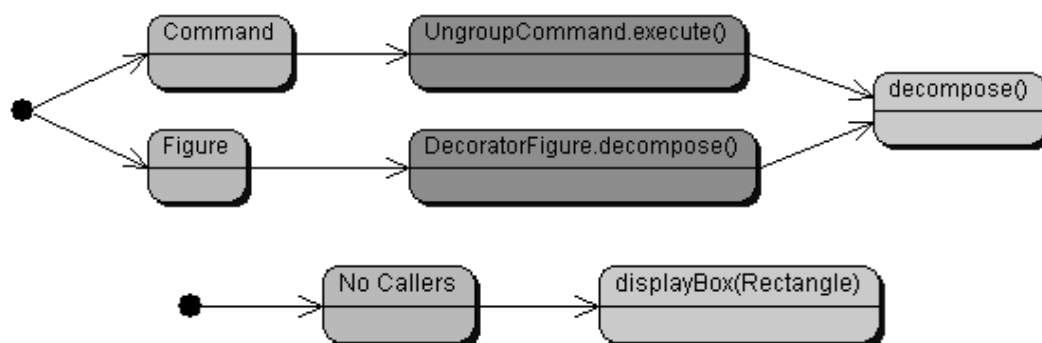


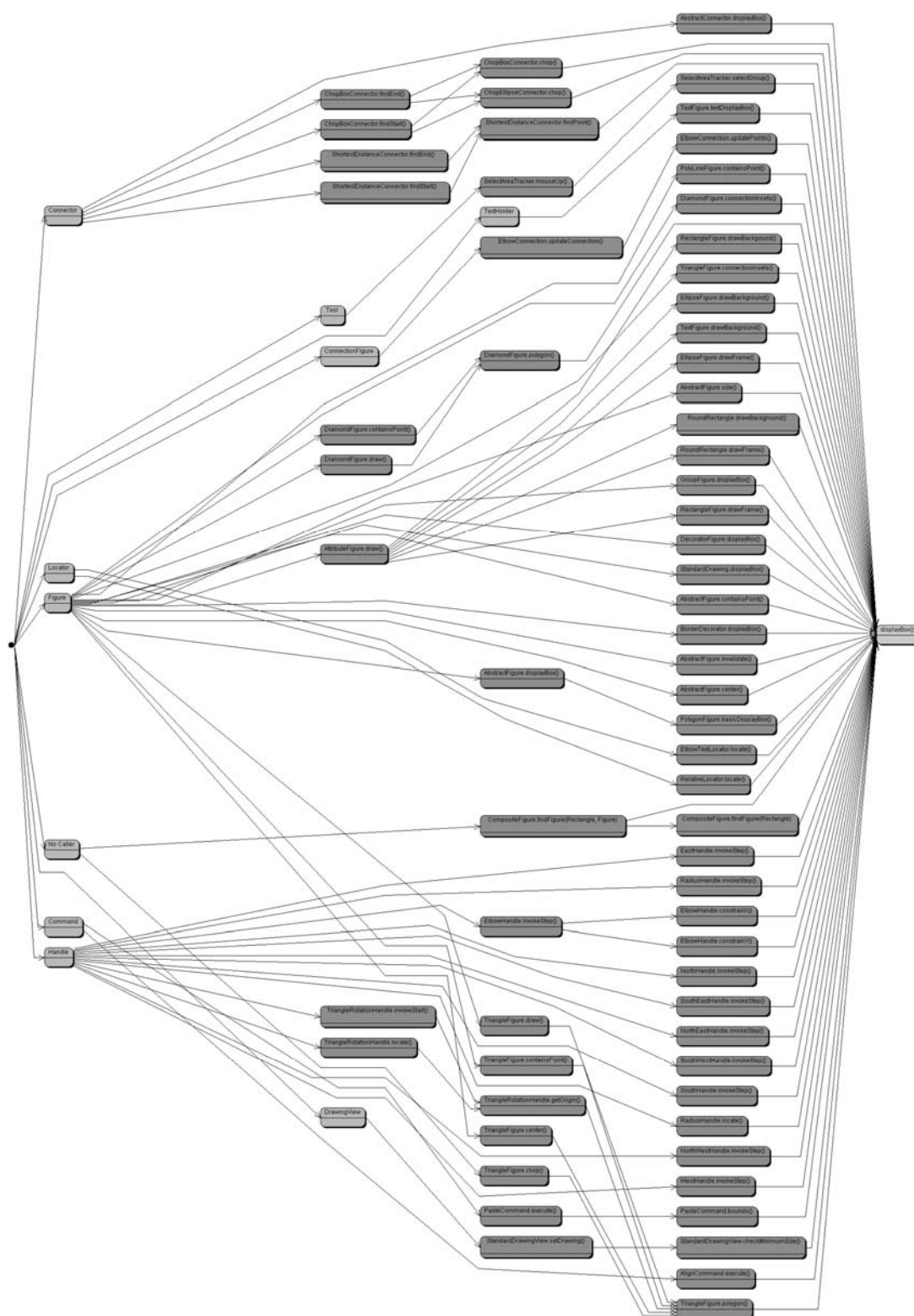
<div>Storable Cloneable Serializable</div> <div>interface Figure</div>
<div>+void addFigureChangeListener(FigureChangeListener f)</div> <div>+void addToContainer(FigureChangeListener c)</div> <div>+void basicDisplayBox(Point origin, Point corner)</div> <div>+boolean canConnect()</div> <div>+Point center()</div> <div>+void changed()</div> <div>+Object clone()</div> <div>+Locator connectedTextLocator(Figure text)</div> <div>+Insets connectionInsets()</div> <div>+Connector connectorAt(int x, int y)</div> <div>+void connectorVisibility(boolean isVisible)</div> <div>+boolean containsPoint(int x, int y)</div> <div>+FigureEnumeration decompose()</div> <div>+void displayBox(Rectangle r)</div> <div>+Rectangle displayBox()</div> <div>+void displayBox(Point origin, Point corner)</div> <div>+void draw(Graphics g)</div> <div>+FigureEnumeration figures()</div> <div>+Figure findFigureInside(int x, int y)</div> <div>+Object getAttribute(String name)</div> <div>+Vector handles()</div> <div>+boolean includes(Figure figure)</div> <div>+void invalidate()</div> <div>+boolean isEmpty()</div> <div>+FigureChangeListener listener()</div> <div>+void moveBy(int dx, int dy)</div> <div>+void release()</div> <div>+void removeFigureChangeListener(FigureChangeListener f)</div> <div>+void removeFromContainer(FigureChangeListener c)</div> <div>+void setAttribute(String name, Object value)</div> <div>+Dimension size()</div> <div>+void willChange()</div>

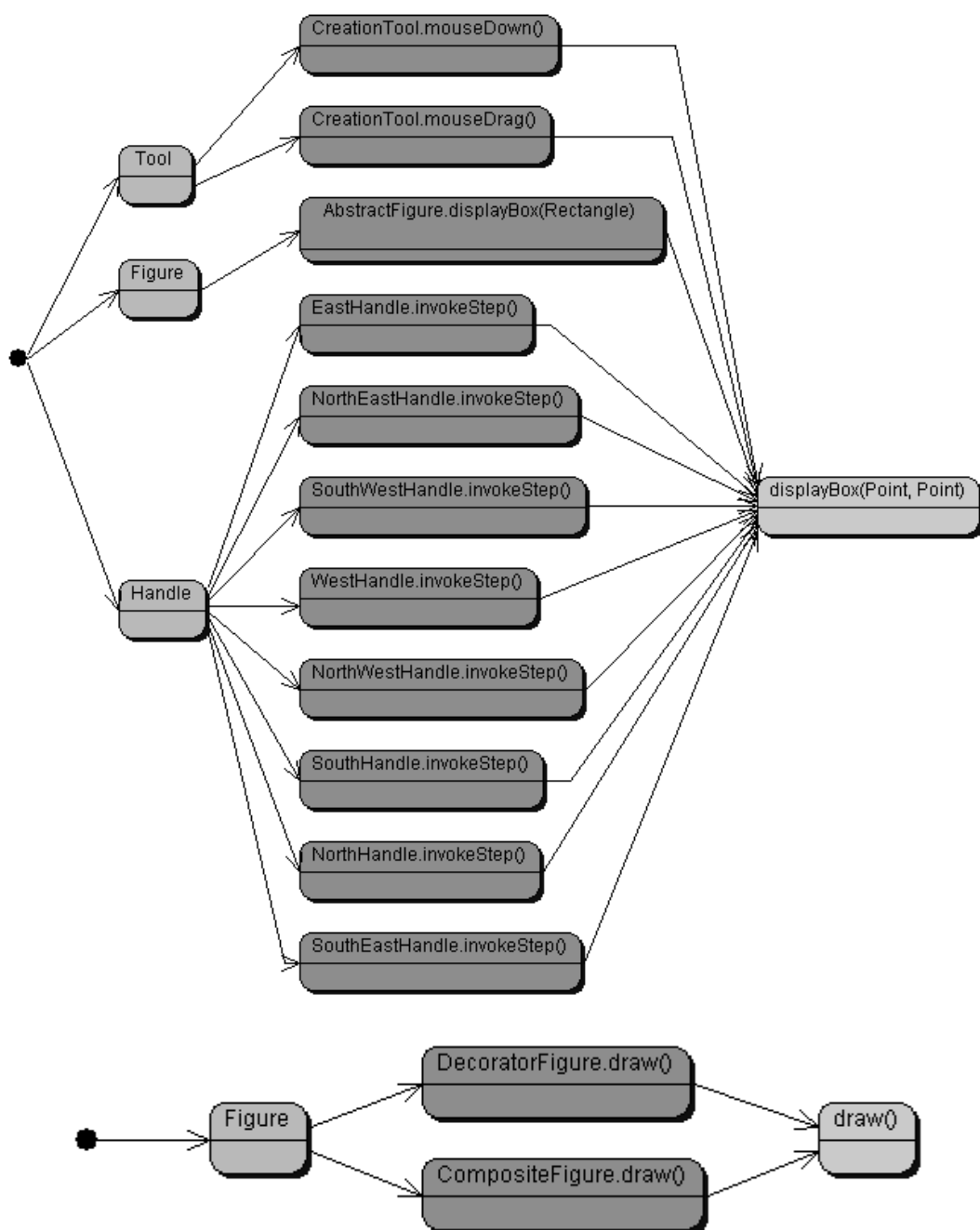


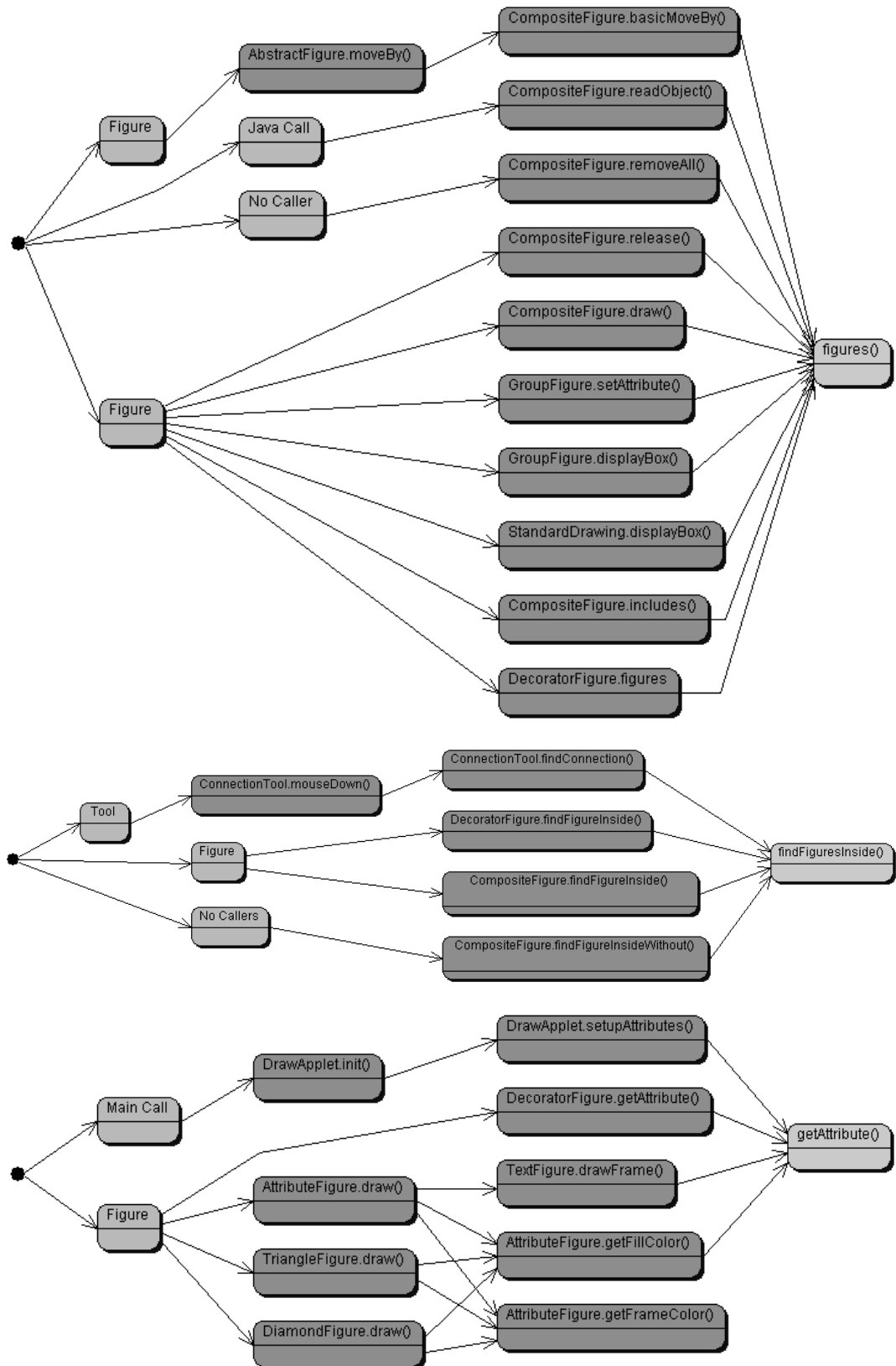


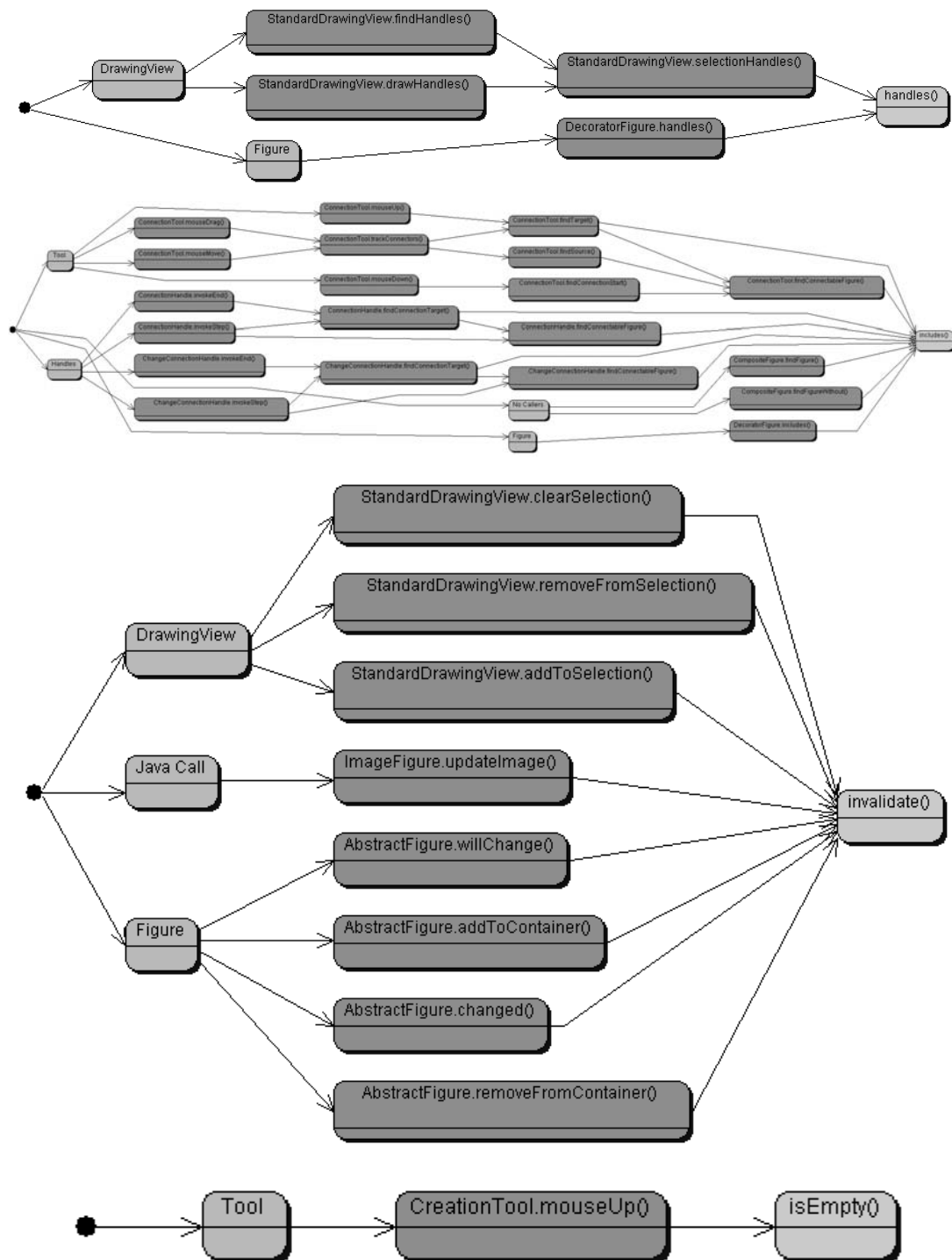


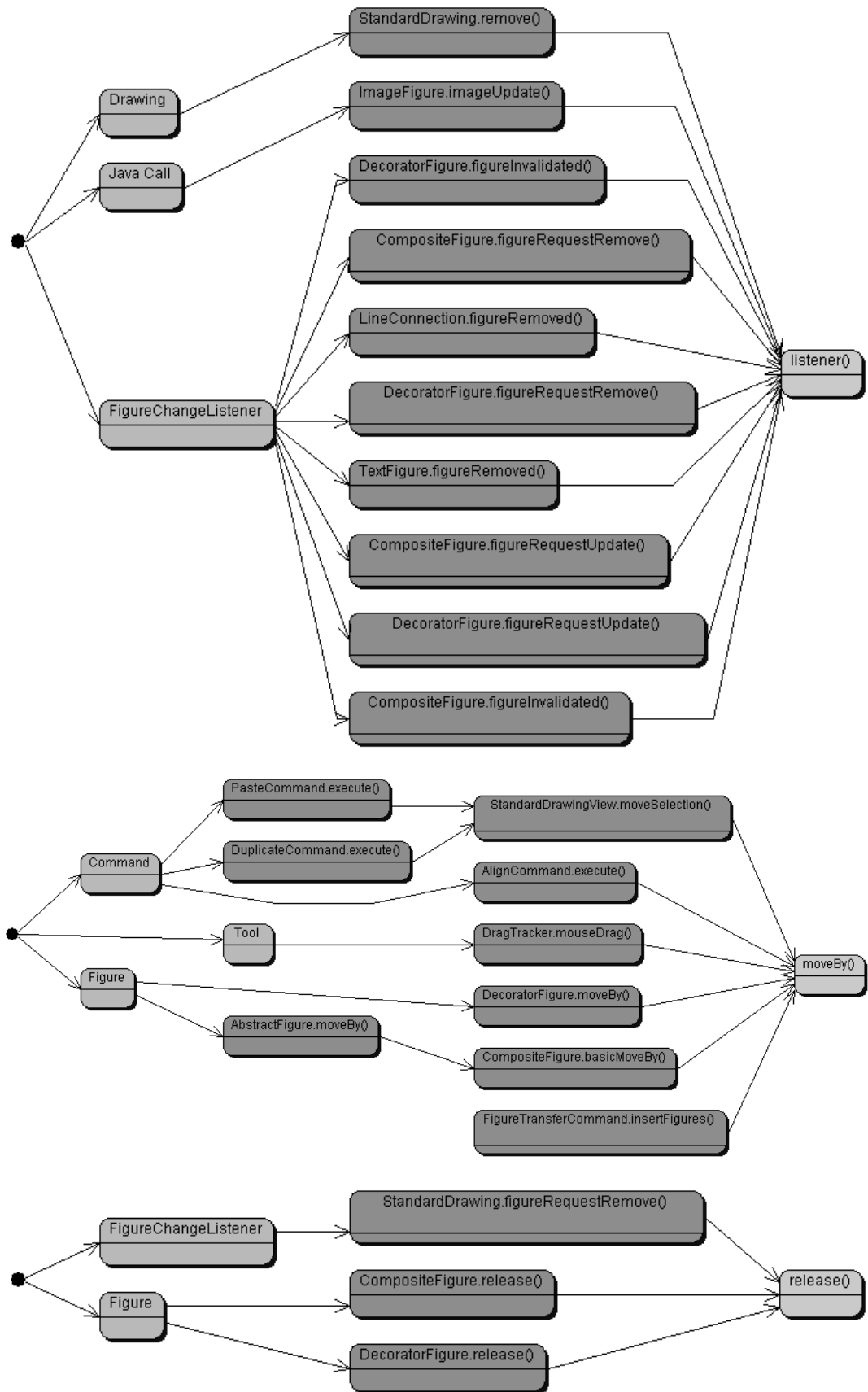


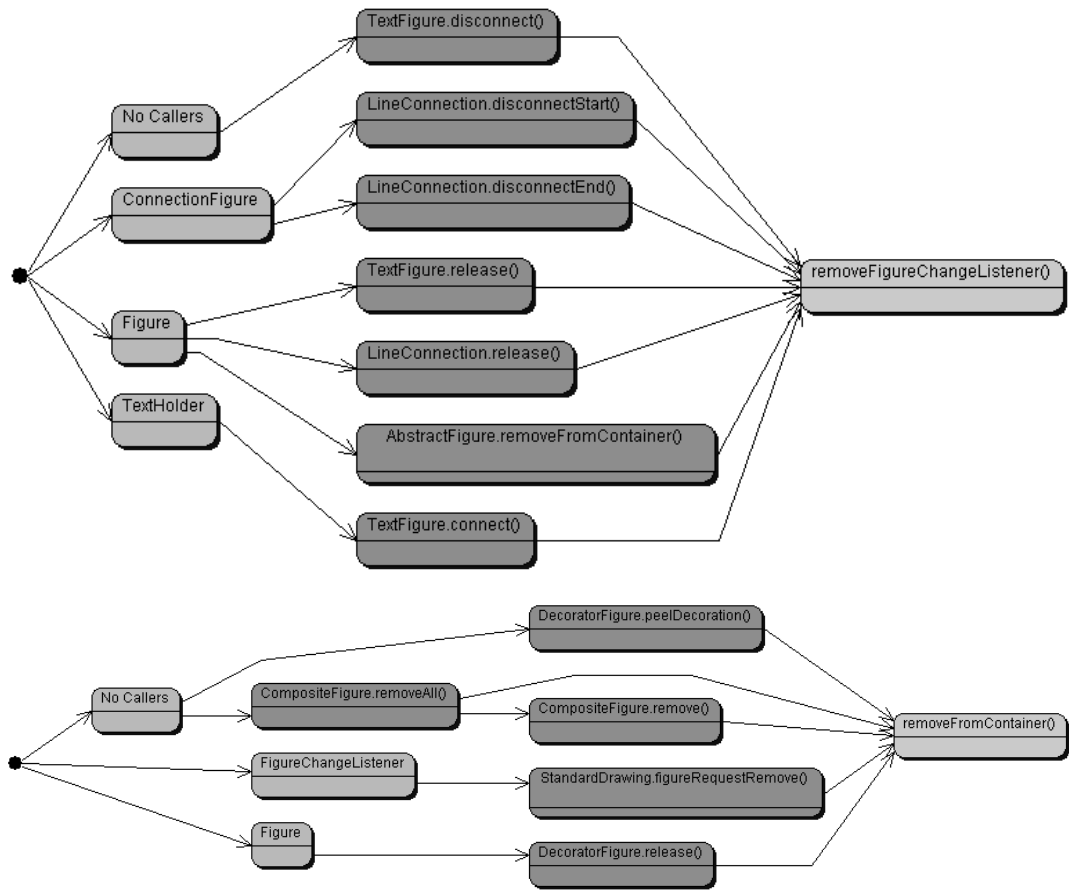


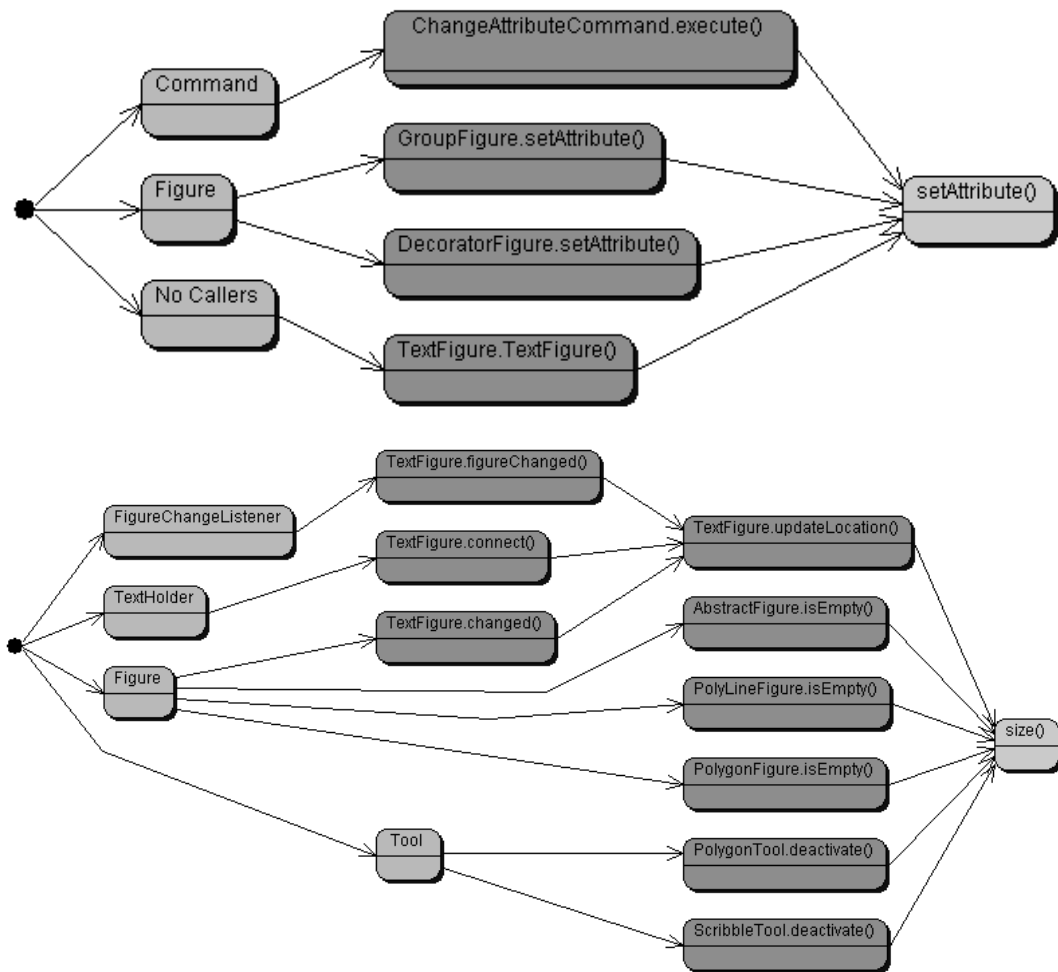




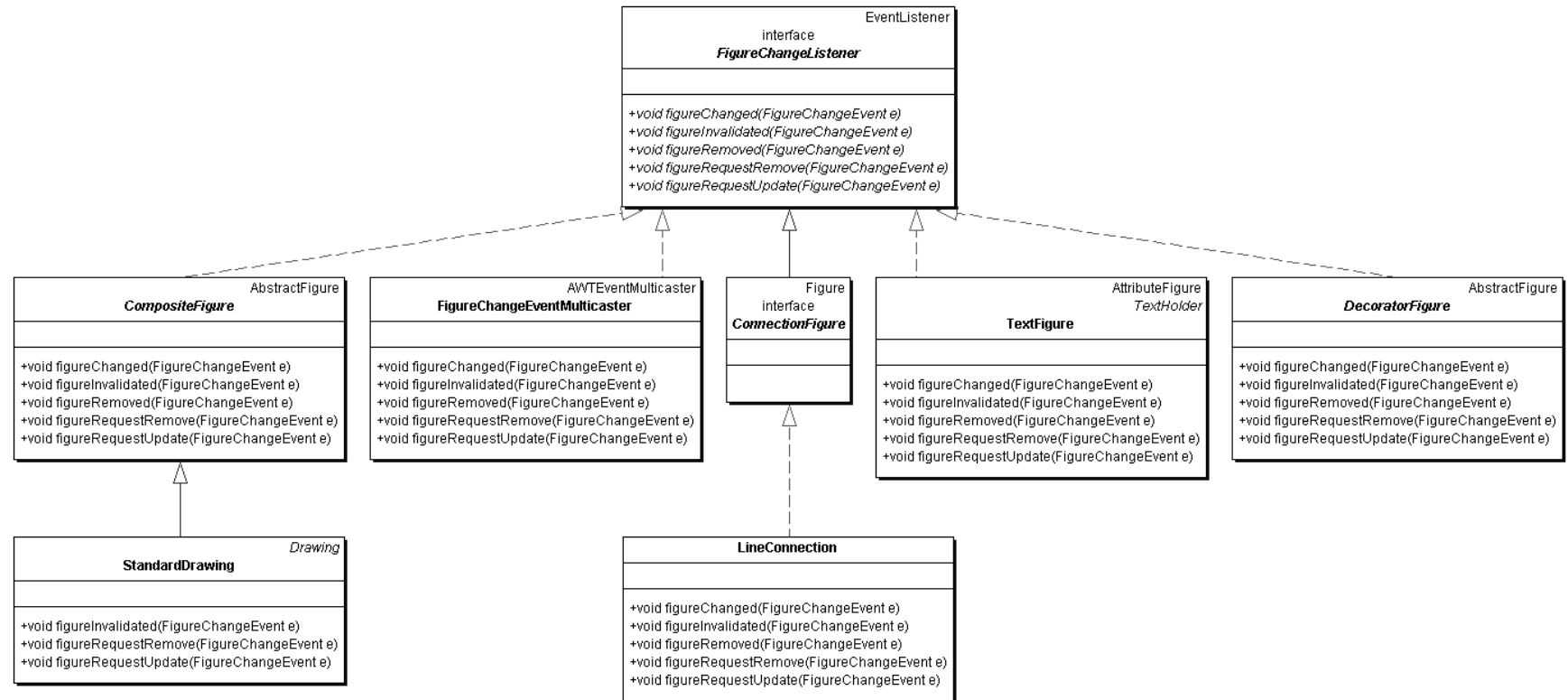


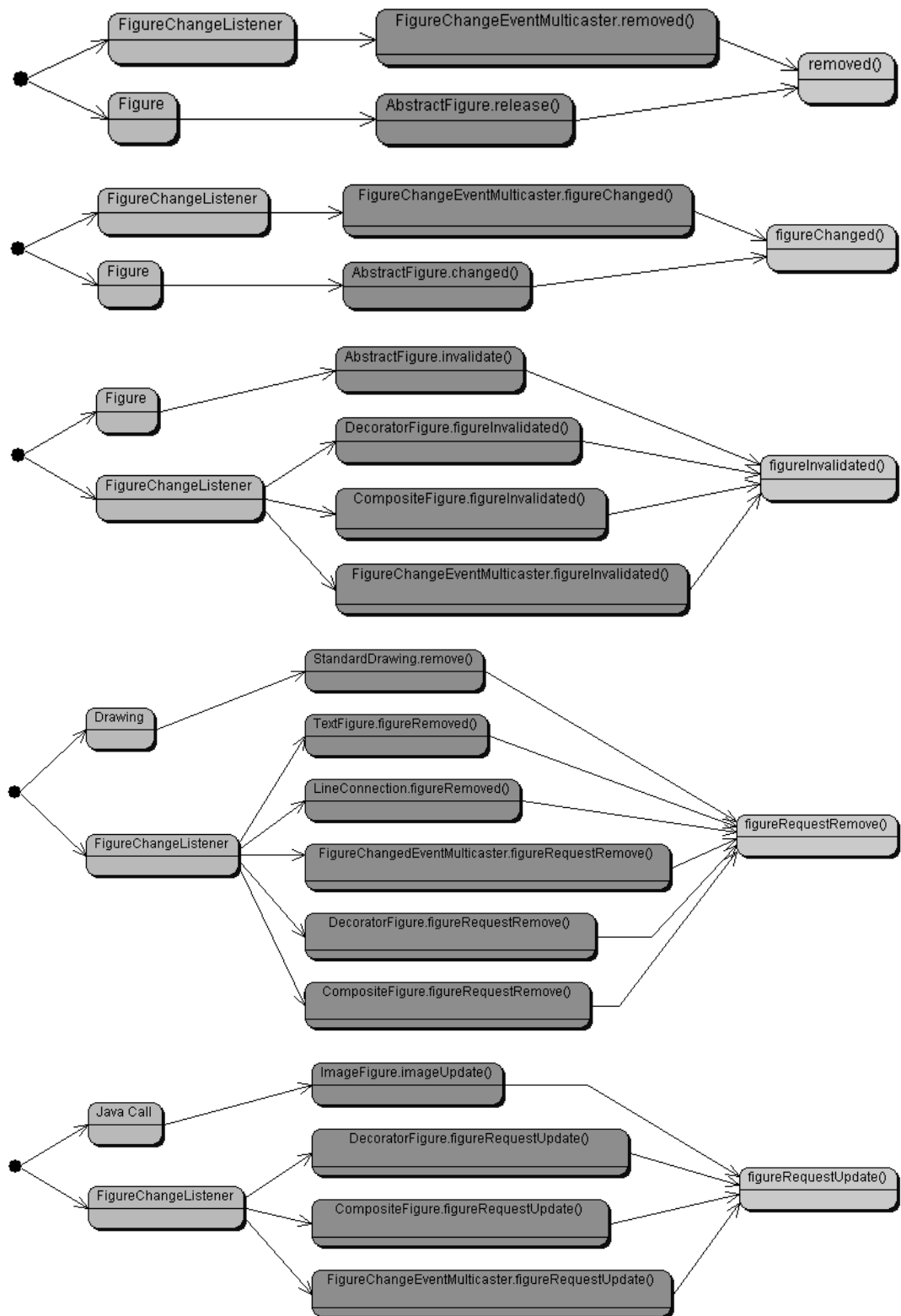


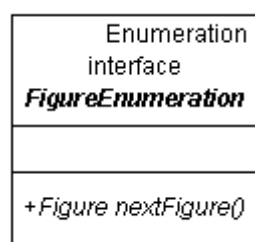


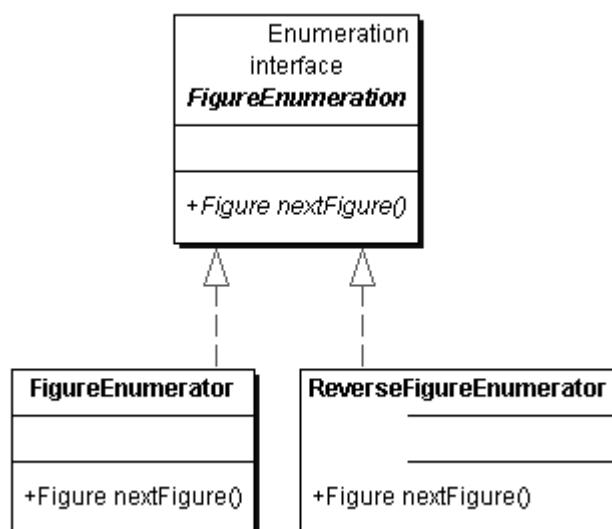


EventListener	
interface	
<i>FigureChangeListener</i>	
<i>+void figureChanged(FigureChangeEvent e)</i> <i>+void figureInvalidated(FigureChangeEvent e)</i> <i>+void figureRemoved(FigureChangeEvent e)</i> <i>+void figureRequestRemove(FigureChangeEvent e)</i> <i>+void figureRequestUpdate(FigureChangeEvent e)</i>	



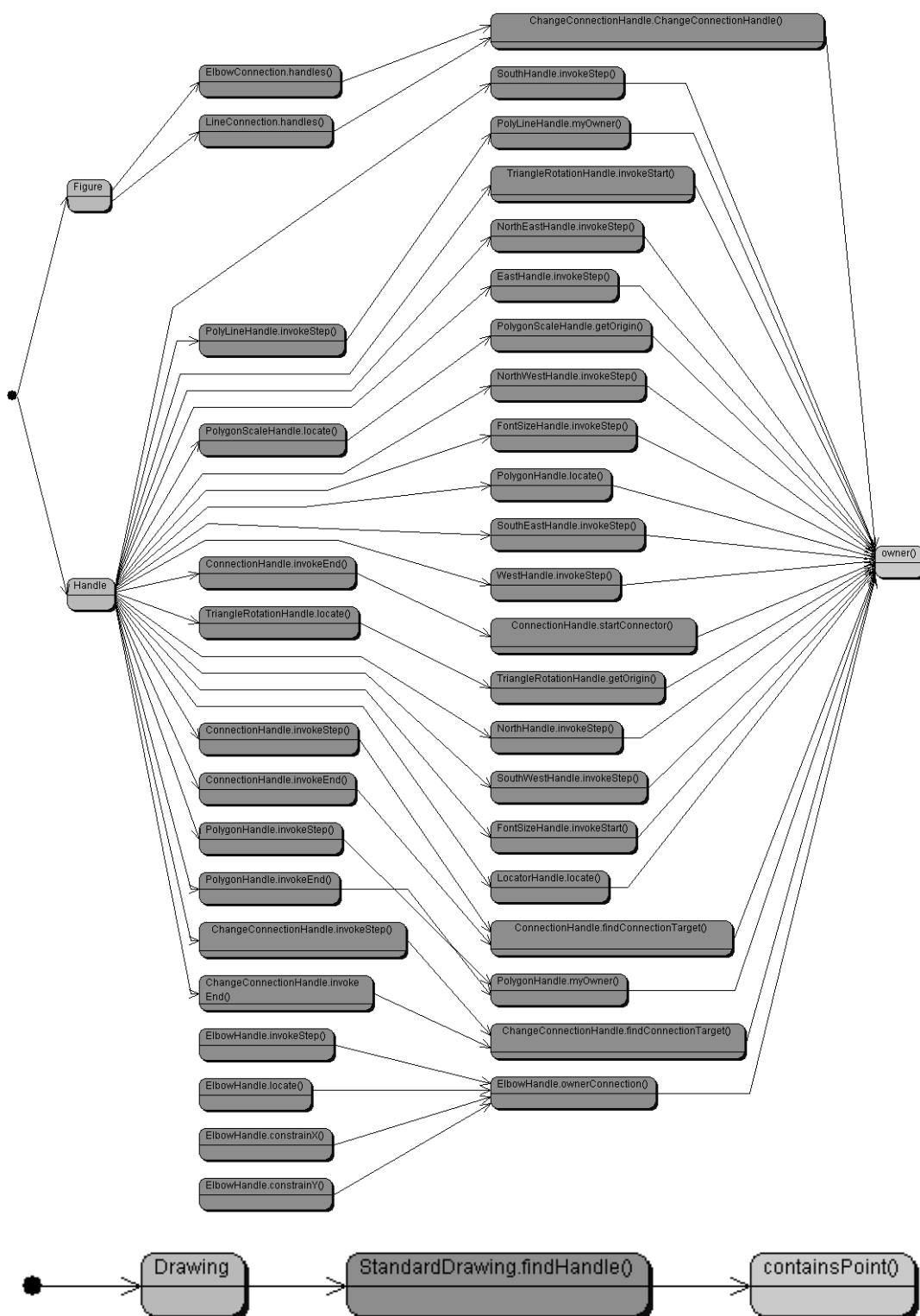


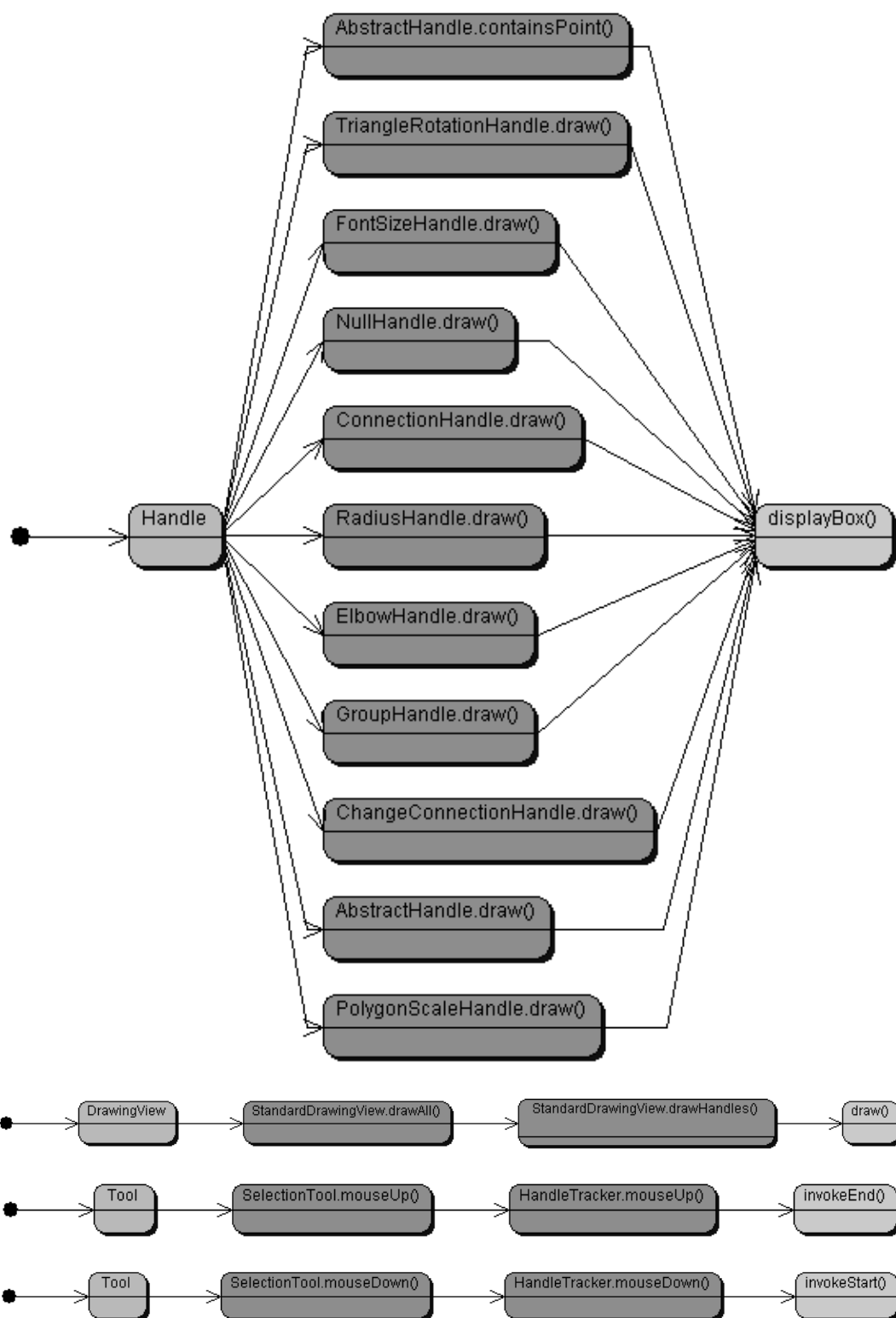


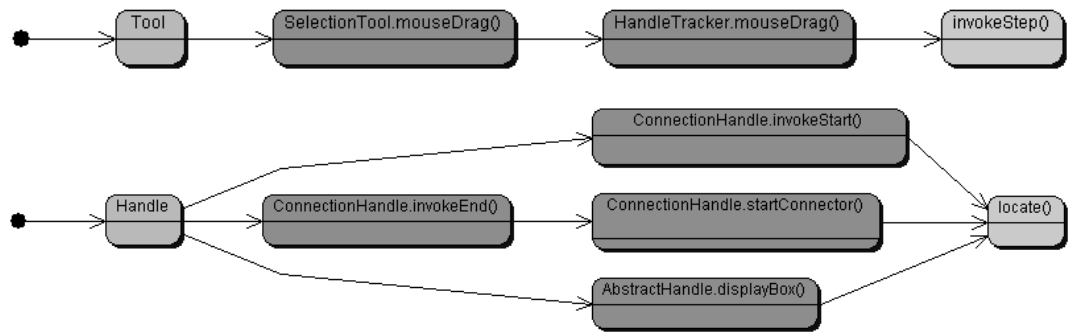


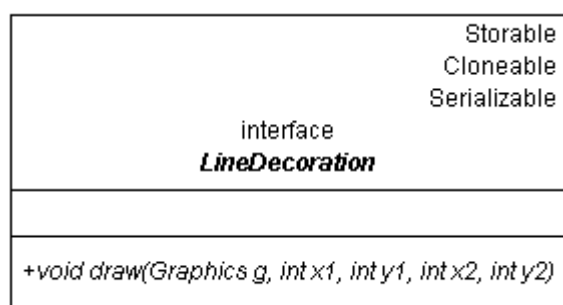


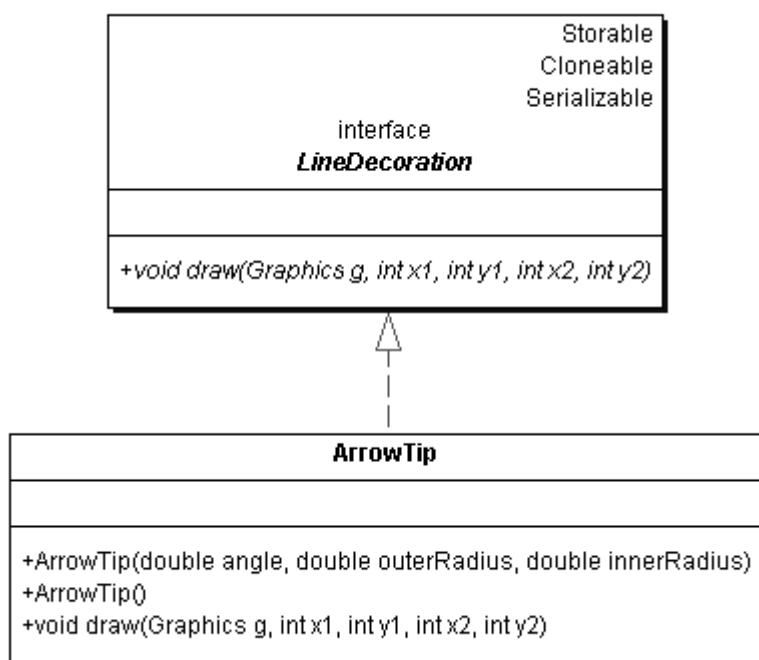
interface <i>Handle</i>
<div><div>+boolean containsPoint(int x, int y)</div><div>+Rectangle displayBox()</div><div>+void draw(Graphics g)</div><div>+void invokeEnd(int x, int y, int anchorX, int anchorY, DrawingView view)</div><div>+void invokeStart(int x, int y, DrawingView view)</div><div>+void invokeStep(int x, int y, int anchorX, int anchorY, DrawingView view)</div><div>+Point locate()</div><div>+Figure owner()</div></div>

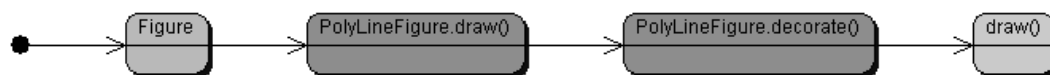


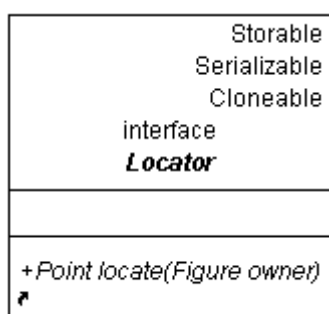


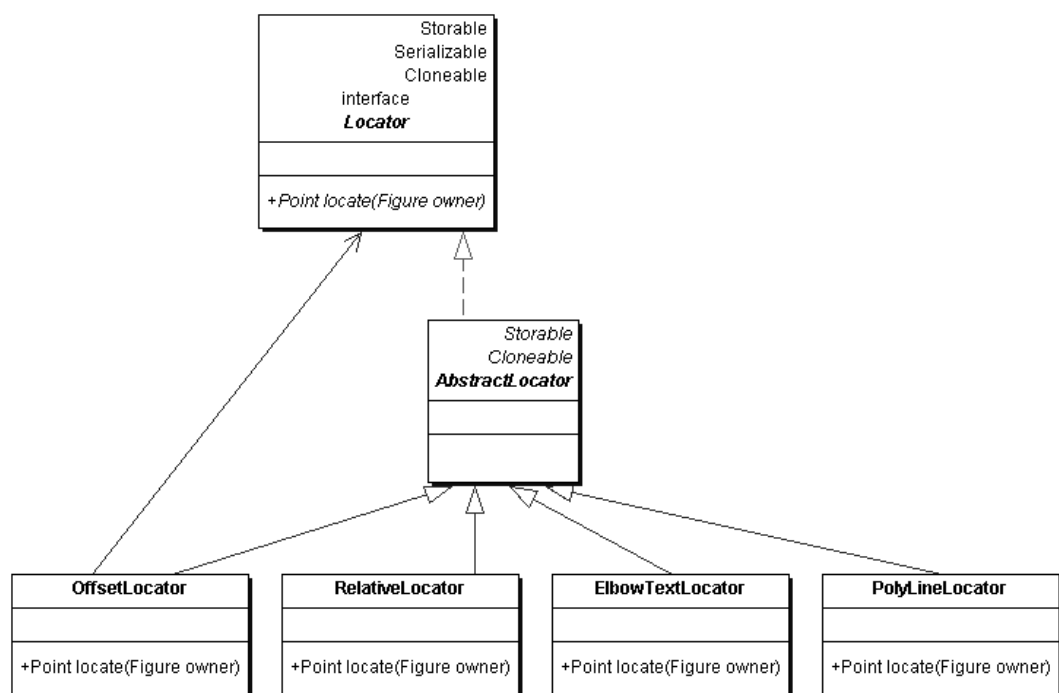


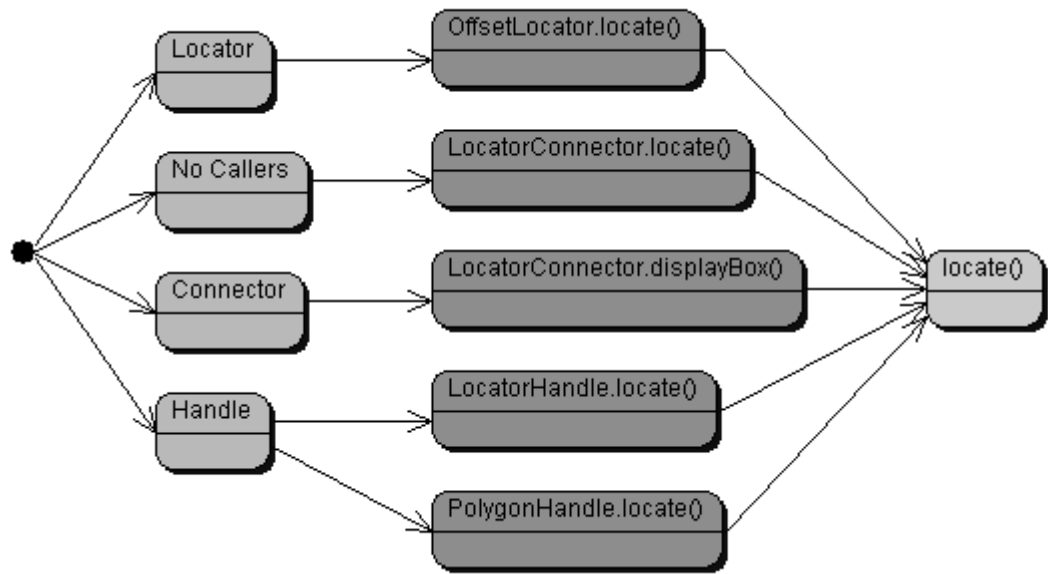




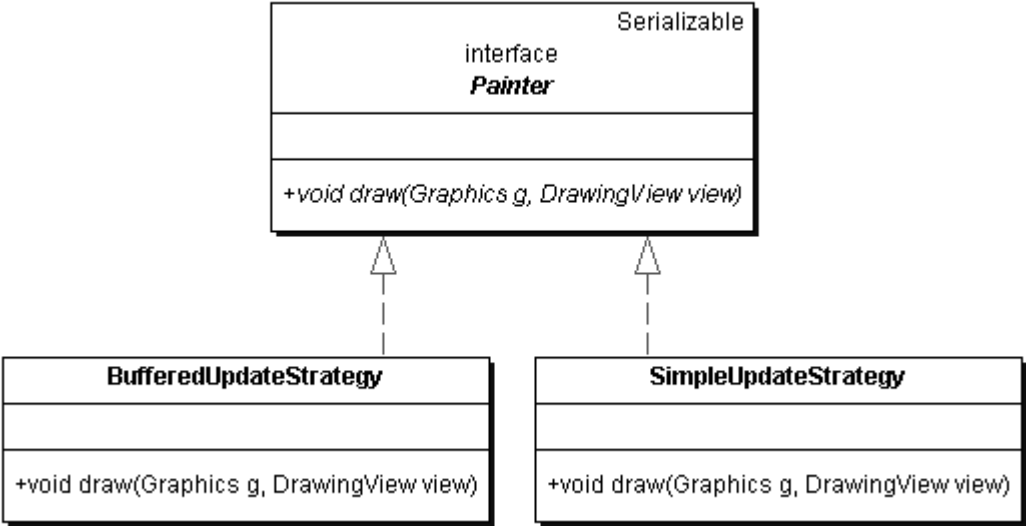


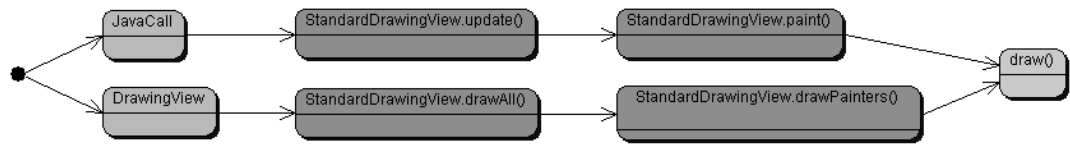




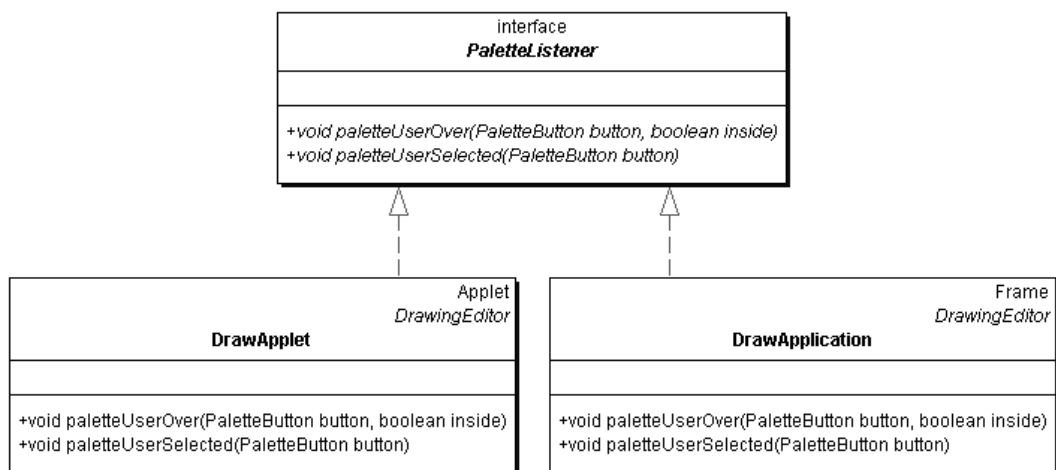


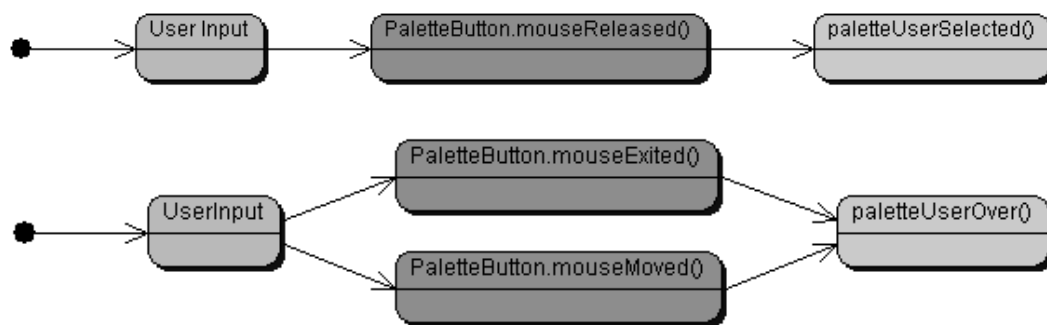
Serializable
interface <i>Painter</i>
+void draw(<i>Graphics g, DrawingView view</i>)

