Lab Class Visualization

- Part 1: Assignments in InfoVis: *10 Pt.*
  (Patrick Riehmann)
- Part 2: Assignments in SciVis: *10 Pt.*
  (Carl Matthes)
- Part 3: Final Project: *30 Pt.*

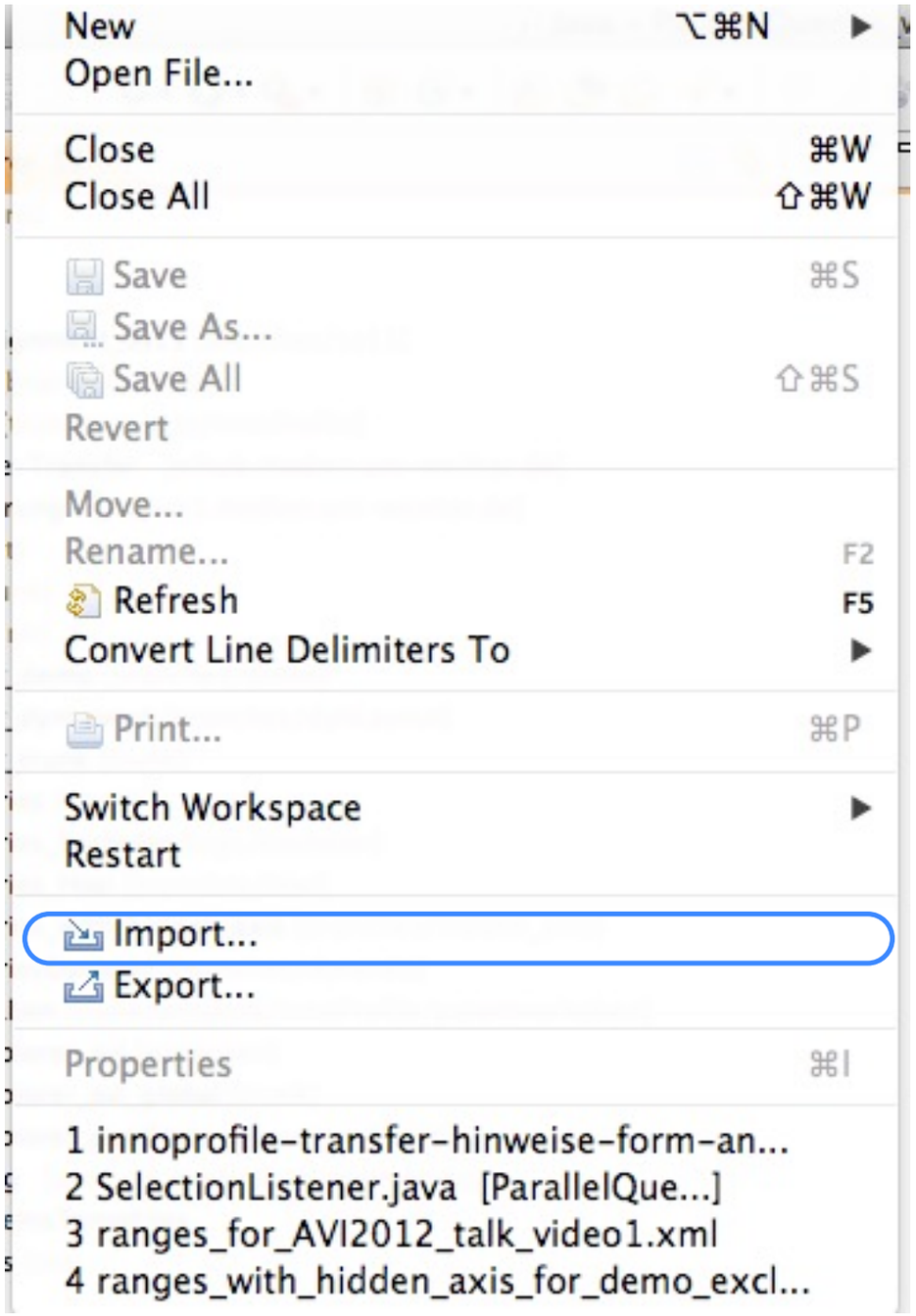
Final Project Vis/InfoVis

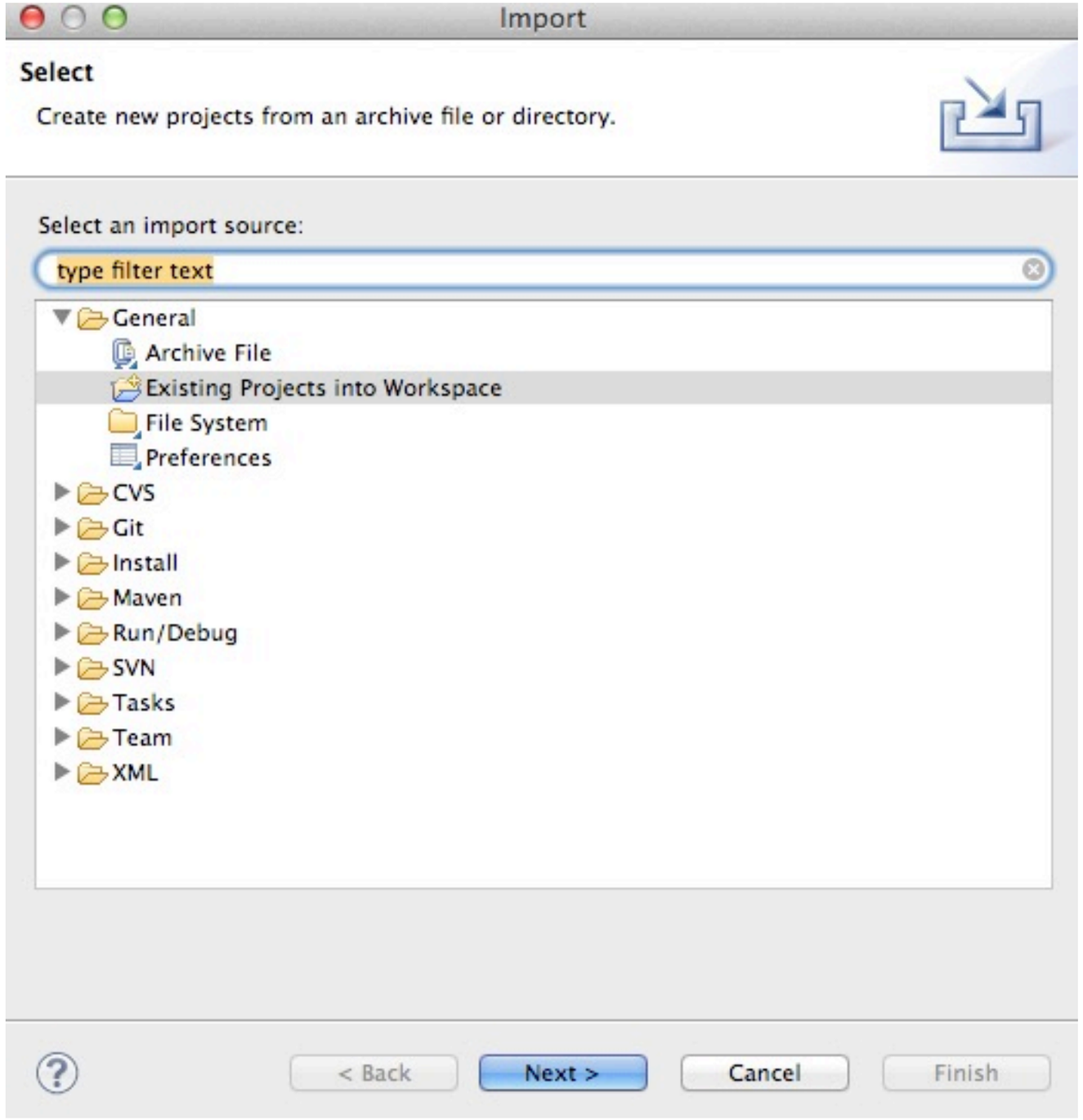
- Topic: Up to you (Either InfoVis or SciVis)
- Expenditure of time: ~40h/Student
- Requirements:
  - Autonomous implementation
    (Groups of max. two students will be accepted)
  - Unique and fresh kind of visualization
  - At least two complex interaction techniques
- Due to ...
  - Send your code to
    - patrick.riehmann[at]uni-weimar.de (InfoVis Topics)
    - carl-feofan.matthes[at]uni-weimar.de (SciVis Topics)
- Project presentation on ...

InfoVis-Assignments