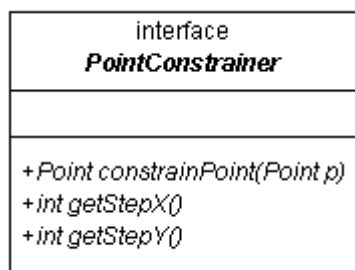


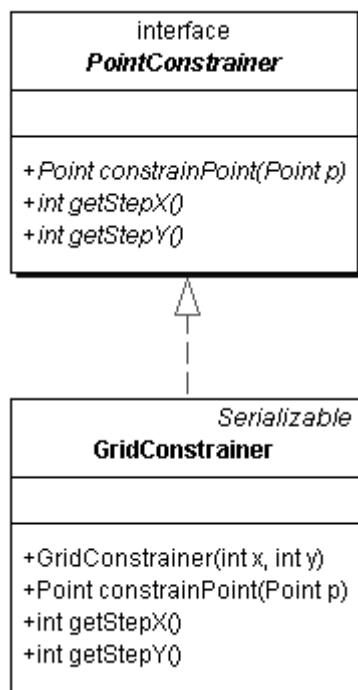


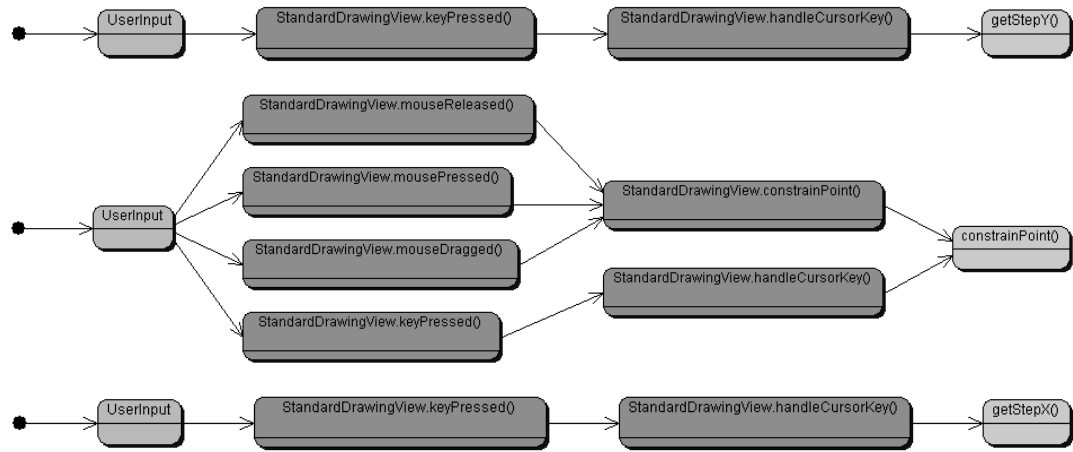
interface <i>PaletteListener</i>
+void <i>paletteUserOver</i> (<i>PaletteButton button</i> , <i>boolean inside</i>) +void <i>paletteUserSelected</i> (<i>PaletteButton button</i>)



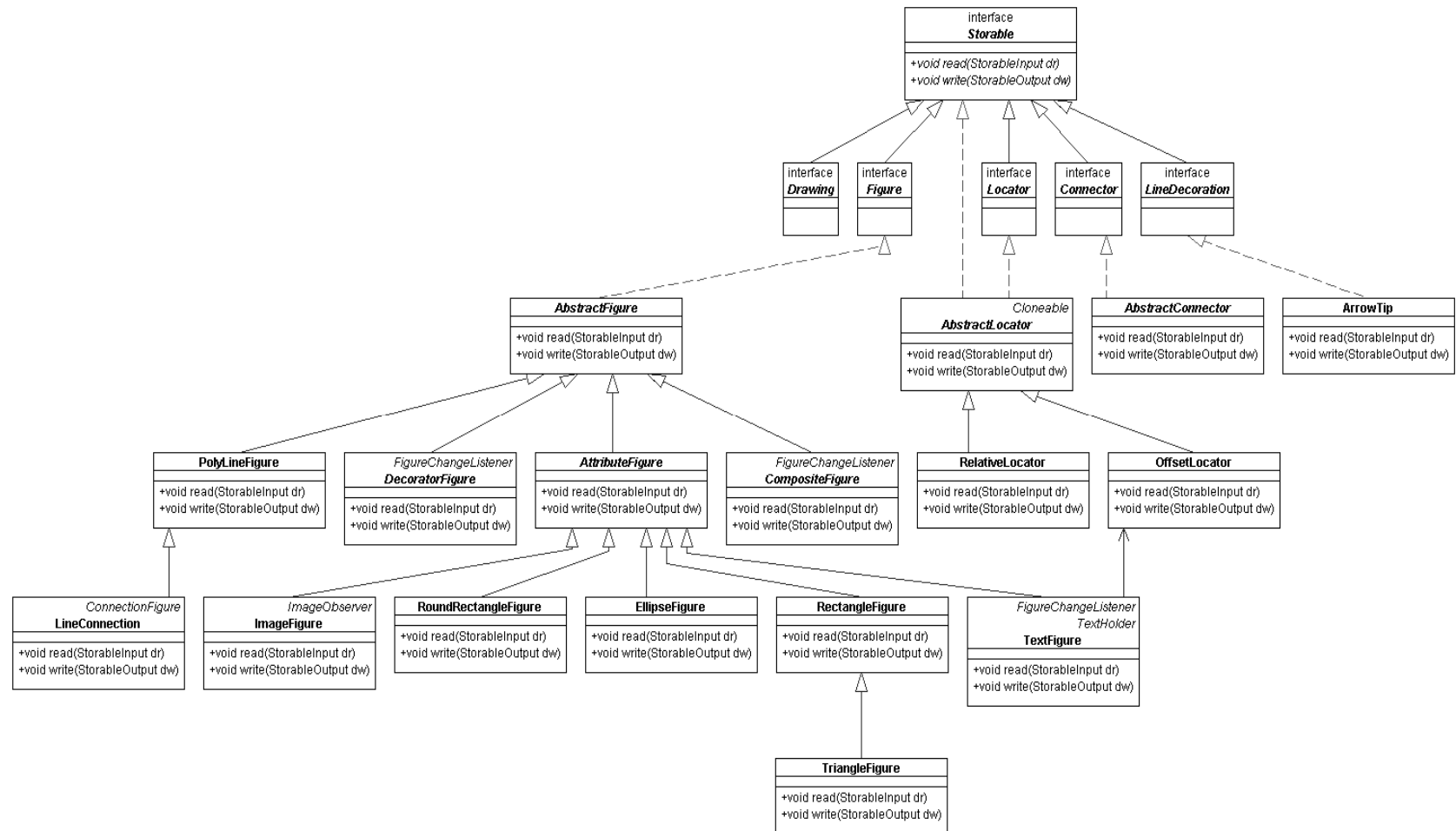


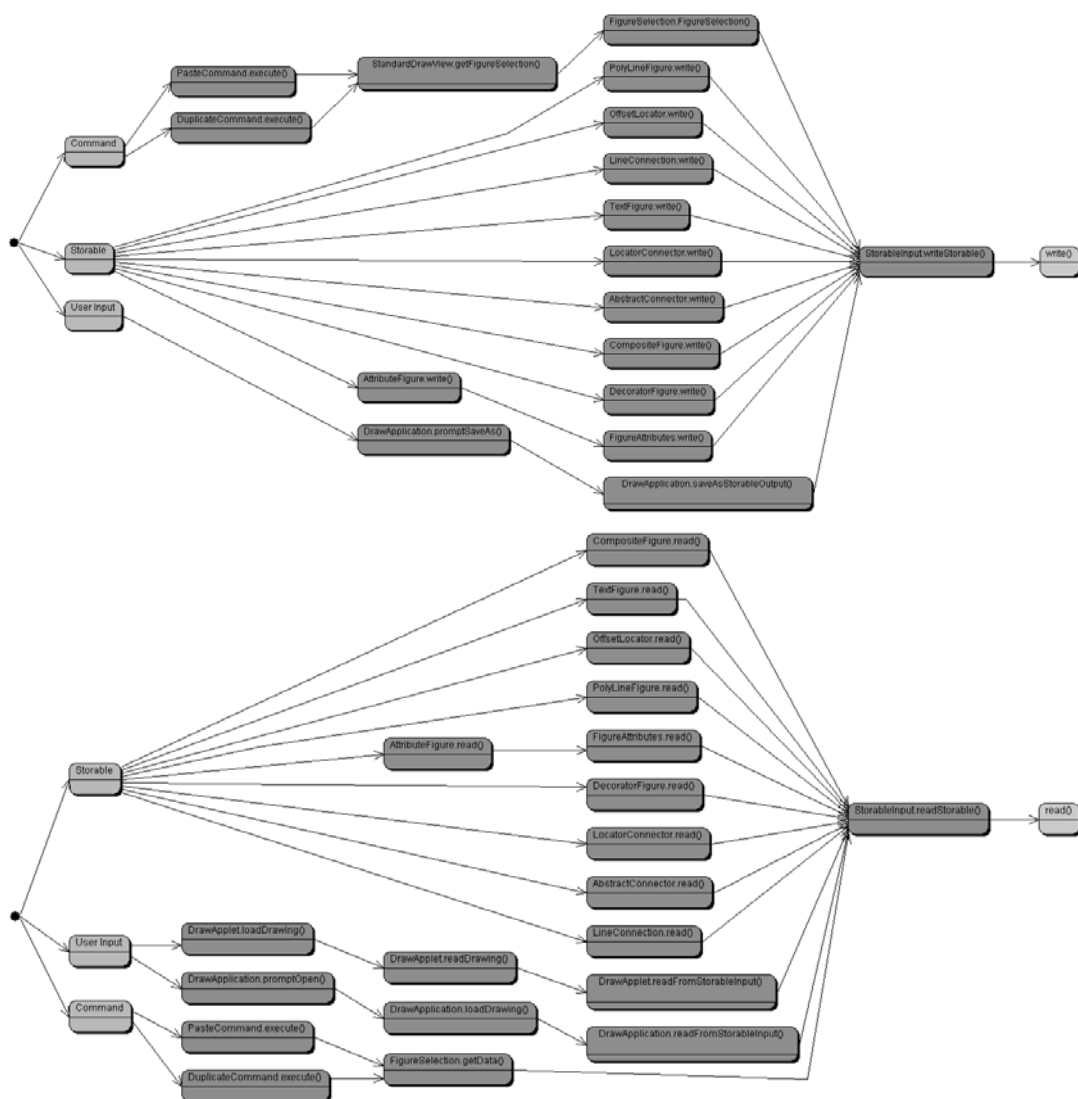




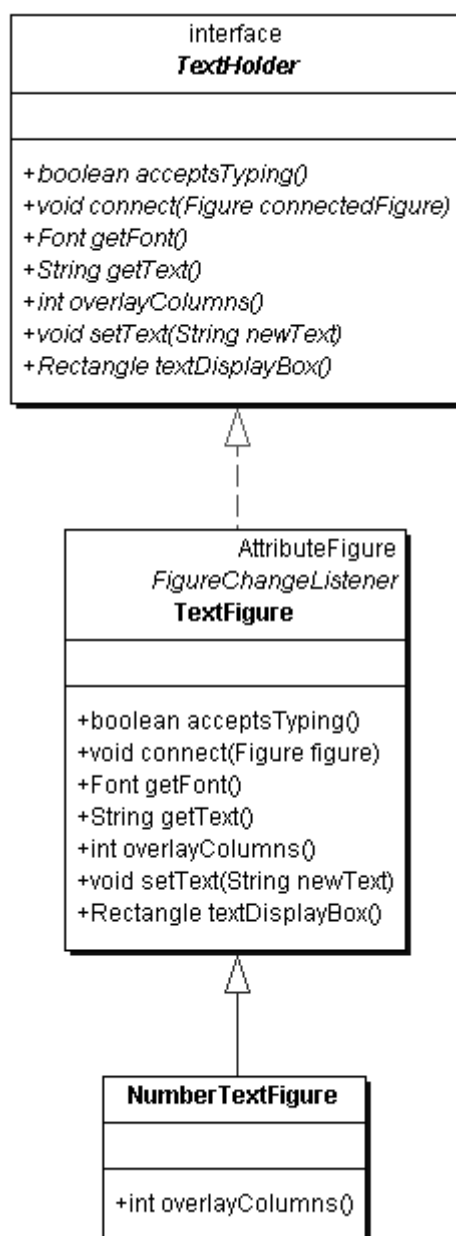


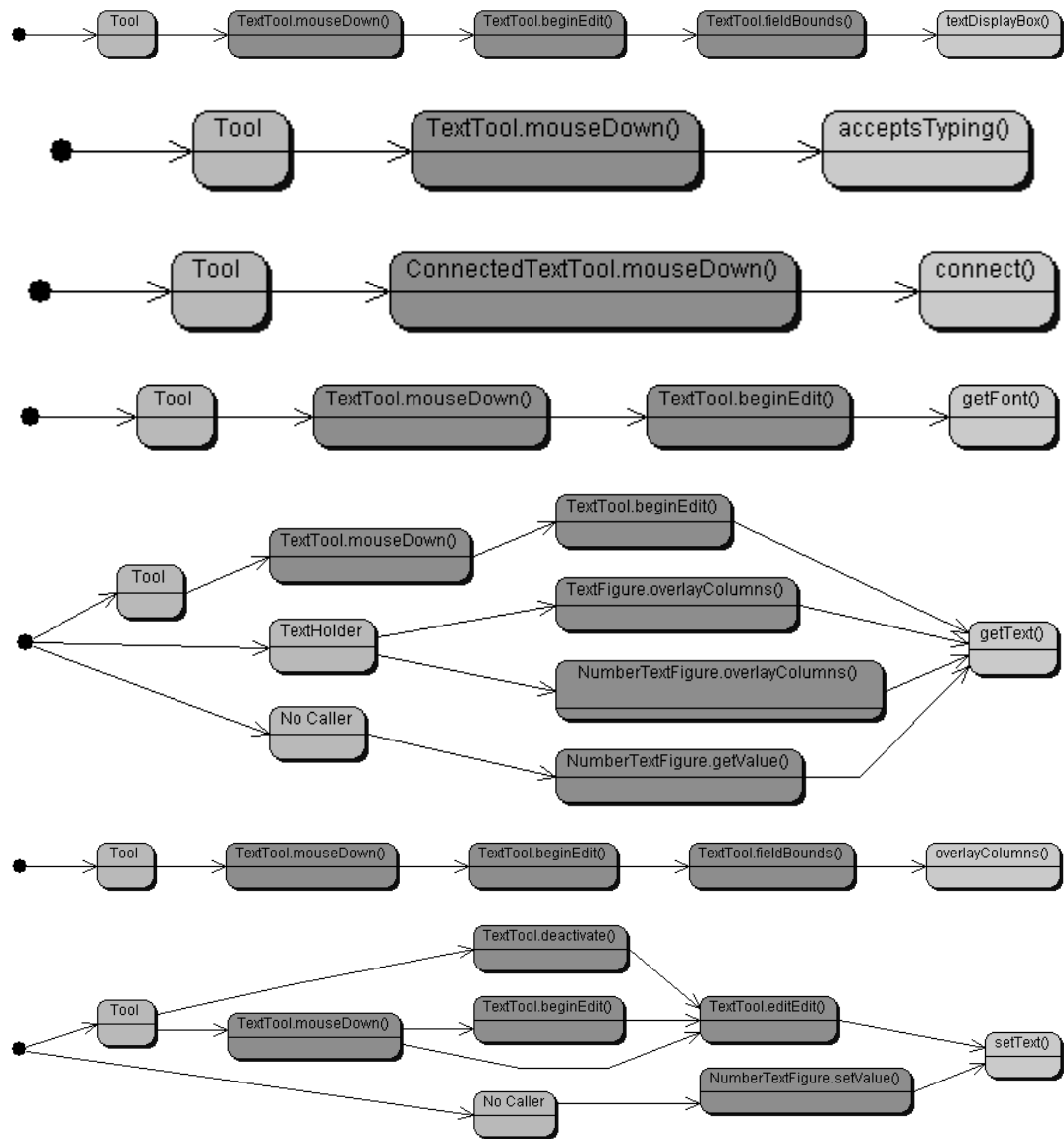
interface <i>Storable</i>
+void read(<i>StorableInput di</i>) +void write(<i>StorableOutput dw</i>)



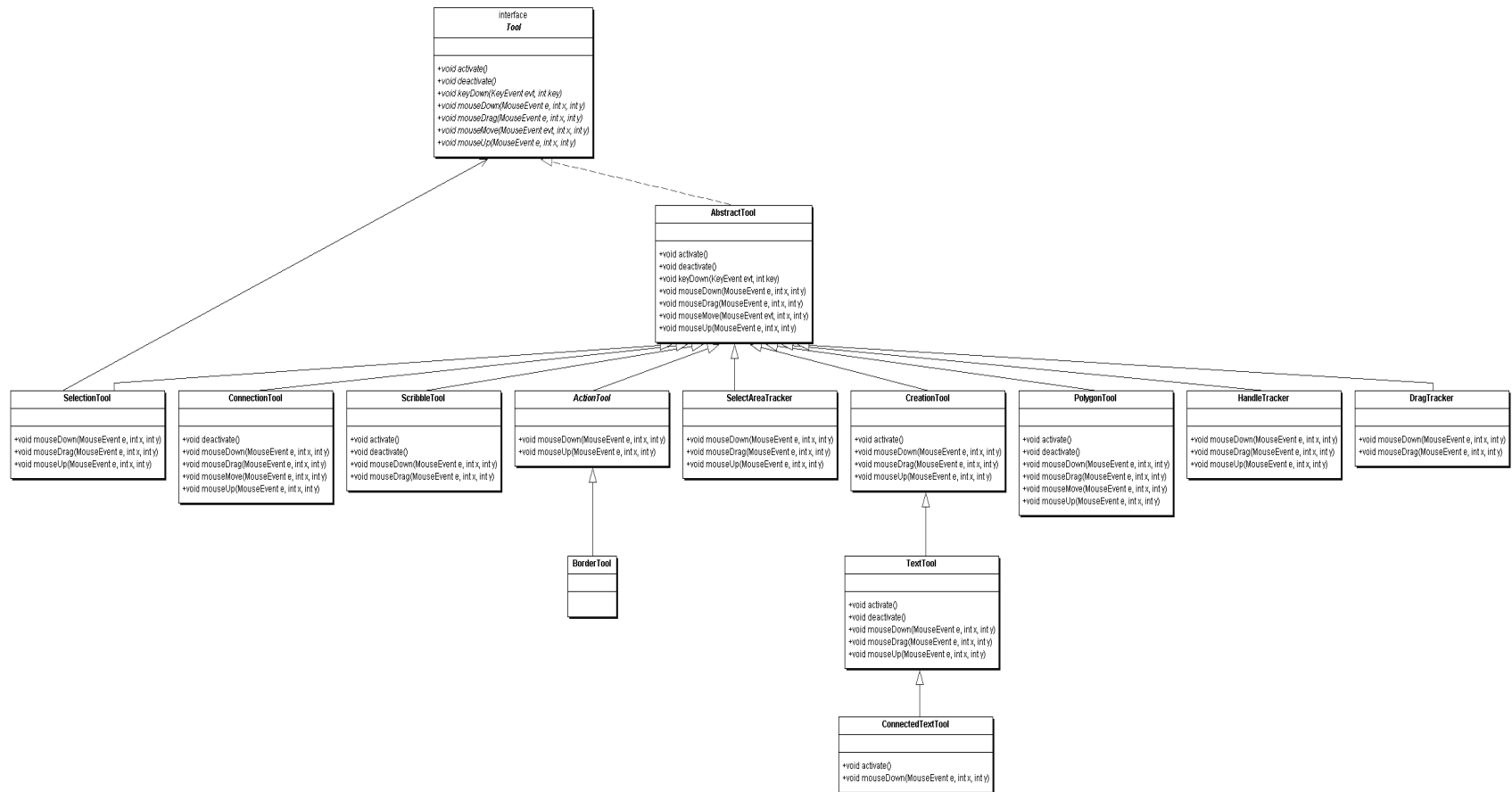


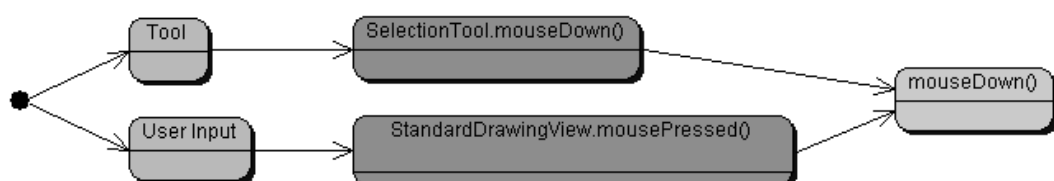
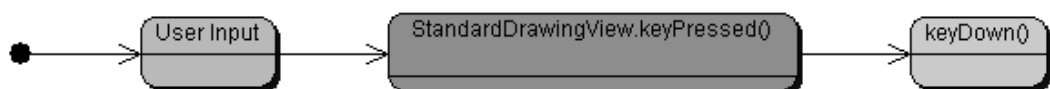
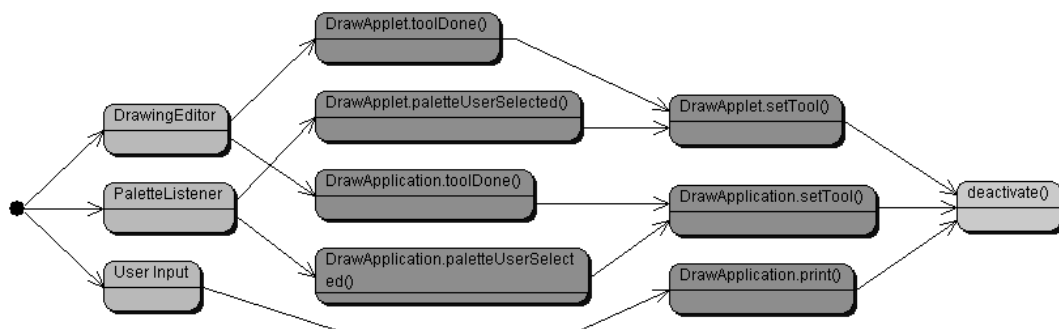
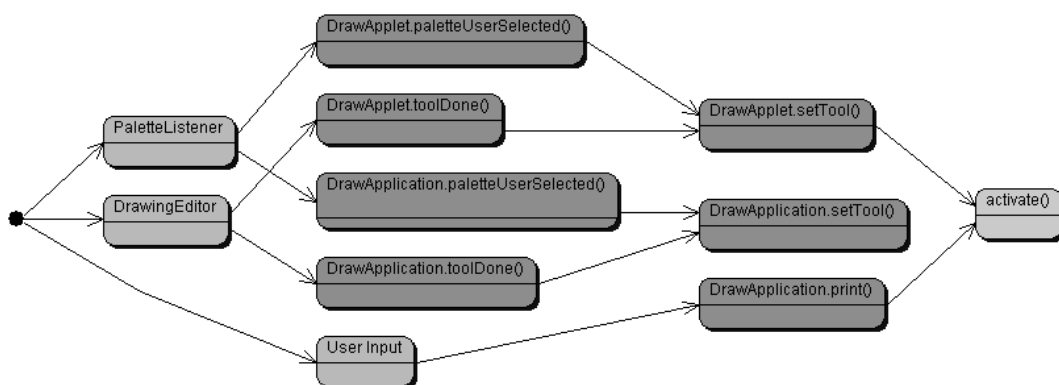
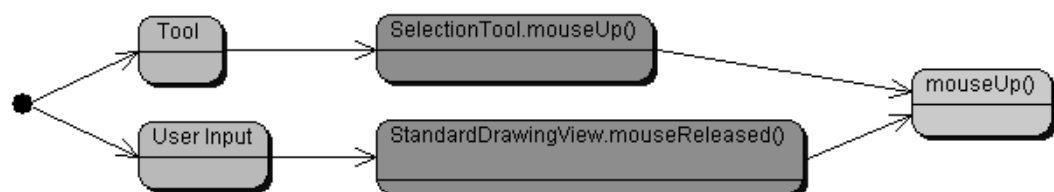
interface <i>TextHolder</i>
+boolean <i>acceptsTyping()</i> +void <i>connect(Figure connectedFigure)</i> +Font <i>getFont()</i> +String <i>getText()</i> +int <i>overlayColumns()</i> +void <i>setText(String newText)</i> +Rectangle <i>textDisplayBox()</i>

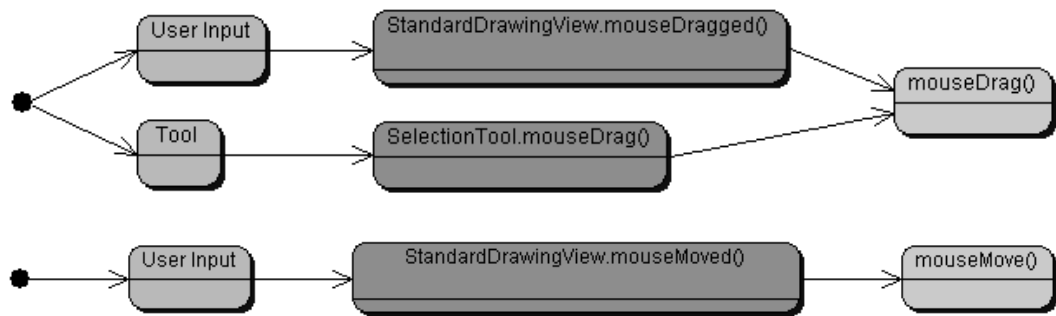




interface <i>Tool</i>
<div>+void activate() +void deactivate() +void keyDown(KeyEvent evt, int key) +void mouseDown(MouseEvent e, int x, int y) +void mouseDrag(MouseEvent e, int x, int y) +void mouseMove(MouseEvent evt, int x, int y) +void mouseUp(MouseEvent e, int x, int y)</div>







Appendix C

This appendix includes material from the evaluation of framework documentation described in chapter 5 of this thesis.

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Experimental Materials

4.1. Call for Participation

Student version

Dear <Name>

I am aware that you have been using JHotDraw as part of your final year project and was wondering if you would be willing to lend me your experience for a couple of hours. I am researching how people reuse frameworks and I am particularly interested in the role that documentation plays in that task. I have developed two new forms of documentation for JHotDraw and I would like you to help me evaluate their effectiveness.

I appreciate that this is a busy time for you but the experiment will only last a couple of hours, should be quite enjoyable (a good chance to show off those JHotDraw skills) and will give you an insight into university experimentation (in case you fancy a future in this field). You will also retain the right to stop the experiment at any time (so if you get bored, feel it's a waste of time or whatever you can walk away no pressure or questions asked).

PS I received your email address from Murray, he knows that I am approaching you about this matter but he will not be involved in the experiment and will not be informed about your decision to participate (or not) in this task.

What you would have to do:

The study will last between 2 – 3 hours. You will be given a problem to address with the framework and the two experimental forms of documentation plus source code. You will be asked to talk aloud while solving the problem so that the process of framework reuse can be captured (your monologue and interactions with the documentation will be recorded for further analysis). Before and after the task you will be asked to participate in a short (10-15 mins) interview to establish your familiarity with the framework and your opinion of the documentation. You will also be given a short (10-15 mins) period to familiarise yourself with the experimental documentation.

I plan to conduct a number of these experiments between now and Easter. If you are interested all you have to do is email me at doug@cis.strath.ac.uk, suggest a date/time that suits you and I will take it from there. The study will take place in L10.08.

Your Rights:

The university has an ethics policy, which applies to all experiments carried out on its behalf. This study poses no health or safety risks to you but you are granted the following rights to protect you from accidental harm.

- The researcher performing the study will solicit subjects; this researcher has no power over any of the potential subjects, which might otherwise coerce them to take part.
- No other member of staff will be informed of the subjects' participation nor have access to source data. The researcher will anonymise the data before analysis/dissemination takes place.
- Subject participation is voluntary and they will be allowed to stop the study at any time.
- Before accepting to take part subjects will be provided with information about the nature of the task, duration and the experimental conditions that are required (i.e. tape recording responses, screen capture of activity, ability to leave the room).
- Subjects will be asked to sign a consent form that will repeat the conditions of the investigation before they take part in the study.

Thank you for your time,

Douglas Kirk

Research Assistant

Department of Computer and Information Sciences

University of Strathclyde

Researcher version

Dear Researcher

I am researching how people reuse object-oriented frameworks (skeleton applications which are specialised to create concrete applications) and I am particularly interested in the role that documentation plays in that task. I have developed two new forms of documentation for a framework and I would like you to help me evaluate their effectiveness.

I appreciate that you will be busy time with your own research but the experiment will only last a couple of hours, should be quite enjoyable and will give you an insight into the design and execution of a CS experiment (which might be useful in your own research). You will also retain the right to stop the experiment at any time (so if you get bored, feel it's a waste of time or whatever you can walk away, no pressure or questions asked).

The experiment will use the JHotDraw application framework, written in Java it supports the creation of a variety of different graphical editors (anything from simple paint programs to UML class diagram editors).

What you would have to do:

The study will last between 2 – 3 hours. You will be given a problem to address with the framework and the two experimental forms of documentation plus source code. You will be asked to talk aloud while solving the problem so that the process of framework reuse can be captured (your monologue and interactions with the documentation will be recorded for further analysis). Before and after the task you will be asked to participate in a short (10-15 mins) interview to establish your familiarity with the framework and your opinion of the documentation. You will also be given a short (10-15 mins) period to familiarise yourself with the experimental documentation before the task begins.

I plan to conduct a number of these experiments between now and the end of April. If you are interested all you have to do is email me at doug@cis.strath.ac.uk, suggest a date/time that suits you and I will take it from there. The study will take place in L10.08.

Your Rights:

The university has an ethics policy, which applies to all experiments carried out on its behalf. This study poses no health or safety risks to you but you are granted the following rights to protect you from accidental harm.

- The researcher performing the study will solicit subjects; this researcher has no power over any of the potential subjects, which might otherwise coerce them to take part.
- No other member of staff will be informed of the subjects' participation nor have access to source data. The researcher will anonymise the data before analysis/dissemination takes place.
- Subject participation is voluntary and they will be allowed to stop the study at any time.
- Before accepting to take part subjects will be provided with information about the nature of the task, duration and the experimental conditions that are required (i.e. tape recording responses, screen capture of activity, ability to leave the room).
- Subjects will be asked to sign a consent form that will repeat the conditions of the investigation before they take part in the study.

Thank you for your time,

Douglas Kirk
Research Assistant
Department of Computer and Information Sciences
University of Strathclyde

4.2. Consent Form

EXPERIMENT

- The study will last between 2 – 3 hours.
- You will be given a problem to address with the framework and the two experimental forms of documentation plus source code.
- You will be asked to talk aloud while solving the problem so that the process of framework reuse can be captured (your monologue and interactions with the documentation will be recorded for further analysis).
- Before and after the task you will be asked to participate in a short (10-15 mins) interview to establish your familiarity with the framework and your opinion of the documentation.
- You will also be given a short (10-15 mins) period to familiarise yourself with the experimental documentation.

CONDITIONS

- The researcher performing the study will solicit subjects; this researcher has no power over any of the potential subjects, which might otherwise coerce them to take part.
- No other member of staff will be informed of the subjects' participation nor have access to source data. The researcher will anonymise the data before analysis/dissemination takes place.
- Subject participation is voluntary and they will be allowed to stop the study at any time.
- Before accepting to take part subjects will be provided with information about the nature of the task, duration and the experimental conditions that are required (i.e. tape recording responses, screen capture of activity, ability to leave the room).
- The screen and audio capture will be held privately by the researcher on a university machine and will be retained until a complete (anonymised) transcription has been made before being deleted. (This will occur no later than three months after the date of capture).
- Subjects will be asked to sign a consent form that will repeat the conditions of the investigation before they take part in the study.

I agree to take part in the above experiment and I have read and understand the conditions that apply to this study.

Subject _____ Date _____

Researcher _____

4.3. Micro Architecture Documentation Tutorial

Purpose

The micro-architecture documentation provides two functions:

- It describes the sequences of calls that lead to the interfaces of the framework
- It identifies the location of interfaces definitions within the framework.

The intention is that they should guide you to a method or set of methods of interest, which can then be referred to in the source code for an exact description of their behaviour.

How to Use

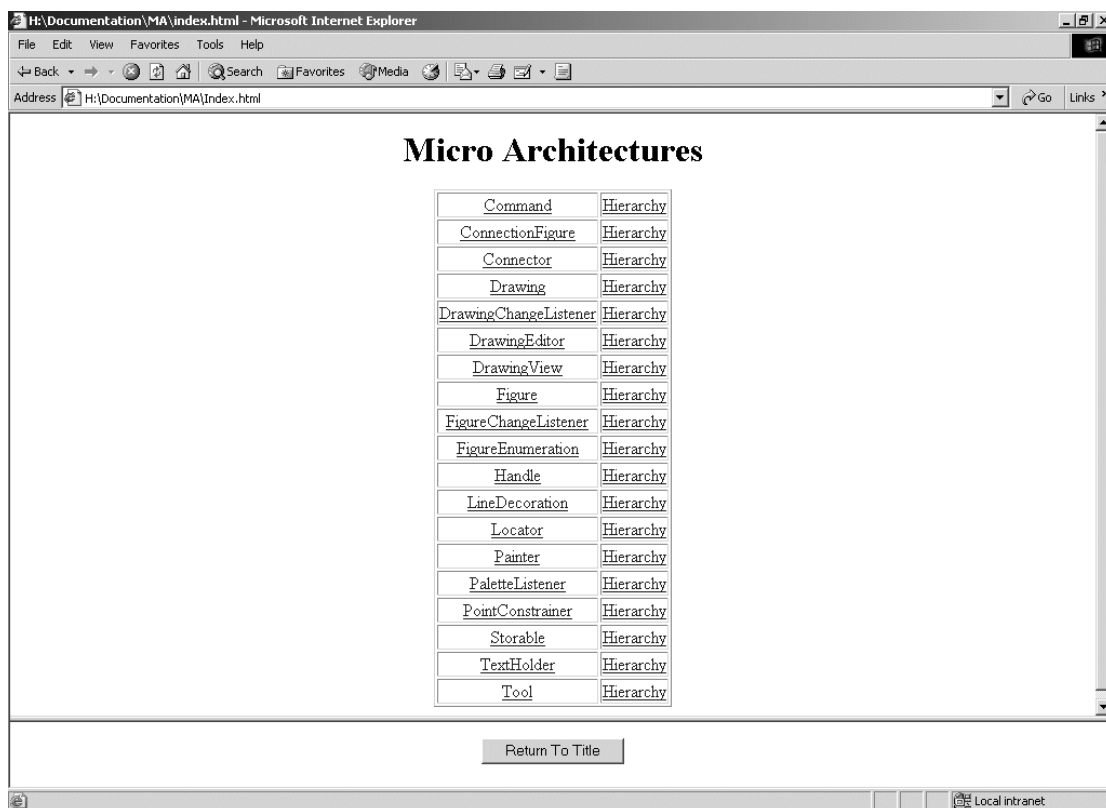


Figure 2: The Micro Architecture Menu Screen

A user begins at the MA menu. This page presents a list of all the interfaces defined in JHotDraw and a list of inheritance hierarchies that describe where the interface behaviour is defined in the framework.

Typically a user will begin by selecting an interface of interest clicking on this will take them to a page that describes the operations supported by the interface.

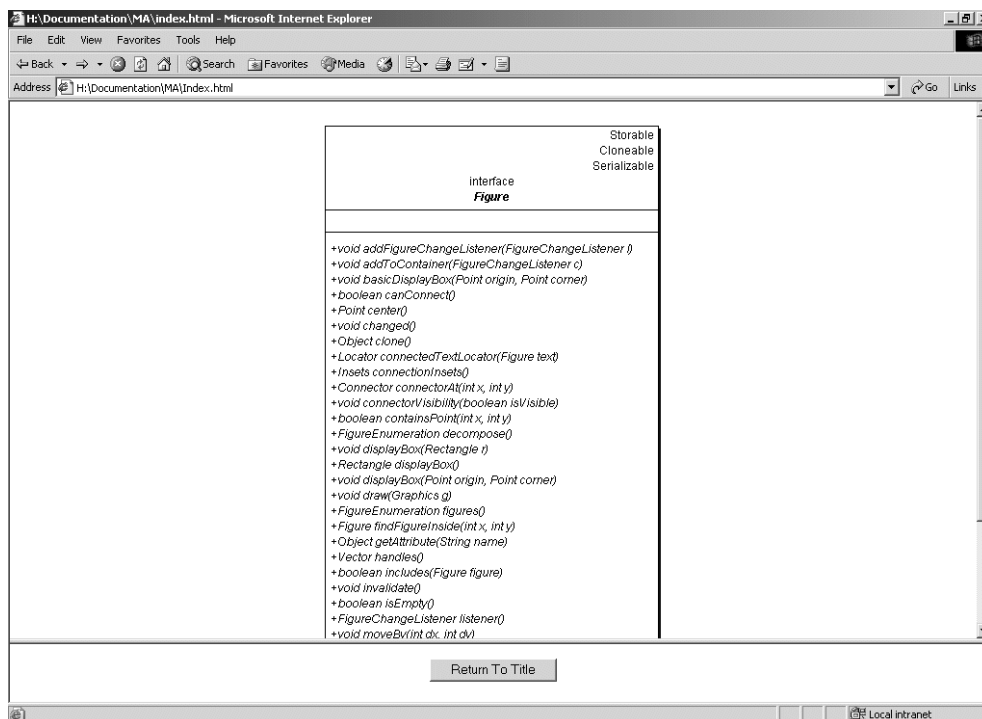


Figure 3: The Interface Screen

The user must then select which operation they want to know more about. Clicking on the operation takes them to a call graph, which illustrates how that method is called by other parts of the framework.

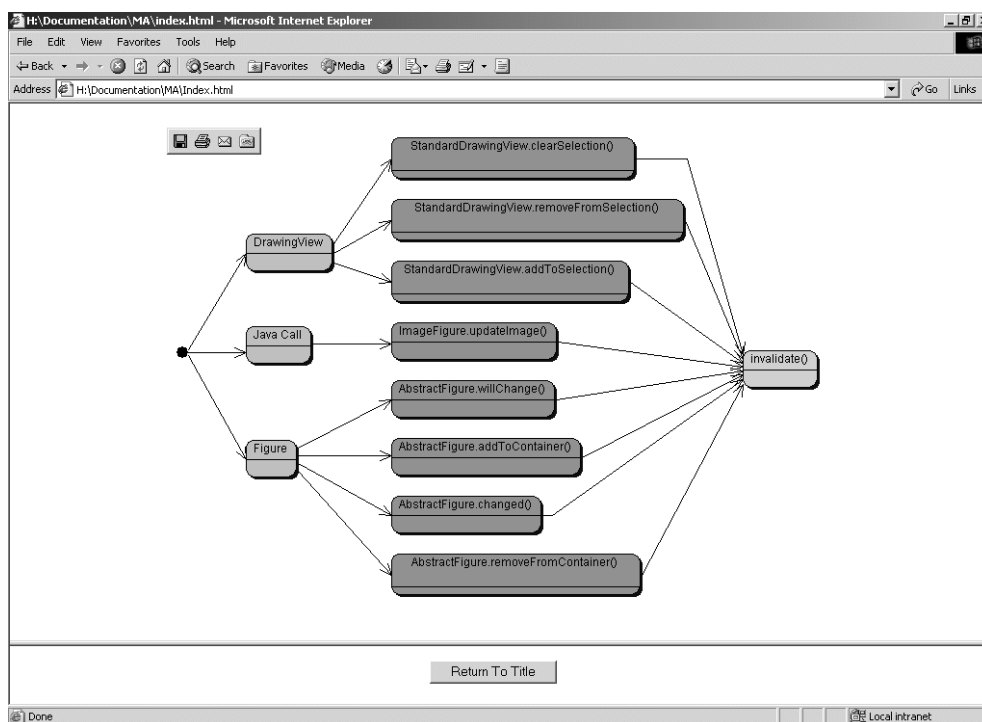


Figure 4: The Call graph

The call graph is made from three different types of method descriptions (represented by different coloured bubbles on the diagram). Blue bubbles represent the called method, red bubbles represent

calling methods (and their classes) while green bubbles represent the start of the call graph and illustrate either a starting point for the interaction (i.e. a call from main or a user input) or a call from an interface. Calls originating from an interface can be traced further back by going to the call graph associated with that interface operation. The call graph identifies what parts of the framework calls a particular method to understand more about the behaviour of the call users must refer to the framework source code.

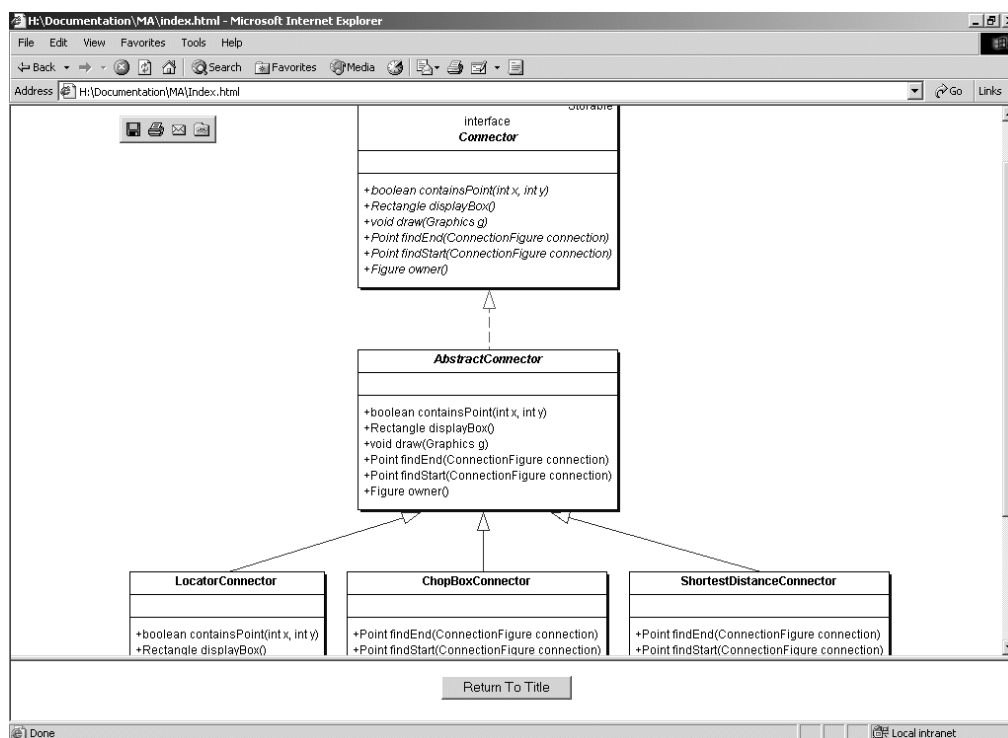


Figure 5: The Hierarchy Screen

The hierarchy screen (accessible by clicking on the hierarchy link next to each interface on the MA menu) helps to identify where interface behaviour is defined (and overridden) in the framework. This can be used in conjunction with the call graph to determine how many implementations might be called from a particular part of the framework or it can be used as a guide to where the implementations can be found within the source code so that different implementations can be compared and contrasted.

4.4. Task Sheet

JHotDraw Study: Task Sheet

Introduction:

In the seventies and early 80's micro-worlds were popular in the artificial intelligence (AI) research community. Micro-worlds are representations of problems that have been simplified down to their essentials to make representation and problem solving easier, the intention being to devise AI algorithms for these simple cases then gradually scale up the complexity of the problem over time. A popular micro-world of its day was called blocksworld (see Figure 1), which consisted of a configuration of blocks resting on the ground.

In AI research the problem was to take a particular description of a blocksworld and then using some simple rules about the environment and a list of possible actions make the machine derive a list of actions that would recreate the desired configuration.

The purpose of this task is to recreate a blocksworld application using the JHotDraw application framework. The application should allow users to create their own blocksworlds (subject to the constraints outlined below). There is no requirement for any AI problem solving behaviour in this task.

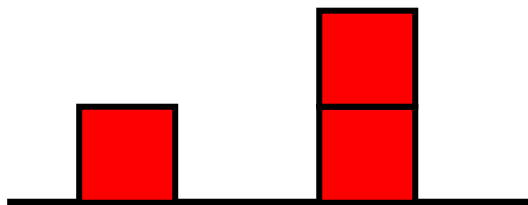


Figure 6: A possible blocksworld configuration

Requirements

The blocksworld application should create suitable representations for the ground and for the blocks (blocks should be square, 40x40 pixels in size and coloured red).

The application should allow the user to create blocks and add them to the world, blocks should be constrained to only exist on the ground or perfectly aligned on top of another block. There is no limit to the number of blocks that can be stacked on top of each other.

It should be possible to select a block in the world and move it to a new position on the ground or to stack it on top or remove it from a stack of existing blocks. Stacks of blocks cannot be moved and only the top block of a stack can be selected and repositioned.

JHotDraw Documentation

JHotDraw should already be correctly set up and installed on the machine you are using. To find out more about the framework you may wish to browse the documentation provided.

The documentation is online (with the exception of the source code) and can be found at <http://softarch.cis.strath.ac.uk/Documentation/Index.html>. This has also been set to be the web browser's home page.

4.5. Inter rater text

T	Documentation	Subject Talk aloud	Observations
0		Pre-task activities	
14		<p>...</p> <p>Right. Okay.</p> <p>R Right. So do you think it is clear what you have to do then?</p> <p>Yeah.</p> <p>R Right so I think I will start you off then by asking how are we going to begin. How are we going to tackle this problem?</p> <p>Right. Can I ask a question? Its probably a stupid question. Is this going to be a just a 2d looking at it from the side thing?</p> <p>You don't have to implement a 3d sort of view of like ...</p>	
15		<p>R No. The intention here is that it is a 2d application and that the diagram there represents roughly what I want. You are free to interpret the actual graphical details [how you represent] a cube well I mean a square but it yeah, its entirely 2d there is no 3d elements whatsoever.</p> <p>Right. Okay that's fine.</p> <p>R So what are we going to do first? Do you have any ideas?</p> <p>Right. Well I'm going to want something to represent the blocks obviously, and also something to represent the surface they are sitting on.</p> <p>[Presume we need] a tool that lets you move a block from one place to another and some sort of constraint</p>	
16		<p>that stops you from putting the blocks in mid air or hanging off the side of another block.</p> <p>Does that sound as though its on the right track?</p> <p>R Yeah. Those sound like the major areas of behaviour that we are going to have to deal with. Where do you think you are going to begin? What one are you going to tackle first?</p> <p>Okay. Right the first thing I'm going to do is have a representation for a block or whatever. So I'll look through the documentation to find ...</p> <p>R Well you can either look through the documentation or</p>	
17		<p>If you happen to know from your own experience I think I would use X then you can just say that.</p> <p>Right. Okay. Then I'm thinking I would use a subclass of, well some subclass of figure at the moment but I will look up and [see exactly] what I will do with that. So will I get on and do that?</p> <p>R Yeah. Yeah do that. You know try and keep talking about anything that you think is relevant so if you are looking and if you are not finding something then you can say you can't find it or like just now where are you going to look, why do you want to look there?</p> <p>I was going to look in the micro architectures because I know that I want to use something that implements Figure eventually and I'd like to know what the hierarchy is from figure downwards so I can see ...</p>	

		<p>R And you know from looking earlier on that the hierarchy... I know yeah, that micro architectures show that where as the pattern language is maybe more about you know, what kind of problem you are solving in the framework.</p>	
18	<p>MA Index</p> <p>MA FigureIH</p>	<p>R. Okay. The other thing that I should maybe have said is that if you feel that while you are going through this task you would normally have looked at another documentation feel free to say that. Right. R. So I'd normally look at JavaDoc I'd normally look at an example now, or these kinds of comments are probably quite helpful to me so if [you mention these it would be helpful] So I'll take a quick look at the figure hierarchy and I'm looking for something to subclass rather than creating a figure from scratch. R And the other thing I should point out is that this diagram, its thrown a few people, it only shows the overridden methods of Figure for each class. It doesn't show you the complete interface for each individual class it only shows overridden methods. Right. R [its only a partial class] Okay.</p>	
19		<p>Is this together, yeah, are these blue lines, implements?</p> <p>R I think a dashed blue line is implements. Oh. Okay. R Is that not just a general dependency I don't know, okay that's cool.</p> <p>Yeah. See round rectangle figure [and there is straight] rectangle figure okay so. Now I can reject diamond figure and triangle figure I'm not interested in them because they are subclasses of that. So what I want to use for the blocks is rectangle figure.</p> <p>So I'll go and check that out and see how I can make it so that it is, forty by forty, so that it is square and coloured red.</p>	scrolling
20	<p>MA Index</p> <p>Doc Index</p>	<p>[So in order to fit that I'll go to the other] micro architecture. What I am looking for is the rectangle figure methods [that are in it] like the format of the constructor and so on R What would you normally use to find this information? I'd normally look at javadoc in this case.</p> <p>R Remember you can look at the code. Source code, right. R I don't know what editor you prefer, Pfe is there RealJ is there... or if you want to download something. [I think I'll use Pfe]</p> <p>R then its C drive and JHotDraw5.1 So looking for rectangle figure.</p>	
21	SC Rectangle Figure	<p>Okay.</p> <p>R So what do you expect, what information are you looking for in the code?</p>	

		<p>What I am looking for is how I can set the size and colour for my rectangle.</p> <p>R but then do you have any preconceived notions of that from your past experience</p> <p>I don't. I was hoping there was a constructor that would set the size and the colour. I suspect that there isn't one, although I can set the size but there is no constructor that lets you specify colour.</p> <p>Okay so I know how to create my rectangles so I'm going to use this constructor here to give it size and position. What I need now is a method that is going to let me set a figure to a certain colour.</p> <p>I'm thinking that's not going to be in rectangle figure that's going to be further up the hierarchy.</p>	
22	<p>MA Index MA Figure</p> <p>PL Overview</p> <p>PL Modifying Existing Figures</p>	<p>So back to Figures micro architecture. [] figure [] I am looking for something that will let you set the colour of the figure.</p> <p>R Okay so basically we are looking at just really trying to match some of the names here?</p> <p>Yeah. That's the only... that's the only plan of action although maybe I'll look at the pattern language to see if there is something there that will let me [] do that.</p> <p>Going to try modifying existing figures. I'll see I might have to define a new figure called red rectangle or something.</p>	
23	<p>PL FigureIH PL Mod Existing Figures</p> <p>MA Index MA Figure</p>	<p>Right so its suggesting that I might want to create my own subclass to get the behaviour that is required, which is that it is red. It should be in the hierarchy [].</p> <p>It is also saying that I should get a good understanding of the existing behaviour, it says there that "to identify which methods will have to be overridden" which is all very well but I don't know which method I want to override.</p>	
24	<p>MA Index</p> <p>MA Figure IH</p>	<p>I'm just going through this to see if there is anything that looks like a method that might let me set the colour of a figure.</p> <p>R Do you see any candidates is there anything that catches your eye?</p> <p>No.</p> <p>R Okay. Well if this doesn't work perhaps looking at the source code for one of the classes in the hierarchy might help you? [you can read the comments in them and that might make it easier]</p> <p>Yeah.</p> <p>Okay. I'm going to look at Abstract Figure it is [that implements] Figure and I can see that rectangle figure inherits from that as well, which I know from this.</p>	

25	SC ?	<p>Set Attribute, if colour is an attribute that could work but I don't know what an attribute is.</p> <p>I think it might help if I looked at the source code for Abstract Figure or rectangle figure I think and see what actually happens when a figure gets drawn I can see where it is getting [colour] from. I might take a look at abstract figure.</p> <p>R Do you know where it is? I am guessing. I'm thinking its probably in framework but...</p> <p>R I think its actually in standard. I never know where to find these things.</p> <p>R Yeah.</p>	<p>Scrolling</p> <p>Called or colour</p>
26	SC Abstract Figure	<p>Abstract Figure.</p> <p>Okay so I'm looking for a method the draw method, in here so I can see where it gets its colour from.</p> <p>[Could maybe use find] Do you know how to do a find in Pfe? F2? These standard keypad combinations! [I'm going to, right, draw]</p> <p>[I don't want it matching on entire words] I'm getting Drawing and drawing. So there is not a method in here called draw.</p>	Sub uses find
27	MA FigureIH	<p>R Does abstract figure override, does it define draw? I don't know if its called draw anyway but the equivalent sort of thing. I think its called draw but... Yeah the thing... No it doesn't seem to. But I shall check [here] first. [] there must be something that calls... ah draw in figure. Okay lets look at that.</p> <p>R Okay but it doesn't actually define it its one of the abstract parts of that thing. Right so figure doesn't. Abstract Figure doesn't implement it. Okay. I'm going to look at the source code for figure to see what draw does as regard colour.</p>	Looking at names in abstract figure
28	SC ? SC Figure	<p>R [do you think that figure] is in framework? Right. Okay.</p> <p>R [it's a standard thing that people can't find the classes but I will tell you if I know where to look] Right. I will say out loud I am now looking for Figure but it would be complete guesswork because I have no idea what path it is in.</p> <p>Framework and Standard are just... I don't know what the difference is supposed to be.</p> <p>R I think that I have roughly figured it out but it doesn't bear explanation really. Right okay. There are comments in here in the draw method. Basically saying that it draws a figure it takes a parameter g which is the graphics context its drawing into.</p>	
29		<p>Right so [there is] something that actually implements this. For example the rectangle figure that I was looking at before.</p> <p>So in here looking for the draw methods... we have draw</p>	

		<p>frame we could use that right so there its calling draw rect on the graphics context which gets passed to it so it uses the colour from the graphics context.</p> <p>I feel like I'm getting nowhere here.</p> <p>R No. No. So you know from your familiarly with java that the graphics context has got set colour and setfillcolour and so on.</p> <p>yeah.</p> <p>R So you think that [] if [].</p> <p>yeah. I could[n't?] find the method that set the colour</p>	
30		<p>so I'm wondering if maybe if all JHotDraw things are drawn in a default colour without anything being set. So if I made that assumption what I could do is set the colour of the graphics context when I go to draw my new red rectangle but that is just presuming that the framework doesn't set the colour somewhere else. So if I do that my screen redraws going to get messed up no doubt.</p> <p>R So this hypothetical solution then would be an override of the draw method is that right?</p> <p>Yeah an override of, well we got draw background and draw frame in here I am presuming that there is a draw method in here as, or maybe there isn't? A draw method from an actual super class that calls these two methods here. So yeah my other solution would be to override draw method.</p>	<p>Scrolling</p> <p>Draw background/ draw frame</p>
31		<p>R Okay. I think that solution might be. I think it might work actually but it's a bit heavyweight the solution that you want to make happen is actually possible, okay.</p> <p>The solution of ?</p> <p>R The notion that you have got that you can actually control the colour. Via some other mechanism.</p> <p>Right, other than overriding the draw method.</p> <p>R That right. I'd like you to keep looking for it but I mean in real life if you were to code just now having seen what you have seen, would you go with the, I mean if I hadn't just said to you not to would you have actually implemented that? And went with the draw... [or would] you be worried about it like you said you had some concerns.</p> <p>Yeah. I would be worried about it because I've struck the redraw in JHotDraw before</p>	
32	MA Figure IH	<p>before and I've found problems when I when, when I messed about with the graphics context I found that the screen didn't update properly the background was a slightly different shade of grey and stuff like that so I've learned not to mess about with that.</p> <p>R Well in that case then [lets continue with this experiment?]</p> <p>Right.</p> <p>R What are you thinking? [Do you want to be] looking at that? I think you are looking [] into all these things [but the] right one</p> <p>Looking in the draw methods?</p> <p>R Yeah. Yeah I mean I think that notion is quite sensible. So far it hasn't seemed to have paid off for you is there anything else anywhere else you could look to try and [find out]</p> <p>I think [the thing] I want to find is in rectangle figure.</p>	

33	<p>SC?</p> <p>SC Attribute Figure</p>	<p>So that must, there must be a method that calls these draw background and draw frame methods in here. Maybe that's in something that rectangle figure inherits from, like say attribute figure and that has a draw method, okay.</p> <p>So what I'm going to do is I want to look at the source code for attribute figure and see if there is anything in this draw method that will involve setting the colour of this attribute figure... so I need to guess what package I'm looking in now.</p> <p>R Try standard again.</p> <p>Nope.</p> <p>R Figures?</p> <p>Yep [here it is]</p> <p>R That's the first one that I've got wrong!</p> <p>Yeah. Right. (laugh)</p> <p>Right so I'm looking through here for this draw method.</p>	<p>Scrolls to attribute figure</p>
34		<p>I have given up on the find in Pfe because it can't match whole words. I get everything with the word draw in it. Okay I've got draw frame and draw background which I have, which are empty but they are not declared abstract for some reason. Ah okay, all figures support attribute names fill colour and frame colour. So I take from their names that frame colour is the colour of the border and fill colour is the colour of the fill obviously.</p> <p>Okay and here is a method for setting these attributes. Right so</p> <p>R So you want to make the rectangle red how do you do it?</p> <p>Right I'm thinking I would need to call this</p>	<p>scrolling</p> <p>Sees list of attributes</p>
35		<p>set attribute on my rectangle figure giving it the parameters fill colour and I'd need to know what value to give that to make the red. This object value. And I'd hope that the javadoc would tell me that. Unless there are some constants at the top of this?</p> <p>It looks like there isn't.</p> <p>R Is there not? Maybe not at the top is there not a ... list of the things, attributes fill colour, frame colour amongst other things?</p> <p>I can't see any if there are</p> <p>R [what would you like to see]?</p>	<p>scrolling</p>
36		<p>What I would like is a constant called red or something that maps onto the object that I need to give this method.</p> <p>R Oh Sorry I was saying that there were constants for names of the attributes but not for the values of the attributes.</p> <p>Right. Okay. Well I've got the names from the documentation here its called fill colour but I need to know what value.</p> <p>R What's your guess if you could guess that what would you stick in there? ...Do you have any idea what it could be?</p> <p>Well it could be just the string red or it could be a string which is an rgb triplet or it could be a hex value which is an rgb triplet, I mean it could be anything.</p>	

		I mean I suppose I could code it and then try a few things but it's a bit, I'd have thought there was a better way to do it.	
37		<p>I don't see where else such concepts could be defined because this is attribute figure this is the first place in the hierarchy that you get attributes. I can only hope that the draw method in here will give a clue as to the sort of format the second argument might take assuming the draw method actually sets the colour to something.</p> <p>Draw, emm.</p> <p>The draw colour here, right okay in the actual draw method that is where it's that's the place where it sets the colour of the graphics context.</p>	scrolling
38		<p>Okay. But it doesn't make any changes to the attributes of the Attribute figure object so I can't get any clue as to what sort of argument I should be passing to that set attribute.</p> <p>R What do you think that that method get fill colour does?</p> <p>That there? Well that would return probably the value of the fill colour attribute. Oh right so that would probably show me what sort of format that takes. Right okay it returns an object of type colour right okay. Am I allowed to look at the source code for the class colour?</p> <p>R Do you think that colour is part of the framework?</p> <p>No it's not.</p> <p>R You know it's not. You know it's part of java?</p>	Scrolling to fill colour method
39		<p>I was just thinking it was referring to java awt colour.</p> <p>R It is</p> <p>Right well that is part of java then it's not part of the framework.</p> <p>R No I don't want you to look at that because I am assuming I think that you know about colour and I am sure you could work out how to set it to be red right. So it is something along the lines of, I think you pass in an RGB triplet, one of which would be 255 and the other ones would be zero and I would guess it goes RGB so pass in 255,0,0 and whatever, you know we are going to get red. In fact actually thinking about this some more there is a constant you can do colour dot red and that should be it. So where have we got to? How do you think, we have been through quite a lot of information here, how would you [just] your block what's the solution looking like just now?</p> <p>Right.</p>	
40		<p>R We have found out how to set the size in the constructor.</p> <p>Yep.</p> <p>R And can you try and condense all that information there about the colour? How do we want to change the colour?</p> <p>Right. Okay we are going to... right I'm going to use in my subclass of rectangle figure in the constructor I'm going to have a call to the method in here which sets an attribute... set attribute, because rectangle figure subclasses of abstract figure [sic] and I'm making a subclass of rectangle figure so I can use this. So I going to pass the fill colour and colour dot red. And that going to give me a red one.</p>	

		R That's super. Can I challenge you here, that is going to work, and I think that might be the way we go but what is [worrying me] about	
41		<p>making a subclass of rectangle figure do you think? Is there strictly speaking any need to do it?</p> <p>You could do it just using rectangle figure and in your code you would call the set attribute method to make it red but the only reason I was making a subclass would be to make sure that anybody that used it would be forced to make it red.</p> <p>R Okay. Good argument. Okay so for the time being, I think that there is another issue that I will come back to probably but... so what are we going to call this figure? Is this a block figure is that ...</p> <p>Yeah. Block figure that's fine yeah.</p> <p>R Okay, I'll come back to that in a little bit, how what's the next thing</p>	

5 Data

5.1. Transcripts

The following pages contain the verbatim transcripts from the seven participants in the talk aloud protocol. The transcripts have been separated into columns for time, documentation accesses, talk aloud comments and non verbal actions.

5.1.1 Participant A

Time	Documentation	Subject Talk aloud	Researcher Observations
*		Pre-task activities	
35		<p>So I've now got a blank application going. My first thought is to try and get a red square and from my previous experience I suspect we want a tool to do that. So I want to add a tool to the blank application. So that, which creates...blocks.</p> <p>I'll have a look in the pattern language to see if there is anything in there.</p>	
36	PL Overview	<p>Create an application, customising... there is one to create construction tools for figures...perhaps that's where I should look at now.</p> <p>To reuse existing figures.... To create construction tools...Ah I'm looking to see if I do need a tool here. I presume I do need a tool. Lets have a look at creation tool.</p>	Sub is interested in link 'constructing tools for figures' Reading bullet points (where?) takes time before acting on material
37	PL Using Creation Tool	<p>Errr du du du du doot. Create tools here it creates an ellipse figure maybe if I used that code and then with some other kind of figure, would do the trick. The question is where this create tools goes? Create tools can be used...prototype design pattern I know a bit about that. Its creating the tool, call the creation tool, creation tool constructor</p> <p>So I want this code, I'm not sure at the moment where it goes in my existing null application</p>	Sub immediately interested in example.
38	SC MainClass PL Using creation tool PL Cust DrawApplication	<p>Application...main method... no, That's just the default draw application; again I think from experience I need to create a new application. I don't know how I missed this!</p> <p>Going back to the pattern language to see, ah to create your application, customising draw application. Main class, draw ...</p>	<p>Sub missed direction in PL that create Tools goes in DA</p> <p>Finds DA from own experience (?)</p>
39	SC Mainclass	<p>Looking for the open method because I want to start customising applications, now [function] extends open directly...template design, create tools, create drawing. Okay create tools is the one I want.</p> <p>The open method defines the design pattern where open is the template, okay, try to put that on...</p>	
40	PL Cust DA PL Cust GUI PL Adding	<p>Its defining a method from the main class.</p> <p>[] the open method, draw application [] obviously it [] the open method is the ...create tools. I suspect I have to make my own ah, information about customising the GUI [] adding buttons to the tool bar</p>	Sub reading paragraph about open method. Pastes create tools into main

	buttons		Sub is looking at adding buttons link.
41	PL Cust Draw Application	<p>I want to look, can I look at some example code here?</p> <p>R: No</p> <p>No ha! I want to, suspect I'm going to have to override DrawApplication and make my own application. The more I'm looking at the, don't think it's the kind of thing that I saw in the micro architectures I'm not sure that there is anything in there that will help me. DrawApp, drawapp.open...</p>	Sub is looking for place to override. (ie DA)
42	MA DrawingIH	<p>So I need to move, I'm sure I need to add that method to subclass of...ah [wonder what I?] can find in application in the micro architectures.</p> <p>Drawing. Hierarchy. What's this standard drawing, this doesn't [have anything to do with a new] application.</p>	<p>Sub is looking at example sees DA.open</p> <p>Looks for DA in MA can't find it goes with 'closest match'.</p>
43	<p>MA Drawing Editor</p> <p>PL Overview</p> <p>PL Identifying existing figures</p> <p>PL Using creation tool</p>	<p>Drawing editor. Don't think this is going to help me here. Go back to the pattern language.</p> <p>[Cant hear -reading]</p> <p>Creation tool.</p> <p>How to create a tool using creation tool. Create tools overrides create tools in draw application. So I need to,</p>	
44	SC Mainclass	<p>I might need...</p> <p>R: what are you looking for?</p> <p>I'm looking for [] override create tools with. I want to override create tools in draw application but not adding it to emmm...</p> <p>So I need my own application. My own subclass of Draw Application and I can't see anywhere in the pattern language that's emmm</p>	Sub is reading the overrides text. 'need to write a new...'
45		<p>I guess its just maybe general knowledge. Okay.</p> <p>I'm not going to get very far here, if this is all...I'm going to create a new (sigh) I've not seen the inheritance hierarchy, lets see, I can't believe I mean you must be able to look at source code!</p> <p>R: Yes</p> <p>But you said no?</p> <p>R: If you look at the original page of documentation you will see that the source code is listed there.</p>	
46	<p>[top index]</p> <p>SC Mainclass</p>	<p>Ah right, but I can't get at the source code through that?</p> <p>R: No you can't [?]</p> <p>Right okay, but you don't want me to look at any</p>	Subject thought not allowed to see this.

		examples? R: Yep Sources...draw... what am I looking for? I was looking for ...	
47	PL Overview PL Using Creation tool PL Cust DA SC DrawApplication	Going back looking to find a bit more about creation tool. Err nope, not creation tool...customising draw application again is the...Draw Application. So need to find DrawApplication. Where is DrawApplication, not on standard, err application. DrawApplication. I'm sure I've seen somewhere in the past how to create your own application	
48		R: What are you reading? I'm reading DrawApplication R: You mean you are reading the JavaDoc comments? Yeah, well I'm reading. ...Standard presentation for stand-alone drawing editors du du the presentation is customised in subclasses. So I've got to create... trying to find the methods that are in here now.	Scrolling
49	SC Mainclass	I would use the micro architecture stuff but I didn't see anything about DrawApplication. InitDrawing, InitDrawing, this is from my previous experience this stuff seems... create file menu, create tool palette, this is what I want! I think. So I'm going to make, I will have to make my own application here. How do I do that? Better move these windows about [editor]	Sub editing code
50	SC new	So I'm going to try and write my own application here....import something ... am I wasting my time here? R: No I don't think so. Err what am I going to say here [import] sheesh. [How am I going to do this]. Something is frustrating there is something missing from the getting going really easily.	
51	SC Draw Application SC new - MyApp	That I know about from my previous experience I'm having to do a whole load of basic stuff. Right what am I going to sub class that I have not[?] had to do in the past? This is draw application. Draw Application extends frame, right, so include Draw Application.	
52	PL Using creation tool SC MyApp	Public class MyApp extends DrawApplication, and I think all I want in here is emm the overridden method. Which is in...using creation tool. Copy. I need to check that this is a method in this...	
53		Create tools...using ellipse figure, I will just try it	Sub hasn't noticed

	SC MainClass	with ellipse figure...extends drawapplication. Save it and need to change main to make it, it's a drawing application still ...	incomplete example code Sub is editing code
54	[compile] SC Mainclass SC MyApp	call it blocksworld...(sigh). I'll be surprised if this works. [compiles] Typo I'll call it blocksapp	
55	SC MainClass [compile]	R: You are quiet Pardon. I'm quiet; you're being quiet with me. What I've got to compile the main class after having added the, tried to add the new application to it, subclass and eh whoa! That was a shock. R: What was a shock? It compiled. So I have a main class running it now!	
56	SC Mainclass *overrides BA	Lets hope there is a wee tool there. Nope. Applica... there is something up because I changed the title so where am I saving this as? Ah that's why saving it on the desktop [not n place expected] save as	
57	[compile] SC Mainclass	Javac mainclass.java. Right that seemed to compile as well R: was that the right one? Probably wrong one. Open main class...	
58	[compile] SC Mainclass [compile]	Hmm looks good, synax error! Made a typo. Two errors.	
59	SC Mainclass SC ?	An error in main class Whats up? Where has my file gone?	
100	 SC Blocksapp	Should be a file called blocks app. Where is? Ah no. I've saved the mainclass over blocksapp. You are making me nervous now (laugh). File save as mainclass.java R: Do you want to stop? You had a bad start... No no I'm fine. Right lets go So I've got to get this blocks code sorted.	
101		I'm forgetting what I was doing. Blocksapp extends DrawApplication. Public class blocks app extends DrawApplication	
102	PL Using creation tool SC BlocksApp [compile]	New blocksapp new draw application... [compile] Five errors! ...couldn't resolve symbol	
103	SC BlocksApp	Oh sheesh [... line] comments there.	
104		R: Can I take this opportunity to say that some of the students reported problems I do remember that some of he patterns in the language had typos	

		in it. I don't know whether that was with this pattern or not but probably best to check.	
105	PL Using creation tool SC Draw Application	That this is the right bit of code? R Hmm hmm. Well not that it is the right bit of code but that the code is not in error. So you would go to DrawApplication ...should be using find [but doesn't]...create tools	
106	SC BlocksApp	CreateTools. CreateTools palette rather than, should be panel. [finally reads comment] Add a button to the toolbar (sheesh) that represents the tools.	
107	SC DrawApplication SC BlocksApp	Just take this code [from DA button for selection tool]. So I'm trying to, need to add a button. So I will try to copy and paste	
108	SC DrawApplication SC BlocksApp	Toolbutton equals create tool. I need to declare. I need to find the type of the button. Toolbutton. tb is that what we will call it, tb	Finds reference at top of DA
109		Create tool button image, selection tool and what we need is ...block tool, and we need to associate it with a tool, that's creation tool. Add tb. (sigh)	
110	[compile] SC BlocksApp	Right try again. Six errors. R: What's the first error? Can't resolve symbol panel because I'm not, the program is not finding panel. So I need to import...get all the imports right. I want to get a general JHotDraw inclusion so that I don't have to include everything individually.	
111	SC DrawApplication	So I need all these things. I also need wherever panel comes from which I presume is import... R: You are allowed to use JavaDoc for the java libraries. Import java.awt I think. I need to get these other hotdraw classes included. It would be nice to find an example that included them all then I could just cut and paste. Aha here we go.	
112	SC BlocksApp [Compile] SC BlocksApp	I guess that's it. Lets try again. [Compile] Two errors! Blocksapp... don't have a constructor. Can't resolve symbol creation tool?	
113	[compile] SC BlocksApp	Public blocksapp that's a string, and it calls super. Spending a lot of time on things that are not much interest to you. R: I wouldn't say that. Right so, java main class, constructor, creation tool...creation tool equals new creation tool.	
114	PL Overview	It cannot resolve symbol so its another [] error, symbol constructor creation tool. Can't find creation tool that matches, that takes an ellipse figure as an argument. Ellipse figures from...right so need a figure. Just to se it works I need a figure to put in there. Better look for some	

		figures.	
115	PL Identifying Existing Figure PL FigureIH	Figures I saw somewhere. Identifying existing figures. The figure hierarchy. You've got [lots?] figures in here to see. Abstract Figure. Looking for something to get going with a [] rectangle, polynomial	
116	Goes to prompt	R: What is wrong with ellipse figure? Why are you not using it? Ah I thought, ellipse figure, because it wasn't, it was giving a syntax error saying it couldn't find the creation tool. I was thinking ellipse figure came from the... I was thinking that ellipse figure was the wrong example. So it says new, cannot find creation tool that takes...creation tool, creation tool new ellipse figure. Cant find a constructor ... (sigh) that matches creation tool with ellipse figure as an argument	
117	SC BlocksApp SC Draw Application	R: Remember my earlier comment that you can't rely on the code in the pattern language being right. Right I was assuming that was... Creation tool, creation tool, there's a new creation tool. Creation tool, creation tool. Right okay, lets look at source code...So find something that's using creat... I want to find out about creation tool. I want to see an example of the use of the creation tool...	
118	SC BlocksApp SC DrawApplication	Not found. I'm sure this constructs... create tools, R: What are you trying to find now? Create tools something up with... Create tools,	
119		...Tool create selection tool. Right okay so...that's selection tool. Creation tool equals new creation tool.	
120	PL Ident existing figures PL Using creation tool PL Tool Hierarchy	To create construction tools for figures see creation tool. [Reading pattern] The tool hierarchy. Creation tool	
121	SC Creation Tool	Going to look at the source code for creation tool Would be better opening another Pfe32 keeping in on. Aww no! R: What's the problem? It's just gone back to the existing one.	
122		And tools...creation tool. Arrrgh! R: What have you found? Mistake in the pattern language. It takes two arguments, the drawing view, aww dear!	
123	SC BlocksApp PL Tool	Right so how to I get the view? So I need... [Something that I saw] think its rectangle figure	

	Hierarchy SC BlocksApp SC DrawApplication SC BlocksApp	be as well putting that in. Rectangle figure and I need the drawing view so how do I...need to find out from [] the drawing view is. View! That was lucky. It appears there is a view method. Create selection tool, new selection tool, view. Just got lucky there. Try that then.	
124	[compile]	R: Congratulations! Well done! A block! Right I am not going to bother with the symbol or anything.	
125		Right so what's next... so we have got a green thing [to go on] the ground and they have to be a square forty by forty and coloured red. I am going to try and... going to try and fix the size and I'm also going to try and change the colour. Right where to start for this? Fixing size... R: Can I interrupt just now to ask how you are feeling about writing source code as opposed to just talking about the solution? Do you think you would be able to go into the depths of the problem without using source code? No I'm not sure...I wasn't sure... It is certainly very satisfying to get that because I wasn't sure about where I was going. Certainly that business I think was a big issue with the	Not looking at documentation
126		...getting the subclass I don't know that the information was around there and that really frustrating... I think if you didn't have any experience of HotDraw getting that subclass would have been... R: Are you happy to be using the code for the rest of this exercise? [or do you want to try some just as design?] No I think I'm quite happy to keep going with the code. The other issue that I am aware of at the minute is that I'm not really coming across issues that... I've spend a lot of time without coming across the main issues that you are investigating hopefully these will [come up?] R: [don't worry Im seeing plenty of interest] Okay. So I want to get fixed size and colour.	
127	PL Using creation tool PL Identifying existing figures PL Overview PL Modifying existing figures	[I don't think I want to look at the code] so I'd go back and see if there is anything here that is going to help me...change the colour, change the size (sigh). Figure Hierarchy Right Modifying existing figures. (reading pattern out loud) 'The framework comes pre-supplied with many different types of figure. Often developers will find that predefined figures provide only part of the functionality required for	Back to using creation tool

	PL Figure Hierarchy	an application...’ Okay so I just used a rectangle last time see if there is anything to do with squares... and I want to see how to change the attributes... just check, so I’m checking to see if there is anything that would give me the fixed size.	
128	PL Modifying existing figures	<p>Is there an easier way of going left to right here? R: I don’t know if you can use the cursor keys?</p> <p>Attribute figure. R: What has put you on to attributes? Oh there is nothing on the screen about attributes I just saw attribute figure. R: But you said a minute ago something about attributes? Oh I just want to change the size and the colour R: and are you guessing they are attributes or do you know that they are? Well... I’ve use attributes generally but emmm... rectangle figure, diamond figure, right so there is no, there doesn’t seem to be any... I’d expect a square to be there, so now I’m in trouble. How do I change the properties of figures?</p>	<p>Sub having trouble with trackpad (scrolling)</p> <p>Sub is distracted by diagram doesn’t answer R’s question</p> <p>Properties rather than attrib?</p>
129	MA Index MA FigureIH MA Figure	<p>Modifying existing figures I would have expected that to be... ‘its important to develop a good understanding of figures behaviour before sub classing...identify which methods will have to be overridden, which methods... okay I’ll need to have a look at this micro architecture thing now. See what it says about figures. Figures, figure hierarchy...abstract figure... group figure okay back to the pattern language. (sic) So figure. Right point center...draw</p>	<p>Evidence of skimming text</p> <p>Scrolling down large diagram – what did sub get? Reading method names?</p>
130		<p>[how?] I’m going to find out if these methods... get attribute? I’ll find something to do with... I’d hope the colour was fairly easy to set.</p> <p>R: What are you expectations? What are you looking for? Well I... okay it would be nice to see a set colour method, set size method. Now I remember I’m going to have to create my own kind of figure here I think, or maybe... construct the... because I know it uses the prototype design pattern I pass in the created rectangle figure maybe the thing to do is create the figure before passing it in and then change... there is a thing get attribute I’ve just seen... get attribute string</p>	<p>Cant hear start of sentence</p> <p>Reading method name</p>
131		<p>So what I’m going to try and do is manipulate the figure before I pass it in as a prototype and I want to find some ways of manipulating the figure. And the obvious thing to me right here is this thing, displaybox, which is not at all obvious, but I know from passed experience and I suspect if</p>	<p>Sub seems to have triggered a memory</p>

		you don't have passed experience ... you wouldn't know to look at the displaybox. So I remember displaybox being something to do with the size so we are going to play with that. Basic displaybox and displaybox, I want to find, I think [one of those will] set the size	
132	SC AbstractFigure	<p>I like that... dimension Size ah right that just gets the size. Set attribute, there is another thing, Set attribute right I will look at that to see if it has anything to do with colour. I'm going to look at that first because that's... but I need to find out about what attributes are there, so I need to find out, I'll look in the source code to find out [about] figure attributes</p> <p>Abstract figure, we will go for that and see what we get...</p>	<p>Pk about set attribute?</p> <p>That's what?</p>
133	MA Figure IH	<p>... expected to see some attributes. Ah right I remember in the hierarchy. Going back to find the hierarchy for figure. It's a bit annoying having to jump about here, Figure. Abstract Figure what will you show attributes? Nope. So trying to find the one that adds attributes... group figure, round rectangle... attributes... and what happened to rectangle where is it in the hierarchy?</p>	<p>Only scrolled down the first few lines</p> <p>(Check AF doesn't have att)</p> <p>finds AttrFigure</p>
134	SC Attribute Figure	<p>Polygon, ellipse figure, rectangle so it's a subclass of attribute figure but I need to find out about attributes. So go to the source code to find attribute figure beginning to wish I'd used a decent editor. Figures. Attribute Figure.</p> <p>Where are the attributes?</p> <p>Figure attributes? Trying to find out what attributes a figure has...Ah get fill colour!</p>	<p>Sub using Pfe32</p> <p>Again sub has only looked at top few lines of code</p> <p>Figure attributes in code</p> <p>Scrolls into it – accident!</p>
135		<p>This is a convenience method...that's what we are going to use.</p> <p>Get fill colour...get frame colour? Ah right initialise attributes...fillcolour, all right okay fill colour new colour 0x7 ? So, fill colour and I'm presuming its going to be colour.red.</p>	<p>Reading comment</p> <p>Scrolling again</p>
136	SC BlocksApp	<p>Get attributes ... set attributes colour.red go of that. Set attribute...set attribute and so back to my blocks app and we will create the recnagle before we go in here</p> <p>Figure</p>	<p>Continuing to scroll</p> <p>Talking about call to creation tool</p>
137		<p>...f equals new rectangle figure, f. set attribute, fill colour, colour.red.</p> <p>[compiles]</p>	<p>Danger of example doesn't put fill colour in quotes</p> <p>Fillcolour error</p>
138	SC AttributeFigure	[It's a string.]	

	SC BlocksApp	[compiles]	
139	PL Figure Hierarchy	Fixed size next! I can see myself having a second coffee here! Right setting the size how do we do that? I was talking about the... I knew the display box I saw it... was it obvious how to manipulate the size I don't know if its in your pattern language but from looking through the interface for figure I saw these display box methods. Which I remember from previous experience...	App runs - red rectangles Sub is looking for something but not finding it
140	PL Overview PL Mod ex Figures PL FigureIH MA index MA FigureIH	...Right how do I find out the... which one of these Identifying figures, modifying figures or creating composite figures... modifying figures emmm figure hierarchy I was wanting to see the interface. I think it was in the micro architecture. It would be nice to see... It would be nice to be able to look at these methods from here. So I've to look...find which one of these methods can change the size of the figure...basic display box	Back out of FigIH quickly
141		I don't know anything about graphics so... forty to forty... I presume its going to be zero, zero... we will need a point. Need a point zero, zero, and then another point at forty, forty. Oh should be square, forty by forty pixels in size... that's okay. Right is it displaybox...basic displaybox... displaybox, right need to find out about these display box methods so back to the code... I'd rather use JavaDoc if it were here.	Sub reading from tasks sheet?
142	SC Figure	Err where to start? I guess start at the top, figure, so I need the framework and figure. Figure try to find out about these methods...so reading the source code, reading the comments... displaybox 'changes the display box of the figure...only a convenience method...implementers should only override basic display box' [] live dangerously.	Fig is interface Reading comment
143	SC BlocksApp	F. basic displaybox new point zero, zero, new point forty, forty [compiles]	Why use basic DB here – prev comment? Can't resolve symbol –newPoint (i.e. typo)
144		(Subject tries to create with a click nothing happens, drags it to create figure) R: What just happened? Its drawing it variable size. It didn't even when I... what I was ah I don't know what I was expecting though... its when I start dragging, right! Oh ho I'm starting to get excited here. I need to find out what is going on. When it draws this thing...	Subject expected click to work (question what does he think is problem) Trying it again with click (only the code trial shows up this problem)
145		...now its coming back to me...its why... so I really need to find the method that is emmm... I	

		want it as soon as I click to draw rather than me drawing a fixed size thing. Rather than me dragging it draws the fixed size [along]. So what happens when it draws the... when you click on the... drawing?	
146	MA Index	<p>This is interesting. One of the things being that I am not sure that I've got the right method so I want to find out now what happens when the tool starts to draw the drawing view. And I hope this micro architecture stuff might help me, how to find that</p> <p>So these interfaces tell me where I start. Is that what I'm trying to... Where do I go? I'm trying to find about where the figures being drawn or tools... whenever tool creates a figure. Tools have a look here.</p>	<p>(House of cards synd)</p> <p>(does sub mean this?)</p>
147	MA Tool MA MouseDown	<p>Keydown, key down. MouseDown! Mousedown tool.... Selection tool mouse down, mouse down method...mousedown method. Now what do I do!</p> <p>R: What is it about mouse down method that interests you?</p> <p>Well I'm trying to find out what happens to selection tool when I put that down I want, when the mouse down goes down I want that figure to appear. I just want the click so I have now found that...</p>	
148		<p>This has helped me. I started off looking at tools and then apparently the mouse down method is the one that I am interested in.</p> <p>R:What [class?] is that mouse down method?</p> <p>Oh I haven't got that far but that is... you are right I haven't...</p> <p>R: I was just wondering if you had read something on the screen that had...</p> <p>I've read, well I'd got to mouse down. And now I want to go, what am I going to do now? So mouse down...</p> <p>R: Does that blue box say mouse down?</p> <p>Uh huh. The blue box says mouse down and that's the one I'm interested in but I don't know where to go from here. I don't know if any of the documentation, maybe have to look at the... I'm going to look at the tutorial again just to make sure... my inclination is to go looking for a mouse down method.</p>	Does this indicate uncertainty about use of MA doc
149	(MA tutorial) MA index	<p>But I'm going to just check what the tutorial tells me about these blue things. 'blue bubbles represent the called methods...[]...call graphs ... blue bubbles represent the called method. Okay I'm going to look at the source code for mouse down. Now where is mouse down defined? Does this tell me?</p>	
150	MA Tool SC Tool	<p>Its in the tool interface. So I'm going to look in the source code this has told me to look for a mouse down method in the tool...class. Its an interface so its not going to give me much help I</p>	Supposed to use MA IH here!

	MA ToolIH	think. Mouse down right mouse down handles mouse down events in the drawing view, so I need to find a concrete implementation of that. Find the inheritance hierarchy for tool. So tool hierarchy...of course I'm working with creation tool...maybe that's just where I go to right away.	
151	SC Creation tool	See if there is anything in between...nope...okay creation tool defines mouse down it would be nice to go straight there. So we going to creation tool. Framework, maybe its standard I think I've already been here...creation tool. Mouse down. New point created figure equals created figure, create oh aye! Create displaybox. Okay so I'm going to override mouse down method in creation tool.	(Navigation improvement) prev sensitised to dB
152		R: Why [annoyed]? Because I'm going to have to write my own creation tool class R: [what is it you are going to do then]? Good point I want to do more here than do this. I think I know what I'm doing here well I'm not sure of the exact answer because I'm not sure I would get mouse down right away. [] tool, but I'm fairly sure by playing around with the mouse down method I could get ... or I think I will. First of all I'm going to have a break. (subject leaves room 117:40)	
153			
154	SC new SC blocks App	(subject enters room 119:05) I'm back, and eh right I'm going to have to create a new version of creation tool that...oh dear[how do I do that?] and then I have to plug it in to the rest of the framework. So here we go... new class all he import stuff and everything so... well just hack it out of that last thing I created which was blocks app ... get all the imports and stuff.	Takes cons as well
155	SC New SC Creationtool	Problems with the mouse again! Copy. Paste. Right. So I'm going to write what is it I'm writing? Creation tool? Blocks Tool... don't know what I'm doing... creation tool.	Sub cant select imports all at once. Forgotten name?
156	SC new (blockstool) SC Creation tool SC blockstool	So blocks tool extends creation tool...blockstool...so need to find out what its constructor... I don't know where the constructor for creation tool has any arguments. It does! [] a view and a prototype	Arg for const different
157	SC creation tool SC Blockstool	So Drawing view and a prototype... hat did it say? Figure. Super. Just pass it on. I now need to add the... I'm just going to add the, hopefully just add a mouse down method to this.	
158	SC Creation tool SC Blockstool	I'm going to cut and paste the mouse down method as a starting point.	(sub worried to replace all behaviour?)
159		And I'm going to save as blocks tool.java. Mouse down anchor point new point x,y. Right wherever the mouse is clicked create the figure that's okay. Displaybox...anchor point to anchor point... so	First time sub has looked at code? Createfigure is a

		that is presumably why it has no size. What does the create figure, []. Right so its creating a figure and then...	method
200		Okay so we have got figure [] it's a rectangle and I've already set the [] to set the displaybox... create figure is the... I don't want it to create figure [] application. Okay I create it there and I past it in. Now the thing is maybe I need to go back there...	
201		...so if I have created it properly I'm passing in the [] drawing. [] create it outside, either that or... The problem is... mouse down is creating a new figure and I've already done that. I think, I presume its going to be [] I'm guessing that... R: Why do you think that? Why do I think it creates a new figure? Because it says fcreatedFigure equals createFigure. R: And are you happy [that's what that does]? Cos that's what that... I guessing that it's a factory method. Because the name suggests create figure.	
202		Ah! fanchorpoint, fanchor point equals new point xy which is where it is created okay so it clicked fcreate figure okay I maybe need to look at what create figure does but created figure anchor point to anchor point. I'm thinking of just commenting out that create figure assume the figure has been created its pasted in... all I'm doing is passing in a clone create figure is going to clone that...	Perhaps problem is trying to understand the operation of a class through one method?
203		so that is going to clone what was passed in... ermmm right try something here. R: []? Okay the problem was that the, I thought, I hoped that I had created a fixed size red block but that wasn't working it was dragging so I'm trying to now the mouse down. It appears when you push mouse down, the mouse goes down and it creates, it then creates a variable size...[of course] when you drag you create the size	
204	SC Creation tool	So I need to find out actually what is going on here. There is a new point, create figure I'm going to [] ... so back to creation tool create figure. Create figure, yeah it clones it. So that creates the figure, f.createdfigure displaybox, so it sets its display box just to be null, view add created figure. So its added it just as a point. But now if you drag it gets bigger. What I want is to add it as a full size and not allow any dragging	
205	SC blockstool	But its adding to the view the created figure? So if I just said displaybox fanchor point and changed the size to be plus forty se what happens there. So I want this point to be... fanchor is a point	

206		So need that to be new point fanchorpoint.getX plus forty and fanchorpoint.getY not sure if these are the right methods, but I'm just going to try them so I need to	
207	SC BlockApp	Just change this I'm now going to use... blockstool to create and I'm going to take out this fixing the size here. I expect it to appear as a forty by forty block but still be draggable [compiles]	Comments line out
208		Nine errors! New point... lets have another look at this...	Anchor point is private Sub doesn't seem to pick up on this error
209	SC Blockstool	Oh no! fanchorpoint is private access (sigh), fcreated figure is private access [] bad practices re-declaring variables in a subclass with the same names as the inherited ones	Sub makes variables local
210		[Compiles] It compiled! Oh aye!	Sub going to save then changes mind and renames variables to ap and cf Runtime expectation
211		Can't find the blocks tool. Blockstool, blocks tool. Maybe it is saved name... nope blockstool?	Cant find blockstool
212	SC BlocksApp	BlocksApp.	
213		A runtime error ermmm its not finding one of my classes Its not finding blockstool, lets try... javac blockstool compile it separately. [compiles]	Sub does dir at prompt 2 errors anchorpoint private and can't find point
214		Point. There is no constructor double double? Ha So need to find out about creating points. What is it saying? Does get x does it return a double? R: Yep Is there an int version? R: No I don't think so.	Sub replaces left over anchor point
215		You can access it directly can't you? R: Yeah. [compiles] Right. R: Whoa what is happening there? We have got well, block we have also got a null pointer exception	Sub is casting to int Figure appears at right size by list of exceptions appear at prompt
216		That might be... so we have got a null pointer exception, right, creation tool mouse up ah ha! Okay which is perhaps understandable because I've just done the mouse down and I was	

		expecting... emmm and you usually draw it by dragging and then taking the mouse up which I don't want to do. Somehow what I've done has caused a problem for that. So I need to find the sequence of events need to trace through [those three] and what happens on mouse down, mouse drag and up. So we have got a null object and a null pointer exception happening in mouse up which is in creation tool.	(Advantage of runtime)
217	SC Creation tool SC Blockstool	Right look in creation tool or [maybe the tool]... Mouse up its created...figure. Okay I overrode so I haven't, its created as null because I didn't create. What is the name of that... was it blocks tool [cos I called it Cn]. So the figure... hmmm [create figures], presumably the parent class is null...	
218	SC Creation tool	Which is this private variable. We need to [use the... okay] so how to do that? If created equals created figure ...	Reading from MDown
219			[subject is reading code – muttering hard to distinguish]
220		So I need to affect the created figure variable which is [] private in the parent class and there doesn't appear... there is a get method [maybe the hierarchy will help me] out.	
221	PL Figure IH MA FigureIH	This one hasn't got any methods!	Reading method names (on figure and abstract figure)
222	SC Creation tool MA Tool IH SC Creation tool	This is the wrong micro architecture! So tool... [alright there is tool] R: What are you looking for just now? Still struggling with trying to get... to find a method that gives me access that is private. I want to set this... the other way of dealing with it is to override...	Couldn't sub override the Mup?
223		Ah we are going to have to override these... R: One thing that I should say is that the micro architectures only show the overridden methods not the complete class but I don't know if that tells you... what you want. Right. I have got this issue here. I need to set. The problem is having sent mouse down which seems to be working okay. It means there is then a sequence of method calls that includes mouse up and I haven't set figure properly. The variable is private so I need to get access to it and I don't know. There doesn't seem to be a method for setting. What I want to do is... set that need to set that figure variable I have found a get method but I haven't found a set method	

224		<p>The other way of doing that is to change the mouse up method or the sequence of actions which I don't want to do. I don't want to.. Lets look at [] again, because What I do want is... just draw uh ah okay, just checking, it was working okay. Its not expecting me to drag its just drawing it.... This is fine. This is important though.</p> <p>R: So in short you think there are two ways of doing it?</p> <p>Two ways of doing it. One, I'm changing the sequence of actions so it not longer does, after drawing the... but I don't like that so after doing the mouse down</p>	Goes to running application
225		<p>What I will do, is presumably the sequence of actions that does it invokes a mouse up. When it invokes a mouse up its going to do something anyway I can't [] get it to do, but I'm worried also that you have that and I haven't set that... the created figure attribute properly... which presumably, I think is very dangerous not to do. So I must set... I must get that attribute set up properly. You have just told me maybe there is still a method, I don't think that there is a method there. So it takes a... see creation tool</p>	
226		<p>Here we have this variable so the methods to manipulate it should all be in. Is only declared in creation tool so any methods that manipulate it ... you have got mouse down[], mouse drag, mouse up, that gets the created figure.</p> <p>I think I will copy these methods into the...I have seen this before with others who had problems with private.</p>	What?!
227	SC Blockstool	<p>So I'm going to create my own creation tool that is parallel to it...so I'm changing</p> <p>R: [Are you worried about that? Duplication].</p> <p>[]</p> <p>what am I going to do with my existing method? I don't want to override the method that already works. Paste. Okay.</p>	Pastes all of CT into blockstool
228		<p>So what I'm doing now is instead of creating a subclass of creation tool I've moved up a level.</p> <p>R: How do you feel about doing this?</p> <p>I'm not that happy about it. I have seen it used before though I wasn't that convinced about it was a...</p>	Pastes new mouse down back into place
229		<p>I'm surprised and I would expect there is a better way of doing it. Multiple students have told me I need to do that.</p> <p>R: Would that be influencing your decision?</p> <p>Its convincing... yeah I suppose it is because I've heard it from two or three sources so... and having had a look here I can't see...</p> <p>R: Can you define... tell me more about the nature of your concerns why... is it the private variable?</p>	

		<p>Well I need access to it because other methods, inherited methods are using it and I don't seem to have a way to access it.</p> <p>R: But why are you concerned about it?</p> <p>Because the other method that... mouse up uses that variable and I don't want to I'm concerned about just, you know I could write a new version of mouse up but I'd then have to find out everything that that's basically what I'm doing I'm copying across...</p>	Not thinking about super calls?
230		<p>All this functionality at mouse up. The other way of... would be to write a subclass that... has a new version of mouse up in it. And this is saving me doing this.</p> <p>R: Why wouldn't you like to do that?</p> <p>Why are you asking me that? I want to get on with this?</p> <p>R: No I think we will stop now...</p> <p>No I want to see if this works...</p> <p>R: Okay.</p> <p>But why would I be worried about it? I would be worried about it because I need to find out about the functionality of what is already in there.</p> <p>Looks like the source should extend abstract tool.</p> <p>Now I'm in trouble.</p> <p>R: Why?</p>	<p>!</p> <p>Subject had enough questions</p>
231	SC BlocksApp	<p>Because it also inherits from creation tool.</p> <p>Hmmm complication, creation tool equals new blocks tool... I'm in trouble.</p> <p>R: Okay well if you would like to stop there...</p> <p>Ah dear it has frustrated me now.</p> <p>R: I think it's best if we stop here.</p>	Talking about mouse down method?
232		<p>So its going now?</p> <p>R: Yep we should be recording so...back for part two!</p> <p>And still no mouse!</p> <p>R: Will I try and get one?</p> <p>That would help because...</p> <p>R: Ah that one can't ... unless you have a mouse that is usb?</p> <p>No...</p> <p>Okay so what was I doing? Yeah I was writing this new class. It would be a new tool... a blocks tool. I thought the mouse down method was working okay. And I had...so... the reason I was doing this was ...</p>	<p>Sub accidentally minimises app</p> <p>Other mouse is PS2</p>
233	<p>SC BlocksTool</p> <p>SC BlocksApp</p>	<p>The mouse down method... using local the local figure rather than a figure that is shared amongst all the mouse methods. With created figure ...something has gone... so its back to that method got to go back to the tool to see if you can... back to the application to see if you can add this tool in. Creation tool equals new blocks tool, can't do that so hopefully the toolbutton will</p>	[sub has cut creation tool into blocks tool]

		take any kind of tool so...	
234		Create a blocks tool, new blocks tool and pass in... create tool [] abstract tool. Try this [compiles] Ah! Geese! R: Eighteen errors I assume I'm compiling files that I don't want.	Sub uses javac *.java Sub del Mapp.java
235	SC BocksTool	[Compiles] Obviously something up. Hmmm hmmm. Just have some stuff that I didn't need.	13 errors sub has copied package stuff as well as class
236	SC BlocksTool	[compiles] blocks tool invalid method... called it creation tool	9 errors constructor still says CT (problem with cut and paste) Sub does find and replace for CT
237		[compiles]	8 errors
238	SC BlocksTool	[compiles] class blockstool extends abstract tool... cannot find abstract tool.	Sub missed one cons. 7 errors
239	SC BlockApp SC BlocksTool	[wonder if we are] importing abstract tool There are some imports missing!	Sub looking at imports Sub cuts n pastes imports
240	SC BlocksApp SC BlocksApp	And there was a typo some where... blockstools... line 24	{Sub goes between two different files with same name?}. Changes typo
241	SC BlocksTool	I think I've just corrected some syntax errors. [compiles] back to my old friend. FCreatedFigure... can't resolve symbol created figure in blocks tool. So...	1 error- cannot resolve symbol fCreatedFigure.
242		Stupid typo... [compiles] Aww Come on... sorted that introduced a new one...blocks tool. It is it's the same problem, I've got to go back to the... get rid of the... go back to the old instance.	Previous modification making local created figure still there 2 errors
243		R: Does that apply to the anchor point as well? No I think that is okay as a local variable. I'm going to go with it but I will get this runtime	

		<p>error I'm still presuming. [compiles] Right so need to create a rectangle</p> <p>R: [have you thrown any exceptions? No? Why not?] Haven't a clue. Why...</p>	
244	SC BlocksTool	<p>Oh because I've created the right figure... of course because the last time In the subclass I was just creating a local which was also being passed, which err which I have now done. Okay Good. R: Right where do you feel that you are now in the task? Quite near the beginning. (laugh) R: What do you feel you have got? I've got these red blocks which are... when I click a fixed size and colour, but I think I've got a lot of hard work still to do. R: And can I ask in your current implementation there... can you change the size of a block?</p>	App still running
245		<p>Ah, I suspect so...yep R: You can't change the size of a block when you create it though? No. R: Even if you try to drag? It doesn't go on to... well we will try. It doesn't really give you a lot of... maybe with a proper mouse. R: When you click and drag you don't get a box up? It is difficult to determine holding down and ... you see the mouse hasn't appeared until I... and I'm not sure whether that is my mouse action. Do you want to try?</p>	Handles still work.
246		<p>R: Okay so click down and then... no I think that just on click down it creates the figure. I'm not sure it does but... R: It does... you create the figure on the mouse down event But don't give them the... right. Okay so what does this sheet say. The block should be square... but it doesn't say at all times. R: It was implied though. Okay so it should be constrained to only exist on the... do you want me to go on and... R: Yeah please feel free to go on... Getting rid of the handles and stuff is...oh I might be able to do it. But if I did that...[I would] know that was something. R: That's fine. I'm not saying I can do it might not be [] use of the documentation. Right I'll try doing it</p>	
247		<p>One thing I'm not happy with just now that I've just noticed is my constraining of the blocks is split over two methods. I create it before I pass it in here and constrain the size which I don't thing is a good thing. In the mouse down method R: What two methods is it? The mouse down</p>	

		<p>and?</p> <p>Another class where I create the [block]. I don't thing that is good...but I'm not going to worry about that.</p> <p>Okay so trying... I know that's to do with, these things are to do with handles... I think. I'll go back and look at...</p>	
248	PL Overview.	<p>Pattern language... create handles. Yeah directly manipulates using handles...to add handles... to add a handle... create custom handles, that's if you want to do something with its shape. I just want to know how to get rid of them, so you want no handles so this wont... I want something that talks about null handles or something. I'm going to try to do it. I think by looking at the pattern language but it seems like I want to override...do something to the handles method and just make it empty and so it looks... from what I see here... I can override the handles method and don't add any.</p>	<p>(the handles shape)</p> <p>PK?</p>
249	<p>PL Overview</p> <p>MA Index</p> <p>MA Figure</p>	<p>That might do the trick. Just make a null handles method. Question is what are we talking about is it the handles... its a figure. [But] to do that.</p> <p>Where to add handles to a figure so... I'm going to look at... just to see if handles is a method associated with figure which it suggests.</p> <p>The best mechanism I've found for finding methods... well its not complete... just going to look at ... [Vector] handles. It returns them?</p>	<p>What do we think about PK?</p>
250	<p>PL Overview</p> <p>PL Create Handles</p>	<p>I think I'll use the pattern language. Err creating handles.</p> <p>Add... to add handles to a figure. Public vector handles so that returns the handles, but what does it do with them?</p>	<p>Interaction?</p>
251	<p>MA handle</p> <p>MA Figure</p>	<p>Return ah maybe the figure... right. So</p> <p>R: What does the figure do?</p> <p>Maybe the figure uses that method... err so I want to see how it happens... wait a minute maybe you, this is an opportunity to use the... find out the context of the use of the handles method. So need to go to micro architecture... I want to find out about handles where it is used. So Handle. Nope. Its in figure the handles method. Handles.</p>	<p>Wrong place!</p>
252	MA handles	<p>Standard drawing view, decorator figure... figure uses it.</p> <p>R: Figure uses it?</p> <p>Well decorator figure. That is what that's told me. Decorator Figure[. (sigh)</p> <p>R: Is decorator figure the only thing that uses it?</p> <p>Well there is drawing view, drawing view.</p> <p>R: Drawing view and border decorator.</p>	

		Yeah. Well	
253	SC blocks tool	<p>Aye so maybe drawing view uses it to put the handles up. I don't want to know how to get the handles up. I want to know how to set... okay so if I write that handles method as null it will get me there.</p> <p>That's strange. What I'm trying to do is set the handles. This seems to be saying get and return them. Which is what I'm going to try.</p> <p>So my figure ... override the handles method.</p>	
254	SC Figure	[static] write my own figure class... that got me into trouble the last time.	
255	SC BlocksTool		<p>Seems to be looking for an open source file (flicking through options)</p> <p>Seems to want to cut and paste imports.</p>
256	SC Blockfigure	<p>Okay so I'm creating a new block figure, extends rectangle figure, I think it is. Let me check what the constructor looks like... before do that better save this...</p>	(subject regrets not using RealJ easier to manage files – not transcribe as brief comment)
257		What I'm going to do is start up... I'm going to use real J for browsing some of that... going to use realJ for browsing.	
258	SC RectangleFigure SC BlocksFigure	<p>Figures... rectangle figure. Its got two constructors... [two points]</p> <p>Public blockfigure</p>	
259	PL Create handles	<p>Public vector handles ... returns a new vector an empty vector.</p> <p>[check that] vector handles... add handles.</p>	
300	SC BlocksTool SC BlocksApp	<p>Need to change emmm, think its blockstool, nope, blocks app. The place were it creates...</p> <p>A block figure. Try this.</p> <p>[compiles]</p>	
301		<p>I'm suspicious of that.</p> <p>R: how? Was it too easy?</p> <p>Right.</p> <p>R: [can you still drag the figure]?</p> <p>No can't move.</p> <p>R: Can't move.</p> <p>Can move</p>	<p>Sub ditracted by app opening. App works</p> <p>Sub having problems dragging</p>
302		<p>Happy with that? Its up to me?</p> <p>R: Do you see any weakness in that?</p>	

	PL Create handles	<p>You don't know if its selected. So I could have [] handles which is what you suggested I do</p> <p>R: Personally the solution I was looking for was to use null handles.</p> <p>What are null handles?</p> <p>R: Null handles are handles that allow selection but have no behaviour.</p> <p>Right how would I... okay. I was aware as I said I was slightly aware that there was a null handles around but how... okay the question would be there is nothing I saw looking through. I read this and I saw handles and I didn't see anything that would</p>	
303		<p>That suggested the possibility that [well ...] from null handles.. the other thing now that you have said that which I would have tried to have done. Is rather than remove the handles remove the behaviour of the handles which I guess is what null handles does but not knowing about null handles... unless I'd maybe looked at, where would I have looked to have found that? I would have probably ended up trying to do it myself.</p> <p>R: Okay.</p> <p>[]</p> <p>R: That is fine.</p> <p>So I'm fairly happy I think with my blocks what I want...going to try and get my line in.</p>	
304		<p>I'm going to try and get my line in along the bottom of the screen.</p> <p>It's a different problem. I don't want to use a tool. I want it just to be there. I'm aware of having seen in the past and others having problems doing that. I want the application to kick up with a black rectangle.</p>	<p>Sub reading ground def in task sheet</p> <p>Prev. knowledge</p>
305	SC Blocks Application	I want to add a figure to the drawing as the thing starts up. I'll go back and look at my draw application code. What happens when the drawing is created?	Reading create tools
306	SC DrawApplication	<p>My temptation is to look at the code.</p> <p>R: What are you looking for?</p> <p>Something like create drawing.... Init Drawing! ...Create drawing, returns new standard drawing...</p>	
307		I'd override create drawing and do new standard drawing and add figure to it.	
308	PL Overview PL Customising the DA	<p>So, what methods? Standard drawing is a drawing. Lets see pattern language.</p> <p>That encourages me!</p>	Quickly sees create drawing (in bold)
309		I'm going to try this create drawing	Sub cuts and pastes existing definition into own code
310	MA Drawing MA Add	<p>How do you add a rectangle?</p> <p>This is how it is called not how it is used! (sigh)</p>	Sub sees add immediately

311		Need to create figure. What controls the position of a figure? Display box controls the size of it, that might be it! (sub guesses parameters for Display box)	
312		Not at all sure what I am going to do here. Trial and error... Don't know if I'd find anything in the pattern language that would tell you how to position? That is forty What is the coordinate system? Never did do graphics.	Sub is trying to position figure Sub is estimating distance either side of ground for positioning purposes
313		R: Where is zero, zero? Top left (details about coordinates follow - omitted) At the back of my mind others always had some problem with figures popping up at the origin. Will I make it black?	Hard coding solution - bad Sub is coding (prev. exp)
314		I'm going to make it black. I know how to do that!	
315	MA Drawing	(Complies code - 3 errors) Drawing doesn't seem to have an addfigure...It's just add!	Sub has three errors to debug
316		Forgot to return drawing! That was just me because I wasn't copying	
317		(Runs)	
318		Not bad not quite what I wanted! Going to shove this up a bit.	Ground is lower than sub would like.
319		This is starting to get interesting! Create blocks... block should be constrained to only exist on the ground or perfectly aligned on top of another block, there is no limit to the number of blocks... so how do I? What's wrong? R:[] No this is where it is starting to get interesting!	Sub is reading constraints task Loads up the application and creates a few blocks (Reading task constraints from sheet.)
320		But I'm thinking...whats the...have I to place it exactly there or just place it and it drops onto the ground? R: I will [] talk about that. My assumption was that no matter where you clicked it would create at a valid position. Okay but then...okay it always goes onto the...there is a problem well when you said that there is always going to the...geese. Of the ground...of the ground, but so... R:[...blocks] Lets try and get it on the ground then, see if we can do that for starters. So I want this to always	

321		<p>To appear on the ground but I don't want them to...so I always when I create it want its position to be... do I click then?</p> <p>On the ground and I want them to move across [] the next one to be beside it...or on top of it. Just piled up on top, is that a reasonable...[]easy way of doing it. But then you can move them around, [] select [then and then] move it to a new position</p>	
322		<p>The selection issue...to stack on top to move it from [] existing. Only the tops the top blocks... it needs to know where are the top blocks so its just something needs to know...</p> <p>Need to know where all the...all the piles of blocks and which block is the top block in the pile. So a block needs to know whether its..one way of doing that would be for a block to know if its sitting on top of it.</p>	
323		<p>Of if it's a top block [] a block just needs whether it's on top.[...then comes off]</p> <p>The problem is when you take a block that was on top and switch it to be...well it depends where it goes it might still be a top, but the one underneath we want it to be...need to be able to access that.</p>	
324		<p>So that it could maybe know if it was the...a top block</p> <p>We also need to know where blocks are currently positioned...so that they don't clash and so that you can check that a block is completely on top of another block.</p>	
325		<p>How would you know if something was at the top? []</p> <p>Right. This is not something I should do piece by piece because... R: What are you thinking? ...worried that doing it piece by piece could end up in trouble. Okay I'm going to try and think of the main things that I need to do here. So have another look at the requirements. First one is... a block</p>	Sub is talking about design
326		<p>New blocks are positioned...positioned only on the ground or on top of another block. [Need a] Top block. Okay and moving blocks...same kind of problem positioned on the ground. Clear ground so need to know... have clear ground. I don't know is this the same problem here? Clear ground and whether it's the top block? When you move a block... the block underneath you becomes the top block</p>	
327		<p>[]Top block. So there is this business of when a block moves in here it needs to know where to move to [] so have it sitting there. So a block</p>	

		<p>must see which block it is sitting on.</p> <p>[] ground.</p>	
328		<p>So...</p> <p>How to do this? Two thoughts in my head from my previous experiences. One thing I'm thinking of a, of doing something with a composite figure or a group figure that holds all this information but I'm not sure that is the right approach. The other way I'm thinking of is connections so... ack don't want make explicit connections so block is connected to the ground when it is added. So the ground knew its position and a block was connected to another block...</p> <p>R: Which way are we going to go? [] first solution[]</p>	<p>Sub hasn't seen drawing is comp?</p>
329		<p>Because I was more going towards the second one but I don't want to have to move.. to make connections. Err I don't know I'm not sure except that I know there is the ability to move figures within the...I'm thinking about a group figure... it has some global knowledge about all the figures within it.</p> <p>Err (sigh) Definitely. I don't like the idea of the connections, you don't want to be drawing connections. The other thing is just the manipulation of the drawing and trying to find out what state the drawing is.</p>	<p>(could create in code?)</p>
330		<p>A lot of work to do... I wonder though if I had emm find out, if it was easy to find out okay I wonder drawing knows about figures and the drawing... and the figures that are there. I know that we need blocks and they know where the ground is. So if we can iterate we can find, easily find out the properties of a block, the interesting properties of a block the drawing [] actually a sort of brute force [] drawing to see what figures it has. I think we could go that way.</p>	
331		<p>So I'd like to find, I'd like to have an easy way of finding at least two things about figure, where it is... where its position is and [] whether a figure has something on top of it. Do it by brute force... whether it has another block on top of it. I would like to know, I would like to know if a... if a block had something on top of it rather than interrogating the drawing methods to find that.</p> <p>R: What's your expectation of... if you could describe for me how you would actually use this system. In terms of when you take a figure. What kind of sequence does that give? Do you know what I mean?</p> <p>Mmm hmmm. So when you create figure...</p>	
332		<p>[] When you click on it I want it either to appear on the ground or on another block and that any. What you can do after that is just move that along the ground. Position it somewhere else on the</p>	

		<p>ground just drag it and...</p> <p>R: When you drag it can you move it up into space or is it only dragged into valid positions?</p> <p>R: And when you click to add it does it add automatically or is it added somewhere in relation to where you clicked...</p> <p>I was thinking... right It would maybe just appear anywhere.</p> <p>R: Anywhere.</p> <p>Mmmm hmmm.</p> <p>R:[is that at random?]</p> <p>No [I think I'm just going to put it the] next place along or on top of a block.</p> <p>R: basically programmatically then... but the user would specify with the mouse some where over here?</p>	
333		<p>[]</p> <p>R: Do you want to back off now and try doing it with out source code? [] or do you want to continue just as you have been doing?</p> <p>I'm quite happy continuing its not that it's, at the moment it's not the source code that is the problem it's the challenging problem of getting this... I suspect the source code might become [] take a long time to [develop]. What do you think?</p> <p>There may be more...</p>	
334		<p>Obviously if I get further.</p> <p>R: I am worried that we might not get the kind of quality and detail if you are not programming. I think that you actually being there is helping you think through and see all the issues that you are going to have. [might not] get as far but...</p> <p>Okay I'll keep going. I'm happy to do it until say four o'clock or something.</p> <p>R: You shouldn't feel under any obligation.</p> <p>No, no I'm finding it challenging.</p> <p>R: Are you finding it enjoyable?</p> <p>To some extent. Every time it works I'm finding it enjoyable but...</p>	
335	MA Drawing	<p>I'm a bit intimidated by this in that I suspect to me it's the kind of thing I need a wee bit [thinking] about to solve the problem rather than solving one particular [element] I'm trying to design it. Looking around the framework to... [] just find the next thing [] do these kind of things. I will see if I can get... maybe break it down into something that's sensible... Okay one of the things I'm going to do is if I go for this... assume I can get it all done in drawing. Its just in the drawing then[]... well I want to see what methods are in the drawing... to decide whether. I can use the drawing as a sort of store for all the figures.</p>	
336		<p>So well there is add... ermm listeners don't know how to use... figures enumeration okay. So I can get figures back out. Go around the [find out the</p>	

	SC BlockFigure	position] of figures. Maybe I can do it with that? I think we will just add a wee method to my blocks... my block figure. I am giving it a wee Boolean, just Boolean.	
337		clear equals, won't initialise it. This is whether it has got something on it. Just initialise it in here, clear equals true ermmm R: Where clear assumes there is not a block on top? Not a block on top it will also have get and set methods... get clear...	
338		...public void set clear...just make it clear...public void unclear	Set clear sets it to true
339	MA Figure	I also want to... I think I want to find out the general position of a block so it might be that I can use a method already in figure. Point center that's what I was interested in... center. So now I need to look at the code to see what center does. I also want to find out the general position of a block. Maybe I can use a method in figure?	Past tense?
340	SC Figure	Gets the figure's center. Yep that might do. Right have a centre err ha just thinking about clicking and making it go to the nearest point on the [] on the ground.	(why look in interface?) Does a find for center
341	SC Block figure SC Attribute figure SC creation tool SC Blocks tool	Right got to do that. For the moment I'm just going to do it so that when it clicks it goes on at... on the ground anywhere [] So I was wondering what happens when it clicks outside of the ground. One of the ways is to make the ground dead long the other answer is if its beyond the left or right is to bring it in to the ground. So I'm going to try and add it now so...	Looking through open files
342	SC Blocks app	Create figure. I have got the co-ordinates [of the graph] Forty, two fifty, two sixty and three hundred and so the middle... the centre is going to be twenty I think so it should be twenty above.	Reading co ords for ground (reads in funny order)
343		Centre, should be in stead of top left hand should be... two ten, so blocks should be created at two ten something. The top corner should be... two ten and the bottom should be two fifty	
344	SC Blocks tool	Create figure ah its display box okay. So want the point it was created at to be [] x and ys on the same range then... three hundred then it just goes down other wise if its less that forty its [] back to two sixty. Right so create figure... if x... is it x?	
345		[] high or as low as you like when you click,	

		greater than or equal to forty... less than two sixty and that's it, created figure, display box.	
346		The x co ordinate is legal so you would [] That's okay so you want that to be top left hand... but keep the x where it is.	
347		The x is going to be the top corner so it will be new point... That is the x co-ordinate in the top left hand corner so...always going to be forty above. Two fifty.	
348		Two ten? The other new point is going to be... move the x along but its going to be two fifty	
349	SC Block tool	[compiles] Do you see it! R: Right good. It doesn't work... if I do one here its doing nothing. R: Have to got it selected? I haven't... I was going to get it so that it zaps in but one possibility is that it does nothing. R: There is actually a consequence of having to change the block too that if you	Block on line.
350		Drag it out there and then bring it in will it do it? I was going to come to that... because I think that's just the same as I click here and then I move it. Maybe I'm doing too much here R: I don't mind the amount of code that you write because I think that a lot of the problems you have is in the mixture and you have to write some code before you get there. Don't want you to worry about where these things [].	(Mixture between custom code and fw.)
351		Copy and paste. R: What are you doing just now? I'm just dealing with the two other cases. If x is less than forty...so if x is less than forty the x co-ordinate is forty two, two ten okay.	Sub is copying line sets size & position of figure
352		So this one here is going to be... at that side (sigh) two sixty.	
353		Two sixty... two ten. And this will be two fifty. [compiles]	Clicking off the side now creates a block on ground.
354		There is something else up here or [is this coming along] adding figure. Figure is being added to a view. View add figure so it is not adding to... so it's not being added to the drawing. So what does view.add actually do? So I want to find out what view.add figure actually does. I presume it does add it to the drawing because that's what the	

	MA DrawingView	<p>framework used. What's the best way of finding that out? Not sure the pattern language would tell me. I hope that the micro architectures... the drawing view</p> <p>There is something else here. The figure is being added to the view not the drawing? What does view.add do? Add figure I want.</p>	
355	MA add MA DrawingViewIH	<p>You see there is something up about the...about this I'm wanting to see... and I've found this a number of times looking at this. This is telling you what calls that and I want to see what adds doing.</p> <p>R: That's what the other view shows... the hierarchy view. The definitions of add. Then you need to go and look at the source code to see what add...</p> <p>Right. Right okay so what was that drawing view, hierarchy... add it doesn't tell me.</p> <p>R: All that's telling you is that that is defined you know that if you look at the drawing view hierarchy that that is the definition of add and indeed that that is the only definition that you need worry about.</p>	<p>Sub clicks on add</p> <p>(slightly inaccurate as sub is pointing to interface)</p>
356	SC Standard drawing view	<p>R: It's a bit crude but it is only a prototype. So add. Standard drawing view. So I want to see what standard drawing view add does.</p> <p>Add figure... drawing so its adding the figure to the drawing. Right okay right so I've got them adding now I need to get some semantics in them.</p>	
357		<p>[] Which do I do next. [] top of blocks so instead of just adding willy nilly to no that...I want it to go what I want to do is if there is a block below it what I'm going to do next is if there is a block below it when I add it that will go on top of a block. Is that going to cause me problems later on? So if I concentrate on the adding</p>	Sub has application up
358		<p>I can achieve the moving [] just drag and click and its going to be the same mouse down... I want to write a method somewhere that... is going to... so I click and its going to go to the position vertically below it. It is either going to go if there is a... what I want to do is if there is a block anywhere below it I want to position on top of that block. []</p>	
359		<p>Are you happy about me just trying?</p> <p>R: No that fine, I'd say that you either do that one or you deal with the movement method.</p> <p>Right think about what I'm doing here, need to pick up...so at the moment I can... you see I think that is just...</p> <p>When is the mouse, [on this keyboard]? when is the mouse up? So the mouse is down...I'm doing a, holding the button down that's the drag and mouse up that's when I want...</p> <p>R: [mouse down] happens as soon as you press...</p>	Sub goes to application and moves a block off the line and is placing it onto another block

		Yeah I'm talking about this so yeah, I now understand that. Dragging, mouse up is when I let go...	
400		Of that, there. R: Yep. As opposed to [] so that's mouse down and mouse up? Okay. So when I mouse up I want it to drop. So this... one of the things I could do is look at...[after I've] dragged this up I do mouse up I want it to go boom back down to. So the same functionality I've got at the moment, when I do mouse up here I want I want it to fall to earth in the same way that it fell. Ah so I'm not to bothered about that anymore. I'm bothered about getting it on the block. If I can get that going on this thing I would be delighted.	(does sub know this is different tool?)
401		Okay so I want [want it ... out] the problem being I'm doing all this work...in the creation tool. [] Okay so if I put some functionality in here and that functionality I'd want to be shared with where ever the selection was going to involve []. Errr just going to try to get it out see what [we have got]....	(good answer would be sub-tool)
402		So I need to know, what I want to do before I position it, I need to know is there a block? Ah right Its not just any block it could be we have got a pile of blocks... So is there a block? What block okay what blocks are directly below it?... Or above it? What happens if you drag it, what happens if I drag this down to here?	(Opportunity to thing of pile as object?) (underneath line)
403		R: Nothing will happen. Yeah but ultimately. I take it down there and it does nothing. It just jumps back... no it doesn't. And what happens... I wonder what happens when I create a new block? Okay. Right so I want to find, is there a block...I want to find the top block on that vertical. So I want a message that gives me the co-ordinates, give the point of the top block ...	(Interesting episode, building dynamic knowledge?) creates new block under line (it appears on top of line)
404		In that vertical. Anywhere within the co-ordinates... to do that. So I've got to have... a block that's fine but errmmm... so we have got x []	
405		And I want to find any... I want to find the highest block that goes from the ground which is two fifty [] so going to use [] to see if, to find out [] figure and what I want it to do is return and the co-ordinates of this should be drawn or the co-ordinates of the highest block. So want it to return [] the top left hand corner which is going to be [drawn].	
406	SC block tool	So I want to write a method that is going to go through the drawing given actually just the top left corner of a block to find out the place at which its going to be drawn. So with that method it is going to interrogate the drawing...can I get access to the drawing? R: []	(not good oo solution) (where is method going?)

		So I what to know [] access to the drawing? It has access to the view! And we know that the view has access to the drawing.	
407	MA DV IH MA Tool IH	Again could look at the... but there are no instance variables in this. Find where we want tools... Tool Hierarchy. Going to have a look at that.	(why want instance variables?) scrolling around
408	SC Abstract Tool	Drawing view. Want to interrogate the drawing from the tool and the tool has access to the drawing view, where I know I can get the drawing, from the drawing view. Okay. Go with that.... So the method, is this the right place to position	Sees this mentioned in JD or instance variable. Interesting position - should I do this?
409		Eh [I'm going to write a method] that will give me the position of which to draw the block by interrogate the drawing. So the other possibility is [is there another possibility] in terms of putting the code to do that? I could put the code... it may be more useful to put it in say [a new version] that add a method to drawing? [] have access to find out the position of the blocks. The problem with that is I'm going to have to make... I don't think I have my own drawing. So []	
410		R: Which of the approaches do you favour? I feel that as a method that is going to be generally useful so [you] mentioned earlier that other tools might want this. So I'm dragging it around. Other tools might want it... as a property of a drawing is it? What a property of... the tool needs to know it (geese) the tool... needs to [use the method to] position and the other thing is. Okay [] that instead of when I do, my created figure [...position it...]	(looking at code)
411		Drawing could position it. When you do an add to the drawing. The drawing repositions it. And then anytime its added to the drawing. It's a property of the drawing so anytime a block is added to the drawing. Problem I've got to be careful of is that, okay there is two kinds of figure in here so would only want to do it to blocks and not to the ground for example. So we would have to check that it was indeed a block. But I think ideally the drawing controlling the position of it.	
412		Rather than the tool so that any other I use has the same functionality [for free] and I don't need to do this, getting the drawing, drawing from the view. So what I want to do is look at and change the method that adds. I fear that I am then going to have an if statement that checks that it is a block that we are constraining and not. []	
413	SC Standard Drawing	Right going to have a look at this. Drawing add back in the source code. Open ... standard drawing.	(has prev exp of add)
414	MA Drawing.	Going to have to look at the interface for	Find for add (finds adddrawingchange

		drawing. Add figure! That's what I want. [how do I call it] have we got a new drawing in blocks application? That would be nice.	listener etc)
415	SC Main class SC BlocksDrawing	Create drawing, create new standard drawing. What I want is my own blocks drawing [] in that method Copy Blocks drawing. Extends standard drawing.	Sub is taking import statements
416	SC StandardDrawing	Need to find signature for the add method. What's its parent class? Oh! So it's a composite figure	Sees its composite figure
417	MA Drawing MA Drawing IH	R: I think it's the hierarchy view you want It says drawing, oh because it's an interface. And its inheriting from composite. So we have got public... I don't know... have a look at composite figure.	
418	SC Composite Figure SC BlocksDrawing	Add figure. Figure contains figure. add to container and it returns it? Returns it? [] this hopefully is the interesting part.	Sub is overriding add here
419	SC Figure SC BlocksTool SC Figure SC BlocksDrawing	So we want to add a figure and when we add it...do we know the position of it? ...created figure okay so its position [] set.	Figure already open might be mistaken click Looking at mouse down
420		So its got a position on it so we need to check its position against [] figures position. Check it against...lower bounds but a problem with it being that [I have a] ground in there somewhere. So I need to find, I want to find if there is a drawing anywhere within	Sub presumably means figure
421	MA Figure IH	The top block [] So first of all I need to get [] center. See what I can find out about figure. Point center is that all? [] displaybox [] display box [] displaybox. I'll get the center that's probably [what I want].	
422		I presume that is just the center of it. So its twenty on either side. Its twenty wide what's the... R: [...midpoint...] [] R: I don't think it will matter I know. I know. So we can get the center [] and when we look at each figure	I think sub is worried about even lengths not having an exact center.
423		We want to find the highest point, the problem as that [...again] I find each figure and see if any of them are underneath it and then find the position of the highest one. So []center and it returns a point, what else would we need to use? Thinking	

	MA Drawing IH	of using... Where is it...drawing hierarchy. Enumeration. Which is figures []	
424	SC BlockDrawing	(sigh) So Point p equals f. center. ... Need to find out [about figure] enumerator [] according to the [] its just a...	
425	SC Figure Enumerator SC BlockDrawing	R: What are you looking for? Figure enumerator Has no [arguments] Figure Enumeration...	
426		Fe equals figures... (sigh) So just get the next element out.	Creates a while loop pauses to consider what to put in it.
427		Emmm so I've got both of these. I also need to keep hold of the highest one. So need to keep a position [] which is going to be an int. Int highest pos, its going to be a new pos, the lowest it can be is two fifty...got to watch that the figure we are getting isn't	Hard coding
428		...well it doesn't matter if it's the ground. Because if it was a block would be higher than it. So the next thing to do... so need to figure out this... get the center of it, p2 equals fn.center. I want to see if that is anywhere within...	
429		Is it between the bounds [] [] center, p1 never at center. So if its within the center of that is within twenty [within] forty. X co-ordinate. If the x co-ordinate is within forty then get overlap	
430		So emmm just [] p2 , int p2 gets... minus...	
431		Can I do abs? R: You can. Math.abs...forty, forty so if it was negative...so whats forty that way and forty that way?	
432		Wanting highest no high pos equals ... fn dot [] figure[]	
433		Need to go for top left. High pos equals ack I'll so do... I'll keep with center. High pos equals p2 ... center [] figure assuming this is all right	Going to change to corner – why?
434	SC Figure SC Blockstool	[this gives] the center of the highest block that's below it need to draw in the corner of that so need to shift up to the... back ten and up ten from that position. Back twenty and up twenty. Okay so need to shift that figure so...how do we shift a figure? [] Display box	(should be twenty?) why look in tool unless PK?
435		F display box and then what we do is draw that at an [appropriate setting]. That's only if it was	(is subject fed up?)

		moved. Have you had enough of this?	
436		Highpos not equal to two fifty... f. displaybox... this is the center of it	
437		Is this worth doing?	Pause no action (20s) values for display box.
438		R:[I'd like to see it running] I'm going to have to compile all this. R:[I have to tell you you have about ten minutes left...] Okay. I don't know if I will get anywhere but I will give it a go. R[...what you have just know is interesting....] I'm sure you are not going to get anything out of this but I'll keep going. []	
439			Sub still coding up position of displaybox
440		The problem is I haven't got it in the drawing either. Haven't added the...and I've still got...so that's just the [moving about] I've still got to do... super...is it super.add? or is it just super? So that adds it, return it.	What? Decides its super()
441	SC Blocksapp	R: I think you want super.add back there Is it, that's only the constructor... So blocks app...extends drawing application. Where is create a drawing. New block drawing.	
442	SC BlocksDrawing	Right try and compile blocksdrawing. [compiles] that's not equals, need to decide where the brackets are...	6 errors
443		R: Is there a reason that [....forty forty or....]? No its because I can't count! [compiles] good grief! High pos	errors capitalisation HighPos
444		Forgot to cast that. That should be center. [compiles]	Figure from enum 6 errors
445		Do you want to stop? R: You have only got a bout five minutes more... I'd like you to try and get through these errors. Right okay.	Maybe sub has had enough
446		Right okay	Subject mumbling cant make it out.
447			Reading through code? – Checking brackets?
448		Check the brackets... errr there is too much going	In method?

		on here. Lets start with things to do with point. So these two have things to do with point...inside here we are just dealing with the coordinate...so that was okay.	
449		This high pos I'm treating that as a point and I've set it up as two fifty... point ah... R: Whats the problem now? What I was using was the default... it needs the center of that. R:[]	
450		I haven't check whether its higher than high pos I've just checked whether is in a range. R: Can I ask you to stop there then?	Sub sees problem with solution
513		Post task interview	

5.1.2 Participant B

Time	Documentation	Subject Talk aloud	Researcher Observations
0		Pre-task activities	
30		The first thing that I'd do you've got these three paragraphs, I see them as things that have to be solved in sequence.	
31	PL Overview PL Identifying existing figures PL Figure hierarchy	First thing that I'm thinking about is representing the ground. I'm guessing it will be some sort of figure. I'm going to look in the pattern language. It's annoying me it's too big (laugh). R: What are you searching for?	Scanning Figure hierarchy Scrolling around
32		I'm thinking about either using a line figure or just using some sort of rectangle. Not entirely sure... don't know if that is a reasonable use of line figure or if they are meant to exist as part of more complex figures.	
33		Line figure exists by itself... Only thing that bothers me is that line figure extends poly line figure, doesn't seem like a proper use of it because its not poly!	Maybe this is why sub is worried about line figure?
34	PL Identify existing figures	I reckon that a line figure would be okay. Aesthetically it would look, hmmm concerned about thin line try to alter its attributes to make it a big thick line.	
35	PL Overview PL Modifying existing figures	I want to modify a line Now I'm frustrated I've been to figure hierarchy... I feel that I've hit a dead end now. My reaction previously would have been to look at the source code, I'll have a look in the micro architectures but I don't feel that its going to tell me what I want to know.	Mod figure links back to figure hierarchy.
36	MA Figure MA FigureIH	R: Say if any other documentation would be useful. JavaDoc would be useful. This is kind of helpful I've got the methods at the interface.	Scrolling (in hierarchy) looking at Abstract figure
37		What I'm looking for is something that will allow me to make a big fat line. The only ones that I'm thinking about and this goes back to experience is that... either set attribute or display box...hang on there is size but that is returning a dimension so that doesn't allow you to do anything.	
38		What I want to do now... right I'd look at JavaDoc or code for set attributes and basic	Scrolling around centre of diagram.

		display box to see what those did.	
39		Got a problem doesn't know where code is. R: Open RealJ and then finding the source code...(omitted)	
40	SC LineFigure	Now I'm hmmm I can't remember the hierarchy now. I'll have a look at line figure. Right there is basic display box there. I would guess that this might affect the width of a line	Sub is talking about package hierarchy Looking at basic DB.
41		R: (agrees thinks it will alter line thickness) (Rationale for the 'origin and corner' argument)	Wrong doesn't work Sub feels that naming of parameters suggests resize possibility.
42	MA FigureIH	I'll have a look in attribute figure...From experience I know that's where attributes are. R: Have you noticed in hierarchy how attribute relates? No that's one of the things I'm going to go back to. Not convinced I'm looking in the right place. There's attribute figure, attribute way over to side...That suggests that attribute figure is not going to help me.	Sees line figure
43	MA FigureIH		Looking for Abst. Figure Can't find it Scrolls to Abst Figure why? – think sub is looking for package.
44	SC AbstractFigure	I'm having to search...JavaDoc would be ideal because I now don't know which package to look in. R: What are you looking for? Set Attribute Right okay hmmm by default figures don't have any attributes requests are ignored	Reading JavaDoc comment
45	SC PolyLineFigure	So I'll have to look in poly line figure, see what attributes that's got...Not quite sure why I didn't look at that earlier. So what have we got...	Scrolling
46		Right I'm looking at set attribute...It suggests that its not going to do what I want	Pauses at get attribute

		<p>it to as it involves things like arrow tips and frame colour. What is frame colour? I guess it's the colour of a line don't know why its called frame.</p> <p>What I'll do is abandon that and go back to the display box.</p>	
47	MA FigureIH	<p>R: Still working with line figure? Yeah</p> <p>Next thing is how to position that on a drawing or how to get that to appear on the drawing.</p>	
48	PL Custom DrawApplication	<p>Conscious I don't want a tool to do this I just want the ground to appear.</p> <p>That doesn't tell me what I want to do.</p>	Reading page
49		<p>Trying to think now about the point I want to do this and the place.</p> <p>It hints at (points to create drawing) (reading about open method)</p>	
50	PL Customising the GUI	Quick look in GUI don't think that is going to tell me what I want... Okay perhaps it will...(diagram shows figures on drawing)	Scrolling no real pause for reading. Sub decides not helpful
51	PL Overview PL Identifying existing figures	<p>Okay so I'm thinking about create drawing. Going back to see if it tells me anything.</p> <p>R: What are you looking for? Everything points towards using tools at the moment and I don't want to use tools. I want something else. Either verify if create drawing is right place to go or to see if there is something else I should be looking at before I start looking in that area.</p>	Reading page
52	MA Drawing	<p>Have a look in MA cos, Just have a look in drawing.</p> <p>What I'm looking for is a way into create Drawing R: Is there anything in there about create drawing? No.</p>	reading
53	MA Drawing Editor MA Drawing View MA Figure PL Customising DrawApplication	<p>Hard to think where to go.</p> <p>Look in figure but I'd be very surprised... My guess now is that I'm going to have to go back to... So I want to look at Draw Application back to micro architectures again.</p>	<p>Quick look then out</p> <p>Quick look then out</p> <p>Reading para about create drawing again. Mentions DA</p>
54	MA ? SC DrawApplication		Can't find MA for DA

			Pauses at open() scrolling
55			Scrolling
56	PL Customising DrawApplication SC DrawApp	That surprised me it didn't tell me what I thought it would tell me. In this it says Open calls create drawing but I didn't find it. There is init drawing...	Sub goes back to open...sees init looks for definition of init
57		Calls create drawing	Sub looking at init... pause Goes to find create drawing
58			Scrolling down
59		This returns a new standard drawing	Found CD...continues scroll
100		What I'm thinking about now is that what I should be doing is looking at standard drawing and extending that to add my ground into it. In draw application override create drawing to return a 'block drawing'	Don't need to override drawing
101		R: Why are you hesitant? I've noticed standard drawing view (in the code) and I'm not very comfortable in hotdraw about the relationship between drawing and drawing view. I know the theory but don't understand the interaction between them well enough. R: Are you worried in case it damages that relationship? No, I'm more concerned that I have to do something more to get the view to reflect the Drawing	Delay... sub not doing anything
102		The way I'd do it is to try it...worry about it later, assume that changing the drawing, the drawing view will pick that up.	
103	SC Standard drawing	The reason I'm finding this quite hard is everything I've done in the past has been done using tools, I've not actually drawn anything directly on to the background. So this is why I'm struggling with this a bit. Right why have I gone to the code? Good question!	R did not ask question
104		R: You were already in the code? Yeah I'm already in the code so I didn't see any reason to break out of it. This is weird now...I didn't know what was in standard drawing, I've got things like removing the figure, things for notifying when going to move the figure (listeners etc)	Sub is scrolling through code looking at method names

		doesn't appear to be any way of easily adding figures.	
105	MA Figure	So I'm looking up the hierarchy in composite figure. Would usually go to JavaDoc. I'm looking for a method that will allow me to add something...add to container hmmm	Extends composite figure on screen Pause sub is quiet
106	MA add to container	Okay so what that has told me now is that I have composite figure.add	Is this luck by chance CF.add calls addtocontainer
107		This makes me think I want to look at composite figure more (Sub notices lack of parameters in MA call graphs) R: Why did you look at figure in micro architecture? Good question. Gone from drawing to composite figure looking for closest match	
108	MA DrawingIH	R: Can I lead you further and ask you to click on MA DrawingIH? Okay that would have been more sensible! So I have got things like add, that's fine except (sub is worried because it returns a figure).	
109	SC Composite figure		Struggling with package hierarchy again takes a while to find class.
110			Scrolls to add... pause... then scrolls down
111		I've got add which takes a figure so my next line of reasoning will be to develop my own standard drawing – 'blocksworld'. The only thing that I'm unsure about now and this is where the micro architecture might help. I've noticed that...trying to figure out how this method works.	Add figure method
112		It's not really what I thought it would do. Not sure why it returns a figure...perhaps its not a problem. What do I do with the return result...don't need to worry.	
113		What I'm going to do here...what am I going to do actually?	
114		Trying to figure out the relationship between ... was talking about overriding before don't know why that is rubbish!	Sub realises that overriding is not necessary
115	SC Standard Drawing SC Draw Application	The reason I was thinking along those lines was it was just my initial train of thought. Where is it I've lost it? Its overriding Draw Application	What's going on here?
116		Wanted standard drawing with line figure added to it. What I could do... create	Looking at create drawing

		standard drawing in there add, create a line (adjust its thickness) and add it to standard drawing. Will return reference to figure and I can't see what to do with that.	
117		What I would do...presume that sometimes you will want to ref the returned figure. I will create my own application and hold an instance variable for ground and set it with the return value from add.	
118		Don't know why I want to do that (just in case) R: Okay do you have any thoughts on position?	
119		I would set the basic display box as well as thickness to be central. Want to know what the dimensions are for standard drawing. This tells me the size (pointing to getDrawingViewSize)	GetDVSize happens to be on screen. (this won't deal with resize)
120		I'd sketch that out and assuming origin at top left...then I'd want the ground to be ... R: Towards the bottom? Yeah ...(other coordinate details omitted) R: Okay I think that will be fine but what happens on resize of window? Right	
121	SC LineFigure SC DrawApplciation SC Polyline figure SC DrawApplication	What happens with my ground is that it stays where it is....That wasn't mentioned in the requirements! R: No I'm tempted to challenge you here. Right. Okay what I would do then is go back to...Line figure... I'd actually expect... well hmmm... that's mouse []. Back to... Its probably... R: I will let you be very vague in your solution just say what ever you think is going to... Right ermmm okay my guess...	scrolling
122	SC Standard drawing MA Index MA Drawing	Right what I'm thinking is its got to be some sort of interaction between the drawing and the figure so I'm actually going to go back to the drawing, standard drawing... errrr.... I'm actually going to go and have a look in the micro architecture... Other wise I'm just going to route around... R: [are you uncomfortable having to route around in code?] I think it would have taken too long ... Errmmm... right what I'm thinking now is that I've got to add listeners into this...	Mouse moving over word listener in method names
123	MA add DrawingChangeListener MA Index MA DrawingView	Not quite sure how its going to work... okay so there is... add drawing change listener sounds like a sensible thing to do...but I'm not sure about that... its not...drawing is fine. I need to look at the view or I think I	

		want to look at the view. Because I don't feel that the drawing has changed at all. Right so...	Looking at methods
124	MA Index MA Drawing MA Index MA Drawing Editor MA Index MA Drawing View MA Check Damage	The ones that I'm thinking about, you have got things like clear damage and check damage I'm not terribly sure now because I sort of feel... that I'm probably going in at too low a level And this shouldn't really be... Ermmm...	Biiig diagram!
125	MA Drawing View MA Index PL Overview	Yeah okay what I'm thinking is that this should be, this is too low a level it should be handled for me, well not so much for me but... but there should be an easier relationship than standard drawing view that I should be able to exploit [I'm having a look] in the pattern language. Just to see if there is anything about this.	Scrolling scrolling
126	PL Mod Existing Figures PL Overview	R: Is that giving you anything? Hmmm well I'm not really sure what I'm looking for. R:[] One thing is this says to create constraints on figures and drawings modifying existing figures. Now I'm looking at that purely because it mentioned drawings. Again that is going to take me to the figure hierarchy so... don't want that. So I'm going to go back	
127	MA Index	Micro architecture.... Hmmmm what this really comes down to is again this problem I have between [I don't have a really good] grasp of the relationship between the drawing and the drawing view and that MVC interaction. I know its MVC and so on but I know it's a fairly complicated one and I have never really explored that. R: Do you think you have any preconceptions? Do you know it is MVC? No, no, all I know is... somehow or other a view is derived from the drawing now I don't know how that view is derived from the drawing.	Mouse on dV then stops
128	MA DrawingChangeListener MA Drawing Invalidated	I'm going to look at drawing change listener. It sounds promising errr.... This points me towards figureInvalidated errr... that sounds good. Right... that sounds actually most encouraging, the context looks	(defined in standard drawing - mouse pointing at

	MA Index	right so its looking... coming from figure change listener R: To go back to the problem how does this help us? Right what I think I need to do ...is okay, I can't remember what I did so far (laugh)	it in diagram) (tried clicking on it)
129	SC Standard Drawing SC DrawApplication	This is actually one of the things when not coding... trying to remember the solution in your head. I need to image what my solution looks like but okay what have I done so far... so I have got my... R: If it would help I'll tell you what I think your solution is so far. No, no that's all right I'll try it. I extended draw application so lets say I called it my blocks world application. I have, within that I have defined a... R: You are free to make notes if that would help you. So I have got...right blocks world application and that extends draw applciation	Why opening code
130		Within that I've got a line figure R:[...method overridden?] Sorry, no I'm just... within blocks world application I've got a line figure as an instance variable... so [just mouse down] right. Ermmm Which I'm calling ground... [] I'm jut thinking why am I there.	Indicating open S.C.? - scrolling
131		Right so I'm just wondering where to add this functionality in. Right so I have declared my line figure and... in my constructor... what I'm going to do is I want to do a super and create a new line figure. R: I don't think you really need []. No I'm just using it for my own benefit.	
132		Emmm I'm going to change the dimensions of that... right so I've just... right what have I still to do now? I'm going to go back to this... R: This problem? To the ... just a minute I'm just looking up what I've got so far... R: You can ask me about your solution. I'm just trying to remember [] hotdraw.	scrolling
133		Right so I'm going to override create drawing. I'm going to create a drawing here, a new standard drawing call it new [].	Mouse on create drawing
134	SC Standard Drawing	And I have added my ground figure to that and the other thing is just trying to think what the [limitation] of this thing. I've forgotten where I find that now. R: I think it is location Ah the location of the ground oh sorry yeah just sort of roughly that's in my basic display box... right add the, add the ground to my standard drawing.	? (must have misheard)
135		Keep the reference to that, I'm not	

	MA Index MA Figure change listener MA Figure changed	comfortable with that, I'm just not happy about that... anyway I've done it because it needs to go somewhere and then we turn my... my new standard drawing [view] create drawing. Right so now got to worry about... this thing about errr... R:[] So I've got things like figure change listener So there is... figure changed. I don't think that... I don't see the figure as being changed at all.	Mouse on red boxes (FCEM. Changed, abstract figure. changed)
136	MA Index MA Drawing View	Or rather what I'm trying to figure out is what send... R:[] Sorry? R: The ground figure. My ground figure yeah. I'm trying to think about what is going to initiate this and how its going to... I still feel I should be looking in drawing view	
137	MA Checked damage	[]. Have a look at what checked damage does. It doesn't feel right.... There is something about mouse dragged.	scrolling
138	MA Drawing View SC Standard drawing	I'll assume check damage is the closest thing to what I want to do. R: Yep. Okay. I'm actually going to look at the code for check damage just to see... R: If you feel that... if you get to a stage where you can't make anymore progress then... Yeah. No it's fine. What I'm really struggling with is [] going to be...	scrolling
139	MA Drawing View SC Standard drawing view SC Composite figure SC Draw Application SC Standard drawing view	R: [] Yeah just trying to think where it is. That's in drawing view. Right I'm in the wrong thing.	Didn't mean to look at this. Closing open file down Had this open previously - scrolling
140		Will using things like control f affect the recording of this? R: No don't thinks so...	Brings up find - damage Finds rectange called damage - calls to check damage and def.

141		Okay so... we have got check damage... so go through every thing in the drawing with a drawing change listener on it, then calls repair damage. Damage instance variable	Scrolls back to find it
142		Yeah okay its just the damaged area. Hmmm. Okay that's no help.	Find on damage again - to find instance var. Find continues - looks in repair damage
143	MA Drawing View	Right okay. Trying to think about how this would be initiated and I'm not really sure... there is a thing here drawing invalidated which I guess could possibly to do with the... but I don't know what effect resize really has and I don't really know how to get that. R: [...where was that?] In the drawing. Oh sorry in the drawing view. So what I'll do is I will go back to drawing view. See if there is anything...	Looking at methods
144	SC Standard DV	The only thing there that is... suggests []... There is also things like this has got a method drawing invalidated	The only thing = nothing?
145	MA Drawing view SC Standard DV	Which... I don't know where that comes from because that's not in the drawing interface R: The Drawing view interface? The drawing, sorry I keep doing that, the drawing view interface. I'm assuming that's not vitally important, that's an assumption Right okay so what I'm going to do is, right stick with my idea of that its something to do with check damage and repair damage.	Checking?
146	SC Standard drawing	So what I reckon I need to do then is... when I've got my, when I created my standard drawing... What I'm thinking about now is where to put the listeners. R: [What are your options] Right okay	scrolling
147	SC Standard DV SC Standard Drawing	What I'm thinking of is... I want to look at the standard drawing view what this does is... I'm a bit confused now actually... okay this goes to the drawing change listeners...	Check damage on screen
148	SC Standard drawing view SC Poly line figure	[only] defined... errr... right if I [only] need to add a listener to my figure errr... I'm slightly confused now.	Scrolling Selects a cmt which reads handles a remove from drawing request (figure request remove)

			scrolling
149	MA Drawing view MA Index MA Figure IH SC Poly line figure	Right we have got [] know where, right okay I want to know where to do this, figure change listener hierarchy I want to know at what point in the, where I need to do the add listeners and okay. So Figure gives me add figure change listener, which I guessing is in poly line figure	Mean to go figure IH one above FCL IH? scrolling
150	SC Abstract figure		
151		R: [what are you looking for?] Well I'm looking for a listener and I've noticed... well this add to container thing which takes a figure change listener as its argument	
152	SC Standard drawing SC Polyline figure SC Abstract figure SC standard drawing	And within... [we are in] standard drawing	Why looking at all the code?
153	SC Composite figure SC Abstract Figure	Right. Right that does an add to container. Calls add to container on figure Abstract figure	Looking at add sees add to container (get here from memory?)
154		Right err. Right okay I've got the ordering back to front... right	What?
155	SC Standard drawing SC Standard drawing view MA DrawingView	I think it s back to front...I think I was looking at adding listeners to figures and I've just... I don't know it doesn't seem right. It seems the wrong way round, you have the listener and the... on the view and if the view changes it broadcasts to the figure asking the figure to change but I can't...	(think sub has got this mixed up?)
156		R: [] saying you want the figure to change? Not the view. Yeah, I think that sounds right. Errr, no, no I'm not happy with this, this is where... [] Doesn't work, this is where I started from! Right. And this is where I've got checked damage and... I'm trying to get this relationship sorted and I haven't got it right.	
157	MA Check damage SC Standard drawing view	Right. What I'm struggling with here is... how to [explain] this... right I want to find where check damage is defined. I feel check damage is the right starting point	
158			(finds def)

		So this goes through... On the drawing, which I assume returns the standard drawing or something associated to it.	looking for drawing
159		Right okay	Finds drawing
200		Right okay	Search for damage()
201	SC Standard drawing	<p>Right okay so I'm going to look at the... drawing change listeners... ... in standard drawing.</p> <p>R: What is your understanding of these drawing listener things... Poor. R: Well okay, what do you know about them? Honestly very little at all. I don't have a good grasp of what happens at all when these interact. R: Are you mainly trading of the name then? Yeah, yeah. Absolutely</p>	
202		<p>And I have got some, yeah basically just my understanding of observer... okay so drawing change listener returns [] right. R: I think you want to pay particular attention to what direction [] Yeah this is where I'm going backwards and forwards a little bit. Right in this case the drawing change listeners. I expect... you see this is what I'm struggling with.</p>	scrolling
203		<p>I mean again its tied up in the relationship between the standard [and the] drawing view. What I think happens is, something happens to the drawing view. R: [] resize? Yeah which is the resize thing []. The view then goes through its drawing, so it goes to the model it represents and tells it to broadcast to each of its listeners that something has happened errmmm... R: That sounds, that sounds perfectly fine. The solution you seem to be trying to find though is you want the drawing to [expect] the individual elements to do something</p>	
204		No I'm not really happy with that, because I feel that is going to far. [] All I'm trying to do at the moment is tell this figure that I've added on to the drawing that... errmmm... it should respond to... well... what do I want it to do? I feel it should be a, should be a listener, so it should listen to events so what I want to do is... I have added it in to the... err into the standard drawing	
205	SC Composite figure	<p>I think it should register it as a listener R:[]</p>	scrolling

		I wouldn't have thought it was actually but I suspect it is. In some ways you might expect it to be... don't want a method... I guess you might want to add things into a drawing that you don't want, have as listeners. So keeping it separate is sensible... so what I'm looking for now is...	
206	MA index MA Figure	So there is add figure change listener within figure R:[] No	
207	MA add figure change listener MA Figure	What I'm struggling with there is... figure change listener, so that's called by add to container that gets called by err... Hang on that doesn't seem right. I want to add... I want this figure to be told if something happens to the drawing.	
208	MA Index MA Drawing change listener MA drawing invalidated MA Index MA Drawing IH	So I want to register it as a listener with the drawing. R:[] Well I'm struggling with, why I'm having problems here is... drawing right I've had a look in drawing	
209		I can't see anything in drawing that will do it except...[] add drawing change listeners doesn't seem right. R: [] Is there anyway that you can describe to me how to solve this problem without being concerned about the framework because to me what is happening is that you are looking are looking at the framework just now. And I can't distinguish whether you don't know how to solve this problem, or you do know how to solve this problem and are not getting the right information. Okay. What I'm trying to do, I will try and put this in general terms.	
210		One thing I'm not entirely sure about is what it is going to do in response to this, being resized. Which is part of the thing I'm struggling with. If, there is a simple solution, that if the thing gets resized... R: [if what then?] Sorry if the, right, if you change the size of the drawing view. I'm assuming that there is some redrawing goes on there. Again I don't really... R: [not interested in being draw view ...] Yeah. So some sort of redraw goes on and there are a couple of things you could do,	scrolling

		you can either just assume the [whole] thing gets redrawn the	
211		Other thing you can do is to take it further and err... [] re-locate the figure within the drawing. If I want to do that I need to do some more work with... with my line figure so what I'd have to do is... change the set basic display box so that this was then [proportioned] to the area in which it was located . That would be good.	
212		R: I'm certainly not wanting the details of that algorithm but what you are saying to me just now is that [the view] changes the size, broadcasts to figure [] the line figure []? That's what I think has happened yeah. R: What I want to challenge you with then it to say that obviously the view and the drawing are tied together, when the view changes size the drawing changes size. Yeah. R: Well might it be that you want to look to the drawing... [You see I would disagree with that] I don't see that the drawing should change size, if the view changes size. I don't see any reason for it because I don't think the drawing has a size. Perhaps it does. R:[I think you should assume it does...] []	Good point!
213		Okay so what I want... R: I can totally understand why you are stuck this is a very hard problem. I almost regret setting it but... [] but what I'm trying to do. I don't feel that I'm getting any further by looking at the view when I start looking at the drawing I will be able... I've got things like [add?] drawing change listener, this takes a drawing change listener as its argument. And that's not right. What I want to do	addDCL
214	MA Index MA Drawing change listener MA Index	What I feel I want to do is add in a... I feel I should be looking for a method that, which is... registered... which takes a figure as its argument which is called something like add listener and takes a figure as its argument. That's what I'm looking for I can't find anything like that Perhaps its an issue to do with my	Mindset?
215	MA Drawing	... when I add, when I add the figure to the standard drawing ... I guess one way to do it is... okay I will look at figure and see if I can get, if there is a way I can get a ... []... R:[]	Looking at add stuff

216	MA Index MA DrawingView	Possibly this is too low a level of detail, perhaps I should just be trying to get at the, or should I just be trying to get the standard drawing and the view? I would have thought that would have given me [... automatically]. R:[... you don't need to worry about...] No I really worry about hard coding it because there is so much stuff here	
217	MA Index	To do with listeners, I really worry about that and I feel that I'd be missing something out and I wouldn't be happy that I would pick up on the events properly. One thing I'd probably do actually at this point is I would use javadoc and I'd look at every single thing that has got listener in the... as a method name	
218	MA Drawing View MA Repair damage	So you are saying that drawing view acts as a controller R:[Did I say that? Its entirely possible but ...] [] adding the controller is that it invokes things like... repair damage [].	
219	MA Drawing View MA Index		
220	MA Figure change listener MA Figure changed MA Figure change listener MA Index	I'm clutching at straws I'm just looking at anything that... sees to go down... I just want to tie this figure up! ...to something I cant see a place to tie a figure, to register it.	
221	PL Overview	Try the pattern language. R:[] It doesn't look like we have got anything... or nothing that I certainly haven't looked at before.	
222	SC Composite Figure SC Standard drawing		scrolling
223		R: Do you think it can be done or...? I'm sure...It has to be able to be done. There must be a way, there has to be [] support for this. R:[... support than this] Yeah definitely R: Are you surprised at how are this is? Yeah. I suspect what it is, is I have some severe conceptual misunderstanding of the framework which is stopping me finding	

		<p>this.</p> <p>R: I don't even know if it's that. I think you have a preconception about the solution</p> <p>Yeah okay yeah, indeed.</p>	
224	<p>SC Polyline figure</p> <p>MA Index</p> <p>MA Figure Hierarchy</p>	<p>R: []</p> <p>Okay there is a figure dot listener, right, which I've noticed...</p> <p>R: That returns the listeners for this figure?</p> <p>Yep okay. Which makes me want to go back to... poly line figure, again java doc would help</p>	
225		<p>Right okay this is suggesting that, okay listener returns a figure change listener, of a figure. I guess what I could do, I could get that from a figure</p>	Looking at figure interface
226		<p>Right I'm going to try and work thorough this... since the figure and the drawing are both figures right. So we've got figure change listener and add figure change listener defined in both right so.... What I could do possibly is</p>	
227		<p>Get the figure change listener from the... drawing and add that to the figure</p> <p>R:[]</p> <p>Yeah but I don't...</p> <p>R:[]</p> <p>Yeah, which is using display box. That's a possibility I'm not [I'm struggling with that] it feels... I'll tell you why I'm struggling with that</p>	
228		<p>I cant...</p> <p>R:[...decoration]</p> <p>Right I will tell you what I'm not happy with just the relationship with drawing view again</p> <p>R: I believe this is a hard relationship []</p> <p>Drawing view... when it does a check damage it gets the listeners but I will tell you why I'm not happy with it, I'm not happy with it [] explicitly registered the... the relationship between the drawing and the drawing view I suspect is established elsewhere right and that a drawing has automatically a listener for a drawing view.</p>	
229		<p>I'm not comfortable with that at all does that take you far enough or... because I'm actually going to use figure change... so listener and add figure... change listener so I'll get a listener from one and add it to another.</p> <p>R: I think you could probably get a listener, I could tell you implementationally what problems would come up. The solution that I was thinking of was more that the drawing, either delegating or internally laying out its figures as it saw appropriate</p>	Sub is pointing to figure change listener

230		<p>So the drawing knows that the ground figure has to exist along the bottom so it is the drawings responsibility to put it there. [] basic display box get its collection.</p> <p>I'm using the standard drawing so []</p> <p>R: I think it would be reasonable to add a drawing for that purpose. And I think your solution has the potential to be even better than that in that you might [].</p>	(ideal - dv with v acting as a view and a controller ?)
231		<p>The point I would do it is before I have got create drawing. I'd do it within there so that's all...</p> <p>R:[...registration]</p> <p>Yeah</p> <p>R: Okay I think we will stop at that today. That seemed to take forever.</p>	
232	PL Overview	<p>Right Okay the next thing I want to do is to create a block.</p> <p>Emm this is going to involve two things. Creation tool and I'm going to use,</p>	Sub scrolls down to figures bit of PL before talking. Points to CT link with mouse
233	PL Identifying existing figures PL Figure hierarchy PL Ident existing figures	<p>Okay I'll see what figures there are in here that I can use for this.</p> <p>R: Do you have any preconceived notions? I'm guessing, I'm assuming there is a rectangle of some nature or another ermm well I've got a vague recollection of there being a rectangle.</p> <p>Which there is. Okay that's fine so I can use that and</p> <p>The other thing I'm wondering about now is</p>	<p>Sub should know there is(?)</p> <p>Straight through to FH. Scrolling onFH</p>
234		<p>How to define that so that it is square and forty by forty and red.</p> <p>What I would like to do is look at attribute figure...again what I'm thinking about it that there are either two ways of doing this. There is either something you can do on construction or use the attributes to set []. So again what I would normally do here is kick up JavaDoc. Ermm I'm going to look at the source code now.</p>	PK or not?, (mentioned on current pattern)
235	SC attribute figure		Sub finds it easily. Scrolling down
236		<p>R: [What kind of attributes do you expect to find]?</p> <p>I know you can change the colour so there are things like fill colour so...</p> <p>Okay so there is things like... ermmm... there is set attribute there so I can change I know I can change the colour so I could use set attribute, fill colour and then colour.red</p>	<p>PK</p> <p>Scrolls to attribute list in code. Pauses then scrolls passed</p>

		so I'm confident I can do that. That's fine. Dimensions	
237	SC Rectangle figure	Lets have a look at rectangle figure just now....Right I can define the...okay so the constructor for rectangle figure which takes two points and then calls basic display box with those two points so that I'm assuming...	Constructor on screen Call seq?
238		That governs the location of it, but you want its dimensions.... Or rather it initialises those dimensions but doesn't errmmm... R:[What are you looking for]? Right what I'm looking for is the method that I can...which governs the resizing. Right. So what I'm thinking at the moment is	Interesting point of confusion position and size blur. - scrolling
239		This is actually...I'm also thinking back to the hotdraw orerry practicals because I know there is a way of doing this. I can't remember how I did it. Right. Okay there is nothing... [nothing in] rectangle figure.	PK but can't quite... Scrolling (hoping spark off memory?)
240	PL Overview PL Modifying existing figures PL FigureIH MA Index MA Figure	Go up to the... see what is in the pattern language. Modifying existing figures. There is figure hierarchy again, I'll have a look at that. No.	Sub goes back immediately Scrolling through names
241	MA displaybox MA Figure MA index	So I'm looking for something, some method that, governs the growing and shrinking of the figure. I know there is ... well [can't remember this very well] but something at the moment at the back of my mind	Clicks no talking – back out a few moments later. (nothing use actually on diagram)
242	MA Handle MA invoke step	That obviously you use things like handles to stretch and manipulate figures I'm just trying to figure out whether... what the best way to go is because I'm assuming the handles would possibly call some method [or other] in figure [but I don't know which way to go yet] So you have things like...invoke step	Is sub using handles as a kind of example? Mouse is on displaybox method in handle/ caller not behaviour
243		Which... the possibility one thing I am nervous about with the handles is you still want to be able to manipulate the figures so that would be one point in it I know I could do something I could override invoke step for example so it is a null method and I think that would have the desired effect that you open the thing and its fixed at the same size. What I'm then worried about is if the size rather than handle becomes selected and then moved around whether that is done by same	This seems interesting don't know what it is but pay attention! Interaction Sub looking at diagram (selection

		<p>thing. Looks like it isn't</p> <p>R: [are you saying that if you do something outside of the] handle [that that would affect the figure]</p>	tool mosuedrag)
244	<p>MA handle</p> <p>MA invoke start</p> <p>MA handle</p> <p>MA index</p>	<p>Yeah I don't think that is related. Again this seems to suggest that it isn't. It seems to suggest that you are using selection tool to select the object then select the handle and then drag it...ermmm I'm not one hundred percent sure.</p> <p>R: Do you feel you are getting towards a solution?</p> <p>Just emmm... [*]</p> <p>R: Well you have said to me you think that you can get it coloured red.</p> <p>Yeah.</p> <p>R: I have to agree with you I don't have any problem with that.</p>	<p>Sub seems to miss question</p> <p>* might say no in here</p>
245		<p>R: And you have found a way to create a figure of size forty, forty?</p> <p>Erm... </p> <p>R: By using... the constructor for rectangle figure takes two...</p> <p>Oh. Yeah, yeah, yeah. That's right but it will put it at a particular location. That is another thing I'm going to worry about in a minute.</p> <p>R: [] looking at handles as a way to... well you see handles as a [threat] to the size?</p> <p>Well there a solution and a threat what I am worried about is the, overriding [handles?] will override more behaviour than I want it do so what I'm trying to do now is. What I really want to know... is... I want to know...</p>	Did he? Leading!
246	PL Overview	<p>When I select an object, right yeah, what I'll do is [when I] select an object and just move it, when I select a figure and move it [I imagine] that involves the handles or []</p> <p>R: Is there somewhere in the documentation...</p> <p>That is what I'm trying to find.</p> <p>Can't remember whether it mentioned handles in here. [Customising handles] There is creating handles right</p>	<p>Sub is reading para. before link (mouse movement)</p>
247	PL Create handles		<p>Reading pattern?</p> <p>Pause looking at code?</p>
248		<p>Right. Errrr... This seems to suggest don't know if I'm misinterpreting here but... you ordinarily wont have handles on an existing figure.</p>	<p>Misinterpret</p> <p>Danger Danger!</p>
249	<p>SC Rectangle figure</p> <p>PL create handles</p>	<p>R: What makes you say that?</p> <p>Well okay it says here to add a handle to the figure. So to add a handle to a figure... To add a handle to a figure the figures handles method must be overridden right so this points me back to figure. I will have a look in ...</p>	

		Just when I see... R: I think I should point out that ...	
250		If you were to create a figure without overriding its handles method it would have handles. Right okay, so that's what I thought [was implied] and that was why I was confused. So one way I can see doing this to remove the handles so define. So I've slightly changed my approach... my strategy now which is to... create my own, I'll call it box figure which subclasses rectangle figure and which overrides handles with null behaviour	
251		So I'd take that approach to it... that being... if that's the case then I can... [with] box figure I could actually set its attributes and its dimensions at the same time. So that box figure will always have the same attributes and dimensions. [] R: How will you [] override the handles behaviour? What do you see as the contents of tat method? I see it being null. R: [It returns an empty vector or just null?] Oh sorry sorry.	(No one prevents setattribute being called) Sub means in cons?
252		Hmmm interesting... R: [what are you thinking]? Yeah, What I'd like to think through now is the consequences of that.... My initial thought actually would be I had initially just thought about having... just doing nothing and having absolutely nothing in the method	
253		R: but you cant. Yeah but I realised that that was going to cause problems so easiest solution is to return null which I could do what I'd be worried about there is the consequences of that in terms of null pointer exceptions elsewhere in the system and I guess the other way is to return just an empty new vector. And I guess that is fairly safe so I think I would go for that. Return an empty vector. R: One worry that I have with this solution is that handles obviously [play an important role] in telling you that the figure is selected. How are you going to get around that?	(if sub had done this might have encountered dynamic probs?) Sub wouldn't have worried about this?
254		Right, ermmm... Right okay if that's the case then...right this takes me back to... ermmm... okay what I could do is have a look at the different types of handles that are available and see if there are any which are... suitable for doing what I want to do which is to allow selection	Is sub thinking null handle?
255		But not allow resize R: Do you have any recollection of doing anything similar before? [] no.	

	PL handle IH	<p>I don't have a good feel for what there would do either.</p> <p>There is null handle...What I would do then with each of these things here is to look at the different types of handles and see what, in javadoc and look at what all these provide</p>	<p>(Only got names here)</p> <p>(future tense as though not really doing it now) he lacks behavioural knowl</p>
256		<p>I have not got a good feel for what [these things are doing]</p> <p>R: Do any of them interest you?</p> <p>There is things like null handle looks appealing because it looks like a handle with minimal behaviour. The other thing I'm worried about is I'm kind of aware down the line that I'm going to have to do something else with that.</p> <p>R: in a different ask do you mean?</p> <p>Yeah. There is locator handle which I think looks... interesting</p>	
257	PL Create Handles	<p>R: what you are saying at this point in time is that you don't know what you are getting from the handles?</p> <p>Definitely not. That is right.</p> <p>R: You don't know []</p> <p>No. Sorry say that again</p> <p>R: If you replace the default handles with some of the other handles you have seen you are worried that you don't know if they will [allow movement]</p> <p>No I'm not really worried about that what I want to be able to do is to look at each of those and see what it is they do. But as I said at the back of my mind I have a feeling that further along handles might have a role to play. I'm not sure that that will...</p>	
258		<p>R: How are you going to continue here?</p> <p>Right.</p> <p>R: [would you try different handles?]</p> <p>I would...what I am going to do is have a look at the source code but I really would like to look at the javadoc</p>	Slight scroll
259	SC Locator Handle	<p>R: Where are you going to look?</p> <p>I'll have a look at... there is locator handle, there is null...</p> <p>I'll have a look at locator handle</p>	<p>Having bother finding them</p> <p>First one found Reading JD cmts</p>
300	<p>Closed SC</p> <p>SC Null handle</p>	<p>R: []</p> <p>What I'm looking at... I'm looking for useful comments actually.</p> <p>R: You are trying to read the javadoc?</p> <p>I'm trying to read the javadoc. Yeah.</p> <p>'Locator handle delegates location requests to a locator object'... don't think I need to know about locators</p> <p>Right null handle 'a handle that doesn't</p>	<p>Powerful comment</p>

		changed the owned figure its only purpose is to show feed back when figure is selected'... Right lets have one of those please.	
301	PL Create handles	Right so what I would do... [] what I would do actually is try that one so I'd go back and use that with that little snippet of code in here and I'd add a bundle of null handles into it. [] that would not resize it. R: Okay that was very much the solution that I was looking for [].	Presume sub would make adaptation okay
302	SC Null handle	I'm certainly surprised actually that that actually inherits from it (locator handle). I was expecting to see behaviour overridden but I suspect it just hasn't added it in the hierarchy so things like invoke start and invoke step and so on I kind of assumed that those were implemented further up the hierarchy. But I guess they are not. I am assuming its just null. Okay so the next thing we need is a way to create figures...	Interesting observation!
303			
304		Now the next bit I'm worried about and this is going to be much harder! Is... So I think I can create them and add them to the world and that's...that's okay what I'm worried about is this constraint that they can only exist on the ground or perfectly aligned on top of another block. There are a couple of approaches I could take with this. One easy one would be with my block figure... would be to... upon creation to bang the thing right on the ground so I'd just locate it on the left-hand edge of the world. That is quite attractive because its fairly straight forward.	
305	PL Overview	The... there is one down side which is that there could be another block in its way R:[I think also that we are looking for a bit more than that simple solution] Yep... right so again I'm thinking back to the Orrery thing where we were using connectors. At least I think its kind of a similar thing to [the...]	Doesn't really look at doc here
306		R: [... methods] Oh okay what I was thinking about is... can't actually remember what we were doing... it was something like creating a satellite that had to be... that had to be fixed to another... that had to orbit a planet and the way that was done was again using [handles] to make sure that upon mouse up if the mouse was over a planet. I'm thinking this will be a similar sort of solution, I'm quite influenced by that.	(look at detail in desc) prev sol influencing
307		R: Would that mean that you would only allow mouse up in a valid position? Yeah...well a reasonably valid position, approximately valid position. So you need to	

		<p>have some degree of tolerance</p> <p>R: What about if I say that that solution... really doesn't have to be accurate you can position it at the top of the screen and then the block will, you don't need to see it drop but it will just appear...</p> <p>Emmm, to be honest I think that is the same solution. I just think all that's doing is ignoring one axis. One dimension of measurement. I'd see a nicer solution being to use a... to use sort of... approximately close to the ground</p>	
308		<p>I don't see something as being at the top of the screen as</p> <p>R: Are you saying that the user wouldn't be allowed to move the block. When you create the block they wouldn't be allowed to move it anywhere</p> <p>Oh no yeah move it anywhere but it will only release when its... if you like a reasonable distance from the ground. Which I suppose is making it that little bit harder but...]</p> <p>R: While we are in this area. I think we have agreed that creation tool is the way to go? You want to add something with creation tool?</p> <p>Uh huh.</p>	Has sub agreed?
309	*	<p>R: The current view of that is that you have to click and drag and release to create a figure and it will create a figure at that size. Right</p> <p>R: So your forty, forty would be ignored. Right okay. Ah right</p> <p>R: You specify the shape as forty, forty but the actual process of creating it overrides the size.</p> <p>Right uh huh. So my solution doesn't work for that.</p> <p>R: What your handle solution works for is after that point you can no longer change the size.</p> <p>Right.</p> <p>R: The handles solution is still valid but you [have more to do when its created you need to control its size]</p>	
310	PL Using creation tool	<p>Okay the comment down here which I [] hadn't read before. I wasn't really aware of this, it says 'the creation tool automatically provides the behaviour for creating the size of the new figure when a tool is selected... and dragged to determine its width and height'. So what that tells me is... what I want to do then is... find that method and ...</p>	
311	PL Tool IH	<p>Or yeah, or do something to that method constraint its behaviour or something. I'll have a look in the tool hierarchy...</p>	

	<p>PL Using Creation Tool</p> <p>MA Tool</p>	<p>Ah that's not going to be very helpful its not got... I'm always expecting methods there. I don't feel that gives me... again I'd like that to...</p> <p>R: [zoom?]</p> <p>Well a zoom and well... my perfect solution to that would be a class diagram that can zoom in and then have the javadoc directly behind it. Right so go back up to the micro architectures</p> <p>So there are things like, mouse drag sounds really promising.</p>	(with methods)
312	<p>MA MouseDrag</p> <p>MA Tool</p> <p>MA Tool IH</p>	<p>Right... what's the... ah right.</p> <p>R: problem?</p> <p>No I'm just trying to figure out the UML... yeah so okay so you have got abstract tool...</p>	
313		<p>So is that saying that selection tool...does that create another tool ?</p> <p>R: What that's saying is that selection tool has a reference to another tool</p> <p>A reference to another tool? Oh right. So look at creation tool so its got... mouse drag</p>	Scrolling around
314	<p>SC ?</p> <p>SC Creation tool</p>	<p>So I think that what I'd do then is okay I'll have a look at the code for creation tool. There is a couple of things I'd do is... what will I do?</p> <p>R: [tell me]</p> <p>Well first of all my views are that have to think about overriding that behaviour to eliminate it</p> <p>R: The mouse drag behaviour?</p> <p>Yeah. The mouse drag what I would also look at is see if there is anything else I can do in creation tool in terms of, or I want to look at it in terms of things like positioning and so on</p>	
315		<p>I think that... that gives me control as well of... so I can remember where that appeared. So using things like mouse down for example, I could make that appear at a certain point I believe I could. So its got so I could override that behaviour and</p>	Scrolling stops at mouse down
316		<p>[] thing called anchor point... well I could override that and just keep [predetermined] x and y.</p> <p>R:[]</p> <p>I could hard code it</p> <p>R: [would that give you your start positions is that...]</p> <p>Yeah. [] already called mouse down.</p> <p>Yeah, no, yeah okay. I could have a version of moue down which is in my own [creation] tool which did a super mouse event and then</p>	scrolling

		substituted the x and y. At the end of the ground...so I could do that if I wanted to.	
317		<p>R: Yep. You could do that. [it also affected?] Yeah yeah no. I'm just looking for the, its almost like a R:[fall back position?] Yeah exactly. You know so you can get some behaviour that is close to want you want. Right errr... mouse drag... right I think what I would do, is have my own box figure creation tool which overrode mouse drag and [just] had null behaviour. R: What does moue drag do? Errr... it calls display box in the created figure</p>	<p>Scrolling</p> <p>Looking up code</p>
318		<p>And [] the anchor point which is where it was initially positioned and a new location according to whether the mouse is actually down. R: So a potential solution at the moment is override mouse drag, turn it off and override mouse down and specify [start] Yeah that's what I'm going back... R:[] Yeah that's right... I think moue drag will do, for the moment if I just override mouse drag to prevent this resizing behaviour I think that is okay....confirmation of that would be appreciated! R: Well what I'm worried about is that although you have already specified the figures size, I don't know that mouse down will mouse down keep that? Will it alter the size?</p>	(this is not in the drag method)
319		<p>Right R: It might be that you create a figure with zero size. Okay....what mouse down does R: If you think about its behaviour when you click down it doesn't automatically give you a figure of any dimension. It's zero zero. Lets have a look in mouse up....removes empty figures? Lets see...</p>	<p>Scrolling to down</p> <p>Too much help!</p> <p>Reading code</p>
320		<p>Not entirely sure what an empty figure is. Wonder where that would be defined? [Probably in figure somewhere]. We are looking at mouse down... that calls create figure. That will clone the prototype its been given. The prototype well obviously it's a prototype...so that has dimensions so I'd have thought that would have been okay! I would have felt fairly happy with that actually. R: What about the line immediately below that? Below create tool. Below the... ? R: Call to create tool.</p>	<p>Seq from code No ref to code – assume</p> <p>Doesn't see problem in code</p>

		Okay it sets the display point at...	
321		<p>At anchor point, anchor point that's not very good is it!</p> <p>Right okay yeah. So it will be a miniscule box of zero dimension. Right okay, so all you have to do, well I'll tell you what I want to do then is to...</p> <p>That's quite annoying actually.</p> <p>R: Hmm hmmm. What would you like to do?</p> <p>Okay well what I'd like to do is to</p>	scrolling
322		<p>I can see a solution to this which overrode that and took out that line but again I'm, what I'm thinking about here is that there are two candidates... there are a number of things here. I suspect I might want to use that line for... or something like that for the positioning of it. So one solution would be that the display box, we have got the box already defined and what that is doing is changing the display box behaviour in the created figure. So just by overriding that and taking that line out the figure will then appear as defined in the prototype so I would be confident in that. So I'd do that for one [whole] part of the solution I think that would work okay.</p>	
323		<p>I'm now going on to the next bit which ... which is about locating it.</p> <p>R: Basically at this point if you do that Then I would say that you have a tool that would allow you to create blocks anywhere on the ground...</p> <p>Yeah that's right of a defined size.</p> <p>R: Of a defined size... and the behaviour is going to be constrained so...</p> <p>Yeah I feel that I've got all of that and I just need to get it to locate on the ground. Right now how to do this?</p>	scrolling
324		<p>There are a number of ways I think I can do this one of the ideas we mentioned earlier is this idea of... letting it appear or just if you like fixing the x location and ignoring the y location. So again I can see overriding mouse down... looking at the [] by looking at the anchor point...</p> <p>R: [Can you get access to that?]</p> <p>Its private</p> <p>R:[]</p> <p>It doesn't really matter</p>	Anchor point is on screen
325		<p>I've got to be a bit careful about it because... okay drag uses it [] somewhere. I think its okay actually, its only really used by down and drag. I don't think I need to worry too much about... being unable to see it. Right</p>	(Sub doesn't check everything this is an assumption)

		okay so one solution would be to look at the x location... check if... I've got my ground not occupying the full extend of the drawing...	
326		It's fifty in from each side or something. So check the x location if its comfortably above the ground, so if its [] greater than seventy then... less than five thirty or something like that. What I could then do having got rid of that line is alter the display box to create... to make it put something in that defines the display box and the created figure as being	?
327		As being better...I've translated the x and y locations. Oh sorry check the x location and translated the y location R: [You would do that with displaybox?] I'd do that with... yes with displaybox Yep. So I think that would give you the solution that... that will give you a first stab at the solution, which you suggested. [Get it there] and just drop it. My preferred solution would be to check it was at least close to the... close to the ground. I've got an intuitive thing about dropping the box and if you drop if from too high it will smash. R: Its not a major tweak then? It just looks at the y location and [determines if that would do it]	Fall back and then better solution
328		R: What about if there is a block there? Yeah I was going to get on to that bit... but there is one thing I haven't thought of yet which is what happens if its not... if its outside the edge of the ground or not near the ground. I think the solution then would be to... just not to... there is this line, view .add created figure would just be to ignore that so you would not add the created figure. It would only be added if it was within the dimensions... well I guess the other thing you could do is... R:[.... Does that apply to below the line and above the line] Yeah. Yeah.	Referring to code
329		R: Does the fact that [] affect it [] blocks []? Errr sorry I'm just following one train of thought here R: Carry on. What I'm not sure about is whether that is sufficient or whether I have to do something else about mouse up... R: What's your concern about efficiency? No no not efficiency. No no I just felt some concern with that about whether that is sufficient... sorry sufficient not efficient... because mouse up has got this thing, this created figure is empty and what I want to do... what I'd like to do is look at the definition of is empty to check whether ...	

330	MA Figure IH	... Possibly to do two things I don't want to add it and perhaps I want to make it empty. Why am I in the code? I'm in the code again (laugh). I want to know where is empty is defined.	Worried about interaction with rest of system Finds it in abs figure (does not look for further def)
331	SC Abstract figure	That's fine. So what it does is to alter its size or... looks at its size and...	Scrolling... cant see it... uses find - finds JD cmt
332	SC Creation tool	Right checks its display box. So going back to that... okay R: Are you looking in creation tool? I'm looking in creation tool R: Can I ask you a question? Before you continue [What you have just done there] Why [did you assume there were no other overridden definitions of isEmpty?] I don't see any reason to override it looks like a perfectly adequate definition. [I may well be] wrong?	
333		R: No. Its just that... there is only one definition... I just... It looks like... it looks figure independent its just using displaybox and it doesn't seem to be... Right so what I would do there is... in terms of feedback... R: Supposing I... I'll tell what I think would be a really nice solution, right which is what I'd like to do... which is actually not doing anything until mouse up right so go through all the mouse down	R misinterprets sub quiet
334		Mouse down remains pretty much as it is... except... R: Are you having trouble remembering your previous solution? No I'm just trying to... yeah going back up to the... line created figure dot displaybox which stops the drag behaviour. Okay leave that out... so we just create a figure. So mouse down is my new version of mouse down with created figure dot... created figure []. Right we are now going to concentrate on mouse up and what that's going to do is look at the notation of where it is so I'm actually shifting the behaviour out of mouse down	Mouse down on screen
335		And what I'm going to do... is R: So the problem has changed from [constraining] to validation then? Where as in mouse down you were maybe trying to ensure that a block was positioned in a valid place here if its not valid... Yeah, yeah. So what I'm going to do is... I'll	

		have something in mouse up, which looks at its location right? In exactly the same way as mouse down did. If it... [I'm wondering if this will work] what I'd like to do is on mouse up if it, if the thing isn't correctly positioned	
336		<p>I'd actually like the thing to shrink to nothing and disappear... I'd like the box just to shrink...</p> <p>R: Yeah I see what you mean.</p> <p>Right so what I'd try in there is again look at its location [compare it to] my location if the are not within a reasonable tolerance of the ground then have a loop which just reduces the displaybox to zero... or to one or something like that and then what that would then do is go on to this thing that checks if the created figure is empty. That looks at the size of the display box so that will then automatically remove it from the drawing. What I'm not sure about with that is whether it would appear? Would you actually observe that? I'm not sure when the thing gets drawn.</p>	(really nice idea - real hard to image it working)
337		<p>R: Emmm</p> <p>The other alternative...</p> <p>R: I have a feeling that you wouldn't see it Right. Yeah. But just that thing about giving the user some feed back its kind of obvious that...</p> <p>R:[...have that behaviour some how separated out from the tool so it can have a couple of cycles to do something]</p> <p>Do you want me to persue that or do you want</p> <p>R: Its up to you to be honest...</p> <p>I'll leave that, I don't think that it is essential.</p> <p>The other way of getting feed back is from...</p> <p>R: Okay I don't see any reason why the user shouldn't receive feedback</p>	R keeps interrupting sub
338	<p>MA Index</p> <p>MA Text holder</p> <p>PL Overview</p>	<p>Okay I was going to say, the other thing you could do is on mouse up is just have something appear in the...</p> <p>R: The thing down the bottom?</p> <p>Yeah. I couldn't remember the word for it the...</p> <p>R: I'm not going to give you any help. You will have to look for it... (laugh).</p> <p>Right! I keep saying toolbar or something... tool button... I'm trying to think what its called within... its not text holder is it?</p> <p>No. I'll have a look in...</p> <p>This thing.</p>	Indicates status bar with mouse on image
339	<p>PL Customising the DrawApp</p> <p>PL Customising the</p>	Try customising the GUI	Sub looks at all the hypertext links before deciding to go DA.

	GUI	Status bar.	Status bar text on screen misses it. Even says it!
340	MA Index	<p>Okay so I'm going to have a look at the ... micro architectures...</p> <p>Looking for draw application...</p> <p>Drawing view might? I'm trying to guess that now! I want to find where select status bar or what ever is called from</p>	Sub knows want status bar.
341	PL Overview PL Customising DA PL Customising GUI	<p>So I'm guessing its going to be within draw application</p> <p>R: [was the nothing in pattern language that came to your attention]</p> <p>Well...this is customising draw application so the implication is that it is there. There is customising GUI</p> <p>Gui is defined within the draw application</p> <p>R[]</p> <p>It just says illustrates the various parts that comprise the interface.</p> <p>R: Do you see the part...</p> <p>Oh sorry, sorry, I just... there is something at the bottom that I didn't bother reading very stupidly.</p>	Sub scrolls status bar text on screen
342	SC Creation tool	<p>Okay status bar displays information about the current state... 'to display specific information about an application show status string method in draw application can be used...' That's what I... that's fine. So right what I'm going to have to do then is... Okay, in creation tool what I'd have to do is... want to find out the result of the creation tool, whether creation tool has succeeded... there's a method figure, sorry there is a method created figure that returns what has been created</p>	
343	PL Using creation tool	<p>so what I could do then is in my draw application I've used creation tool to [deliver a figure] the created figure and if that is null then show status</p> <p>R: Say that again?</p> <p>Right...</p> <p>R: That's not what I was expecting. Right I'm going to be using...</p> <p>R: [Just tell me you have got this creation tool and this created figure is going to return null when its not created what is it that receives that again?</p>	
344	PL Adding buttons to the toolbar PL Using CT	<p>Errr that's what I'm looking at now... [] I've got a creation tool that's within draw application... so that calls create tools and...</p> <p>[] creation tool...</p>	

345	PL Adding buttons to toolbar PL Customising selection behaviour	R: What are you looking for? I'm looking for this thing... how you get the results back from that. R: [] Yeah. Well [just want] the interaction.	Scrolling Reading text
346	PL Adding buttons to the toolbar	R: [anything there?] Ermmm adding buttons to the toolbar. Right. Errrr.	
347	SC Creation tool MA Tool MA mouse up	What I'm thinking now is that I might have to do something in creation tool. Or tool button. I've kind of lost where I am in the chain of invocation Right this is creation tool. Right I'm going to have a go at the architecture to look at [just what happens with the] creation tool	
348	MA Tool MA ToolIH SC Creation Tool SC Selection Tool	R:[] Yeah its just back to search in tool. I want to do something [I know about the] selection tool. See what happens start with the, this [sequence] of events for that is. R: Does creation tool go back to selection tool? No well I'm not sure where the creation tool goes back to... again this is an area I'm not terribly familiar with.	
349	MA Tool MA mouse up	But well no...right okay...no, no that's wrong, that's wrong. Barking up the wrong tree. R: Can you go back to the tool micro-architecture? Yeah I am misinterpreting that. What I did was to look at mouse up R: That's telling you its called from two places, either the selection tool or the standard drawing view Yeah. Okay so its...I'll have a look at standard drawing view.	Suddenly sees something? Scrolling Selection tool is mentioned here!
350	MA Drawing view MA DrawingViewIH	R: What is it you are looking for? [] Mouse released. R: That's not part of the view hierarchy.	Looking for mouse stuff? Scrolling- wont see it here either.
351		Well I'd say its part of mouse listener. I'm	(mouse listener is

	SC Creation tool	<p>assuming its part of mouse listener. Mouse listener... doesn't mention anywhere in here errr...</p> <p>I think I'm getting a bit... kind of got a bit too deep here</p>	listed in diagram as super class)
352	PL Overview PL Using creation tool	<p>I'll tell you what my problem is... that you have got things like...</p> <p>The creation tool so we do this... we override</p>	
353	PL Adding buttons to the toolbar	<p>Create tools in draw application creation tool...okay what this does then is to change the palette...</p> <p>What I'm not happy about... not comfortable with is the... [what] that interacts with. Yeah where the interactions taking place</p> <p>R:[?]</p>	
354		<p>Right what is confusing me is that... you have got draw application right? We have added a tool in... now the thing is I need to know precisely the behaviour of that tool to know what's...what goes on there and to track that and check whether a figure has been created right? So I've got... and what I really...what I don't really know is when someone comes a long and does that. What the precise sequence of events that occurs is... that's all kind of hidden.</p> <p>R: So I presume you want to understand the relationship between a tool button and a tool?</p>	Indicates clicking on a button
355	MA index MA activate	<p>Errr well the tool button [] the application</p> <p>R: The tool button is in draw application. Yeah</p> <p>R: I'm very surprised that the micro-architectures isn't giving you anything to help you do this.</p> <p>Okay so I'll have a look in tool. You have got things like [] activate. Comes from... I'm not entirely sure what activate does [] draw application set tool</p>	
356	MA Tool MA KeyDown MA Drawingview	<p>Deactivate. Keydown.</p> <p>Standard Drawing view key pressed. [Is that key already in there]. Mousedown. Now you see we are into things like down up and drag, move, up. Now I know we are in tool. What I don't know is. I'm assuming [] standard drawing view.</p> <p>R: You are basically trying to identify just now what calls...</p> <p>Yeah.</p>	Don't think sun knows its key as in keyboard
357	MA Tool MA Keydown	<p>[], So all it did was...</p> <p>[R: I would like to draw this thing to a close.]</p> <p>Hmmm okay well is this key down [the right one] or is it not? [don't think it should be...</p>	No behavioural knowledge

	MA Tool	<p>don't think it should be]</p> <p>R: What do you think key down does?</p> <p>I don't know, because I don't see you interacting with keys unless they, unless it was some terminology for the tool button. But it doesn't seem right.</p> <p>R: Your initial assumption is correct, its to capture key events</p> <p>You see I see mouse down as being [after it] it seems the wrong point interaction</p>	Assumption
358	MA DrawingView MA Index	<p>R: [why describe in the application what you see then.]</p> <p>Okay what I want to do is you are in the drawing view I expect to see something like... press button on toolbar... its possibly a little optimistic</p> <p>R: I think that you are interpreting the drawing view as being the application. Okay lets have a look at the application. Draw... its not there.</p> <p>R: But just to point out something interesting there are actually two micro-architectures there that are related to draw application. Right so for your information draw application</p>	
359	MA PaletteListener MA PaletteSelected MA PalettelistenerIH	<p>Implements drawing editor and also implements palette listener</p> <p>Right. Okay would never have... right okay. I'll look in palette listener these are [].</p> <p>Yep. Okay Can I assume that's... want to know what that calls... where that is defined or implemented... Think I'll have a look in the hierarchy.</p>	Indicates palette button
400	SC ? SC DrawApplication	<p>Okay so then go to draw application and user selected</p> <p>This is the point I made, you know I was saying yesterday about something... [a little bit] just to point you towards.</p> <p>R: I've actually got my own opinion about that...</p>	Find on palette - pal
401		<p>R: Is that not it there?</p> <p>Oh right okay. Yeah that's over okay yeah that hovers over it... that's selected so that it casts a button to the toolbutton. Set selected?</p>	Almost jumped past it
402		<p>[]</p> <p>R: What where you expecting to happen?</p> <p>Right well... what do I want... what I want, what I'm expecting is this actually sends a message to creation tool to tell it to do something. Perhaps set selected does that? [lets have a look]</p> <p>R: What kind of thing do you expected it to do? Are you expecting it to do a mouse down?</p>	Doing a find set

403	MA PaletteListener IH	<p>No its already done a mouse down, I thought.</p> <p>R: At this point []</p> <p>I thought it had done a clicked. The user selected [means that it has done a mouse and done a clicked] clicked. I thought</p> <p>R:[I think you are on the wrong track with this]</p> <p>Right. Well I don't know how it gets to there then I thought that... because user over is just hovering over it and it brings up the status that is absolutely fine...</p> <p>R: [what happens with] user selected because a user has clicked on a button.</p> <p>Un huh That's what I thought its going to do its done a click.</p> <p>R: Ah sorry I'm [getting mixed up here] You are right. Now what do you, are you expecting the tool to do? You are coding the solution but what are you expecting</p>	<p>Mouse down?</p> <p>(like know this already)</p>
404	SC DrawApplication	<p>Its not a mouse down is it?</p> <p>Hang on a minute...I see this working in two... there are two interactions here okay?</p> <p>The user seeing this tool button there goes click on that that has selected it you then drag it and do that which positions the figure</p> <p>R: What if I said there are three interactions?</p> <p>The first interaction is that you got to select the tool and click. Right? That changes the state of the application so that that tool is currently active.</p> <p>This was why I was going to look at set selected.</p>	<p>Knew sub had wrong end of stick</p> <p>Find set selected</p>
405		<p>So it sets the selected tool button.</p> <p>R:[... palette ...]</p> <p>R: Are you stuck?</p> <p>No its alright. I'm slightly frust... I'm missing a link here and I can't see...</p>	
406		<p>R: I don't know whether we are going to get more out of letting you batter away at it or actually telling you how it works and then know why it didn't make sense to you?</p> <p>Okay I'll tell you what... yeah... so I'm assuming right, you go click you have then selected a particular tool right... now okay so I'm then looking for some other behaviour in the drawing editor... some sort of I presume a sort of mouse down... in the drawing editor</p> <p>R: Right. Now you are getting somewhere. Which will then do something... I'm not happy with...</p> <p>R:[for the moment ignore the detail]</p> <p>Yeah but I haven't got a link to the creation tool or whatever so again...</p>	Scrolling code
407		R: The bit that you are missing here is that	

	MA PaletteListener IH MA Drawing View	<p>you are looking in the wrong place for that. Good.</p> <p>R: And I think that it has actually come up in the process of... where are you...drawing view, yep.</p> <p>Presumably... I think what happens now is the application that hands over. There is a control aspect to this... handing back control to the view. I think so...</p> <p>R: [] The draw application acting as a drawing editor has an instance variable current tool. And that has been set...</p> <p>Yeah, yeah I've got that...</p> <p>R: right.</p> <p>That's fine which is why I'm now looking for the next thing that will invoke the []...send it in to that.</p>	
408	MA Index MA DrawingView SC DrawApplication	<p>R: The drawing view... is then because that is the graphical representation it is listening for mouse clicks, in the standard draw view, on itself when it gets them it goes to the drawing editor gets the current tool and then passes on mouse down and...whatever. [You are never going to find the tool in standard drawing]</p> <p>Yeah again it implements a listener so...</p> <p>R: That's why you found when you went to the tool mouse down, standard drawing view.mouse pressed.</p> <p>Yeah.</p> <p>R: that was the method that was getting called. But there was no way to relate that fact to the original selection in the first place. No</p>	
409	SC Standard drawing	<p>R:[]</p> <p>Yeah I'll stop fairly soon.</p> <p>R: I would like to ask you some question on your experiences in this section</p>	scrolling
410	SC Standard drawing view	<p>R: What are you looking for?</p> <p>That's a good question. I want standard drawing view don't I...</p> <p>Is it in standard?</p> <p>R: Yeah. []</p> <p>[]</p>	Scrolling (not apparently finding ?)
411		<p>Right okay. So you have got this thing tool dot mouse down. And that will... right.</p> <p>What I would then do, okay, within that I would then do tool dot whatever has called it, created figure or something like that and</p>	Find for mouse Mouse pressed on screen

		<p>check that.</p> <p>R: Couldn't do that</p> <p>Couldn't do that. Good. Okay.</p> <p>R: Well you could but [...creation tool...]</p>	
412		<p>Right</p> <p>R: That's just putting a very artificial hurdle but its only []</p> <p>Okay. So, right.</p> <p>R: Once you get back to []. I think you were working[on the right track actually]. So mouse [] if it was mouse released then [] its going to get, its going to get a [fail] how does it then tell the status bar which is over in draw application how do you get a hold of that to set its value?</p>	Prompting sub – would they have got it?
413		<p>Right yeah, this is where I was coming from initially because you have got the... create tools is implemented in draw application this is [why] I was trying to link the whole thing together which is something I find very, very hard with hot draw.</p> <p>I don't know if it's the same thing... Yeah. I don't know. I would have to look at things like the drawing view to see if there is anything that... anyway of discerning that a drawing view has changed in some respect. If the drawing...</p> <p>R: Why do you want to know if the drawing view has changed?</p>	
414		<p>I'm just...I'm just cycling through options really. I guess the drawing [] maintain the status before and after the drawing that's why things like you can take a ...</p> <p>R: Are you still worried about figuring out whether the tool is [] or not? Don't worry about that.</p> <p>No, no, no. All I'm trying to figure out now is...</p> <p>R: Well I'm telling you that depending on where you are, you can actually get a hold of draw application.</p> <p>Yeah but I'm in draw application.</p> <p>R: No you are in standard drawing view.</p> <p>No... no what I'm thinking of in the context of draw application where I've got create tools in draw application. I've got my blocks world application so I'm thinking of this as being the... the starting point in someway</p>	Stuck – fed up?
415		<p>Right? Draw Application has kicked off this chain of events.</p> <p>R: The chain of events was started by the click on tool button though?</p> <p>Yeah... okay.... Errrr....</p>	Scrolling a little in code
416	MA Drawing View IH	<p>I've actually lost my whole chain of... control of my brain! I can't think what... what...</p>	Not using doc?

417	MA index MA Palette listener MA Palette Listener IH MA Drawing View MA Index SC Standard drawing view	Just thought [looking] at listener Draw Application implements that. So Draw application notes the tool that was selected that's all it does it stops there. So that's all it does it just has a reference to the tool. Right. We then. We are in standard drawing view. Then. R:[] Right okay. Yeah so standard drawing view checks the mouse events. R:[you want the mouse pressed]	? Might say mouse events wont appear on diagram.
418		Yeah so...so mouse pressed does a request focus...errr... it then gets point. It sends a mouse down message to whatever tool happens to be selected and then a check damage. R: I think that what you want to understand is that tool method there. That tool mouse down method? R: No tool is a method that returns... Oh sh*t! Right okay. I didn't actually spot that or just ermmm yeah. So I need to look at that.	find
419	MA index MA Drawing Editor IH	I just assumed that was going to return a reference to the selected tool, which I suspect it does but it may be a wee bit more than that. R: I think its important that you look at it. That will fill in your missing gap. Right. Return fEditor dot tool! Right so fEditor is the reference to the current drawing editor. Is that right? R: Yep. Right. And... I have absolutely no concept of what the drawing editor is... R: In fact I will tell you that it is an interface... Right okay. R[] Okay you have got the drawing editor. I think I will look at the hierarchy. Okay so I have the application	Feditor.tool
420	SC Standard drawing view	So... R: So I think now you can guess what tool does it returns the currently selected tool. The important point is that we are back in draw application and that is where we are selecting the tool and getting a hold of the tool Right so So are you suggesting that...	scrolling
421			

	MA Drawing editor IH	<p>That what I could do then is just use that, not actually use a tool but... just use a reference to fEditor to set the status, show status.</p> <p>R: If you look at the [editor] interface show status is one of them.</p> <p>Yeah</p> <p>R: So yeah. Actually you want the behaviour to, the figure was not added because of whatever problem</p> <p>Right we still have got this. Right Okay to actually do that.</p>	
422	SC Standard drawing view	<p>I would have to [I don't see] exactly how I'd do this... there is still some point at where I need to determine if this has succeeded.</p> <p>R: Your actual tool would need to []. I wouldn't worry about that. I think that you can do that that's quite a low level detail.</p> <p>No where I do it that's what's bugging me, is actually where I do it</p>	scrolling
423		<p>R: I think that you have already said this before. You said to me earlier that you can use created figure and the only problem with created figure is it then involves this [] but... You can check if its an instance though</p> <p>R: Yeah exactly and we are already overriding [standard drawing view anyway]</p> <p>No we are not.</p> <p>R: You will be... if you want to change your mouse up behaviour...you want to do that.</p> <p>No</p> <p>R: You said you want to use fEditor to [] in drawing view to set the show status and the only way you are going to do that is to override...</p> <p>The only mouse up behaviour I'm overriding is in creation tool I never mentioned overriding anything in standard drawing view.</p> <p>R: Its tape recorded don't argue!</p> <p>I think you will find when you review this that I never mentioned overriding...</p>	Said tongue in cheek
424		<p>R: Well I think you said it. The solution you have taken encourages you to do that.</p> <p>Erm... </p> <p>No. because tool is public</p> <p>R: Yeah but fEditor is definitely not public. And you need to use fEditor to call show status.</p> <p>Ah right.</p>	Scrolling. Find for tool
425		<p>Yeah... so that... yeah okay. One of the things that I did in the previous thing was that within my application I wasn't overriding standard drawing [] the view? I never even thought about...</p> <p>R: What was that?</p> <p>I never thought about the role of standard drawing view at all. Until this. It never really</p>	

		<p>featured in...</p> <p>R:[what's your perception of it now?]</p> <p>I'm still very...</p> <p>R: Its very vague not well defined.</p> <p>Very unclear of the whole MVC set up really am that's my biggest problem really in this.</p>	
426		<p>There is a chain of events through these things and then you have got these things that's my biggest hurdle. I'm still not... still don't understand it</p> <p>R: Lets stop at that.</p> <p>Yeah sure.</p>	
437		Post task interview	

5.1.3 Participant C

Time	Documentation	Subject Talk aloud	Researcher Observations
0		Pre-task activities	
20		I'm trying to get the ground to appear when it loads up. Create a drawing and have a ground object on it...(Subs describes other problems from task)	
21		R: which of these are you going to start with? I think I'll start with the ground. Where is the source code? (R gives instructions to find it)	
22	PL Overview PL Identifying Existing Figures PL Figure hierarchy	R: What is the first thing that you will be looking for? I'm going to create a figure. I found the pattern language... the hierarchy of the figures quite good. I have to decide at this point whether to make the ground a figure or a composite figure (rectangle). Probably look at both cases...	Scrolling
23		Two options I'd have a rectangle figure or a group figure. So I'd start with it as rectangle figure. It's quite good to see where it is in the hierarchy form this, makes it easier to find in the source code.	Sub is looking at package info on diagram
24	SC Rectangle Figure	No limit on the size or shape of ground just a thin rectangle. I would override the constructor [for the size]	
25	PL Figure Hierarchy SC Draw Application	R: What method would you use to set size? Basic display box R: How are we going to get that to appear? Create a new drawing (Finds standard drawing on diagram) It would be in the draw application where it sets which drawing it is	R should not have asked this sub already said how to do size R did not pick up on it. Sub looking for create drawing takes a little while to locate it in SC
26		Create drawing, instead of putting in standard drawing you can put in your drawing, which would inherit from standard drawing. On its constructor method it would create and add a ground figure. R: And then you would set up position and we don't need to worry about that.	R shouldn't have said that now don't know if it would have occurred to sub or not!
27		R: To make it a bit harder how do we handle window resizing? I suppose the drawing would control that. The drawing is just a composite figure so it knows	Quick answer no need for doc (seen similar problems?)

		where it is and knows its size. So its 'basic display box' method, it could then reposition all the figures inside it including the ground.	
28	PL Figure IH	<p>R: Yeah that's pretty much the essence of it. Definitely</p> <p>I think the next thing is to create boxes. So its just a case of using a creation tool but we will define our block figure first.</p> <p>R: Okay so supposing we start there [how are] we going to create this block figure?</p> <p>I think it is just basically a rectangle with the constraint that it is a fixed size and colour.</p>	
29	SC RectangleFigure	<p>It also has got to be connected to the ground or another block so could actually get a... have a line connection created... when creating the figure create a line connection which would then link up to either another box or the ground</p> <p>R: We will come to that in just a moment but lets [] go into some of the points you mentioned earlier how are we going to constrain its size and its colour? Specifically how are you going to do these things?</p> <p>Hmmm. Rectangle figures display box... method it can just pass in a fixed size or even if you tried to drag it anywhere else it would just be fixed.</p>	<p>Scrolling</p> <p>Gets name form IH</p> <p>Several people go connections why?</p>
30	MA index MA figure MA Set attribute	<p>To be forty, forty. set attribute... the micro architectures might be useful.</p> <p>R: What is that telling you? Is it telling you anything useful?</p> <p>Hmmm [].</p> <p>R: Actually who calls... Who calls set attribute.</p>	Looking for SA?
31	MA Figure MA FigureIH	<p>Doesn't really help me because we just want to call it from rectangle figure, we know where we want to call it from we don't know [what we want to do with it].</p> <p>R: What about the other view the hierarchy view that will show you where set attribute is defined. Then after that you might want to look in the source code or...</p> <p>In abstract figure its defined... ... Attribute figure.</p>	Scrolling around looking for method
32	SC attribute figure	<p>There is set attribute need to know an attribute and a value. Which is the fill colour and the colour.</p> <p>R: So we have got the colour and we have got was it basic display box on rectangle figure?</p> <p>Hmm mmm.</p> <p>R: we now have a block who's size is set in basic display box, where is its colour going to be set where are we going to do that? I know we are going to call set attribute but where are we going to do that?</p> <p>You could just put it in the constructor I suppose.</p>	Might see atrib in code but equally might already know it

33	<p>PL Overview</p> <p>PL Using Creation Tool</p> <p>PL Adding Buttons to the tool bar</p>	<p>R: I think we can now say we have got a reasonable idea about our block how are we going to create this?</p> <p>R: Right so I think we can now say we have got a decent idea of our block how are we going to create it?</p> <p>The pattern language I know from using it before is a good example for creation tool. So basically just put that code into the draw application obviously with a new creation tool that would create a new blocksfigure and we have also got help with adding the button as well. So that's quite useful to help create the button on the palette.</p> <p>R: So now we have got a solution where ...</p>	<p>Sub knows exactly what they want to do. R doesn't push for enough detail, no mention of resize problem detail about mouse actions etc</p>
34		<p>We have got our ground in position, so it doesn't matter a resize will not affect it, we have got a block figure and we know we can add that in. So now we turn to constraints...</p> <p>...</p> <p>R: So now we turn to the problem of constraints. How are we going to tackle them? You said earlier on when you were kicking ideas about, you said something about using line...?</p> <p>I was looking at line connection. Between the block and either the block or the ground. The only problem with that is a that you can only put a block onto a block if its at the top of a stack. And its how that block knows it is at the top of the stack?</p> <p>R: How would your solution there work? In terms of the user, what...</p>	
35		<p>R: Would the user have to do?</p> <p>Well they would have to click on the block and then click on the screen and then drag the cursor...</p> <p>R: So this would allow the block to be up in space?</p> <p>Yeah. Once the connection was made it would know to move itself...</p> <p>R: and once you had made the connection that would have...</p> <p>The connection would automatically move it there.</p> <p>R: Okay supposing, I wanted to be a difficult customer and said I don't want it to work that way, what I want is the user creates the block and where ever they click the mouse, regardless of where it is. I want the block to fall into the nearest valid position. If you see what I'm saying... so if you clicked up above the ground I want it to be at the corresponding position on the ground. Or if there is a block there on top of the other block. If you see what I mean?</p>	
36		<p>I think it would be the drawing that would control that then. It's the only thing that knows where all the things are on the screen.</p>	

		<p>R: So it would add, the creation tool, would add the block at whatever position and then the drawing would have some logic in it that said, I know where my ground is, I know that block is in an invalid position and then it would have some algorithm that would move that block into a valid position on the drawing?</p> <p>Hmm mmmm.</p> <p>R: Okay, and then there would be another complication about checking to see if another block was there and doing something. Okay I think that is a reasonable solution.</p>	Sub never said anything!
37		<p>R: and would that also work for the alignment of blocks? The drawing would have to decide if two blocks were aligned?</p> <p>Uh huh it would. The only thing it wouldn't be able to do is if you are moving the blocks, you are not allowed to move one that is at the top of a stack. I suppose because you are [clicking] on an actual block maybe the drawing could actually, maybe there could be some sort of variable held in the block that would let it be moved or not be moved depending on if it was set or not and the drawing could then set that variable to true or false so that would then, you would override move by so you wouldn't allow the user to move a block if the variable had been set to false</p>	
38		<p>By the drawing would not let it be moved. []</p> <p>R: That's fine. I don't think there are any other requirements on that sheet!</p> <p>I would try that out the other way. If I was actually programming it and see if it worked.</p> <p>R: Right. I think that is fine. Its amazing actually... I think I have seen a few different people going through this and they have not been as quick as that,</p>	<p>Referring to the use of compfig for blocks (not serious about this)</p> <p>R should keep opinions to himself</p>
39		<p>but I guess the one area where you could criticise that solution is your drawing. You have got an awful lot of responsibility in it.</p> <p>[]</p> <p>R: Do you see any other ways of making it more modular? I suppose there is this idea that the drawing is in control of this is there anyway we could take some of that responsibility away from the drawing and put it any where else?</p>	
40		<p>Could try to keep the blocks [].</p> <p>R: Yeah.</p> <p>If they were pass in where another block was it could move itself or something.</p> <p>R: What about if you, do you think it would be possible to have a, say something like a composite figure that acts as a stack of blocks? Does that sound plausible?</p> <p>Hmm mmm</p> <p>R: And maybe that could control the alignment of it.</p>	R again is feeding answers!

		<p>It could also control whether a block could be moved or not. Without variables having to be set or whatever. But you are not allowed to move the whole stack at a time []</p> <p>R: How would you handle that?</p> <p>If you are moving one block then you are sort of moving it from one stack to another</p>	
41		<p>So its... its not making the composite figure move at all [].</p> <p>R: Is there any implications for the way that the tool works?</p> <p>In the creation tool?</p> <p>R: Well the selection tool I'm thinking. []</p> <p>Well it could detect if you are selecting a block, if it was a composite figure that you where clicking on, so it would get a composite figure to pass back to the tool whether it was allowed to select that block or not [] select the one at the top.</p>	
42		<p>You'd have to [change] selection tools mouse down method make that, just detecting the figure, usually its just detecting composite figure, you actually have to go inside the composite figure though, to get the figure at the top of the stack.</p> <p>R: For the bonus point can you tell me the methods you methods you would use to do that?</p> <p>Emmm, just the figureAt, there is a find figure and you need to put in the coordinates and it would find the figure inside the composite figure</p>	
43		<p>R: I think that's fine. [You've done really well]... I think that the subjects I have had previously haven't had your experience, which seems to have really cut through the problem. You are familiar with how it works and you don't really need to use the documentation...</p> <p>Yeah you just think about the ways you have used it before.</p> <p>R: What project was it you were doing? Was it the sliding puzzle one?</p> <p>Uh huh. I had to have the board coming up on creation of the, drawing so that's how I knew I could do that and I was using a composite figure to hold all the tiles and the board. So I had had that with selection, needing to click on it.</p>	
44		<p>R: Yeah for moving a tile?</p> <p>For moving a tile. [] composite figure, figure at R:[]</p> <p>A composite figure sort of controls everything so... [] the drawing and the standard [] figure. [].</p> <p>R: Right that is fine. I will ask a few questions before we are finished and then...</p> <p>I found the patterns really useful during the project,</p> <p>R: Yeah. That's good.</p> <p>[especially animation] So that was really handy.</p> <p>R: What kind of things? Obviously you had more time with the pattern language? Is it the things that are quite specific and concrete? You mentioned earlier on</p>	

45	PL Creating Animation	<p>About the creation tool. Hmmm that was good. R: because it kind of shows you that example... You have got the code yeah. R: So I mean I can't remember what animation does is that similar? Yeah it gives... R: An actual example. And it gives you the classes and...I don't then have to go and look through all the classes. [that saved time]. R: And you also said about the hierarchies, were good? The hierarchies were useful, especially the figure hierarchy. R: In terms of identifying what options are there? I didn't even know that drawing was a composite figure until I looked at that. R: Yeah that's a cheeky one isn't it. It makes you understand a lot more about what it does. And the different types of figures and the different types of connections. R: Because you understand that if a drawing is a composite figure then it can react anyway that a figure can react? Hmm hmmm.</p>	
46	PL using Action tool PL Tool IH	<p>And the same for the tool hierarchy as well. And action tools, I used that as well.</p> <p>I was using...for the code I was just using standard selection tool... uh its not here? R: What is it you are looking for? The action tool. R: Oh the action tool, Is it descended from that? It inherits from selection tool but I don't know... R: Ah flaw in the diagram! There are a few of them I'm afraid. Have you found any...if fact you mentioned the code in creation tool. Yeah it wasn't until I compiled it that it was coming up. R: Did that throw you? Was that a big problem? No I don't think if you read the code it really was.</p>	<p>Sub is looking at selection tool</p> <p>Interesting sub was trying to show use of doc must have found this out another way – but remembers the PL positively.</p>
47	PL Mod existing figures.	<p>Anyway it was giving you the general idea of what was going to be involved. R: There is a pattern in here that I'm really embarrassed by because I think it is quite useless but I would like your opinion on it. If you go to modifying existing figures. I don't know if you have ever had need to look at that before. Does that give you anything? Figures are sort of the easiest ones to...have. I've not really looked at... R: You've not really... Because that was the first thing we did in the architecture practical so... all the first practical were about modifying a rectangle figure. R: What about some of the more obscure things, things that you haven't used in your project.</p>	

		Things like locators for example.	
48		<p>Not used locators at all, I had a quick look at it but never really used them. Looked at handles a bit. Just because I wasn't wanting to have handles</p> <p>R: I see to disable them?</p> <p>Uh huh. I just used the null handles. But again I didn't have that much to do with them I don't think.</p> <p>R: Okay lets go through these questions then....</p>	
58		Post task interview	

5.1.4 Participant D

Time	Documentation	Subject Talk aloud	Researcher Observations
0		Pre-Task Activities	
12		<p>R: I would just start you off by asking, how are we going to do this?</p> <p>I think the first port of call is to look into the rectangle figure [constrain it to be squares of the right size and colour]</p> <p>R: okay so you are going to start off essentially with how to create a block?</p> <p>Yeah. So I think the first step will be to do a subclass of rectangle and within that you can limit the drawing view to a certain size. So the drawing view is always that size.</p>	? this is not even correct!
13	MA index MA Figure MA displaybox MA Index MA Figure	<p>R: Do you know specifically what method you would use to achieve that?</p> <p>I think there is... one way you would just change...</p> <p>R: []</p> <p>Yes its...</p>	Sub has mouse on displaybox
14	Closes window Opening code SC Rectangle Figure	<p>R: Are you looking for a particular thing or are you trying to see what possibilities you have?</p> <p>I'm trying to think what methods may be... yeah its just a displaybox, in particular if you just put forty and forty in there that would make sure it was...that's one way of doing it don't know if that's...</p> <p>R: That sounds as if it is a possibility</p> <p>And obviously it can be drawn where ever these other two parameters are set. That just fixes it</p>	Scrolls db onto screen Indicates width height in method Indicating x and y pos
15	MA figure SC rectangle figure	<p>R: Okay I don't think I see any problems with that. Possibly I would prompt you to say is do you know whether you would use display box or basic display box?</p> <p>That was just display box</p> <p>R: Does it not call basic display box? Anyway that's all right you can play around with that and you wont have any problems... I was wondering whether there are any other alternatives you could use except for that? Maybe? Is that the way you would do it?</p>	Shows R code again.
16		<p>Erm...</p> <p>R: I mean I think it could be done just...</p> <p>No I'm sure there are other ways to do it this, I think I'm getting bogged down because this maybe how I've done it for the assessment exercise.</p> <p>[] I suppose the other thing is where do I set the colour? There are a couple of ways you can do it. In a sort of draw method, set it in there. Or you</p>	

		<p>can just set is as an attribute. Which might be a better way of doing it</p> <p>R: Yeah I'm more interested in that way. Again I would ask for more detail. What method is it we are looking for?</p>	
17	<p>MA Index</p> <p>MA Figure IH</p> <p>SC rectangle figure</p>	<p>I think its attribute figure I'm looking for.... It's a super class... you would just use the set attribute?</p>	<p>Not sure where to go here (att fig - not visible)</p> <p>looking for set attribute</p>
18	<p>SC Attribute figure</p>	<p>R: Are you looking for what attribute to set? Is that it? [just going to use that]</p> <p>R: My next question is then what kinds of attributes can you set?</p> <p>Really the...attribute, my understanding was that you could just set it to any kind of object so that's maybe the more general way of... I just wonder if there is a more specific one.</p>	<p>Scrolling - pauses at list of attributes (initialise list) Stops on get set colour</p> <p>Hasn't seen get/set colour?</p>
19	<p>MA FigureIH</p>	<p>Yeah you see this it sets the attribute fill colour for you.</p> <p>R: That's fine. The other way the way that you were originally looking at. You can actually do that, the set attributes, as opposed to the set fill colour, frame colour. The set attributes is just passed in a string that is, whatever it is the frame colour, and then the value that you want it is the same way of doing it actually. Slightly different path to get there. Okay so I think we are getting there, we have got our figure that is now... its constrained to be the right size and the right colour . I don't think any thing else can affect... we can't resize this figure in anyway can we?</p>	<p>Set colour</p> <p>Why change doc?</p>
20		<p>No it won't...</p> <p>R: [] handles but it wont?</p> <p>The other thing to do with handles is to set null handles</p> <p>R: Yeah. Okay. But I thing that the way we have done this you wouldn't need to bother about that. One thing that we do have a problem with however is that when we create a figure [] create a figure... well I'm getting ahead of myself a little bit. You haven't told us how to create a figure yet. But I think there is a potential problem</p>	

21		<p>When it comes to creating a figure, that part of creating a figure is specifying its size and that's going to be an issue that we are going to need to deal with but I think that is fine for just now. I think we have got a start on our figure so we are going to have this block figure that is descended from rectangle figure. What are we going to do with this? What is the next thing we are going to look into?</p> <p>I suppose we have to do the ground?</p> <p>R: Okay. Right...</p> <p>R: What is the next thing?</p> <p>I suppose we have to do the ground. Maybe thinking of doing a customised drawing view. The default has nothing there and obviously...</p>	Does sub make distinction between D and DV?
22		<p>...we want the ground to be there all the time so probably drawing the rectangle would...</p> <p>Maybe create it as a figure. Could create it as a figure that can't be moved.</p>	
23	MA Drawing ViewIH	<p>R: Sounds good, how are we going to achieve this?</p> <p>I think standard drawing view is a prime candidate. Never actually thought about how you put something there all the time. Obviously you don't want a button to create it so...</p>	Sub is scrolling down method names, focusing on standard DV
24		<p>Okay yeah, just on initialisation of the standard drawing to ask it to draw a figure, the specified rectangle (without handles?) at a particular point. It will always be there but can't be moved. I think you would need to create rather than just drawing on the screen because you would be able to attach things to the ground. So need a subclass of rectangle again which is black and skinny.</p>	
25		<p>R: Initially you said Drawing View then the last thing you said there was drawing, which did you mean?</p> <p>Drawing View</p> <p>R: Can you tell me where in the process of initialisation that would actually happen and how you add the figure to the drawing view?</p> <p>(Sub is looking for DV)</p> <p>I should probably look to see where this is?</p>	Sub ignores question
26	MA DrawingView	<p>So if I've just come across this and want to know which sub directory its in...is there any way?</p> <p>R: Probably easier just asking me? Drawing View is in framework but it is an interface its implementation is Standard drawing view is in standard.</p>	
27	SC Standard DrawingView	<p>R: What are you looking for? Initialisation?</p> <p>Constructor – This is where it basically sets it up</p>	Sub is scrolling quickly to the constructor.
28		<p>R: Are you thinking, override drawing view and add ground figure in constructor?</p> <p>Yeah. I mean I suppose you shouldn't really?</p>	

		R: Why are you worried about the subclass? Create a subclass, my standard drawing view, and it would just be overriding the relevant ...	Scrolling around
29		R: Are you trying to get an idea of what is in drawing view? Hmmm hmmm. Yeah. I could probably try to override the class R: If you did that what would you see in the implementation?	Stops scrolling (don't know why)
30		Assume we create a figure called the ground and just pop in the line, ground equals new figure and put the parameters in for position. R: If we do that it wont appear on the drawing! There is a wee bit more to investigate. Well I know you have to call my standard drawing view	Sub moves to constructor
31		R: That is true you need to make sure that the application is using the correct drawing view. What we need to make sure is that ground figure is a part of the drawing. Just now if you create a ground as a private variable inside the view it wont physically appear on screen!	
32		Yeah because ... the drawings underline the view so you have to put it in the drawing itself. Okay so I'd put it in drawing. R: Okay and it's the same story there! What method do you use to put it in the drawing?	
33	MA DrawingIH	Normally the application itself would call add(figure) so... I'm not too familiar with drawing R: So you think you would use add(figure)? Is that what you are saying? Well that's how I've seen figures, I don't really know... R: That's fine, that's fine. That is how we would go about it. I need some clarification about the structure.	Reading methods? Not spotted quickly
34		Ah yes where the add(figure) goes. I think sensibly it would have to go where the initialisation is done. R: Do you have any idea where that is?	Sub pauses on MA title page for a while
35	MA Drawing Editor PL Overview PL Customising DrawApplication	I'm not really sure R: If it helps feel free to use the pattern language and the source code. Yeah. Is it not just in the subclass of application? That's where you add all the other figures? R: Sounds promising	Stays on DE briefly
36	MA ?	I'd look in draw application	Sub goes to MA

	SC Draw Application	Should I know this? R: It might be a bit of the framework you haven't seen before. There is a lot to get through here not worried how far you get.	looking for DA (not there)
37		There is initialise drawing there. Which looks helpful but that's calling ... create drawing.	Scrolling down Continues scrolling (to find CD)
38		Back to init drawing! (Sigh)	Scrolling, goes back to top of file and scrolls from there. Continues to scroll.
39		Yeah pretty much just add a figure to drawing at that point (init Drawing) using dot add R: Okay that sounds about right. Okay so we don't need to override drawing you just add it? I think that would be more sensible.	
40		R: That gives us our ground. What about, we have got this block figure now we need to figure out how we can add [The blockfigure] how are we going to do that? Okay. I think with a button. [] multiple ones [] R: Yeah that sounds like a good idea. But I have to make sure that they can't exist apart from, they can only exist on the ground or on top of the block So at the point of creation ... I suppose we could use our constraints to create a connection...	
41		...on that has to be attached to another block or the ground and [] valid you then have two reference points that you can move them with. R: Lets take this one step at a time before we get to far ahead. I think that is an interesting idea and I would like to come back to that but before we do that lets just assume that the constraints are not that important just now and all we want to do is look at the actually ability to add blocks and have the blocks on any position on the drawing. Lets see how we would do that. Then worry about constraining it later.	
42		In your new application [] and err... It would just be a creation tool. R: Yeah, that's right. And how would we add that? You would have to change the... you'd have to change something [] hmmm. R: [where is it we would add the tool?]	
43	SC Rectangle Figure	Is it... I think its basic display point, display box, sorry but hmmm ... R: Are you trying to do it from memory are you trying to remember? Yeah. Cos I remember creating [a figure and tool before] changed one of the methods...	
44		R: I don't know if we are maybe talking at cross-	

	MA ?	<p>purposes. All I'm looking for just now is how to you actually add this tool? How do you actually add that onto the application?</p> <p>Well you inherit the... well we discussed how we added the button did we? We haven't oh! After you inherit the button palette [you put it?]</p> <p>ermm...</p> <p>R: Maybe the pattern language might have the solution?</p>	
45	PL Using CreationTool	<p>I am thinking on the wrong track again! Having to make sure that [] composite []. There is Creation tool.</p> <p>Yeah you would inherit the, you would override the basic palette and you would inherit the basic, the default tool, the selection tool. I would imagine.</p> <p>R: So basically you know that you would override the...create tools method was that?</p> <p>Yeah super.create tools you would inherit</p>	
46		<p>R: Okay that's fine, so you basically do that and that takes us to the point where you have got a block, you have got the ground and you can have as many blocks as you want. Now I want to turn to this problem of how we are going to create the constraints what do you think about... oh wait, sorry, sorry before we do that. The problem that I mentioned earlier comes up here, you constrained the block size using basically by calling display box okay? So that it is set to be forty, forty. The trouble is that creation tool when initially it starts up allows you to create figures of any size. So basically you click then you drag...</p>	
47		<p>And then whatever size you have clicked and dragged is the size of the figure that you get after that the constraints on the display box come into effect. So do you have any thoughts before we go on to constraints about how to deal with this?</p> <p>Yeah that should, the line here into new square figure you can pop some parameters into there.</p> <p>R: Yeah. Even if you do that though you are still going to have this problem. I know it sounds kind of counter intuitive but if you set rectangle figure forty, forty, the creation tool after that creation tool still has the ability when it creates it to change its size.</p> <p>There is one way of stopping it. Its not perhaps the most obvious way, overriding</p>	
48	MA Index	<p>...the mouse movement and actually subtracting mouse movement because it wont be actually needed. [Is that not the easiest way?]</p> <p>R: No but that sounds promising!</p> <p>Okay so have to see the mouse...</p> <p>R: what are you looking for just now?</p> <p>DragAreaTracker is the one that I...its it's a rubberband rectangle []. You can override that and just remove the code and that will stop that</p>	

		actually working. You do a subclass of that... I think...it could be in drawing view... something like that...	
49	MA DrawingView SC DragTracker	R: Is this going to be called by creation tool?	Quiet reads methods?
50	SC ? MA DrawingView	[] R: No I can remember having a conversation or two about... No no drag tracker is something else that's [don't know what I was?] thinking there. Select area tracker [] its fairly simple to inherit from that class, select area tracker and then you call that one, that's called, is that selection tool there is a method in there which calls the standard drawing. R: it calls the select area [then]? Yes. You change that and put in a new one R: You see this kind of goes back to my problem that you are absolutely right [] spot on	
51	MA ToolIH	...are we working with creation tool? Creation tool handles these things Ermm... look at tools See creation ermm mouse drag and mouse... mouse events are... control is given to the current tool, which would be selection tool, I think. R:Yep [If its another tool I don't know if its any different] so it would be in selection tool I suppose, subclass of that.	
52		R: Well the point you are making is an important one, if we are creating a new figure then creation tool would be our current tool and basically we have this problem that we want to try and prevent creation tool from changing the size of the figure it creates. Ermm you could create a subclass of creation tool and call that instead of normal creation tool, the subclass has had something removed from it. [I'll go and look]	
53	SC CreationTool	Yeah you just override the mouse drag and ... so that's saying that the point that was clicked, this anchor point was dragged to its new point, so the new point...	
54		Surely you would... all you want it to do is when you click... ermm... no just disable mouse drag. You don't need it. R: That sounds fine. Just to be more pedantic if you go to... well if you do that [we still have to set the size to forty, forty]. Is there a place in here that we can do that? I mean what I want is when you click the mouse I want the shape to appear at that size	
55		If you don't do something else now then when you click drag it, right you just create a figure of zero size. How are we going to get around that?	

56		<p>In... mouse down method if you just specify... the display box...</p> <p>R: No keep going...</p> <p>Okay, the new point is where you click and its... yeah...</p>	
57		<p>Yeah, you can put four parameters into the display box, instead of two, so you put your x and your y and then [width and height?] and then basically you have got things the right size.</p> <p>R: Okay that sounds totally fine. Your solution is to override creation tool and then remove mouse drag and you would have mouse down with the modified display box and specified sizes. Having done that would you still need to, [override] rectangle figure?</p> <p>You are specifying the size in here, you are saying at this point []</p>	
58		<p>...outside of [].</p> <p>R: I guess then just one thing though one advantage to having the rectangle is that well you mentioned null handles if we are not going to have display box [] null handles? So that you can't then []</p> <p>I would still be tempted to have a subclass in terms of the [] in the future</p> <p>R: [] Subclass overriding displaybox that would enforce that constraint [].</p> <p>No because you wouldn't have to have that. No so I wouldn't do that</p>	
59		<p>...If you can do it there I think its easier.</p> <p>R: Yep, Yep I agree with that.</p> <p>I'm just thinking if I need to in future...</p> <p>R: Oh I see a subclass will have handles. You would need a subclass to override handles to set the null handles wouldn't you?</p> <p>Yep.</p> <p>I think the point would be if you did it all and then realised that you didn't actually have to, go back... I think that I would be inclined to leave it in at the moment. But you are right it would need that line in there.</p> <p>R: Right okay. Just to try and keep track of where we are. We have got a block figure</p>	
100		<p>...And it overrides our handles and either does or doesn't set the colour like you say we can do it [] or inside, it doesn't really matter. We have a tool allowing you to create these things and it [] the size [] you have got the ground, which is added at the start. Now we have got this problem of constraints. Probably the hardest part of this task, how are we going to proceed?</p>	
100		<p>...</p> <p>R: Now we come to this thorny problem of constrains. How are we going to solve this?[] You already suggested a possible solution earlier</p>	

		involving... connections. Is that something...?	
101		<p>It's possible. Its something that I've done both, well no sorry, I've used them for there was a kitchen application, that had units and stuff and to join them together what I did was I created a unit connector to the opposite side of another unit and it would just move it to where it...</p> <p>R: [] a creation tool that would create units you would create a unit, create another unit and then there would be a connection tool? Where you would...</p> <p>Yeah</p> <p>R: So you say right I want that method [] and dragging it and it would put...</p> <p>It wasn't a constraint it didn't have to connect, you could have isolated units but it was a convenient way of getting them to [join]</p>	
102		<p>R: So if that were transferred into this application how do you think that would work? What would you do?</p> <p>You would have to make sure that when you create a , one of those squares, it has to [either] join onto the top of another square or onto the ground.</p> <p>R: [the problem would be how] the user would do it. If the user is using this application and they have this little tool that is creating these wee squares so they do that, click to create a square what happens after that?</p> <p>Clicking the... when a square is created and [its been...] a new connector is also created... so a square, the square appears the line also appears.</p> <p>R: Okay. And is that attached to the mouse then? Do you then have to...</p>	
103		<p>Its anchored on the square and it can be dragged and stretched. [] by moving the handles.</p> <p>R: Okay so...the operation that the user has to perform then is to click and then automatically this line appears and you have got this line on the mouse and you are looking to attach it to something and when you do that a handle or some other thing [] and then... okay. Let me act as the customer for a minute and say to you, that might work but that's not how we envisaged this. What we want is that we want the user to click on a tool with the selection tool and then click on the drawing to position a block...</p>	
104		<p>And we want the block to be positioned in the, if you like closest available position so if we click on the ground it goes there if we click up in space then it goes to a point immediately below that, that is on the ground. [] that's the kind of functionality that we want to appear.</p> <p>Oh, you would use a drag tracker.</p> <p>R: Okay.</p> <p>That [extend the implementation of?] drag figure. So you customise that... it's a bit... my project was actually like this.</p>	Immediate and from PK

		<p>R: What was your project?</p> <p>Jigsaw puzzle. You are dragging pieces around and [you had to connect] other pieces as well. So something similar to that would be...</p> <p>R: Yeah that sounds interesting so...</p>	
105		<p>The user would then have []. In your application when you create a block [] its just sitting there and then you pick one up. I am just wondering how the user gets a hold of the... it would be you would need to create a block and then position it and then the block would say okay I'm allowed to go here. Which is nice but you would need to work on that initial part where I don't want them to use. I don't want them to create a block in an illegal position. But I wonder if, its maybe worth coming at it in a different way?</p> <p>The first block obviously has to be stuck to ground it has no choice...</p>	
106		<p>When you create it and place it on screen, you could have it so it wont actually the user can't get rid of it.</p> <p>R: Okay that sounds good.</p> <p>So you are dragging it around the screen wont be able to let go of it unless its in the right place.</p> <p>R: That sounds quite suitable.</p> <p>One the first []. The first way to do that would be to... because you know where the ground is, you can work out exactly where you can position along the ground [] the square. You can also work out a [proximity] to that so that if its close enough...</p>	
107		<p>R: Okay that sounds credible. We need to get a wee bit more specific about how to implement this. You mentioned the [] part of your solution? I don't think so.</p> <p>What... in terms of the user not being able to get rid of it you would have to do something with the mouse up on the...</p> <p>R: On the creation tool?</p> <p>Err no... its in drag tracker.... Because at the moment pick up the figure an drag</p>	
108		<p>[as soon as you reach?] unselect you have to put a value in there so that figure wouldn't unselect.</p> <p>R: Okay I like that part what I am concerned about just now is how these go from create figure to being selected? You want that to be automatic don't you?</p> <p>Yeah. You press a button and... um its already selected.</p> <p>R: You press a button create the figure...</p> <p>Ah no sorry...</p> <p>R: How can you... is there anyway you can let creation tool stop and then selection tool start without the user having to do anything?</p>	
109		<p>It would just be a [] straight.</p> <p>R: You mentioned to me before something about the current tool [] is that something that you []?</p>	

	MA Tool IH MA Index MA Tool IH	Yeah. I'm not sure where it is... (sigh) in tool [Oh no that's for building tool] would it... in drawing? There would be a reference to the current tool in... drawing view or drawing.	
110	MA Index MA Drawing	R: [] If you went to drawing view or drawing could you find out from them from the interfaces what that method was called? Yeah. I will look... R: If you know it then... Yeah I do This is where [it would be really useful if I] could do a search you know [look for] methods like in the javadoc... R: If you could do that what would you search for? Erm... something to do with current tool . It would be good if you had a sort woolly search that would find it if its not quite right. You generally know what you want but don't...	
111	MA Index MA Drawing View MA tool() MA Index MA Tool MA Drawing	R: Okay supposing I acted as your woolly search tool and I said I believe... I'm not sure. I'd certainly say there was a way of getting hold of the current tool from the drawing view. And I think you might actually find it in drawing view. R: Have you found any methods? In drawing view there is a tool which presumably just returns the current tool. Though I'd find out... R: Yeah I recommend you look but yeah I think you are on to something.	Sub looking at methods
112	SC Drawing View SC ? SC Standard drawing view	[there is the] tool instance. Current tool. R: Is that drawing view, the interface that you are looking at? Hm mmm. Its standard drawing view that... R: [] You are in creation tool, right? And you want to get a hold of this, current tool and	scrolling
113	MA Index MA Tool IH	in fact you actually want to change the current tool [] so getting the tool doesn't seem enough. Yeah. There must be some sort of set tool [] R: You are definitely on the right lines, the question is where... Where are these methods?	Quick look then out
114	MA Index SC Draw Application	The one place where tools are changed is in the draw application. I'm trying to think where else. R: [...look at draw application?] R: [] you could do your search, search the code for tool.	Big pause Suddenly remembers this Scrolling Find tool (finding lots of tool...)

115		There it is. Current tool. [] So you could call tool done to say creation tool is finished and then call creation tool instead.	Gives up and starts scrolling again. Tool done on screen but PK
116	MA Index MA Tool MA Tool IH	There is a set... set the tool. R: I think you might be right. Set tool takes in a tool doesn't it? It takes in a tool and a string. R: [... creation tool....]	Scrolling (String name) looking at creation tool
117	SC Creation Tool	Erm... R: I think I should point out actually while you are looking at that diagram. These diagrams only show overridden methods they are not complete descriptions of these classes there may be other methods that are there. If you are looking for something in particular.	Scrolling up and down quickly
118	SC ? MA Tool IH MA Drawing Editor MA index MA DrawingEditor IH MA Index	This interface [oh yeah it an] interface... [] more specifically you call set tool [] R: Set tool is part of that? [] R: Draw application	Whats sub looking for?
119	SC Draw Application	[in] draw application... there is a set tool. R:[] Can you not just call it from the... from the edited version of... creation tool? Call whatever dot set tool.	
120		R: Yeah. I mean I think [that kind of thing] is what we are looking for its just... how does that tool get that reference are you going to pass that in? or can you get it from [somewhere else] [I'm not saying you can] I'm just asking the question. Clearly you have created [a custom] creation tool and I guess its possible that you could have a [reference] inside of that. That is of type drawing application or whatever and whenever we create the creation tool we just pass that reference on and get a reference back that []	
121		I'm wondering it feels very heavy weight [I'm a bit worried about it] I don't know if there is a better way. Yeah... R: I mean that's fine [If you want to go with that one, then go with that one] I think it will work. []? R: No. Well it is perhaps giving tool access to more things that it should but the question remains	Scrolling ?
122		First of all... is that the only way you can do it	

		<p>and if so then how bad is it to do it that way? And I don't have hard and fast answers to these questions. It depends on your opinion. If you where coding this which way would you go? I'd give it a go.</p> <p>R: Right.</p> <p>[I'd probably use that] If I had problems with it or [...]</p>	
123		<p>R: So lets do that in this case then. We will bear in mind that it is a slightly controversial decision but I think it would work and it would get us as far as I can imagine... which is difficult without the code... I have to imagine that that will... I can see a flaw... the problem being that you want to set, from creation tool, you want to set it to be equal to the selection tool, but you don't have a reference to the selection tool. You can get a new selection tool but I don't know if that would work... it seems a bit strange.</p>	
124		<p>Would it not be possible to make another tool altogether that wasn't a creation tool that [] subclass of that. The combination would be what you want.</p> <p>R: Perhaps so, perhaps so.</p> <p>You inherit further up the hierarchy. You inherit from abstract tool. That would give you flexibility.</p> <p>R: Okay for the sake of progress lets say that sounds plausible I don't know like anything else it might fall apart in detail but I think that's the risk we take when we are designing like this. I quite like the idea</p>	
125		<p>And I would like to see how it worked in code actually. So we have got that, we can now swap between our tools as we want, right. What's next? How are we going to make progress with this? [] Ermmm....</p> <p>What I'd do is override, inherit... subclass drag tracker or alternatively, since we are going to override the whole lot anyway []</p>	
126		<p>Then the mouse up I think is going to change.</p> <p>R: Lets just keep working in drag tracker for the sake of [continuity] mouse up is going to be changed and from what you said earlier [the basic algorithm is going to be, where are you now you should be somewhere else] []. The question here is can the drag tracker know about the other objects that are in the drawing?</p> <p>It can call, it can call emmm, find figure.</p> <p>R: And where is that defined?</p> <p>Its defined in [tool]</p>	
127	MA Index	<p>R: That's an awful hard question to ask I just wondered if you knew it.</p> <p>R:[]</p> <p>Its not in tool you have to call it... its part... of the drawing I think.</p>	

	MA Drawing	Yeah its drawing and all of its subclasses. Find figure inside, find figure inside without. Its looking at the representation underlying the...[] if you give that some co-ordinates it will return the figure that is there.	
128	SC? SC Dragtracker	R: So lets see if I have got this right. Mouse up then basically would say can I find a [file?] within a certain area of where I currently am. And then it would get it and then it would say okay what type of figure is this. Is that a ground or is it another block and then there must be some kind of [] which I'm not that interested in [] that's the detail of [] line []. That does sound quite plausible. Assuming you are happy with that... how would one go about finding out where figure was and get a hold of a figure and specifically I need to move to here...	
129		[] R: well how would you position them . Right you can't position them [] figures is x and y, it's a mouse event ermmm.. R: Aye no no, what mean is, what I means is the current figure that is being moved yeah, [] the interaction issue because I need to understand Oh right yeah. R: Where one is and where the other is. Well once you have identified the figure you can just call a figure get... figure I think its center that returns the centre co-ordinates of a figure	
130		Figure points at both figures dragged and [] R: That's fine. Are there any other issues left have we been through... things? R: Anything else you want to look at? Ah there is the top. []	
131		You need to know... you need to let it, yeah, yeah, just devise new attributes for the, for each of the blocks call it can move just have a Boolean and can move if its true can't move if its false. So obviously figures on the ground can be moved so true for that, but is a piece is put on top the piece it would be attached to would be set to false. So the process when it attaches to the block, the block it has been attached to, set that false	
132		And then when one is removed set it true R: So when you are moving it you need to determine [] yeah okay I believe that that will work. Yeah no I'm happy at that. That's great I think that's pretty much us just to end up I'd like to ask a few brief questions...	
149		Post task interview	

5.1.5 Participant E

Time	Documentation	Subject Talk aloud	Researcher Observations
0		Pre-task activities	
14		<p>...</p> <p>Right. Okay.</p> <p>R Right. So do you think it is clear what you have to do then?</p> <p>Yeah.</p> <p>R Right so I think I will start you off then by asking how are we going to begin. How are we going to tackle this problem?</p> <p>Right. Can I ask a question? Its probably a stupid question. Is this going to be a just a 2d looking at it from the side thing? You don't have to implement a 3d sort of view of like ...</p>	
15		<p>R No. The intention here is that it is a 2d application and that the diagram there represents roughly what I want. You are free to interpret the actual graphical details [how you represent] a cube well I mean a square but it yeah, its entirely 2d there is no 3d elements whatsoever.</p> <p>Right. Okay that's fine.</p> <p>R So what are we going to do first? Do you have any ideas?</p> <p>Right. Well I'm going to want something to represent the blocks obviously, and also something to represent the surface they are sitting on.</p> <p>[Presume we need] a tool that lets you move a block from one place to another and some sort of constraint</p>	
16		<p>that stops you from putting the blocks in mid air or hanging off the side of another block.</p> <p>Does that sound as though its on the right track?</p> <p>R Yeah. Those sound like the major areas of behaviour that we are going to have to deal with. Where do you think you are going to begin? What one are you going to tackle first?</p> <p>Okay. Right the first thing I'm going to do is have a representation for a block or whatever. So I'll look through the documentation to find ...</p> <p>R Well you can either look through the documentation or</p>	
17		<p>If you happen to know from your own experience I think I would use X then you can just say that.</p> <p>Right. Okay. Then I'm thinking I would use a subclass of, well some subclass of figure at the moment but I will look up and [see exactly] what I will do with that. So will I get on and do that?</p> <p>R Yeah. Yeah do that. You know try and keep talking about anything that you think is relevant so if you are looking and if you are not finding something then you can say you can't find it or</p>	

		<p>like just now where are you going to look, why do you want to look there?</p> <p>I was going to look in the micro architectures because I know that I want to use something that implements Figure eventually and I'd like to know what the hierarchy is from figure downwards so I can see ...</p> <p>R And you know from looking earlier on that the hierarchy...</p> <p>I know yeah, that micro architectures show that where as the pattern language is maybe more about you know, what kind of problem you are solving in the framework.</p>	
18	<p>MA Index</p> <p>MA FigureIH</p>	<p>R. Okay. The other thing that I should maybe have said is that if you feel that while you are going through this task you would normally have looked at another documentation feel free to say that.</p> <p>Right.</p> <p>R. So I'd normally look at JavaDoc I'd normally look at an example now, or these kinds of comments are probably quite helpful to me so if [you mention these it would be helpful]</p> <p>So I'll take a quick look at the figure hierarchy and I'm looking for something to subclass rather than creating a figure from scratch.</p> <p>R And the other thing I should point out is that this diagram, its thrown a few people, it only shows the overridden methods of Figure for each class. It doesn't show you the complete interface for each individual class it only shows overridden methods.</p> <p>Right.</p> <p>R [its only a partial class]</p> <p>Okay.</p>	
19		<p>Is this together, yeah, are these blue lines, implements?</p> <p>R I think a dashed blue line is implements.</p> <p>Oh. Okay.</p> <p>R Is that not just a general dependency</p> <p>I don't know, okay that's cool.</p> <p>Yeah. See round rectangle figure [and there is straight] rectangle figure okay so. Now I can reject diamond figure and triangle figure I'm not interested in them because they are subclasses of that. So what I want to use for the blocks is rectangle figure.</p> <p>So I'll go and check that out and see how I can make it so that it is, forty by forty, so that it is square and coloured red.</p>	scrolling
20	MA Index	<p>[So in order to fit that I'll go to the other] micro architecture. What I am looking for is the rectangle figure methods [that are in it] like the format of the constructor and so on</p>	

	Doc Index	<p>R What would you normally use to find this information? I'd normally look at javadoc in this case.</p> <p>R Remember you can look at the code. Source code, right.</p> <p>R I don't know what editor you prefer, Pfe is there RealJ is there... or if you want to download something. [I think I'll use Pfe]</p> <p>R then its C drive and JHotDraw5.1 So looking for rectangle figure.</p>	
21	SC Rectangle Figure	<p>Okay.</p> <p>R So what do you expect, what information are you looking for in the code? What I am looking for is how I can set the size and colour for my rectangle.</p> <p>R but then do you have any preconceived notions of that from your past experience I don't. I was hoping there was a constructor that would set the size and the colour. I suspect that there isn't one, although I can set the size but there is no constructor that lets you specify colour.</p> <p>Okay so I know how to create my rectangles so I'm going to use this constructor here to give it size and position. What I need now is a method that is going to let me set a figure to a certain colour.</p> <p>I'm thinking that's not going to be in rectangle figure that's going to be further up the hierarchy.</p>	
22	<p>MA Index MA Figure</p> <p>PL Overview</p> <p>PL Modifying Existing Figures</p>	<p>So back to Figures micro architecture. [] figure [] I am looking for something that will let you set the colour of the figure.</p> <p>R Okay so basically we are looking at just really trying to match some of the names here? Yeah. That's the only... that's the only plan of action although maybe I'll look at the pattern language to see if there is something there that will let me [] do that.</p> <p>Going to try modifying existing figures. I'll see I might have to define a new figure called red rectangle or something.</p>	
23	<p>PL FigureIH PL Mod Existing</p>	<p>Right so its suggesting that I might want to create my own subclass to get the behaviour that is required, which is that it is red. It should be in the hierarchy [].</p> <p>It is also saying that I should get a good understanding of the existing behaviour, it says there that "to identify which methods will have to be overridden" which is all very well but I don't know which method I want to override.</p>	

	Figures MA Index MA Figure		
24	MA Index MA Figure IH	<p>I'm just going through this to see if there is anything that looks like a method that might let me set the colour of a figure.</p> <p>R Do you see any candidates is there anything that catches your eye?</p> <p>No.</p> <p>R Okay.Well if this doesn't work perhaps looking at the source code for one of the classes in the hierarchy might help you? [you can read the comments in them and that might make it easier]</p> <p>Yeah.</p> <p>Okay. I'm going to look at Abstract Figure it is [that implements] Figure and I can see that rectangle figure inherits from that as well, which I know from this.</p>	
25	SC ?	<p>Set Attribute, if colour is an attribute that could work but I don't know what an attribute is.</p> <p>I think it might help if I looked at the source code for Abstract Figure or rectangle figure I think and see what actually happens when a figure gets drawn I can see where it is getting [colour] from. I might take a look at abstract figure.</p> <p>R Do you know where it is?</p> <p>I am guessing. I'm thinking its probably in framework but...</p> <p>R I think its actually in standard.</p> <p>I never know where to find these things.</p> <p>R Yeah.</p>	<p>Scrolling</p> <p>Called or colour</p>
26	SC Abstract Figure	<p>Abstract Figure.</p> <p>Okay so I'm looking for a method the draw method, in here so I can see where it gets its colour from.</p> <p>[Could maybe use find] Do you know how to do a find in Pfe? F2? These standard keypad combinations! [I'm going to, right, draw]</p> <p>[I don't want it matching on entire words] I'm getting Drawing and drawing. So there is not a method in here called draw.</p>	Sub uses find
27	MA FigureIH	<p>R Does abstract figure override, does it define draw? I don't know if its called draw anyway but the equivalent sort of thing. I think its called draw but...</p> <p>Yeah the thing... No it doesn't seem to. But I shall check [here] first.</p> <p>[] there must be something that calls... ah draw in figure. Okay lets look at that.</p>	Looking at names in abstract figure

		<p>R Okay but it doesn't actually define it its one of the abstract parts of that thing.</p> <p>Right so figure doesn't. Abstract Figure doesn't implement it.</p> <p>Okay. I'm going to look at the source code for figure to see what draw does as regard colour.</p>	
28	<p>SC ?</p> <p>SC Figure</p>	<p>R [do you think that figure] is in framework?</p> <p>Right. Okay.</p> <p>R [it's a standard thing that people can't find the classes but I will tell you if I know where to look]</p> <p>Right. I will say out loud I am now looking for Figure but it would be complete guesswork because I have no idea what path it is in.</p> <p>Framework and Standard are just... I don't know what the difference is supposed to be.</p> <p>R I think that I have roughly figured it out but it doesn't bear explanation really.</p> <p>Right okay. There are comments in here in the draw method. Basically saying that it draws a figure it takes a parameter g which is the graphics context its drawing into.</p>	
29		<p>Right so [there is] something that actually implements this. For example the rectangle figure that I was looking at before.</p> <p>So in here looking for the draw methods... we have draw frame we could use that right so there its calling draw rect on the graphics context which gets passed to it so it uses the colour from the graphics context.</p> <p>I feel like I'm getting nowhere here.</p> <p>R No. No. So you know from your familiarly with java that the graphics context has got set colour and setfillcolour and so on.</p> <p>yeah.</p> <p>R So you think that [] if [].</p> <p>yeah. I could[n't?] find the method that set the colour</p>	
30		<p>so I'm wondering if maybe if all JHotDraw things are drawn in a default colour without anything being set. So if I made that assumption what I could do is set the colour of the graphics context when I go to draw my new red rectangle but that is just presuming that the framework doesn't set the colour somewhere else. So if I do that my screen redraws going to get messed up no doubt.</p> <p>R So this hypothetical solution then would be an override of the draw method is that right?</p> <p>Yeah an override of, well we got draw background and draw frame in here I am presuming that there is a draw method in here as, or maybe there isn't? A draw method from an actual super class that calls these two methods here. So yeah my other solution would be to override draw method.</p>	<p>Scrolling</p> <p>Draw background/ draw frame</p>
31		R Okay. I think that solution might be. I think it	

		<p>might work actually but it's a bit heavyweight the solution that you want to make happen is actually possible, okay.</p> <p>The solution of ?</p> <p>R The notion that you have got that you can actually control the colour. Via some other mechanism.</p> <p>Right, other than overriding the draw method.</p> <p>R That right. I'd like you to keep looking for it but I mean in real life if you were to code just now having seen what you have seen, would you go with the, I mean if I hadn't just said to you not to would you have actually implemented that?</p> <p>And went with the draw... [or would] you be worried about it like you said you had some concerns.</p> <p>Yeah. I would be worried about it because I've struck the redraw in JHotDraw before</p>	
32	MA Figure IH	<p>before and I've found problems when I when, when I messed about with the graphics context I found that the screen didn't update properly the background was a slightly different shade of grey and stuff like that so I've learned not to mess about with that.</p> <p>R Well in that case then [lets continue with this experiment?]</p> <p>Right.</p> <p>R What are you thinking? [Do you want to be] looking at that? I think you are looking [] into all these things [but the] right one</p> <p>Looking in the draw methods?</p> <p>R Yeah. Yeah I mean I think that notion is quite sensible. So far it hasn't seemed to have paid off for you is there anything else anywhere else you could look to try and [find out]</p> <p>I think [the thing] I want to find is in rectangle figure.</p>	
33	<p>SC?</p> <p>SC Attribute Figure</p>	<p>So that must, there must be a method that calls these draw background and draw frame methods in here. Maybe that's in something that rectangle figure inherits from, like say attribute figure and that has a draw method, okay.</p> <p>So what I'm going to do is I want to look at the source code for attribute figure and see if there is anything in this draw method that will involve setting the colour of this attribute figure... so I need to guess what package I'm looking in now.</p> <p>R Try standard again.</p> <p>Nope.</p> <p>R Figures?</p> <p>Yep [here it is]</p> <p>R That's the first one that I've got wrong!</p> <p>Yeah. Right. (laugh)</p> <p>Right so I'm looking through here for this draw method.</p>	Scrolls to attribute figure
34		I have given up on the find in Pfe because it can't	

		<p>match whole words. I get everything with the word draw in it. Okay I've got draw frame and draw background which I have, which are empty but they are not declared abstract for some reason. Ah okay, all figures support attribute names fill colour and frame colour. So I take from their names that frame colour is the colour of the border and fill colour is the colour of the fill obviously.</p> <p>Okay and here is a method for setting these attributes. Right so</p> <p>R So you want to make the rectangle red how do you do it?</p> <p>Right I'm thinking I would need to call this</p>	<p>scrolling</p> <p>Sees list of attributes</p>
35		<p>set attribute on my rectangle figure giving it the parameters fill colour and I'd need to know what value to give that to make the red. This object value. And I'd hope that the javadoc would tell me that. Unless there are some constants at the top of this?</p> <p>It looks like there isn't.</p> <p>R Is there not? Maybe not at the top is there not a ... list of the things, attributes fill colour, frame colour amongst other things?</p> <p>I can't see any if there are</p> <p>R [what would you like to see]?</p>	<p>scrolling</p>
36		<p>What I would like is a constant called red or something that maps onto the object that I need to give this method.</p> <p>R Oh Sorry I was saying that there were constants for names of the attributes but not for the values of the attributes.</p> <p>Right. Okay. Well I've got the names from the documentation here its called fill colour but I need to know what value.</p> <p>R What's your guess if you could guess that what would you stick in there? ...Do you have any idea what it could be?</p> <p>Well it could be just the string red or it could be a string which is an rgb triplet or it could be a hex value which is an rgb triplet, I mean it could be anything.</p> <p>I mean I suppose I could code it and then try a few things but it's a bit, I'd have thought there was a better way to do it.</p>	
37		<p>I don't see where else such concepts could be defined because this is attribute figure this is the first place in the hierarchy that you get attributes. I can only hope that the draw method in here will give a clue as to the sort of format the second argument might take assuming the draw method actually sets the colour to something.</p> <p>Draw, emm.</p>	<p>scrolling</p>

		The draw colour here, right okay in the actual draw method that is where its that's the place where it sets the colour of the graphics context.	
38		<p>Okay. But it doesn't make any changes to the attributes of the Attribute figure object so I can't get any clue as to what sort of argument I should be passing to that set attribute.</p> <p>R What do you think that that method get fill colour does?</p> <p>That there? Well that would return probably the value of the fill colour attribute. Oh right so that would probably show me what sort of format that takes. Right okay it returns an object of type colour right okay. Am I allowed to look at the source code for the class colour?</p> <p>R Do you think that colour is part of the framework?</p> <p>No its not.</p> <p>R You know its not. You know its part of java?</p>	Scrolling to fill colour method
39		<p>I was just thinking it was referring to java awt colour.</p> <p>R It is</p> <p>Right well that is part of java then its not part of the framework.</p> <p>R No I don't want you to look at that because I am assuming I think that you know about colour and I am sure you could work out how to set it to be red right. So it is something along the lines of, I think you pass in an RGB triplet, one of which would be 255 and the other ones would be zero and I would guess it goes RGB so pass in 255,0,0 and whatever, you know we are going to get red. In fact actually thinking about this some more there is a constant you can do colour dot red and that should be it. So where have we got to? How do you think, we have been through quite a lot of information here, how would you [just] your block what's the solution looking like just now? Right.</p>	
40		<p>R We have found out how to set the size in the constructor.</p> <p>Yep.</p> <p>R And can you try and condense all that information there about the colour? How do we want to change the colour?</p> <p>Right. Okay we are going to... right I'm going to use in my subclass of rectangle figure in the constructor I'm going to have a call to the method in here which sets an attribute... set attribute, because rectangle figure subclasses of abstract figure [sic] and I'm making a subclass of rectangle figure so I can use this. So I going to pass the fill colour and colour dot red. And that going to give me a red one.</p> <p>R That's super. Can I challenge you here, that is going to work, and I thing that might be the way we go but what is [worrying me] about</p>	

41		<p>making a subclass of rectangle figure do you think? Is there strictly speaking any need to do it? You could do it just using rectangle figure and in your code you would call the set attribute method to make it red but the only reason I was making a subclass would be to make sure that anybody that used it would be forced to make it red.</p> <p>R Okay. Good argument. Okay so for the time being, I think that there is another issue that I will come back to probably but... so what are we going to call this figure? Is this a block figure is that ...</p> <p>Yeah. Block figure that's fine yeah.</p> <p>R Okay, I'll come back to that in a little bit, how what's the next thing</p>	
42	PL Overview	<p>R: we have got our candidate block figure, it seems to be more or less there it's the right size it's the right colour. Having set the size are you worried about anything changing it?</p> <p>Yeah. I don't want to let anyone change the size of it once its been created so that's my favourite bit of HotDraw [sarcastic], handles. I know from previously using the pattern language that all the objects in, all the objects in a HotDraw diagram have got handles. When you click on them the handles pop up and when you drag them you change the size. So we want to some how disable the ability to change the size of an object. So one way to do that would be to some how stop it displaying any handles when it is clicked on.</p>	
43		<p>Well you would want it not to display handles but you might also want to redefine the behaviour of what happens when someone drags a handle. Rather than just having that behaviour there but not displaying the handles on the screen. You know in case you click on the same place and it does something [because there] is a handle there. Which could be another argument for having a subclass as it could define null behaviour for the resizing handles.</p> <p>I don't know if that makes sense.</p> <p>R No I, there are two ways to interpret it and I an trying to understand which way you mean.</p> <p>Will I try and explain it some more.</p> <p>R Yeah. [you can try it that way or...]</p> <p>Well what I was trying to say was you know how when you click on it in JHotDraw you get the four little boxes, the handles and you can drag them to resize it. What I was meaning was somehow, the first thing I said was to stop the handles from being displayed</p>	
44		<p>but I'm not sure in JHotDraw whether that necessarily means that if you clicked where there would be a handle whether you would be able to then drag which wouldn't be intuitive because there would be no handle but dragging that by accident would resize it.</p>	

	MA Figure	<p>R Okay. Well lets take this to start with [] I say to you that I want to see that solution. How do we turn off the handles?</p> <p>Okay.</p> <p>R Do you have previous knowledge you seem to have used handles in the past.</p> <p>Yeah. If I remember rightly there is a method in figure that returns the handles for a figure. [] so I want to take a look at the figure micro architecture again.</p> <p>If its not in here it in abstract figure.</p>	
45	MA Figure IH	<p>Don't think it is here anyway.</p> <p>Try abstract figure. Don't see... unless its called handles possibly.</p> <p>R I think handles is part of the figure interface.</p> <p>[] Oh right Okay handles right handles, which returns a vector, which is presumably a vector of the handles for that item on the diagram.</p> <p>R So in order to turn off handles, you would override that method. What would you put in its place?</p> <p>I would need to; well one thing I could do is just to make it return an empty vector... but the danger there is that there is something that goes into the vector</p>	R feeding sub answer!
46		<p>and assumes it is not empty. Although obviously you should check the length of a vector before you go into it. I don't know whether it is safe to assume that all the Hotdraw code does that.</p> <p>R But by a similar argument you could return null which presumably is very bit if not more dangerous.</p> <p>Yeah. I know.</p> <p>R What are you going to do in order to find out [about that]?</p> <p>Well I would need to... I would need to know every place where handles was called so I could check, check that out. I mean you can do that, you can do that actually in Jinsight it will show you uses of a method obviously I don't have that here.</p> <p>R One of the goals of the micro architecture is that it shows everybody that calls a method so could you use micro architectures to show who calls handles?</p>	
47	MA index MA Figure MA Handles	<p>[]</p> <p>Oh that was my hierarchy right I'll try that. []</p> <p>Okay. That's the method, handles, in the blue box and that's called by these ones</p> <p>R And only those ones.</p> <p>Sorry?</p> <p>R And only those ones.</p> <p>Yeah. Right. Yeah. Okay.</p> <p>So the only methods I need to worry about are</p>	

		<p>standard drawing view selection handles and decorator figure handles.</p> <p>R Which of those, just seeing those two names does that give you any idea of which of those two [definitions] are most important or do they both seem as important or...</p> <p>I think probably standard drawing view would be more important because that</p>	
48	<p>SC?</p> <p>SC Standard Drawing View</p> <p>MA Handles SC Selection handles View</p>	<p>would all, drawings, I always need a drawing where as decorator figure I might not be using decorators, yet, in this. So what I would want to do is check the source code for these two to see if its safe to return a null value when they expect a vector.</p> <p>[Look it how I am going to do that] Start with standard drawing view.</p> <p>R I think the last thing you said about decorator figure is valid and I would just, I wouldn't bother with decorator figure.</p> <p>Okay.</p> <p>R Although I appreciate that in a proper environment you would be concerned with all types of calls.</p> <p>Yeah. Okay standard drawing is in standard.</p> <p>Right now I'm looking for selection handles method I think I'll try the find method because this name is quite long, what was it called selection handles.</p>	Find selection handles
49		<p>Okay this is abstract it is not defined in here. So probably have that every...</p> <p>R That on the screen, that is not a [] method?</p> <p>Well I'm assuming that...</p> <p>R We have just found the first thing called selection handles.</p> <p>Oh. God yeah. Sorry Right Yeah. That's an instance variable. I wondered how it was transient. A transient method God help us. Right okay</p>	Finds an instance variable - doesn't realise this
50		<p>find next on this thing. Right I'll go with F2.</p> <p>R I don't if you have ever used Real J?</p> <p>I have but there are that many bugs in it that I got sick of it</p> <p>R Well there is that problem it is not perfect but I think its find works a bit better than that does.</p> <p>Yeah. Well wouldn't be hard.</p> <p>R So you have found it.</p> <p>Right I've found the selection handles method and yeah its checking if fSelectionHandles equals null so maybe better look at where it gets its fselection handles from.</p> <p>R that was that transient that you found...</p> <p>Right.</p> <p>R Up at the top.</p>	

		Okay. So where does it. It calls the handles method here	
51		<p>which is the one I am worried about returning null from and gets [] and then it calls elements on handles so what I need to know is. Does the method elements complain if you give it a null attribute, a null object?</p> <p>R Do you mean null or do you mean empty? Right okay if I was just returning an empty vector then it would be okay. I mean that if would be okay but if I gave it a null object I don't know if that would be okay.</p> <p>R If you gave it a null object I think you would very quickly find yourself a compiler error I can tell you that. So you can't call elements is not defined basically it wont know.</p>	
52		<p>Well the compiler would know it would be null though. It would probably give a null pointer exception.</p> <p>R yeah you are right that's what it gives exactly.</p> <p>Okay so if we assume that we are going to return an empty vector then I know that this method doesn't mind an empty vector so as soon as [it will return an enumeration] its going to be empty and then this down here checks while kk has no elements, so that's the fail because there wont be anymore elements. It doesn't mind it being empty so its not going to do it. So it would appear so that's fine that's not a problem.</p> <p>R Okay. I think that what we have found about that is fine one problem I have got with this solution is see if we turn off handles? Yeah.</p> <p>R We are not going to know if a block is currently selected or not. I mean I don't know, its not a big part</p>	
53		<p>R Of this task you could maybe make a case for it not mattering but lets just suppose that you wanted to keep some indication of selection is there a way we could do that? Assuming that we are not going to use handles?</p> <p>R No I wouldn't assume anything. Right. Okay well assuming that I wasn't going to use handles then I could somehow decorate the figure like to show give it a highlight or a thicker border or something to show that was the selected box.</p> <p>R Supposing I wanted to be really annoying and say I like handles and I want a handle? Can you give me a handle that is not going to do anything? Right.</p>	
54		<p>Handles that are not going to do anything. I've seem it done so I assume you can. So what I want to look at is ...</p> <p>R Well lets start with the bit that we presumably</p>	

		<p>know right? We have got this handles method in figure and I guess that we know that we can change the default handles for our own new handles. So from that position how do we go about finding the right handles or change or modifications to handles or whatever it is. Okay. So I want some handles that instead of letting you resize the object just don't do anything at all. So I want to find out what happens when you click and drag on a handle object.</p>	
55	MA Index MA Handle	<p>So try and look at the micro architectures for handles.</p> <p>Right. I know from, well I think I know from using it in the past that start that is when you first click on it, step is each step of you dragging it across the screen and end is going to end.</p> <p>So what we want to do is have some sort of null behaviour so that when, start step and end don't actually do anything. Instead of transposing, well resizing the figure I want them to not do anything</p>	
56		<p>so it's a similar case to when I said [it would be coming out to effect the] handles See if its... See if it is okay to do that</p> <p>R What you have described to me so far what are you proposing then, that you would override the final version of handles with that?</p> <p>Yeah, because the handles already do something's [so I'd need to override] handle.</p> <p>R As I said that would work but there is a better way but I'm not going to ask you any more about it. I'll tell you that if you looked at the handle hierarchy you would see that there are a number of alternative handles that already exist and one of them is called null handle and I'd guess without really knowing that it sounds like it would do exactly what you have just described and in fact that's what I was originally thinking that we could have a block with null handles on it in the corners.</p>	
57	MA index MA Handle IH	<p>I think that we have seen enough that you could definitely implement that but from what I've seen would you say you would have when ahead and implemented that yourself rather than you would have missed... would you have missed the one that was already there do you think or...</p> <p>I think that I would have gone to look but I would have had to go back and then go in here and forward again and then looked down here. I think I would have, I don't know if I'm thinking about this wrong but I just felt that it would be easier to have the clicky bits actually in here rather than on a separate page.</p> <p>R Uh huh, I definitely see what you are saying, you probably are right I think.</p>	

		<p>Its just because I was in there first the bit with the clicky bits that I didn't see what other handles were in here. But yeah I would have looked to see the, because the whole point of a framework is that its hierarchies and things.</p>	
58		<p>R I took the decision that by the time you had decided to solve it you had decided to implement but I take your point about []. And I think that it is probably safe to say that having seen null handles as a name you could guess what it actually does?</p> <p>Yeah. If there was any doubt I would go down to the actual source code and see what it actually does.</p> <p>R talking about how the clicky stuff could have been all sort of on the one diagram. See how the, the colour diagrams, the ones that have got the blue and the red and so on?</p> <p>Yeah.</p> <p>R Does that apply to that as well would you have liked to have clicked on that and have seen source code or some help on using the code or.</p> <p>Yeah. I think that would have been helpful. Yeah, if you could then, yeah, if you were able to click on a method in the coloured blocks diagram and then jump straight to the source code that would be helpful, that's really the next sort of logical stage once you are in [the code where it is called] yeah.</p>	
59		<p>R I mean these kinds of comments it is quite important that you make these sort of observations but equally it is important to say that this is just a prototype and of course it has these rough edges but we need to see where those rough edges are. So lets move on, so we have got a figure its got null handles on it, its been coloured correctly we have constrained its size in the constructor to be forty, forty. I think we are getting there how... what's the next task, what are we going to do?</p> <p>One thing that we haven't done is that we haven't drawn a little floor but I'm thinking that's trivial, well I assume that's quite a trivial thing.</p> <p>R Do you want to do that just now or do you want to go on...</p> <p>Will I tell you what I think the next major thing is?</p> <p>R Yeah</p>	

100	PL Overview	<p>Its obviously constraining them so that you can only put blocks on top of one another. And the higher you ...</p> <p>R Well, can I pull you back a little bit?</p> <p>Yeah, yeah.</p> <p>R You might have just been about to say this but I think that one of the most important things that you need to use, we have got the blocks as an object but we don't really have a mechanism to add that on to the drawing. Is that where you are going or is it ...</p> <p>I wasn't, I wasn't no.</p> <p>R That's fine.</p> <p>Now like you say we need a new tool to place your object on the diagram. Okay so I know how to do that I will have a look at the pattern language.</p>	
101	PL Using Creation Tool	<p>So I have seen in here before that to put a new figure in the diagram you would have a new tool to do that. It tells me here about figure creation... create construction tools for figures see using creation tool, so we will check that out. This one tells me about creation tool, which is the prototype pattern, to clone an instance of the object that you want to create []</p> <p>R: Are you familiar with the prototype pattern?</p> <p>Yeah... [I've seen it] working if you use, overriding the create tools method and you pass it in an instance of the figure I want to create an instance of on the diagram so in here I would have, I think it would be just a new block figure then I need a new... something that extends creation tool like a block figure creation tool and it would have a create tools method that does this part and creates a new block figure</p>	
102		<p>R: Where is create tools [residing]?</p> <p>In creation tool.</p> <p>R: No its not.</p> <p>Oh okay sorry, in draw application</p> <p>R: And then to add a button to the toolbar? Is that... down at the bottom there is a comment "that can all be []". You know we were talking through that code there and the code to add the you know [underneath where it says define] we add a button there.</p>	
103	PL Adding Buttons to the Toolbar	<p>Yeah.</p> <p>R: Do you have any idea how to do that?</p> <p>Well I think that I can probably remember how to do it but yeah.</p> <p>R: You would probably do something like that pattern there?</p> <p>Yeah. Uh huh. It's a similar sort of thing do the prototype idea again.</p> <p>R: Right Okay. You have now got that they</p>	

		<p>would override create tools in draw application. Right?</p> <p>Yeah.</p> <p>R: And that you would create, you would create a new creation tool? Which you would pass in a prototype that would be...</p> <p>Your block figure</p> <p>R: Your block figure and it would be sized to forty, forty. Okay?</p>	
104		<p>R: Okay. That won't work.</p> <p>Right.</p> <p>R: The problem with in everything is actually good, everything works well except that by default creation tool overrides the size of a figure. It doesn't matter what size you create it and pass it in, when you create a figure, when you create, the basic operation you use is that when you click. It creates a figure of zero, zero or something similar and then as you drag it will change the size and this sets the size so...</p> <p>Right.</p> <p>R: So you wont actually be set to forty, forty, you know it will just be stuck with what size you create it. Okay so how can we solve this problem?</p>	
105		<p>R: Where do you think the problem lies?</p> <p>I think its something in creation tool. I'm guessing there is maybe; there is probably methods in there for button down, button drag and button up for creating a new figure. So if that was the case what I would do is change the methods so that the button down just created an instance of figure sized at forty, forty and then dragging and releasing the button wouldn't do anything.</p>	
106	MA Tool IH	<p>R: Well I think that sounds quite plausible so I want to see if you can confirm that.</p> <p>Right. Okay. I'm going back to the micro architectures thing...Creation tool... So somewhere in the tool hierarchy...Should be creation tool.</p> <p>Right. Which is here. Okay and there is right. There is a mouse down, mouse drag and mouse up methods.</p> <p>R: So [basically] you would override those and you would have some behaviour in mouse down that defines and sets the size?</p> <p>Yes.</p> <p>R: And some behaviour, well you can just effectively remove the behaviour in the other places.</p> <p>Yeah.</p> <p>R: I think that sounds [interesting], I think that that will work.</p>	
107		<p>R: I'm interested though in mouse down, how will you set the size what are you thinking about in terms of the... you have already passed in a</p>	

	MA Figure IH	<p>created figure so we are not going to call the constructor.</p> <p>Right. I'm thinking you would need to call, there must be a method in figure that allows you to set the size of a figure? So I would need to go and find that. [Does that sound reasonable?]</p> <p>R: That sounds plausible yeah.</p> <p>Okay. I'll look at the figure hierarchy and I'm looking for something like set size...So there is a method that returns the size.</p>	
108		<p>[] new figure.... Attribute figure []</p> <p>R: If there is not a set size is there anything else that sounds possible [].</p> <p>There is a method that lets you define the display box but I only know what display box is from having used the framework before.</p>	
109		<p>...So I know that well that lets you define the top left and bottom right corners and you can change the size that way. But I wouldn't have known to use that if I hadn't used HotDraw before.</p> <p>R: How do you think you developed that understanding in the past? I realise that its grossly unfair to ask you that question but basically you are saying just now that it doesn't seem very obvious that basic display box or display box can [change the size]</p> <p>Yeah. There could have been something on display box in the pattern language... I can't remember. I think it was something that came up when I was trying to do the practicals for software architecture and I found that display box had,</p>	
110		<p>...were rectangles so you could have truly circular shapes and most recently I found that when I was doing my own research into ways of [doing things with] the framework.</p> <p>R: I think and I'm not going to suggest that you actually confirm it by [] and I don't think you need to its [] and you are right, your previous knowledge is correct there is no obvious set size method and you have to use either the display box or actually a hook, template and hook design pattern here and it's a thing called basic display box that you can override and well in fact in this case I don't think you even need to override would you agree with that?</p>	

111		<p>Yeah. You can just use the one that is there yeah. Just pass in the arguments.</p> <p>R: And we would put that in mouse down and I think that would give us a way to create the blocks.</p> <p>Yep.</p> <p>R Okay. You mentioned a while ago that you still had this ground thing to do.</p> <p>Yeah.</p> <p>R So if you don't mind maybe we can turn to that? How are we going to, what do you think the issues are here and how are we going to tackle them?</p> <p>Can I assume that the ground is fixed and the user isn't allowed to move the ground.</p> <p>R Yeah. You can assume that. Yeah. Okay.</p> <p>R Further more I think that you should assume that the ground is not created by the user.</p> <p>Right. Okay. Yep.</p>	
112		<p>So I assume that when the application pops up, you have got the tools down the side and you have got the ground, for the sake of argument at the bottom of the screen. So that would obviously be a figure because its on the diagram but it would be a figure that you couldn't select, you couldn't move and that it is set up by the application when it starts so the user can't do anything with that.</p> <p>R So how are you going to do this?</p> <p>Okay well I'd implement it as, the class that we subclasses before was rectangle figure that was just a rectangle so you could define that as a rectangle.</p> <p>R Basically you would have a very long skinny rectangle yeah?</p> <p>Yeah. Filled black I am assuming, yeah so that another case, so should we have a subclass as a black, a black long rectangle or should we just use the one that is there? I'd say probably just use the one that is there because we are only using it once so...</p> <p>R [I think I should point out that] I am not anticipating a separate ground object at least to start with.</p>	
113		<p>Right. Okay so I'd want to look at what happens when the application starts up so that I can somehow put in a call to draw this ground object automatically when it starts before the user can do anything.</p> <p>So I'm wondering if there is something in the</p>	

	<p>PL Overview</p> <p>PL Customising draw application</p>	<p>pattern language that tells me what happens when the application starts up. (how it initialises the drawing and so on)</p> <p>Okay and the first link I see is “to create your own applications see customising the draw application”.</p>	
114		<p>Okay, “the open method is an obvious target for customisation” “it should not be overridden directly”. Ah okay the hooks, so open is an example of the template pattern so create tool and create drawing are the hooks there that you override in your own subclass. So we are going to have a subclass called blocksworld and obviously we have got our own create tools method because we are creating our own tool already so we are going to have our own create drawing method that is going to draw the ground at the bottom of the screen.</p> <p>R Okay, I like that solution that sounds fine. I’m going to need a little more detail on how its going to draw the ground? What’s happening in create drawing?</p>	
115	PL Customisng the GUI	<p>Okay. “ draw application is responsible for setting up the applications GUI, for more information of customising the GUI see this, customising the GUI”.</p> <p>Okay. Menu bars, Tool bars, status bar... they don’t seem to include [anything].</p> <p>Possibly what I would do was look at the source code for one of the sample applications that came with JHotDraw, would that be a viable thing to do?</p> <p>R In this case No, but yeah, I can understand your motivation So I’m not allowed to look at them then! Okay well then if that want available then, okay I just want to know what happens in create drawing, want am I allowed to do in create drawing. Okay so I’m going to look at the draw application micro architecture I suppose.</p>	
116	MA Title	<p>If there is one... and it isn’t.</p> <p>R These only list interfaces and unfortunately draw application although it implements a couple of interfaces its really a concrete class. Oh of course. Right. Okay. [So it wont help me in there] So I don’t have an example of how to use this and I don’t have any javadoc. I’m just going to have to resort to the source code which is a bit [frustrating] maybe the source code or...</p>	Looking for DA
117		R Are you reluctant to do that? You’d rather use these other documentations?	

	SC DrawApplication	<p>My first option would be an example my second option would be the javadoc, although I'm hesitant to use the javadoc in JHotDraw because I don't think it is very good but then my third option would be the source code.</p> <p>R Okay. Lets have a look at the source code and see what you think. Where are you going to be looking?</p> <p>I was going to look at maybe draw application.</p> <p>R And do you know where that is?</p> <p>No.</p> <p>R Its in... there is a...</p> <p>Oh. Is it just application that it is called?</p> <p>R Yeah.</p> <p>Ha and there is one class in it! That's really good! Right okay. So what I'm interested in is the create, the create drawing? Is that what its called. That gets overridden in here somewhere.</p> <p>Okay there is [open this is the template method] and somewhere in there its going to call create drawing hopefully. ...[maybe it doesn't then] maybe init drawing calls it later....Right init drawing calls create drawing. Okay....There is create menus... its just creating standard menus not interested in that... create Tools... ah create drawing. Is that what I was looking for?</p> <p>R Yep.</p> <p>Okay it returns a standard drawing</p>	
118		<p>Okay, standard drawing. I don't know if standard drawing [would have any] appropriate micro architectures?</p> <p>R Well Drawing is an interface so...</p>	
119	MA Title MA DrawingIH	<p>Drawing is an interface; okay well I'll maybe take a look at that and see what that tells me....Standard drawing is the class that implements drawing and its also it inherits from composite.</p> <p>Oh okay these drawings don't show... what am I trying to say?</p> <p>R They only show overridden methods? Right.</p> <p>R They don't show a complete implementation but they should show you the complete implementation for the drawing interface. Right, that's okay but that's why there is no constructor in here called standard Drawing.</p> <p>R Oh right. Yep.</p>	
120		Okay. I'm going to go back to the source code	

		<p>then.</p> <p>R Why are you going back? Are you looking for the constructor?</p> <p>I was just trying to come back to the diagrams rather than go to the source code I don't know why I thought of this, I was hoping that I would have the constructor here and that I could click on it and go to the right bit of the source code, but [I have realised] it doesn't work like that.</p> <p>R No the question was more what value is there in knowing about the constructor?</p> <p>Well this create drawing it returns new standard drawing so that's really just the next clue that I was following ...</p> <p>R So that's really [unintelligible] creation [unintelligible]</p> <p>Yeah.Yeah. So I'm going to look at the source code for standard drawing.</p> <p>R I think that the code for that is in standard. Right.</p>	
121	SC Standard Drawing	<p>Right so it calls its super class constructor but... okay so it calls the constructor in composite figure, which is the super class and initialises this instance variable fListeners to an empty vector. I am not sure where that gets us really.</p> <p>R We are in this situation we have got this ground figure and we are trying to somehow make it appear on the drawing. What options do you have?</p> <p>Well I was hoping I could add it to the draw... add something to this err create drawing was it called?</p>	
122		<p>R Yeah that's right.</p> <p>I want to add something to that that says put this new figure in here, but now I'm just completely lost! The only clue I've got there is that this create drawing method calls this constructor, then this constructor calls the super classes constructor so I guess the next place to look would be the composite figure constructor.</p> <p>R You are only looking there because you can see that has been called? There is no sort of strategy or plan?</p> <p>No it just sort of desperation really.</p> <p>R Do you want to do that or do you want me to push you slightly towards a different solution?</p> <p>Err Well go ahead yeah I don't think I am going anywhere here anyway.</p>	
123		<p>R What I think is you have basically given me the solution but you haven't realised that you said it. Right. I think that you should go back to the</p>	

		<p>drawing micro architecture and have another look at that and see if you can find a way forward. I think that particularly, the point you made even earlier on was, ah you were looking for the constructor [and so you were looking in that class] [back to MA DrawingIH] but standard drawing is very unusual its implementing an interface where some of the interface implementation is happening in composite figure okay, so between composite figure and standard drawing you have got a complete implementation of Drawing. So is there anything between the two of them that you think might prompt you towards a different solution?</p> <p>Well there is a method that adds figures but</p>	
124		<p>R What do you think about that? Are you not sure about it?</p> <p>I'm kind of confused about the whole composite figure thing so each, I dare say I've [asked] this already in Hotdraw is each drawing a figure? That one inherits from this the fact that...</p>	
125		<p>R Yeah. Well I have to clarify that slightly each drawing in HotDraw is basically the drawing interface okay so in that sense a drawing is not a figure.</p> <p>Right. Okay.</p> <p>R But the default drawing, the one that is in all of the examples and all of the programs you have used the standard Drawing, the standard drawing is a figure, it is a type of composite figure.</p> <p>Right Okay.</p> <p>R There is a separation that a drawing is a separate idea but the actual default implementation is that a drawing is a figure.</p> <p>Okay. Yeah, when I look at it like that, thinking that, well I know from previous experience that a composite figure is a load of figures [bunded] together to make a new figure so what I am thinking is that the sort of standard drawing is your empty work space but that its an extension of composite figure so I could somehow add my new ground rectangle to standard drawing because it's a composite figure so I could add that to it so I am wondering if I could use this add all method and pass it a vector containing one figure which is this black rectangle that is going to represent the ground.</p>	
126		<p>R Why not use, is there not an add figure above that that you can see?</p> <p>Yeah. Oh right, Yeah, Yeah that would be better. But I would use that so there is the question of where to you put it? In terms of x,y coordinates.</p>	
127		<p>R I don't want to get too heavy on that that's the kind of detail that I am keen to avoid what I would say is that in the previous solution you gave me you spoke about display box and the</p>	

		boundary of your figures was the display box you know [] ways of going about it and then it's a matter of deciding where it is the bottom of the drawing and I don't really care how you do that. Yeah.	
128		<p>R There is, there is one aspect of it that concerns me and it's a... [] a few things [and I don't use it all the time] because it is it is a bit of an awkward one but I will raise it for you and I will ask you to think about it for just a minute of two but I'm not, if you don't see an obvious solution then we will move on because it can eat up a lot of time and its not that interesting really. Right you have added this figure to the ground and the user shouldn't add it, it should be added automatically but one concern I've got is that if I resize the drawing then if this figure doesn't react to that then it will stay [] in the middle of the screen or whatever, it doesn't automatically resize to the bottom do you have any thoughts on [] how you would actually implement that []. First of all do you understand the problem?</p> <p>Yeah. Yeah I understand it. What I'm thinking you would have to do is when, this is when you resize like maximise the window that you are displaying in?</p> <p>R Hm hmm.</p>	
129		<p>Right okay. I think that you would have to have the drawing application, yeah the draw application would get informed about that so you would need to somehow have the draw application move the ground to the bottom of the window but as it's the redraw would be implicit because the window is getting resized it would just redraw itself, just as it does [some thing you could possibly do] to add a check to the redraw method that checks whether you know the x coordinate of the figure that represents the ground is near to zero like x equals ten or something if it wasn't then you move it down there that's assuming that HotDraw updates its coordinates based on the resizing windows so that what used to be zero, zero, is now 12, 4 or whatever...</p>	
130		<p>R Okay. I get the gist of what you are saying the only slight complication is that zero, zero is in the top left, but yeah I get the gist. Get the total dimensions of the area and then figure out say ten up from the bottom or whatever. Yeah I think it would be close to what I would be looking for the only thing in the solution that is not going to work is that I don't think, I don't think that draw application is the place to actually do it, I don't think that draw application, ever really is aware that a resize has happened okay and indeed I think that the solution is to have some area of the drawing, I am not one hundred percent happy myself about which area but somewhere in</p>	

		<p>drawing because its obviously been changed, right, its resized it says who have I got as my contents oh I've got a ground right I need that to be at my lower area right, and that would be the way I would solve it, and I think you have basically got it and as I say we are not too fussed about it.</p>	
131		<p>R: Okay so where are we at? We have got blocks, the ground, we can add blocks we are getting there right, so next we have got really one of the last challenges which is the constraints between blocks.</p> <p>Yeah.</p> <p>R What are you going to do here?</p> <p>Right so the constraints are that a block can only sit on the ground or perfectly on top of another block and the only block you can move is one that doesn't have blocks on top of it.</p>	
132	MA Figure	<p>So what we are going to have to do is... right, we are going to want to look at how we move a figure, obviously in HotDraw the user clicks clicks on it and drags to a new location. So I am thinking that's going to follow the usual pattern of mouse down, mouse drag, mouse up those three operations I think [I will] check the micro architecture for figure...</p> <p>[cant see them]</p> <p>R Were you expecting to see a mouse down, mouse drag and mouse up on figure?</p> <p>Yeah. I was,</p>	
133		<p>although there isn't for some reason. [there is] a move by method, so presumably move by is called by this mouse drag method which I assume exists.</p> <p>R Do you have any idea if its not [] start in figure [to] explain [the methods]</p> <p>I was expecting it to be in figure because they, all figures can, is that correct? All figures can be dragged?</p> <p>R It certainly is, well [I think you would have to] qualify the word all but figures can certainly be dragged. In hotdraw but if you think about applications that you have seen,</p>	
134		<p>how do you go about dragging a figure is there a certain process that...</p> <p>Well you just move the mouse over it, mouse button down and drag, you don't need to select it first or anything.</p> <p>R [] looking at it in figure then for that behaviour?</p> <p>Well... I suppose it could be in the handles.</p> <p>R Well we have seen before that the handles do have that pattern of behaviour in there but its not in handles do you see that behaviour anywhere else?</p>	

135	PL Overview	<p>Even if I was to say that its obviously not figure and its not handles who else is [involved], even if it's a complete guess who could it be? Any idea? No I mean, figure has got handles but what else does a figure have that tells you [how it moves]?</p> <p>R What about something like the pattern language would that help? Yeah, okay, okay. So I want to know about moving figures.</p> <p>There is something called [Locators] here which I am not at all familiar with.</p>	
136	PL Using Locators PL Overview	<p>I wonder if it could be anything to do with that?</p> <p>[I don't know I'll take a look at that]</p> <p>Right okay so locators represent positions on figures so I don't think its that. That doesn't seem really helpful.</p>	
137	PL Mod existing Figures PL Overview	<p>I'll take a look at modifying existing figures again, is there anything ... no there is nothing very much in here.</p> <p>I don't really know where else to look because [I want to be] moving a figure but not in the handles its in the figure.</p> <p>R What I'll do then is I will tell you that the reason you haven't found it is because well your right logically speaking when you look at hot draw and imagine how it works it seems like you are clicking on a figure and then [moving] but what actually happens is that</p>	
138		<p>the default is that if you haven't selected a tool then the selection tool is active and what is happening is that the selection tool is picking up the mouse event and [dealing with them] and that is what is actually involved in moving a figure. Ah, right, okay.</p> <p>R I can't even remember... why are we looking at this? Because...</p> <p>R We were on the constraints weren't we Yeah, I'm trying to think... Yeah we were looking at how you can move a figure because we want to restrict it to just being figures with no figures on top of each other. Right okay, so selection tool [if] we find that then, I'm thinking that selection tool has this mouse down, mouse drag and mouse up behaviour.</p> <p>R Yep that's right. And so</p>	
139		<p>what I want to do is to constrain, well when I do mouse down normally, and then mouse drag it would say okay and let you drag it but what I want to do is check that the figure, that the block</p>	

		hasn't got blocks on top of it. So I [want to] do that in either the mouse down or the mouse drag formation I want to have it check that there is no blocks on top of it and the mouse up operation I would want to check that it is sitting right on top of another block and not in space either that or on the floor. So I'm going to have, going to have to have a new, a new kind of selection tool something that extends selection tool that has got this behaviour in it and then instead of using the normal selection tool	
140	PL Customising Draw Application PL Customising the GUI PL adding buttons to the Toolbar	<p>I am going to use ours except that when you start up hot draw it automatically creates the other selection tool doesn't it? In the create tools method.</p> <p>R By default it will yeah, is there anyway you can turn that off? Do you think? I don't know that's what I want to know.</p> <p>Lets see... Customising draw application, tells me that there is the create tool and create drawing methods.</p> <p>Customising the GUI.</p> <p>Customising the behaviour of buttons, customising the toolbar [tells me how to add] buttons to the toolbar, does it tell me how to disable them? ...No</p>	
141	PL Customising the selection behaviour PL adding buttons...	<p>Hmm, customising selection behaviour, I don't know if that's something to do with the selection we are talking about just now.</p> <p>Oh okay.</p> <p>Right okay, that doesn't [really help]. So what we are looking for is a way to stop it displaying the standard selection tool. So that's, I'm overriding create tools in draw application</p>	
142		<p>I don't necessarily need to, you would usually call create tools in draw application wouldn't you? To create the standard tools so in this occasion I wouldn't do that I wouldn't call super dot create tools palette and then that way it wouldn't create the normal tools and then...</p> <p>R So that would then prevent selection tool from appearing is that right? Yeah.</p> <p>R That would certainly work but interestingly enough there is actually a hook which I am guessing that you have maybe not found, that's maybe an assumption, but there is a hook in draw application called create selection tool which you could override and that actually obviously returns the selection tool that is used by its method of create tools.</p>	Referring to pattern text

143		<p>What's your opinion on that would you have eventually looked at the codes do you think or what's the chances that you would have found that out?</p> <p>What did you sorry, create?</p> <p>R There is a, create tools in draw application has a call to a utility or helper method called create selection tool so you can override, create selection tool and then provide your own definition of what a selection tool is and then therefore that mechanism is changed, the actual selection tool that appears.</p> <p>Right.</p> <p>R But there is nothing that stops you from doing, exactly what you first said is fine, you can turn off super, right and then add in another selection tool, that's changed. In effect that might be a [] its just obviously the</p>	
144		<p>other solution is a bit more elegant perhaps but it is something that the documentation doesn't take you towards, it relies on having to find it in the code so to speak, so I don't know whether or not it would have happened.</p> <p>I'm not sure I would, at first I thought I wouldn't expect the framework to provide a method especially for that but when I think about it, it is a semantic drawing editor so selection tool is quite important, you know, I suppose I should really have expected that to be there.</p> <p>R [] is does seem to expect selection to be there all the time pretty much. So by either of these mechanisms, obviously it doesn't matter which, they are virtually equivalent in terms of what they are anyway so [] you can add in a selection tool or you can change the current selection tool.</p>	
145	MA ToolIH	<p>The question now is about a bit more of the detail of what we are going to write in that selection tool.</p> <p>Right. Okay. So I want to look at the tool hierarchy to see if, see where selection tool inherits from. Selection tool, okay so this has the mouse down, the mouse drag and the mouse up events, which is what I was expecting. So what I want to do is in my new selection tool I want to have something that checks when you do... I suppose it could be in either mouse down or mouse drag, no it would be in mouse down.</p>	
146		<p>I want to check that there is no, no block, no block figures on top the block figure that I am clicking the mouse on.</p> <p>I don't know whether to put that in mouse drag or mouse down.</p> <p>R Well, the first thing is, my immediate question to you would be how do we, get a hold of these other figures that are round about?</p> <p>Right. Well I know from using the framework</p>	

		before that there was a method that would return an enumeration of all the figures in the diagram. R Do you know where that method is?	
147	MA Index MA Drawing	No. I don't know where it is. I suspect that it is in draw application or something like that but I don't know where it is. R So I guess then, the next question is well first of all, can you find out where it is and also you will get access to it from your selection tool?[] Right. I will [come back out of] tools, I will have a look in micro architectures, drawing view, see if that has a collection of figures... lets have a look at drawing []. I think it was a method just called figures if I remember rightly but I don't know	
148	MA Tool IH	Right okay, there is a method that returns an enumeration of figures, so I assume that that's the one, can I assume that that returns an enumeration of figures on the diagram? R yeah. Right okay. So what I want to know is can a selection tool know about the drawing? So go back to the tools hierarchy. What I really want to is, is there a way I can return drawing from selection tool. R Remember that this diagram is only showing the overridden methods of tool. Of course right. So that's maybe irrelevant to this question.	Finds figures in MA
149		I am trying to think if, this is all the methods that I have got in tool then how do I get the drawing? R What I was saying to you though is that supposing for example that if you have tool, that's all the [interface for] tool but what is the interface for abstract tool or its other descendants? Because they might have additional methods such as	
150		for example drawing that you don't see there. Oh right okay. Right Well I'd like to look at a class diagram to decide if it did show me all that. Right, so we don't know what else... does this imply that abstract tool implements tool and doesn't get anything else from anywhere else? R No. you can't say that. Right R [wait a minute] right no, sorry you can assume that. You don't know though if abstract figure has taken it upon its self to define an arbitrary number of methods that you are not seeing. Right, but I can say that, it would always be correct to say that this, selection tool implements this interface and inherits from this class and	Sub is worried in case the diagram is showing incomplete inheritance

		doesn't implement anything else.	
151	SC?	<p>Is that correct?</p> <p>R Yes it doesn't implement, well right it doesn't implement any thing else but again still we still don't know what its public interface is until you look [at the code] or the javadoc or something similar.</p> <p>Right. Okay well it looks like there is nothing else in tool. That's that so in abstract tool I would like to know if there is something that would let me find out the drawing that... the drawing that the tool is operating on. Although I'm not sure whether it makes any sense to have a [link] between a tool and a drawing. Right so we are going to have a look at the source code for abstract tool</p> <p>R Abstract tool is probably in standard again.</p>	
152	SC Abstract Tool	<p>Okay. So we are looking for something that will return the drawing or something that would refer to the drawing so something that returns the drawing or maybe the drawing view or something... There is a method here that returns the tools drawing. Okay... Okay so I can... in my new selection tool I can call this method that will return the drawing and I can from the drawing object I can call figures, to give me an enumeration of all the figures then I can search through that enumeration and find which figures are on top of the figure that I am trying to move.</p> <p>R I don't think you would be trying to [] that would be.</p> <p>No just testing the co-ordinates.</p>	
153		<p>R Right I like that but there is an even bigger problem that I have... you probably don't want to hear this? [laugh]</p> <p>No... go on.</p> <p>R I'm concerned, I'm concerned about how this constraint is activated. Are we working in a world just now where you place blocks in an illegal position then you have another like the selection tool, which thereafter only allows it to be moved into legal positions.</p> <p>Right. Okay.</p> <p>R The intention was that they were created in legal positions to begin with.</p> <p>Right, so I'm going to have to have similar functionality to what I was talking about here in the method that creates the blocks in the first place so you can't create a block in an illegal position.</p>	
154		<p>R [need to think about that?]. Right okay I think that would probably work out. A couple of questions one is what do you think about the code duplication [is it a part of life really] and how do you detect the top of a block?</p>	

		Right, code duplication... yeah okay I see what you are saying. Its difficult to get around that because I'm going to [use that testing code in] in selection tool and	
155		again in the block creation tool as well and you can't have multiple inheritance so... you could perhaps have some sort of... well I can see why you would want it in one place if you change the constraints so that you can only move the top two blocks or something, you would want to be able to change that. R One of the other reasons that I'm asking is that I have allowed this slight oversimplification in your solution that you were talking about changing selection tool every time	Multiple inheritance mental block on other solutions?
156		that there is a mouse drag if you look at selection tool it is not quite as simple as that...Broadly speaking it is still true but selection tool actually delegates behaviour to sub tools and so I don't see it as being a [big issue] I assume that you would go and look at that, I figure that you would work that out and then you would basically make the relevant changes at that level to one of the sub tool classes. What I am interested in is whether or not you could create a sub tool that would somehow isolate the behaviour and then you would just have a reference just from selection and from creation tool to that third party and delegate to that and it handles this common constraints business.	
157		Do you think you can do that? I'm tempted by it but I don't know... It would be nice but I'm just trying to think, in my code I'm always just trying to think whos actually implementing that, you know, what object calls what and so on. R Well I mean this is a similar way to how selection tool works, selection tool delegates to a drag tracker, which is a type of tool and basically if you start dragging the mouse it will say basically it just forwards on the message so mouse drag on selection tool is just forwarded to mouse drag on the drag tracker if you see what I mean. So I would suppose you would do a similar thing you'd have it that a mouse drag on our selection tool would get forwarded to constraining drag tracker. Ah okay. R Right and then similarly the creation tool	R Giving the solution away to easily
158		they can be forwarded to the same object or whatever. Yeah. Okay. Right. R I mean I'm not that interested in it in terms of, [I think I could take your solution to get passed that problem in the framework] that's fine but the	

		<p>other issue is that I would like you to think on is this idea that how do you know when you are at the top of a stack, how does your block know its at the top of a stack?</p> <p>Well it could go through the enumeration of figures that it has got and check if any of them had, check the co-ordinates of each figure and it would know its own co-ordinates and it would just check if any of them were above it, well had the same x but the y was say one pixel</p>	
159		<p>above the y on the top of that block.</p> <p>R Yeah I think that solution would work out... yeah I think that would probably work out okay the one point I think is how do you feel about that solution? Does that feel like a nice object oriented solution? Are you worried about it in any way? ...Are you happy with it, is that what you would go for or...I mean this is not a trick question I don't know the answer right but have you got an argument that...</p> <p>All I'm trying to think of is, is anything going to change, Yeah I'm, I think that I would be happy with that. I don't see it</p>	
200		<p>as anything that you would change I mean unless blocks are going to start floating with an air bubble between them or something then that would throw it off obviously but no I think that's fine.</p> <p>R Well the only other thing then. It would really just be your opinion on it, what do you feel about having... what the thing I see as a weakness to these kind of designs, like this one, is that a lot of the functionality it is not really held in the objects themselves its basically in this case the tool acting with a lot of intelligence and then the actual object themselves [would not be so dumb] about where they were meant to go and so on, and I wonder if you could create something like a composite figure that represented a stack of blocks and then used that</p>	
201		<p>as a larger container on the drawing that could understand and know about all the blocks within it whether it was the top block and so on.</p> <p>Right yeah I see what you mean. Okay. Just have a method that returns the top or something and it would just fail on that, yeah okay. I think that would probably be more modular because the who is top method could be changed to pick up the top two blocks or something like that, yeah.</p> <p>R Is that it is there any other advance on that [I think we have covered everything]</p> <p>That's pretty much the lot</p> <p>R I think that was a very good solution there well done!</p> <p>Okay. Thanks.</p>	

		R I think we will just stop, we will end it there and go onto a... [You going to ask me to code it now?] [laugh]	
223		Post task interview	

5.1.6 Participant F

Time	Documentation	Subject Talk aloud	Researcher Observations
0		Pre-task activities	
31		I wouldn't bother with the ground just yet. I think, I'd want to see what the, how you can simply add and remove a predefined shape from the canvas.	
32		I'd like to do it as simply as possible... should you be able to remove blocks from it? R: Its not something I've really specified... Well okay we will just keep it without for the time being. So I'd make a right click, a right click would be... no sorry with the left click you would add sorry and the right click would move it. That would be my solution as simple as possible []. So given that I've already managed to get the canvas from [] I'd probably use the mouse interaction on top of the canvas.	
33		R: I'm actually wondering, I feel that you are at a slight disadvantage because you have never seen JHotDraw before and I wonder, I will give you the option [] coding the actual solution. Is that what you would prefer to do or would you [like to continue as you are?] I think, I'm a sloppy coder and a slow coder so I think... R: You are quite content to continue as you are? I'm quite content to just to go through it as long as you... R: Yes I will try and be as accurate as I can and point out any problems for you.	
34		I mean this framework... what I would be inclined to do to be completely honest is I'd have a fallback option I would probably think about [] because I'm use, I'm use to programming in Swing, Awt, therefore using a framework like this is a case of getting use to it. If you just give me a minute. I'll have a look, I'm looking for... how do you know [] interaction with the canvas.	
35	PL Customising the GUI PL Adding buttons to the toolbar	Then again I'm seeing that we have got a adding buttons to the toolbar here. If there is already a set procedure for adding a button and making that then use for adding figures to the canvas. I'd be as well to use that. So I'll see what the [] in here says	
36	 [] toolbutton. Yeah, pretty much. Yeah so okay. I have moved away from the idea of left and right clicking of the mouse. This is giving me [an idea?] how to create a tool button So draw application class creates the toolbar and initialises the toolbar with the tool, the selection	

		tool. Subclasses of draw application can add additional tools by overriding the create tools palette method and	
37		...creating a new tool button to add to the toolbar. Okay Right so here I see that the example creates a [] tool	Reading xample code
38		...which is what I need [] to create something on the canvas. Assuming that we have already got a default toolbar what I'm wanting to do is create a, well add a creation tool which will create my box onto the toolbar. So what I will do I will add in the code for the draw application. R: So at this point you would override create tools in draw application, is that what you would do? Yeah	
39		R: And you would create a customised draw app what name would you give to the application? Err create a customised ... R: I mean we have subclassed draw application so what are we going to call the new class? Erm... the toolclass? R: No, no no no. I am just trying to document the design that we are talking about obviously we want to subclass draw application and just for later, if we need to refer to it later I would like you just to give it a name. Ah right okay. Gotcha R: We could call it say blocksworld application or... Yep yeah.	
40		R: So that's that blocksworld we are going to have to have a create tools method Yeah. R: And I think within tools we are going to have to establish [what we are going to put?] Yep. So we are going to have the create tools method and I'm just going to go back and... [create tools?].	Reading pattern
41		Erm to be quite honest I don't think... I'm just trying to imagine what the source code would look like. I think what I do, do is I go through and code as I look up the documentation. Its quite difficult to keep it completely abstract. R: If you feel comfortable actually coding then by all means start up an editor and code. You don't actually need to compile that code or use that code but you can do that if you want.	
42		*	
43		*	
44		*	
45		*	
46		*	
47		*	

48	MA Tool IH	Right so probably from this [] find what operations are relevant to the problem.	
49		Does the ground stretch right across the canvas? R: That is pretty much up to yourself you, are free to have it that way or you can have it in a bit. Whatever you prefer. Right well what [] canvas, so what I'd probably do is [] add in the blocks for the canvas.	
50	SC Mainclass PL Overview SC Mainclass	I think you would have a gound []. The ground and you'd put them there. So I'll go about adding the [] simple line across the canvas. So we have got our... DrawApp . Going to the pattern language and [] going to be definitely adding a figure with hang on...	
51	PL Overview PL Identifying existing figures PL Overview	So we will be adding a figure []. R: Okay how to we go about adding that? JHotDraw comes pre-supplied with many commonly used figures. So I am assuming that this comonally used figures...Check in identifying existing figures. So you would be adding a figure to the drawing application. R: How do we do this? So I'm assuming that there is a commonly used figure for the line	Sub is reading text "JHD comes pre-supplied with many existing figures"
52	PL identifying existing figures PL Figure hierarchy	I'm going to check if identifying existing figures tells me anything interesting about figures. I'm assuming by existing it means something that is part of the framework or its not something that we have coded already. R: No. No Something that is part of the framework. Not asking it to perform anything we just want it to be added. Yeah. It's the Line figure I would imagine.	Sub is paying attention to the hierarchy structure (tracing connections with the mouse)
53		R: Have you any idea how its going to look? Is it going to be the length of the drawing or is it going to be... Yeah I'll make it the length of the drawing. ...I'm assuming you can get information about the frame. Is it inheriting anything from AWT? R: I should point out, it does, it uses AWT rather than swing and yeah it does eventually go back into AWT but I don't want to say too much about how.	
54	PL Identifying existing figures	I would be tempted to, I'm feeling confined by JHotDraw, not being familiar with it, to back out and solve the problem using AWT. So we have got line figure want to...	Long pause on this pattern

55		<p>R: What are you thinking what are the next goals? The next goal is adding the figure. The line figure stretches across the screen.</p> <p>First I would declare line figure</p>	
56	PL Overview	<p>It would definitely help to be able to be able to see the whole hierarchy which is available in the JavaDoc because I navigate mostly by using the hierarchy.</p> <p>R: Is there any particular information you are trying to find out just now?</p> <p>Well its just if I'm going to declare a line figure in the canvas what would I need to import? And where from?</p>	
57		<p>R: In terms of packages?</p> <p>Yeah</p> <p>R: My reaction is don't worry about that. What I want to do is find a bit more information about line figure. Especially the coordinates. So it goes from one end to the other.</p> <p>Want to see if there is a get method to get the dimensions of the window.</p> <p>R: Okay to recap. You need the dimension of the drawing to control the size of the line figure. Where are you going to add the line figure in the code?</p>	
58		That would be in the constructor. After I've opened the draw application I'd put it straight in there.	
59		<p>R: If you create line figure below the call to open it won't appear on the screen.</p> <p>No. no.</p>	
100	PL Overview PL Modifying existing figures PL Figure hierarchy PL Overview MA Figure	<p>I'd have to have a look at the methods available in line figure.</p> <p>R: Are you looking for a specific piece of functionality just now?</p>	Quiet, pause Very brief scroll in hierarchy
101	MA FigureIH	<p>Yeah. Looking for constructor of line figure, need to initialise it to be the size of drawing.</p> <p>R: You won't find the constructors for any of the elements here. Just methods from interfaces.</p> <p>Right. Right.</p> <p>R: Only way to get that information is from the source code. (R spends some time explaining the package structure and where to find code – omitted)</p>	
102	SC LineFigure	<p>R: Line figure is in the figure package</p> <p>Ah right okay, so that's where...yeah its got set methods</p>	Constructor is empty Possibly a reaction to empty cons

		R: Is this helping? Yeah. This has definitely been helpful because it can initialise line figure.	
103		I would declare a line figure and then set start and end points	
104	MA Drawing	R: Okay so we have found how to set size of line figure. What next? I want to see how I can get the details of the drawing (size?) the details of the frame. So...	Reading methods?
105	MA Drawing Editor MA Drawing	R: There were no obvious methods in drawing? I can't see any for setting the coordinates.	Moving mouse through method names
106		R: is there anything that you have seen that makes you think that they are? No I don't think that there are but I know there are in AWT. So I've got my line figure and I'd set...at this point I've decided that it is impossible to ... I could set it to an arbitrary length but it doesn't appeal. We would get the width of the display from AWT.	
107	PL Overview	R: I can't imagine any particular problems that arise from that but there is a way to do what you want in the framework so now you know does that help?	
108	PL Customising DrawApplication PL Customising the GUI PL Customising DrawApplication PL Overview	I guess its part of the GUI. I don't think it will be here! Can't see any thing that immediately jumps out at me and says how to. Oh locators!	Reading links on GUI pattern. Interested in paragraph about Locators.
109	PL Locators PL LocatorsIH	So locators position relative to other figures. I don't find this very helpful to me	Reading pattern
110	PL Overview	R: Why not? I'm convinced I've seen something to do with locators...now I'm trying to find out how I can use them to specify...	Reading paragraph again "Position absolute or use locators"
111		R: Is a locator the way you want to go or absolute? Yeah I think it would be absolute.	
112	MA ? MA	R: We know a line figure can be sized so absolute position makes the problem to find the dimensions? Exactly R: You looked in drawing and didn't find any is there any other place to look?	

	DrawingViewIH	I suppose drawing view, not sure what that says... Ah (sees AWT component) that gives us get size method.	Scrolls down to see this goes to SDV.
113		R: Is that you happy? Yep. Its not really very intuitive. I'm not enjoying the guess work about it.	
*		Subject talking about task (considered as part of post task)	
124		R: It seems to me that you know what you want to do but are having a lot of trouble finding out how to do it. Yeah. (create line add block to canvas etc I've got it all laid out) but figuring out interactions and effects are hard – mentions liking the oRielly books for learning swing) The pattern language doesn't give me a solution to all the problems I'm coming across, can be misleading.	This excerpt is related briefly not transcribed verbatim as seen as external to task. Go back and get later if important.
125	PL Drawing View	Assuming I've got size at set coordinates in line figure. R: Where is this happening? How are we going to get line figure into the application?	
126	MA ? (looking for DA) PL Overview PL Customising DrawApplication	So you want to refresh? Repaint? R: How do you think that the draw application relates to line figure, what a terrible question! Ah hang on right I've got you ... earlier on when I had the draw application class in front of me... ...it had, it had methods ... called...	Scrolling Overview looking for where to go
127	MA Drawing	R: Can't remember where you say it? Maybe it was... To see how to add this I'm probably going to have to look at the draw application source code.	Sub immediately circles add with mouse
128	SC Draw application MA Drawing SC Draw application	So in your draw application it instantiates a drawing...	Sees instance variable drawing
129		...and one of the methods of drawing is add and I'd be using that method to add line figure to the drawing. R: That's fine. Where do we put the line drawing.add...? Yeah. I usually have an init method in my code so I'd do that in my init method.	
130		R: okay so back to your main right? In between create draw application and calling open you	

		would put drawing.add in there? Yep R: How would you get the reference to drawing? And are there any alternatives ways to do it? Yeah that's what I was just thinking.	
131	MA ? SC Draw Application	R: Is there a way from draw application to get drawing? Ideally I'd look at draw application but its not here so... Private drawing!	Scrolling down
132			Scrolling through code
133		What I'm looking for is a get method to get the drawing. (sub is circling a ref to init drawing with mouse – also sees default size is distracted by this back to the earlier problem of size)	
134			Sub finds init drawing – checks it says nothing and scrolls on.
135			Finds create drawing says nothing.
136			Finds Drawing()
137		R: So now we have got an application that we can open up and have our line drawn across the bottom. I am not going to worry about the case where the window changes size. Because when the window changes you might be worried about making sure that line stays at the bottom. I am sure you could handle that with a refresh or a repaint method. R: [] I wasn't bothered about it anyway.	
138	SC DrawApplication (already open)	R: We come back now to this idea, we were speaking earlier about creating tools to create these blocks. So I think we have identified creation tool but we have still to come up with how we are going to add these blocks. Well I think I would probably get a yeah a [] so what you have here is an example of the selection tool	Trying to find example in code takes while
139		Uh... well I am actually thinking... we can get the, get the palette in the draw application and then [just getting confused with]	
140		I don't like saying what am thinking its difficult to... R: Yeah. As long as you say what you are thinking at some point its alright. What are we working on? What I was wondering was... R: You were looking for an accessor into the tool? Yeah, yeah se if I can get the palette R: How are you going to do that?	
141	PL Overview	I am not entirely sure how I am going to do that. I think what I will do is go to the pattern language.	Reading above

		[] introduce what I want anyway.	creation tool link
142		<p>[]</p> <p>R: []</p> <p>I am assuming that a simple [] button on the palette. When you click the canvas it draws that figure where you have clicked. Is that viable?</p> <p>R: I think that is certainly in the right area but I am going to ask you to continue what you are doing now but at some point identify which particular figure will be used by the tool.</p>	
143	PL Using creation tool MA FigureIH	<p>Well we are not interested in [] we just want to create the figure in the first place.</p> <p>Right so first of all. [] find out what that figure is. I'll have a look in the figure hierarchy I guess.</p> <p>[] figure</p>	Sub is scrolling round entire area – getting a good look
144		<p>R: How do you feel about this [selection]? Is it frustrating you?</p> <p>Well...I mean the way it is laid out on the graph?</p> <p>R: Well just the fact that you are basically looking out of context and having to [look all over this quite large] hierarchy.</p> <p>Yeah...no its not ideal at all. I suppose I'd rather have... a more exacting documentation would be [that's why I like the [] hierarchy] quick, to find out.</p> <p>R: [] each time get a finer slice of it []</p> <p>Yeah. This is a bit too much at once to try and systematically work through</p>	Could this be JD (from other comments)
145		<p>At least its laid out in a hierarchy so you can so I, think I would use rectangle figure, which I couldn't do... not sure then you have got attribute figure [] I'm getting confused now on the one hand I've got rectangle figure over there, which inherits from attribute figure then here I've got a poly line figure with displaybox in it which returns a rectangle.</p>	<p>Sub continuing to scroll</p> <p>Sub looking at polyline figure</p>
146	SC Polyline figure	<p>So in java doc you would have a paragraph and those paragraphs even those little paragraphs are usually useful because they have got, they rule out things. Straight away.</p> <p>R: In this environment though you have the ability to almost cheat and look at the javadoc comments in the source code so...(laugh)... it is allowed in this survey. To look at to identify a method [or anything about it] so why don't you look at the comments?</p> <p>Yeah, yeah good idea. So poly line figure... there you go poly line figure!</p>	<p>Interested to see examples of JD</p> <p>R interference</p>
147		<p>So errmmm.... Assuming that poly line figure is a connector as it seems to be from the arrow? As opposed to a figure. So it would be the Rectangle figure we are looking for now.</p>	<p>Scrolling back and forth – lost?</p> <p>Connector return type of method – can find the arrow</p>
148		R: Okay, what about that rectangle reference?	

		<p>[Was it a mistake or...] Well...(sigh) R: I think it was display box or basic display box you said. [Do you] have any idea what that rectangle actually does for you? Rectangle being outside the framework. Yeah yeah. Well yeah just because...</p>	<p>Sub scrolls to displaybox</p> <p>Looking for displaybox?</p>
149	MA Figure IH	<p>Yeah well it obviously can't be what we are looking for. Because errmm, I think if you are using a [] rectangle in something like JHotDraw its going to have a lot more attributes than the standard []. It could be an [] of some sort. And its only a Display box generating a box object for the canvas. So I will definitely leave that.</p>	Confidence.
150	SC Rectangle figure	<p>And go for... rectangle figure. Right, its got a display box as well R: What do you need to know about a rectangle figure in order to use it? Are you comfortable? Well I'd have to go to the source code to see the constructor for it</p> <p>So it initialises rectangle figure at the [owners] origin. So I can infer that we have got an owners []</p>	<p>Scrolling to rectangle</p> <p>Why say owner? – could it be corner?</p>
151		<p>So it would be the two points would be top left hand corner and bottom right hand corner and so on. So that makes it all right because [] the rectangle we are going to be initialising needs to be forty in one dimension and forty in the other dimension.</p> <p>So I'm just trying to figure out really, initialise the rectangle</p>	
152	<p>MA Figure IH</p> <p>PL Overview</p>	<p>And then place it on the canvas using the [creator function]. [] in the pattern language or whether every time the user clicks the mouse down I generate a new position on the canvas relative to the mouse R: is there [anything that can help you?] Yeah well I'm pretty sure I saw something in the pattern language. I'll definitely have a look at the locators.</p>	Mouse on creating handles?
153	<p>PL UsingLocator</p> <p>PL C. handles</p> <p>PL UsingLocator</p>	<p>Don't know what is meant by handles here. I assume that's the little icon boxes. I'm not sure... yeah. 'A locator interface is implemented by abstract locator ... two subclasses offset and relative locator'. Now</p>	<p>Mouse on creating handles link again</p> <p>Mouse shows reading text</p>
154	PL Overview	<p>I would have a look at emm...how the mouse, how mouse actions [are integrated into this] the mouse listener. [before I look at locator] R: So what in particular? What interactions [] in this solution? Well... how to get, I know how the mouse works in AWT but what I want to do is use the mouse</p>	

		click and determine	
155		<p>A the coordinates and B whether it was a left or right click. Then if it was a left click then create the coordinates and place the square at those coordinates</p> <p>[R: What if there is a square there?]</p> <p>I'd want to see if there was a square there then I'd want to see if the mouse had been dragged, and if its been dragged then wait until its been released again. Assuming there is a mouse click [and then] the system is dragging and releasing</p> <p>R: Okay...</p> <p>Is that right...</p> <p>R: Ermmm I think the concept is right again I don't want to say too much is there anything there that is helping you?</p>	<p>Why?</p> <p>Aware of seq.</p> <p>?</p>
156		<p>No No that's emmm that's just, I'd rather yeah that's just experience, well that's the way I would have done it [] but again I think I'm referring back to the presumption that we have got a similar mouse listener system as AWT.</p> <p>R: I think you should be asking it in terms of I want it to do this is this reasonable? Yeah I think it is reasonable okay how do I go about doing that. Assume that you are right.</p> <p>Yeah.</p>	<p>Sub aware of assumpt</p>
157	PL Using creation tool PL Overview	<p>So using the mouse in JHotDraw... ermmm [think I will see how the tools would use that]</p> <p>So the pattern language doesn't seem to be really helping me to get [I haven't really found] any mention of what the mouse is doing.</p>	<p>Not sure reads much here</p>
158		<p>Searching did help. 'Most applications in JHotdraw will require mechanisms for creating and editing the figures that make up a drawing. Figure creation is usually performed with a tool a button that when selected alters the behaviour of the mouse' Right so the behaviour of the mouse is dependant on the tool selection. So we are not [... Okay I think I'm gradually getting a feel for JHotDraw so its...yeah the behaviour of the mouse determined by the tool that you have selected</p>	<p>Sub does find with mouse in PL</p> <p>Important phrase in PL</p>
159	PL Using creation tool	<p>So I'd have a look in the... So now I'd be inclined to have a look at what's available. What the interface is [] tool, creation tool but... first I'm going to read up on creation tool.</p> <p>Seems superficially similar to Xfig. You pick the function you want and then depending on what function you've picked the behaviour of the [pointer] changes.</p> <p>R: Is Xfig spelt with a ph?</p> <p>No just f. F.i.g.</p>	<p>Creation tool link on screen</p>
200	PL Tool	<p>R: What is it [xFig]?</p> <p>It's a unix program for graphing, they have done it for java as well.</p> <p>Right Tool hierarchy.</p>	

	Hierarchy	Connection tool, action tool, tracker, drag tracker. So we have got handle tracker and drag tracker.	
201		R: What do you think about these things? Well I, no sorry, I was thinking of handles in a different context... handles in this context handles is the little squares. Yeah I thought it was meaning handler for mouse [I don't think its very obvious well] it's a bit ambiguous. So you have got drag tracker. I dunno, I dunno how you would find out about... hmmm probably be useful [to have a bit of sample code].	
202	SC Creation Tool	R: If you have access to the framework documentation it would have several example applications Perhaps I probably would... I think I'll have a look at the creation tool. R: I think its in standard	
203		Then again, it should be noted that the idea of looking up source code to see how an application works is the least appealing option. R: What is the most appealing? Well... its just I think it just means, there should be a much better way to look through it than to have to... because source code is potentially unstructured and got a large [file?]. Its just the whole, manual effort of trying to extract the information that you want... its unappealing. Ah here this is what we want. [mouse down on screen]	
204		This is mouse down. Creates a new figure by cloning the prototype... right. R: Are you familiar with the prototype design pattern? Nope.... Ah R: This is an example of it (laugh) So it initialises creation tool with the prototype... ermm...	Scrolling back up looking at local variables
205	SC Mainclass	R: You saw that mouse down so... Well I am just wondering have I already, I mean given, now that I know that mouse down is, now that I know I don't have to define behaviour of the application dealing with the mouse click, all I have to do is define the prototype have I? R: Mmmm hmmm [] Well as far as I that was what I was... R: You can treat that there as an example can't you? Yeah that is what I am doing.	
206		So as the prototype, yeah so what I'd do is... I'd declare the rectangle figure and then I'd just put in its dimensions, absolute dimensions, forty by	

		forty []	
207		<p>...information about the mouse then I'd just use that to initialise the creation tool.</p> <p>R: So that would be you done then?</p> <p>Ermm</p> <p>R: Do you want me to tell you the result is that was to happen. [] at compile time?</p> <p>If that ran at compile time it wouldn't matter []</p> <p>R: No no I just wanted to give you confirmation of where you have got to.</p> <p>Yeah, yeah.</p> <p>R: You are right, what you said will work fine [it will allow you to build a rectangle figure of size forty, forty]</p>	
208		<p>...And it will automatically add that to the drawing for you [], and that's great. That is going to work. The problem with it is that if you were to run that what you would actually see is... when you click on the drawing and then drag on the drawing. If you just click on the drawing you wont see a figure. If you click on the drawing and drag it, it will create a figure, it will create it at the size that you drag.</p> <p>Oh right!</p> <p>R: So it just ignores that initial forty, forty. And decides to resize it according to its own rules.</p>	
209	SC CreationTool	<p>R: You need to do something else.</p> <p>So what we want to do... is override the mouse drag method.OR actually I'll go [look at code?].</p> <p>So have got mouse down, anchor point, create figure. Ah the display box is the rectangle, the bounding rectangle [] and it adds it to the drawing view</p>	
210		<p>...and ...</p> <p>R: So you want to change it so that when you click. When you press he mouse down once you create a figure []</p> <p>So ideally you want to see what calls this, mouse drag method</p>	Mouse drag
211		<p>Yeah. So I want to find out what is calling the mouse drag.</p> <p>R: Why do you want to know that?</p> <p>Ermm</p> <p>R: I'm not trying to say to discourauge you just...</p> <p>Yep. Well I think initially I wouldn't be [discouraged] its just to give me an idea of how this whole thing fits together. Its not clear. So I think in this way it would give me an idea of how its all put together.</p> <p>R: Lets just think about that for a moment</p>	
212	MA Index	<p>R: You want to know what calls mouse drag is there anything that [will help?]</p> <p>Micro architectures</p> <p>R: Well go and have a look at that and then we can come back</p>	

	MA Drawing change listener MA Drawing Request update	R: So what would have mouse drag? Its one of those, I assume it would be one of those four there. Drawing change listener sounds... interesting	(Drawing, DCL, D, Figure) Comes back out quickly
213	MA Index MA Tool MA MouseDrag	R: is there a, I'd like to remind you [its half] that the column you are in tells you who calls a method on an interface so you want to know who calls mouse drag on [creation tool]. Oh okay right. Ah so mouse drag.... Standard drawing view. Okay, so...	
214		... its telling me that those two methods call mouse down but what we are interested in is the user input. So that means we want to have a look inside the [] code definitely wrote down standard drawing view anyway. R: So we have learned something about a bigger part of the system? Yeah. R: So the user input goes to the drawing view and the drawing view sends them on to the tool. Yep. Yep.	
215	PL Overview	So what we have got to do is... R: Change the moue drag behaviour Change the behaviour of tool... so that will probably be...having to think for a minute... looking up the pattern language. To see if there is any... anything about tools in here that could help.	
216	PL Using creation tool	Creation tool. What I've emm...probably do is have [chosen] a new class that inherits from creation tool and overrides mouse drag method. And in there I'd just, well I mean... yeah so when the mouse clicked okay	Reading ovrview
217		Then on drag I'd want it to move the position of the... of the... R: I think its probably worth pointing out that the way that this works its part of a sequence that you click, drag and then up. Okay so. Right Ah. Yeah so, if you want to edit the position of a box you want to drag it you clicking on the ground you are adding another block to the canvas. R: No well what I'm getting at is this is a creation tool so the block doesn't exist this is actually the physical act of creating it. Yeah okay, get you now.	
218		R: You don't need to worry about moving just now. Okay so if drag [] R: [] When you create a figure you create it where you click []	

		<p>Yep. The attributes on the figure?</p> <p>R: Well the rectangle figure []</p> <p>So never mind what size the [] is. Okay right</p>	
219		<p>I guess I should be looking at the [] in the release handler you can put in you just say when its going to set the size of the line figure.</p> <p>R: rectangle figure</p> <p>Err rectangle figure.</p> <p>R: Yeah I think that sounds like a solution. Actually I'll just look at the source code for mouse up down.</p>	
220		<p>Right yeah it would be better in one of them. Override it. I assume that created figure would be the rectangle figure and there would be a</p> <p>R: Another option that you have here is to override mouse down and set the size in there. I think its six of one...</p>	
221		<p>R: It means that when you click it would appear immediately</p> <p>Yeah. Okay.</p> <p>R: I Think that is well done I think you have got an application that has got a ground in it, you have got a tool that we have more or less been through all the issues and I would be quite confident that you could get this tool to create blocks now that are the correct size. There are two problems left with this part of the solution I'd like to look at them. One of them I'm concerned about the figures size okay it appears at forty forty.</p>	
222	PL Overview	<p>...but what you don't know and I will tell you is that by default it has a set of handles associated with it and those handles allow you to change the size so if we don't do something about that then we are going to be able to change the block size. The other problem I want you to think about is the colour by default figures are coloured a funny shade of green we need it to be red those are the two problems. Before we have solved the [creating blocks problem]</p> <p>Okay what I saw... I feel that I am becoming quite a regular now I am almost comfortable with the going to the pattern language and seeing what they say about handles.</p>	
223	PL Create handles	<p>I'm looking for a quite [concise thing to start of with]</p> <p>All I see down here is creating handles.</p>	Scrolls down focus on code first
224	PL Handle IH	<p>Oh right I was just thinking if you automatically add handles to a... figure then you should be able to go to the figure and find a way to disable them. Or override them and create an empty method. So... look at what handles the hierarchy has see if there are any that [] stand out.</p>	Is sub looking for null?
225		<p>I don't know [if it means] much but there is a null handle there, which... yeah just by looking at it</p>	

		<p>you can't really say</p> <p>R: So looking at the hierarchy you have seen null handle it seems to be interesting?</p> <p>It seems to be interesting.</p> <p>R: Where... do you think you want to look at the source code for that?</p> <p>Errr no. I wouldn't I'd do it in [] the source code, the source code is really the last resort.</p> <p>R: What do you think about null handle what would you expect that to do?</p> <p>I would expect it to... to be a handle that didn't do anything.</p>	
226	<p>PL Overview</p> <p>PL Mod existing figures</p> <p>SC</p>	<p>But it doesn't... it really is difficult to infer anything here so I will bear it in mind and go on to see what I can get, perhaps from the figure hierarchy. And perhaps access the handles through that</p> <p>R: What kind of methods would you be looking for then?</p> <p>Erm mmm I don't know probably the best way to find out is through looking at the source code.</p> <p>Another thing is I know that I don't have, in the source code I don't find useful comments. I usually look at javadoc but when I use the javadoc comments its [more interesting]</p>	<p>Exploring options with out committing - good!</p> <p>(pattern does say look in code?)</p> <p>having problem finding code?</p>
227	<p>SC</p> <p>FigureAttributes</p>	<p>I'm just drawn to the code well if anything is going to say anything, it will be a lot more precise than anything.</p> <p>So there is figure attributes. I'm interested in looking at that.</p> <p>R: [Why are you looking there?]</p> <p>Erm mmm well because ehm the handles to a figure might be [here]</p>	<p>Contradicts earlier</p> <p>Sees name in open dialog – why here?</p>
228	<p>Closes code</p> <p>PL Figure IH</p> <p>SC Figure</p>	<p>That's not very useful. Well I'll look at the figure hierarchy</p> <p>[have a look at figure]</p> <p>Hmmm its got a reference to handle</p>	<p>Ref is in javadoc comment</p>
229		<p>'A figure has a set of handles to modify its shape or attributes'</p> <p>[So looking for a handles method]...yes. So it's a factory method that returns the vector of handles. 'Handle is a factory method for creating handle objects'. Factory method...</p>	<p>Reading comment</p> <p>Sees handles</p>
230		<p>R: []</p> <p>Well I'd want to see what handles does. Figure out what is meant by factory method. I'm not sure how I could use it...[]</p> <p>Oh! (finds no more).</p> <p>R: The other thing is that you are in an interface just now so...</p> <p>Oh yeah, yeah.</p>	<p>Search for handles (trying to find more)</p>
231			

		<p>I think, err what I want to know is if I can set the attributes of the handles so that they cannot be manipulated. I know I can chose a different set of handles for different figures</p> <p>R: So the theory we are going to work on just now is that you are going to do something to them.</p> <p>Yep.</p> <p>R: And some how turn them off?</p> <p>Yeah.</p>	
232		<p>R: Well I think we are going to stop now because we need to go on and have these interview questions. But to put you out of your misery... the solution there you were in the right area. Almost had it right but in fact your original hunch that you could override handles [] what you would do is override it and return a collection of null handles as your handles. And then other things use that accessor method to get the handles and do things with it... [Like displaying them]. The other thing is to set he figures colour. There is a method set attribute that takes a attribute (which is a string fill colour) and...</p>	
233		<p>Then a colour object that specifies the colour red.</p> <p>[] Okay so that's you finished coding thanks very much...</p>	
302		Post task interview	

5.1.7 Participant G

Time	Documentation	Subject Talk aloud	Researcher Observations
0		Pre-task activities	
42		<p>I want to have a drawing on there. So I'm going to have to draw a black line across there or I guess I could use that edge there (pointing to the bottom of the view) but I've got to have constraints on it. I need to find out; how will I know where the bottom of the screen is?</p> <p>Lets assume that the bottom of the screen is the ground and I'm not going to draw anything. How do I get that position?</p>	
43	SC DrawApplication MA DrawingEditor	<p>Is it extends or implements? Extends DA?</p> <p>R: Are you looking for the drawing view just now? I'm not sure.</p>	Not clear what sub means. Does subject mean what extends DA? Why did R ask that?
44	SC DrawApplication MA DrawingEditor SC DrawApplication	<p>I don't know what these are, drawing editor or palette listener so I'm trying to find...I know my drawing area is the drawing. I don't even know what a drawing is!</p> <p>I thought I would try and look at micro architectures for what drawing editor is and what they have actually got.</p> <p>I don't really know what that means!</p> <p>So therefore it's a drawing ermmm.</p>	Unsure what sub doesn't understand the interface or specific method or something else? When DA is open DE is still visible behind Sub sees drawing() in DE
45		<p>R: What are you learning?</p> <p>Drawing Editor is an interface so have to implement all these different parts</p>	
46	SC DrawApplication MA Drawing Editor SC DrawApplication		Sub has found a instance variable called drawing Sub then scrolls and finds drawing() Sub puts mouse on top of view (DE) Scrolling finds drawing() reads code, continues scrolling
47		<p>R: There is a lot of information in here...</p> <p>That I don't really need!</p>	

	MA Drawing Editor	R: Well possibly but, what you don't need to know does that make you uncomfortable? There are a lot of parts. I haven't been taught to program using extends and reusing and stuff so I'm not too familiar in that way but I think I can get there eventually. What I'm trying to do is to see how they have used the drawing editor.	
48	SC DrawApplication	R: Is that because you don't know what it does or because you think its going to be important? I'm still on this drawing I need to try and constrain it. So I think I need to understand what it does.	pause
49	MA Drawing Editor SC DrawApplication	There is this other thing that I don't understand...fDrawing... oh okay. I need to know how to restrict it. Drawing, Drawing View, ah! There we go!	fDrawing is the instance variable that holds the current drawing Sub is reading method names in DE Sub finds drawing view (view()) in DA
50		R: Why have you searched for drawing view? Its quite good actually cos its just got the getDrawingViewSize method so it looks like I might be getting there!	Sub is reading a comment createSDV in DA
51		I still want to know... So that tells me that I know how to get the size of it. There you go that is my solution. If I've got the dimensions then I know where the ground is. So that's my first problem. Is that right?	
52		R: Sounds okay. So I guess that is getDrawingViewSize Lets see what it does (getDVSize).	Sub sees getDVSize in creation code (where exactly?) Long pause Sub is quiet.
53	MA DrawingEditor SC DrawApplication	R: Does that tell you what it does? That's quite sparse actually considering to what you see. I don't know what is related to what. How would it tell you what it is? That's useless! It just returns a fixed size which is not what I want. I want the dynamic size of it.	Sub Is reading getDVSize code
54		Again I can test that if you run the program to see if it makes the dimensions always the same. It's frustrating! Usually you learn by playing around with it!	Sub is frustrated by hands off approach.

		R: I can act like a compiler and tell you that the application is initialised at that size but after that can change size to whatever. But how would I get that information? That's what I'm really after!	
55	MA DrawingView	Ah cos that's telling you the standard drawing view cos that's creating it.	(what is sub talking about?) Think sub is looking for size. Scrolling
56		R: See any methods there that would help? Ideally I want to see a get size! Ah I see okay.	Sub is reading names? (get size is there sub misses it)
57	SC DrawApplication	There you go! There is one called get size! There you go exactly what I want. I don't even know how to use this. I've got the method that I want but now don't know how to use it. What I want to ask is...	
58	MA GetSize	R: Are you sure that you have got what you want? I'm trying to understand what these diagrams do and what they are trying to show. That's what I think I want cos I want the size of the screen.	Pause. Looking for get size in SC (finds it?) Sub is quiet
59		R: What do you think this diagram shows? Isn't it just showing you...these are just the two processes that have it. It can either be done by the user or if you want to make the window size bigger I'm assuming (the way) it will make that size bigger is through the painter. I dunno what painter is... R: Do you want to look up the definition for getSize or are you happy with it? No I just want to know how to use it.	
100	MA Drawing view SC DrawApplication		Scrolling
101	PL Overview PL Customising	All I want to know is, something has changed. I just want to get hold of getSize but I don't know what it relates to. Get drawing editor? I don't know what that related too.	Scrolling up and down then pause.

	DrawApplication PL Customising the GUI		Follows link to GUI immediately
	SC DrawApplication	R: Any thing in particular that you are looking for? Well I don't want to just hack into this thing because I know there is more structure.	Scrolling
102	MA GUI? SC DrawApplication PL Customising the GUI	R: You should do it whatever way you feel comfortable. I'm trying to use the techniques available. I'm getting kind of frustrated a little bit cos I wanna know...need a little bit more information. Don't have enough time really to look into this. Don't think this is going to help me too much. Just says what information there is available. So I'm going to read this to see if it will help	Scrolling (presume can't find anything) Sub reading pattern
103	PL Customising DrawApplication PL Overview		Sub quiet pause
104	MA Drawing	R: Is there a topic you are searching for? Yeah. I'm still on the first hurdle. I'm trying to figure out how this drawing thing works. This is ... is just methods and stuff and I still get lost I don't know how it relates, how to use it or anything.	Long pause
105	PL Customising the GUI PL Overview PL Modifying existing figures	R: Are you managing to find bits of the pattern language that are telling you anything interesting? Yeah. But it didn't tell me the bit about how to customise the drawing bit. Just talks about bars (tool) not the middle bit. This bit down here modifying figures and drawings.	
106	PL Overview		Sub is quiet
107	PL Overview	R: What is it you are trying to find about the drawing? Is it the get size method? I just want to use it so it gets the size of the area. Its been a while since I did a GUI but I know there is a repaint or refresh when that's done I want to getSize. This is putting constraints on it	Sub is reading paragraph about locators
108	PL using Locators	R: Anything there that helps? They seem to be quite, again I don't know how to use them yet but its probably what I am after. Just reading	

		the blurb, 'locators are attached to figures'.	
109		I will be using figures later so I can restrict where its positioned so that it is on the ground or another block. If that is the case then I could use getSize methods to put restrictions on locators.	Hasn't really solved problem but no end in sight so move on.
110		R: Okay how about if we look at this idea for creating blocks just now? I think e have already said that we are going to use the ground and we are going to define the ground as the bottom of the drawing and we have identified the get size method as [] what we need to turn our attention to now	
111		Is how do you define and create these figures? And maybe by doing that we can [] get size method. Erm... well yeah okay. R: Okay so how are you going to approach creating these blocks? Well I'm still really worried about where I'm going to place these things. R: Its okay for you to solve the problem in steps and I would like maybe to see you being able to take blocks and put them on the screen and they are not constrained, don't worry about constraining them if you see what I mean. Oh right. R: I mean you are worried about constraining them but you haven't actually defined what they are going to be yet	
112		I think that you should... Well isn't it just a figure? And then you just constrict it. I... again I wouldn't know how to do that right okay... R: Yeah but I'm just saying maybe you might have more success starting with the concrete figure and then adding the constraint as a layer on top of that. If you see what I mean. Start with the easier problem rather than working on the hard problem.... If I said o you forget about the constraint on the ground for the moment just worry about the block. How would you go about doing this?	PK
113		R: Do you see what I am saying? Yeah, yep. But, okay I was quite worried... I guess just from reading the problem the problem says its got to be [on the] ground first before you mention blocks. Well you are saying restrictions	Sub wants to finish ground

		<p>and stuff so... I think it might be [difficult?] just to read it [] that's probably just me interpreting it. So I was just more worried about well defining the ground and then...</p> <p>R: Well you are free to build it in any way you want I am not telling you what do to I'm just saying that perhaps it might make it easier to worry about creating the figure ad then once you have the figure to worry about positioning that figure.</p>	
114	PL Locator (already open)	<p>Hmmm okay.</p> <p>R: Would that be a better way to try it? Okay right. Okay can I read this first and ten I'll go back and try and sort out []</p>	PL?
115		<p>R: [Whats that saying?]</p> <p>Erm... well... I feel quite frustrating because you can only get it in a percentage and that's not what I want. What about this... ah so I can find the position of it I don't know... what I want to do is trying to get it</p>	
116		<p>That would give me the position of the centre of the shape well that's what I think but then...</p> <p>R: What shape?</p> <p>Oh a figure sorry I meant a figure.</p> <p>R: What figure are you talking about?</p> <p>Its going to be related...</p> <p>R: Is it block or...</p> <p>Yeah to the block. Bu then we have got the centre of it. I don't know what to do with this. I don't like the way it is a percentage but I guess they are probably worth using. Not too much at the moment. I just wondered if</p>	
117	<p>PL Overview</p> <p>PL Identify existing figures</p> <p>PL FigureIH</p>	<p>It would be a possibility.</p> <p>Try that one. Hierarchy</p> <p>R: So are you moving on now to creating a block figure?</p> <p>Yeah, from your suggestion.</p> <p>R: Are you happy with that? I mean don't...</p> <p>Not really but...</p>	<p>Sitting at creation tool</p> <p>Did subject not want this?</p>
118		<p>R: Well don't...</p> <p>No, no, no, no, I didn't mean it that way I meant in, I think you are right that I need to actually get to the bottom [of the screen?] and stuff to begin with. I</p>	

	PL Identifying existing figures	<p>think that... I think...</p> <p>R: But you are frustrated that there is this thing you were looking at that is hard to understand?</p> <p>Yeah. And I think I need to build it up slowly. And I, I thought... I seem to get bogged down in the detail already and errr... I don't think I should be bogged down in the detail. I should just get stuck in.</p> <p>R: Well detail is important... for what you are looking at but I think that you might be...</p> <p>But then there might be like kind of a well a hierarchy of doing things. Well I dunno I'm not really familiar with it. So there are probably lots of questions that I am trying to answer.</p>	
119	SC DrawApplication	<p>R: What do you think are the sort of major things that you need to think about now? [What about] adding this block.</p> <p>I don't know. Can I look, can you not just, well I've got making the button first, which I think is relatively easy. You just add a...</p> <p>R: Have you done that before?</p> <p>Yes. But (laughs) not in hotdraw. Err well yes I have actually. So lets see how to [make a] tool button...</p> <p>No that's not what I want.</p>	<p>Searching for tool button in code</p> <p>Search stopped at paletteUserSelected</p>
120		<p>R: Would it help to have an example application for this?</p> <p>Ermmm yes it would yes and I think again just compiling stuff as well just to build things up. It is kind of a bit frustrating because again you don't really develop just by thinking though things. Maybe you are supposed to do that but you just go along and start coding and then you realise what mistakes you have done so it is probably a good exercise.</p> <p>R: Remember if there are any questions then you can ask me and I will probably give you some sort of understanding.</p> <p>Hmmm yeah... So what I'm trying to find now is what is the big class that actually...I don't know if it will...</p>	Scrolling all the time
121		<p>There it is constructor.</p> <p>R: What have you found in the constructor?</p> <p>Ermm well its using super. I don't think it is...ah it extends frame that is why. Right...</p>	<p>Stops for a second then scrolling</p> <p>scrolling</p>
122			Scrolling

		<p>Hmmm!</p> <p>R: What have you found?</p> <p>I have found the drawing view [you can] get a hold of it...[]back to my other problem, but anyway I don't know what the automat... is there, is there a paint method?</p>	Finds view()
123		<p>R: What kind of process are you using just now, are you just searching through the code?</p> <p>Yeah I'm just trying to get... what the codes are. What I'm trying to look for now is... where the buttons are... here we go... so I need to create a button with another, well with a</p>	Find for button. Finds create tools
124		<p>...picture of a square on it but then...</p> <p>R: [] button with a picture of a square on it</p> <p>But how will we actually perform this as well</p> <p>R: [do you think you know how to create a] button with a square on it?</p> <p>Yep. You just go, well do the same thing that is there. Which is called create tool button. The image well you have to use an image from somewhere and then you give it some...</p>	Reading? Find for palette doesn't to it
125		<p>well I don't actually know what create tool button is.</p> <p>R: Okay but in your subclass in your micro-world application would you override, where would you put that?</p> <p>Would you just override the create tools method is that where its staying or would you put it somewhere else? What would you do?</p> <p>Erm... ..</p> <p>R: Maybe you don't know at this point? But then wouldn't I just... well ...</p>	Doc not touched
126		<p>Well just have... err again okay I've never overridden a... well anything so I wouldn't really know what the notation would look like. But [what] I want to do is add new bits to it so I wouldn't know how to do that. I am assuming you just call it the same name, with and you just have super just put, pass in, palette because that's where [it] would be called, well because if you do super... well you need to do super.createtools?</p>	Doc not touched
127		<p>And then pass in palette and the you would add your button there. I don't know where [create] button is...</p> <p>R: is there anyway you can find out anything about that?</p>	Mean button or tool? Find on create tool Create tool already

		<p>Yep could do a search. There you go. There it is.</p> <p>Quite interesting!</p>	on page! (reading)
128		<p>R: What's interesting?</p> <p>The reason for the method. Because all its doing is just returning a tool button. So we just call [] attributes and then I don't know. So it just gives them a tool button but what I think we are after is... palette.</p>	Find palette (paletteusersselected found – reading?)
129		<p>R: What have you found? Still looking for palette?</p>	<p>Scrolling</p> <p>Find on palette again (goes through options seems to stop on call to create tool palette in open)</p>
130		<p>I have found what palette does.</p> <p>R: Right</p> <p>But I think what I'm trying to find now is what the actual [call] is and I'm trying to find that location. When you actually press the button what actually happens. So what I have found there is just telling me that has subdivided it. They call it a palette and on a palette you have got... well you have got [one]</p> <p>Hmmm... have listeners... hmmm</p>	Sub sees call to AddListeners later in open method
131		<p>R: is that what you are looking for? (ignores Q)</p> <p>Ah that's what I'm after. I want to know what happens when you press the button...Ah I see what they have done.</p>	<p>Find on listener (again its already visible on page - reading)</p> <p>Sub referring to the listener registration in create menus</p>
132		<p>So the button that is actually in there at the moment hasn't actually got a action listener on it.</p> <p>R: Right, err when you run it and click on it you get behaviour.</p> <p>Do you! Right. Okay. Right.</p> <p>R: The difficulty is in terms of your knowledge; your expectations and how it works in hotdraw are kind of different.</p>	
133	PL Overview	<p>R: is there anything in the pattern language that might help you understand how buttons work?</p> <p>Erm okay, Lets have a look ...</p>	<p>Scrolling stops with using creation tool on screen.</p> <p>Might be reading.</p>
134			Sub is silent whole time little bit more

			scrolling
135	<p>PL Customising DrawApplication</p> <p>PL Customising the GUI</p> <p>PL Adding buttons to the toolbar</p>	<p>R: Do you see anything that will help you?</p> <p>Not really... just trying to...</p>	<p>Immediately clicks on link to GUI</p> <p>Appears to be reading the GUI</p> <p>Quickly clicks on adding buttons link</p> <p>Reading?</p>
136		<p>R: Is there anything in that pattern that might help you?</p> <p>That's what I have just seen .but I don't know...</p>	<p>Referring to example?</p> <p>Reading again?</p>
137	PL Using CreationTool	<p>R: is that pattern any use to you?</p> <p>Erm...</p> <p>R: What do you want the tool button to actually do?</p> <p>Well now I'm trying to... okay its probably [easier] if you add the button and [you get an] action listener, if you press it. It should do something.</p> <p>R:[]</p> <p>Well... well is just basically a figure, but again I'm just trying to figure out where you press it instead of [action listener] because I don't know how it does that.</p>	
138		I'm trying to make it so it can actually listen.	
139	PL Adding buttons to the toolbar	<p>R: What []</p> <p>Erm it's a bit frustrating .</p> <p>R: In what way?</p>	
140	<p>PL Customising the selection behaviour</p> <p>PL Using creation tool</p>	<p>Well I [couldn't actually] actually []. I don't... So I can get a button but I cant... I want it to listen but...</p> <p>R: [Does the button you are wanting] to create have a figure?</p> <p>Well I just want, I want to... get into... ah I see what you are saying, ah right.</p> <p>R:Does it help you to [] point?</p> <p>Yeah, because the other page appears here that's how you would relate it to... ah right</p>	
141		So it's the creation tool, [] that type of figure, so you don't actually work about [] action listeners then because its probably in creation tool. Ah right okay	

		<p>and it's a pattern so, [I'm not very good with patterns] I don't know them so.</p> <p>R: Design patterns is that?</p> <p>Yep.</p> <p>R: I don't think that is critical to your solution []</p> <p>Well but if you understood it you would read that and you would know what that meant.</p> <p>R: It might help you to understand some more of these things but I think you can cope without it. Okay so you have got this idea that we are going to have to override</p>	
142	<p>SC DrawApplication</p> <p>PL CreationTool SC DrawApplication</p>	<p>...Micro-world application and the create tools method of that and we are going to add basically the code that is on that page?</p> <p>Well...</p> <p>R: What do you think?</p> <p>Well...[] I reckon.</p>	<p>Sub goes to SC?</p> <p>Trying to do a search for button, typed bottom gives up.</p> <p>Quick flick to PL ?</p> <p>Find palette, returns create tool palette, slight pause then back to pl.</p>
143	<p>PL CreationTool SC DrawApplication PL CT SC DA (both side by side) SC DA</p>		<p>Looking at example code and sc createtool palette.</p> <p>Find on palette, scrolling?</p>
144	<p>PL CreationTool</p> <p>SC DrawApplication PL CreationTool SC DrawApplication</p> <p>PL CreationTool</p>	<p>R: [do you] understand that?</p> <p>Err right, what I want to see, okay we kind of mentioned that this might be what I wanted, this bit here, but if it is I want to know how they did it and see what it actually does for them. And that is what I am trying to get.</p> <p>R: Does that tell you anything then?</p> <p>What does this method do? Or is there something else beyond that you want to know?</p> <p>I'm still more worried, how does it know... I think its creation tool that I want to know about.</p>	<p>(indicates example code)</p> <p>Starts scrolling</p>
145	SC DrawApplication	R: CreationTool? Are you going to look at the code for creation tool?	

	PL Using CreationTool SC DrawApplication	<p>Because I'm still more worried about how does it know [] actually listeners because its still got to know if you press it. I know you have passed in, well in this example the eclipse figure (sic). But I don't know what this one is passing in... and you said it actually does something but I just... this one here is a tool button... but I don't even...</p> <p>R: If you want to look at the source code for creation tool then you can do that.</p>	<p>Sub means ellipse figure</p> <p>Createsselection tool code</p>
146		<p>Yeah but is there any, I haven't, well the thing is I'm trying to figure out what they would use. Because I'm trying to think</p> <p>R: []</p> <p>Whether they would use... well you said it actually does something I am trying to figure out what its doing that actually does that</p> <p>R: The [default] tool [is the] selection it allows you to select objects and move them about.</p> <p>Right. But how can you select objects if there is nothing, you can't actually put things on?</p> <p>R: Well its designed so that its assuming that you are going to add objects to it or they might create a system that has pre-existing things on it or... there are possibilities.</p> <p>Oh or maybe in the future.</p> <p>R: Yeah</p> <p>But then how does it know that? That's what I'm trying to find out. So I'm trying to find out, well I'm trying to find out that. That is to know how does it know</p>	
147	PL Using creation tool SC DrawApplication	<p>What line of code did they use, did they use this line of code? I just want to know what they used. To do that.</p> <p>R: I will give you a start, look at that code there create tool button. I think its actually the one before that that is interesting, the line that corresponds to create tool is that one [] selection tool, they have got a method create selection tool which will return a tool that corresponds to the example code This one here?</p> <p>R: No create selection tool, up a bit</p>	<p>Example creationtool</p> <p>Scrolling.</p>
148		<p>Right.</p> <p>R: So rather than using creation tool they have used selection tool.</p>	

	PL Using CreationTool PL Overview PL Using creation tool	But then again this didn't tell me, some...	Sub on PL Brief look then back
149	SC DrawApplication		Scrolling maybe reading bits?
150	PL CreationTool	Well [if I want to] look at that? I don't even know where that is! I can't, I wouldn't know where selection tool is or... R: Well if you would like to open it up I will tell you where it is. Okay hmmm You see now I don't understand why... R: Do you want to open it up? Or do you want to open up creation tool? Well this one hmmm...	
151	PL ToolIH	R: What's this telling you? [There are all these different tools]	Scrolling side to side
152	PL Using CreationTool PL ToolIH	R: Did that tell you anything useful? Yeah, but... R:[] I'm a bit frustrated I didn't, I feel kind of a bit lost, do I've already mentioned that creation tool, here. Might have got it wrong but then I know there are all these different other types as well. There is one here called... that's the one I'm after really [] the application I've just looked at and that's one that has just been described in the pattern, which okay is...	Just sitting on page
153	PL Using creation tool PL ToolIH	...[Where] I actually want but you see there are all these other things as well, they actually... quite... R: How does that make you feel? To find that there are all these things that you don't know about? Well, its just a bit frustrating, I didn't I was kind of a bit lost by... R: Do you think that any of these things is going to be important? I don't know... well... probably but yeah that's probably later on hmmm but err ... Right so... R: How is this going to affect our [solution]? Well I know where that is now	Package info

154	SC SelectionTool SC DrawApplication	Right so that just tells you what that does.	scrolling
155		R: What are you thinking? Ermmm R: Are you stuck? Do you know how to go on from here or... Err well I was just trying to think... I was trying to see if that was, that's how they do it for action, for section tool.	
156		R: does that cause you any problems? [] for creation tool if you want it? Yeah so I'd need to have, well hmmm.	
157		But surely if you have got, its going to happen in menus as well, and then you [] sometimes they have the same [functionality] as these do but these ones up here have actually got action listeners but I don't see at the top or what I'm trying to get from here is, is there a pattern that actually well abstracts all that information away? Something [that is] selection tool means	
158		you can just you can select things, on the screen and stuff well that is one point but... its probably just my understanding of it but how come there is not a pattern to actually grab hold of the functionality of these things? R: Supposing there was a pattern. Do you need to understand the pattern just now before you can use... do you have any idea how you can use these tools in your program?	
159	PL Using Creation Tool SC DrawApplication PL CreationTool	Ermmm well... its just that line in there. That gives me a creation tool, yep so that gives me a creation tool. Which gives me I'd just have another part that well in the next line, creation tool [that line] would change the tool bit to ... creation tool and then just add it to the palette. R: What figure are you going to pass in? Yep, alright okay.	Creation tool line
200	SC DrawApplication	Ermmm...	
201	PL Using Creation Tool PL Adding buttons to the toolbar PL Using Creation Tool PL ToolIH	Well it wouldn't be an ellipse.	

	PL Customising the GUI PL Customising DrawApplication PL Overview	That's not what we want. R: What are you looking for? Errr yeah, so...ideally we would []	Quick flick
202	PL identifying existing figures (onto PL IH)	So I, ah wait a minute, ellipse. Right so now having a look...ah R: Have you having trouble choosing? Yep it's like being in a sweetie shop. Yeah, rectangle, the rectangle figure.	
203	SC Rectangle Figure	Haven't actually looked... Ah right so I'm going to have to restrict it. Which is going to be ermmm... R: How do we do that?	scrolling
204	PL Identifying existing figures PL Mod figures SC Rectangle figure SC DrawApplication	Ah right... ah...I'm worrying a bit that this is existing figures. Hang on we will go to modify So well the basic solution would just put a square on the screen and... R: [What are you going to use to display it]? Errr hang on... well okay but I just want to	Apparently reading Looking at create tools?
205	PL Overview PL Mod figures PL FigureIH	I'm going to pass in, create tools I'm going to add in a rectangle, so errr we have got that first bit right? So we have created a button with a picture on it what's its going to do is just going to put a rectangle figure on it. What I'm going to do know is look at how to change that to restrict the size that it actually is and should be able to locate...ah [] R: [] Okay. Yep Hmmm I'd just seen it	Sub looking for something?
206	PL Mod figures PL Using creation tool PL Mod figures PL Overview PL Mod figures		Looking at figures section
207	PL Figure IH PL Modifying existing figures PL FigureIH	This doesn't really tell me! R: [What is it you want to know?] Okay well I guess what I'd do is to find out what has inherited this to find what	Scrolling around (could be looking for Ma FigureIH) Points to rectangle

		method I can actually use to...	figure
208	SC DrawApplication PL FigureIH SC Attribute figure	set size. There is a method I want, set size. So I guess we have to... ah right. So what you actually do is override. So I what to make a block...that override this and, I'd have a block, a class block that is going to extend... rectangle figure. So what I should say there is [] which is...[]	Surely sub doesn't think can leave it like this?
209		R: What are you looking for? Attribute names or... Ah there you go, get fill colour, so I need to override that. To do get fill colour. No not get fill colour... its set colour . Set fill colour to that, ah that's all right, need to know the ASCII (sic) value for red. Whatever that number is. So I'm going to have to do, I'd call this thing... attributes so within this new class I am identifying called block then we call one of these things its actually going to do	Leading. What this luck or intent? Found attributes list (almost def. private)
210	PL FigureIH SC Abstract figure	R: What is the name of the actual method? Going to be figure hierarchy...	Scrolling up and down Looking up parent of attrib?
211	SC Attribute figure PL FigureIH	Where did this come from? Whats that? Ah Figure attributes	Scrolls to attribute list Sub spies that list is a FA Scrolling (looking for FA)
212	SC Atribute Fig PL FigureIH	R: Do you think this will be eventually useful? Yeah its what I want really. R: You have got roughly the right idea that you have go these attributes but you need to find a way to set them. Do you have any candidates at the minute? Yep there it is. Ah! Okay... right so what ?I have to do is to change the figure attributes therefore I need to find figure attributes. Is that it? R:[] Well I don't know.. all right.	Pointing to a ref of FA (R clue and name of class get mixed up)
213		R: I suspect it will be in standard. Nope not in here. Util? Nope R: The other one... there is a thing called contrib. anything in there? Nope	scrolling
214	SC Figure Attributes	R: What about figures? Ah there you go. R: Is that what you are looking for?	Scrolling

	SC Attribute figure	[hmm mmm] That's what we want, want this thing called set. That's what I want to do.	Set method in code
215		R: What's wrong with that is that those attributes there are private so you have no way to call the method Really... ah. R: Is there anything in attribute figure that you could use instead?	Scrolls up to check scrolling
216		Ah I could use that! I don't know what I would use, I guess I would use fill colour and new colour. So we would do fill colour and then colour.red. R: Okay yep that would work. [You could put that in the constructor of the block]	Points to set attribute
217		R: Okay I think that is fine. I think we are going to have to stop there. So we can go on to ask you about the documentation now. So we have got an idea of using the bottom of the drawing to represent the ground, and then I think we worked out how to add a tool into the application. You managed to create a figure and make it coloured red not quite managed to constrain its size yet. Okay so that's fine. If it's okay we will stop there...	
241		Post task interview	

6 Analysis artefacts

6.1. Task overview

The following table records the time spent by the participants (in minutes) on the individual stages of the task.

Exp	Subject	Interview	Doc test	Create block	Create ground	Constraints	Handles	Create tool	Resize window	Basic application	Interview
High	C	5	15	5	7	11	*	1	1	*	13
	D	2	10	10	18	33	*	20	*	*	15
Medium	A	3	17	1:24	26	1:30	17	50	*	4	23
	B	5	25	10	50	1:09	20	16	1:11	*	30
	E	2	15	25	16	30	18	11	4	*	21
Low	F	5	23	22	34	*	7	39	*	4	28
	G	4	22	25	12	16	*	42	*	16	23

6.2. Solution Tables

6.2.1 Participant A

Requirement	Solution	Critical Insight	Researcher	Duration
1. Need to represent the Ground	6 Use a rectangle figure	PK	0	1min
2. Need to set its size, colour and position	9 Size + position using display box 10 Colour using set attribute (already done in this task)	PK PK	0 0	5mins 1min
3. Need to appear automatically	7 Don't use a tool 8 Put it in create drawing + use drawing add	PK PK + MA		1min 9mins
4. Need to adjust position during resize	<Not done>			
5. Need to prevent other means of altering its size, colour, position	<Not done>			
6. Need to represent the Block	2 Use rectangle figure (sub-classed) (PL ruled other pos)	PK + PL	0	2mins
7. Need to control its size and colour	3 Use display box and set attribute	PK + SC	0	15mins
8. Need to be able to add as many blocks as required	1 Use a tool	PK + PL example	0	50mins
9. Need to prevent any other means of altering its size and colour	4 Subclass creation tool (eliminate drag + create fixed size) 5 Changing handles (turning them off)	PK + SC PK + PL	0 1	60mins 19mins
10. Need to add blocks on top of the ground	11 Use drawing to position blocks 13 How to get hold of figures	PK MA	0 0	2mins 2mins
11. Need to ensure blocks in valid position (ground or block) after a move	14 Move blocks using display box 15 Model blocks position using centre 16 Writing an algorithm to position blocks	SC MA + SC PK	0 0 0	1min 2mins 30mins
12. Need to ensure only top block can be moved	12 Creates a Boolean inside rectangle class	PK	0	1min

6.2.2 Participant B

Requirement	Solution	Critical Insight	Researcher	Duration
1. Need to represent the Ground	1 Using Line figure	PK + PL (IH + p)	0	4mins
2. Need to set its size, colour and position	2 Thickness: Display box (wouldn't really work) 5 Position: using basic display box	PK + SC PK	0 0	11mins 1min
3. Need to appear automatically	3 Don't want a tool 4 Create drawing and drawing add	PK PL + MA	0 1	2mins 29mins
4. Need to adjust position during resize	6 Involves the interaction between DV and F (cant get this) 7 Feels should be a listener (stop – pot. solution suggested)	? PK	? 0	69mins 4mins
5. Need to prevent other means of altering its size, colour, position	<Not done>			
6. Need to represent the Block	9 Using Rectangle figure (or subclass)	PK + PL	0	1min
7. Need to control its size and colour	10 Colour: using set attribute 11 Size: using constructor (R crucial)	PK + SC PK + SC	0 1	2min 12mins
8. Need to be able to add as many blocks as required	8 Use creation tool	PK	0	1min
9. Need to prevent any other means of altering its size and colour	12 Turning off handles 13 Using Null handles 14 Creation tool, turn off drag and change mouse down	PK + PL PL + SC MA + SC	1 0 1	10mins 10mins 13mins
10. Need to add blocks on top of the ground	15 Use CT mouse down to place blocks 16 Use display box to make the transition	PK PK	0 0	20mins 3mins
11. Need to ensure blocks in valid position (ground or block) after a move	17 Check done within CT – sub wants to use isEmpty and mouse up (only thinking about block / ground) 18 Getting ref bet Tool and Status bar (incomplete)	PK + PL	0 3	15mins 38mins
12. Need to ensure only top block can be moved	<Not done>			

6.2.3 Participant C

Requirement	Solution	Critical Insight	Researcher	Duration
1. Need to represent the Ground	1 Using rectangle figure	PK + PL	0	3mins
2. Need to set its size, colour and position	2 size in constructor 4 Position: R tells sub not to worry about this	PK ?	0 1	1min 1min
3. Need to appear automatically	3 using DA. Create drawing (prompt)	PK + SC	1	1min
4. Need to adjust position during resize	5 using drawing and figures collection (prompt)	PK	1	1min
5. Need to prevent other means of altering its size, colour, position	<Not done>			
6. Need to represent the Block	6 Using rectangle figure (subclass)	PK	0	1min
7. Need to control its size and colour	7 Size override display box 8 Colour set attribute (set in constructor)	PK PK + SC	0 0	1min 3mins
8. Need to be able to add as many blocks as required	9 using creation tool	PK + PL	0	1min
9. Need to prevent any other means of altering its size and colour	<Not done>			
10. Need to add blocks on top of the ground	(Partial given by 11)			
11. Need to ensure blocks in valid position (ground or block) after a move	10 Drawing + figures collection knows where everything is (partial) – lacks detail	PK	0	3mins
12. Need to ensure only top block can be moved	11 variable inside the block that controls whether it can move or not	PK	0	3mins

6.2.4 Participant D

Requirement	Solution	Critical Insight	Researcher	Duration
1. Need to represent the Ground	5 Using rectangle figure (long and skinny) (r prompts)	PK	1	3mins
2. Need to set its size, colour and position	<Not done>			
3. Need to appear automatically	6 Use drawing .add in DA initialise drawing (r prompt)	MA + SC	3	16mins
4. Need to adjust position during resize	<Not done>			
5. Need to prevent other means of altering its size, colour, position	<Not done>			
6. Need to represent the Block	1 Using Rectangle figure	PK	0	1min
7. Need to control its size and colour	2 Size using display box (overriding it to maintain size) 3 Colour uses set fill colour (PK about attributes)	MA PK + SC	0 0	3mins 2mins
8. Need to be able to add as many blocks as required	7 Using creation tool (prompt)	PK	1	2mins
9. Need to prevent any other means of altering its size and colour	4 Handles: set null handles (assume not turn off) (r prompt) 8 tool resize (prompt) – override drag and down	PK PK + SC	1 2	1 min 10mins
10. Need to add blocks on top of the ground	<Not done>			
11. Need to ensure blocks in valid position (ground or block) after a move	9 Use drag tracker and find figure (drawing) to detect figures at current position 10 use center to get position of figure	PK PK	3 1	25mins 1min
12. Need to ensure only top block can be moved	11 Boolean inside figure if true can move	PK	0	2mins

6.2.5 Participant E

Requirement	Solution	Critical Insight	Researcher	Duration
1. Need to represent the Ground	9 Use rectangle figure (long thin and black)	PK	0	2mins
2. Need to set its size, colour and position	11 Position: R says to ignore Size and colour: <Not done> - Sub has done similar tasks	?	1	1min
3. Need to appear automatically	10 At start up in create drawing (using add)	PK + PL + MA	3	13mins
4. Need to adjust position during resize	12 DA detects size change and moves ground (R says D)	PK	1	2mins
5. Need to prevent other means of altering its size, colour, position	<Not done>			
6. Need to represent the Block	1 Using Rectangle Figure	PK + PL	0	3mins
7. Need to control its size and colour	2 Size: with the Constructor 3 Colour: set attribute with fill colour	SC MA + SC	0 2	3mins 19mins
8. Need to be able to add as many blocks as required	6 Need tool – create sub class of creation tool (+ add button) 7 Add create tools to draw application	PK + PL PK (ie PL?)	1 0	2mins 1min
9. Need to prevent any other means of altering its size and colour	4 Need to remove handles 5 selection: Would create own subclass of handle (R says no) 8 Tool resize: override methods for drag and down	PK + MA + SC PK + MA PK	2 2 0	8mins 7mins 4mins
10. Need to add blocks on top of the ground	16 Sub points out same solution as (11) will work (no details of how to make it work are given)	PK	0	2mins
11. Need to ensure blocks in valid position (ground or block) after a move	13 Where to put code – in mouse methods (needs help to id tool) 14 How to turn off existing tool (r points out better sol) 15 How to get existing figures (r confirms behaviour)	PK PK PK	1 1 1	5mins 2mins 2mins
12. Need to ensure only top block can be moved	Use figure collection to check if at top (i.e. check in drawing – not best solution?)	PK	0	2mins

6.2.6 Participant F

Requirement	Solution	Critical Insight	Researcher	Duration
1. Need to represent the Ground	2 Using Line figure	PL	0	3mins
2. Need to set its size, colour and position	3 Size: Makes it the length of the window (gives up initially)	SC + MA	2	31mins
3. Need to appear automatically	4 Add it in DA constructor using drawing add	PK + MA + SC	0	12mins
4. Need to adjust position during resize	<Not done>			
5. Need to prevent other means of altering its size, colour, position	<Not done>			
6. Need to represent the Block	5 Using Rectangle figure (r prompts)	MA + SC	1	9mins
7. Need to control its size and colour	<Not done>			
8. Need to be able to add as many blocks as required	1 Using Creation Tool in create tools method 6 How tool works	PL SC	0 0	8mins 10mins
9. Need to prevent any other means of altering its size and colour	7 Resize problem (R prompt) override drag (nothing about down) 8 Handles (r prompt) (looking at handles method + found null handles but not finished)	PL PL (p + IH)	1 1	14mins 8mins
10. Need to add blocks on top of the ground	<Not done>			
11. Need to ensure blocks in valid position (ground or block) after a move	<Not done>			
12. Need to ensure only top block can be moved	<Not done>			

6.2.7 Participant G

Requirement	Solution	Critical Insight	Researcher	Duration
1. Need to represent the Ground	1 Use bottom of screen	PK	0	1min
2. Need to set its size, colour and position	2 How to find its position: using view .get size from DA	SC + MA	0	18mins +
3. Need to appear automatically	<Not done>			
4. Need to adjust position during resize	<Not done>			
5. Need to prevent other means of altering its size, colour, position	<Not done>			
6. Need to represent the Block	3. Use a figure (which?) (prompt) 5 Use rectangle figure (prompt)	PK PL	1 1	7mins 3mins
7. Need to control its size and colour	6 size: attempted but no progress made <Not done> 7 colour: set fill colour, fill colour attrib and colour.red	? SC	0 0	5mins 7mins
8. Need to be able to add as many blocks as required	4 Using creation tool (?)	PL	0	30mins
9. Need to prevent any other means of altering its size and colour	<Not done>			
10. Need to add blocks on top of the ground	<Not done>			
11. Need to ensure blocks in valid position (ground or block) after a move	<Not done>			
12. Need to ensure only top block can be moved	<Not done>			

6.3. Problem Documentation Matrices

6.3.1 Participant A

	PL		MA		SC		PK		Other	
Mapping	A36 A39 A127 A308	A308	A150 A253		A107		A35 A222 A246 A253 A304 A306 A328 A330 A336 A401 A405	A154 A210 A226 A328 A341 A349 A429 A435		
Interactions			A251		A123 A406 A419		A130 A300 A304 A406 A441			
Function		A248 A250	A129 A133 A147 A249 A310 A339 A336 A356	A147 A310 A355 A417	A105 A111 A121 A134 A142 A151 A156 A204 A258 A340 A357	A117 A150	A132 A136 A147 A248 A312 A354 A418 A425	A113 A159 A416	A141	
Architecture										
Other							A313			

Unclassified Problems

A38 PK ? +
 A52 PL ? +
 A205 PK ? ?
 A222 MA ? ?
 A226 SC
 A306 SC

Observations about doc

A133 "It's a bit annoying having to jump around here" MA
 A140 "It would be nice to be able to look at these methods [behaviour?] from here" MA
 A249 "The best mechanism I've found for finding methods... well its not complete but..." MA

Requests for other doc

A141 "so back to the code. I'd rather use JavaDoc if it were here."

6.3.2 Participant B

	PL		MA		SC		PK		Other	
Mapping	B31 B34 B301 B341	B48 B126 B221 B247 B339		B338			B31 B48 B201 B224 B232 B234 B240 B243 B242 B250 B254 B314 B322 B304 B334 B338 B343 B413	B123 B212 B238*		
Interactions	B53 B310 B352	B56* B344 B353	B128 B314 B330 B347 B400	B52 B125 B145 B355 B356 B359	B147	B105	B42 B102 B253 B329 B336 B421 B417	B101 B211 B127 B143 B228 B245 B354 B404 B415 B422		
Function	B233 B255	B35 B255 B311	B36* B106 B122 B124 B149 B151 B206 B224 B240 B314 B355	B43* B54 B105 B119 B123 B208 B350 B358	B44* B45* B54 B142 B200 B153 B236 B259 B300 B320 B331 B401 B418 B419	B40 B109 B237	B37 B119 B214 B236	B118		
Architecture							B216			
Other										

Unclassified Problems

B50 PL
B239 SC

Observations about doc

B31 "Its annoying me its too big! (laugh)" PL

B36 *"I don't feel its going to tell me what I want to know" MA*

B37 *"This is kind of helpful I've got the methods at the interface" MA*

B103 *"Right why have I gone to the code? Good Question! - R says because sub was already in it, Sub agrees "Yeah. I'm already in the code and didn't see a reason to break out of it" SC*

B129 *"This is actually one of the things when not coding, trying to remember the solution in your head".*

B311 *"My perfect solution would be a class diagram that could zoom in and then have the java doc directly behind it."*

Requests for other doc

B36 *"JavaDoc would be useful" (mod thickness of a line)*

B38 *"Right I'd look at JavaDoc or code for set attributes and basic display box to see what those did"*

B44 *"JavaDoc would be ideal here because I don't know which package to look in" - sub trying to find abstract figure*

B216 *"I would use JavaDoc and I would look at every single thing that has got listener as a method name"*

B234 *"Would like to look at Attribute Figure... ", "What I'd normally do here is kick up JavaDoc" - Instead sub goes to code*

B255 *"What I would do with each of these things here is to look at the different types...and see what in javadoc and look at what all these provide"*

B258 *"I'm going to have a look at the source code but I'd really like to look at the JavaDoc"*

6.3.3 Participant C

	PL		MA		SC		PK		Other	
Mapping	C22 C33 C33				C25 C32		C22 C24 C25 C27 C28 C28 C30 C32 C36 C37			
Interactions			C31	C31						
Function					C29		C24 C32			
Architecture										
Other										

Unclassified Problems

Observations about doc

C22 "Its quite good to see where it is in the hierarchy from this" (sub referring to package details - i.e. lets sub find it in file system)

(Made comments after C37 – Go get)

Requests for other doc

6.3.4 Participant D

	PL		MA		SC		PK		Other	
Mapping	D45*	D35			D36		D12 D16 D20 D22 D23 D33 D42 D48 D101 D113 D126 D131	D12 D21 D23 D30 D104 D129		
Interactions				D17				D51 D108		
Function			D13 D32 D110 D127	D13 D36	D14 D18* D27 D53 D55 D114	D112				
Architecture										
Other										

Unclassified Problems**Observations about doc**

D21 "I suppose we have to do the ground" (negative attitude?)

117 SC Creation tool – scrolling about no find – (another example of not talking aloud)

Requests for other doc

D110 "This is where it would be really useful if I could do a search you know look for methods like in JavaDoc."..."It would be good if you had a sort of woolly search that would find it if its not quite right. You generally know what you want but don't..."

6.3.5 Participant E

	PL		MA		SC		PK		Other	
Mapping	E101 E102* E103 E114 E136	E22 E115 E135 E137 E140	F20				E17 E42 E44 E45 E53 E100 E105 E112 E129 E132 E146 E153	E21 E55 E141		
Interactions	E114		E24 E27 E47		E117		E140			
Function			E25 E45* E55 E106 E107* E132* E145* E148	E22 E115 E119 E125 E148	E21 E34* E34 E38 E48 E152	E26 E28 E35 E37		E43 E132		
Architecture								E30		
Other										

Unclassified Problems

E148 “What I want to know is can a selection tool know about the drawing?”

Observations about doc

E29 “I feel that I'm getting no where here”

E56 “I think I would have gone to look but I would have had to go back and then go in here and then forward again and then looked down here. I don't know if I'm thinking about this wrong but I just felt that it would be easier to have the clicky bits actually in here rather than on a separate page.” MA

E58 “Yeah, I think that would have been helpful ... if you were able to click on a method in the coloured blocks diagram and then jump straight to the source code that would be helpful.” MA

E122 Sub is stuck - “I want to add something that says put this new figure in here, but now I'm completely lost! The only clue I've got there is that this create drawing method calls this constructor so I guess the next place to look would be the composite constructor” – Sub not thinking of add as an operation on drawing rather as something done during construction?

Requests for other doc

E20 I'd normally look at JavaDoc in this case (how to change block colour)

E35 “And I'd hope the JavaDoc would tell me that” (what value to use for colour parameter)

E115 Sub would like to see what the supplied example applications do with create drawing.

E116 “So I don’t have an example of how to use this and I don’t have any javadoc. I’m going to have to resort to the source code which is a bit frustrating...” –Sub continues - “My first option would be an example, my second option would be javadoc, although I’m hesitant to use javadoc in JHotDraw because I don’t think its very good but then my third option would be the source code.”

6.3.6 Participant F

	PL		MA		SC		PK		Other	
Mapping	F35 F36 F52 F154 F200 F216 F224 F225 F226*	F108 F109 F152 F223			F102 F138		F50 F110 F58 F129 F125 F156 F159 F201 F205	F32 F106		
Interactions	F157	F51 F153	F213	F131 F212						
Function	F228	F100	F112 F127	F101 F105 F145	F102 F136 F147 F151 F203 F209	F133 F227 F229*				
Architecture								F34 F53		
Other										

Unclassified Problems**Observations about doc**

F44 “To be quite honest I don’t think... I’m just trying to imagine what the source code would look like. I think what I do is I go and code and look up the documentation. Its quite difficult to keep it completely abstract” (Sub finding working without writing code hard) (sub goes on to write code skeleton)

F124 “The pattern language doesn’t give me a solution to all the problems I’m going across, it can be misleading”

F139 “Uh... well I am actually thinking ... we can get the, get the palette in the draw application and then just getting confused with... I don’t like saying what I’m thinking its difficult to...”

F202 “then again it should be noted that the idea of looking up source code to see how an application works is the least appealing option.” ... “because source code is unstructured and has a large file. Its just the whole manual effort of trying to extract the information that you want... its unappealing” SC

F222 “Okay what I saw... I feel that I am becoming quite a regular now. I am almost comfortable with going to the pattern language and seeing what they say about handles.” PL?

F225 “Err no. I wouldn’t ...the source code, the source code is really the last resort ”

Requests for other doc

F56 “It would definitely help to be able to see the whole hierarchy which is available in the JavaDoc because I navigate mostly by using the hierarchy”

F144 R asks if its frustrating having to look at so many options (leading) – sub says yes and indicates prev. comment about JavaDoc was about this kind of issue “Yeah no its not ideal at all, I suppose I'd rather have a more exacting document that's why I like the [JD?] Hierarchy, quick to find out.”

F146 “So In javadoc you would have a paragraph and those paragraphs are usually useful because they rule out things straight away.”

F226 “Another thing is I know that I don't have in the source code. I don't find useful comments. I usually look at the JavaDoc and when I use the javadoc its more interesting”

6.3.7 Participant G

	PL		MA		SC		PK		Other	
Mapping	G108 G141 G159 G202	G101 G102 G137 G204					G107 G112 G119 G208	G42		
Interactions			G207*	G211		G130 G157		G101 G145		
Function		G151	G49 G55	G44 G104	G122* G53 G209 G214	G44 G48 G119 G128 G214	G216	G132		
Architecture										
Other										

Unclassified Problems**Observations about doc**

G47 PK "There are a lot of parts I haven't been taught to program using extends and reusing and stuff so I'm not too familiar in that way but I think I can get there eventually. What I'm trying to do is see how they have used the drawing editor" – Sub inexperienced programmer

G54 "Again I can test that if you run the program to see if it makes the dimensions always the same. Its frustrating usually you learn by playing around with it" (2 things first sub is not certain about behaviour of code – even though its seems straight forward, second sub not happy about working with out code)

105 R asks if sub is getting anything from PL – sub replies "Yeah but it didn't tell me the bit about how to customise the drawing bit, just talks about bars (toolbars) not the middle bit. This bit down here (indicates modifying figures pattern) modifying figures and drawings" – Confusing account but suggests sub is unhappy with amount or type of info present

126 R asks if sub wants to override create tools? – "Well just err again okay I've never overridden a... well anything so I wouldn't really know what the notation would look like" (sub very inexperienced)

Requests for other doc

120 R asks would an example help here? – "Yes, it would yes, and I think again just compiling stuff as well just to build things up. It's a bit kind of frustrating again because you don't really develop just by thinking through things." (sub not happy working this way)

6.4. Inter Rater Problem/Documentation matrices

6.4.1 Doug

	PL		MA		SC		PK	
Mapping		22		20			17	21
Interactions			24 27					
Function			25	23	21 34 34 38	26 28 35 37		
Architecture								30
Other								

6.4.2 Marc

	PL		MA		SC		PK	
Mapping			18				18	
Interactions								
Function	22	23	24/25 27 33?	20 22 23 24	21 33 34	21 26 28 35 38	21 33? 39	25 30
Architecture							31 41	
Other								

6.4.3 Murray

	PL		MA		SC		PK	
Mapping 16			19				16	
Interactions								
Function 19 20 21 22 *24 *26 35				20 22 24 27	20 34 24 28	 33 26 36	33 30 39	
Architecture								
Other								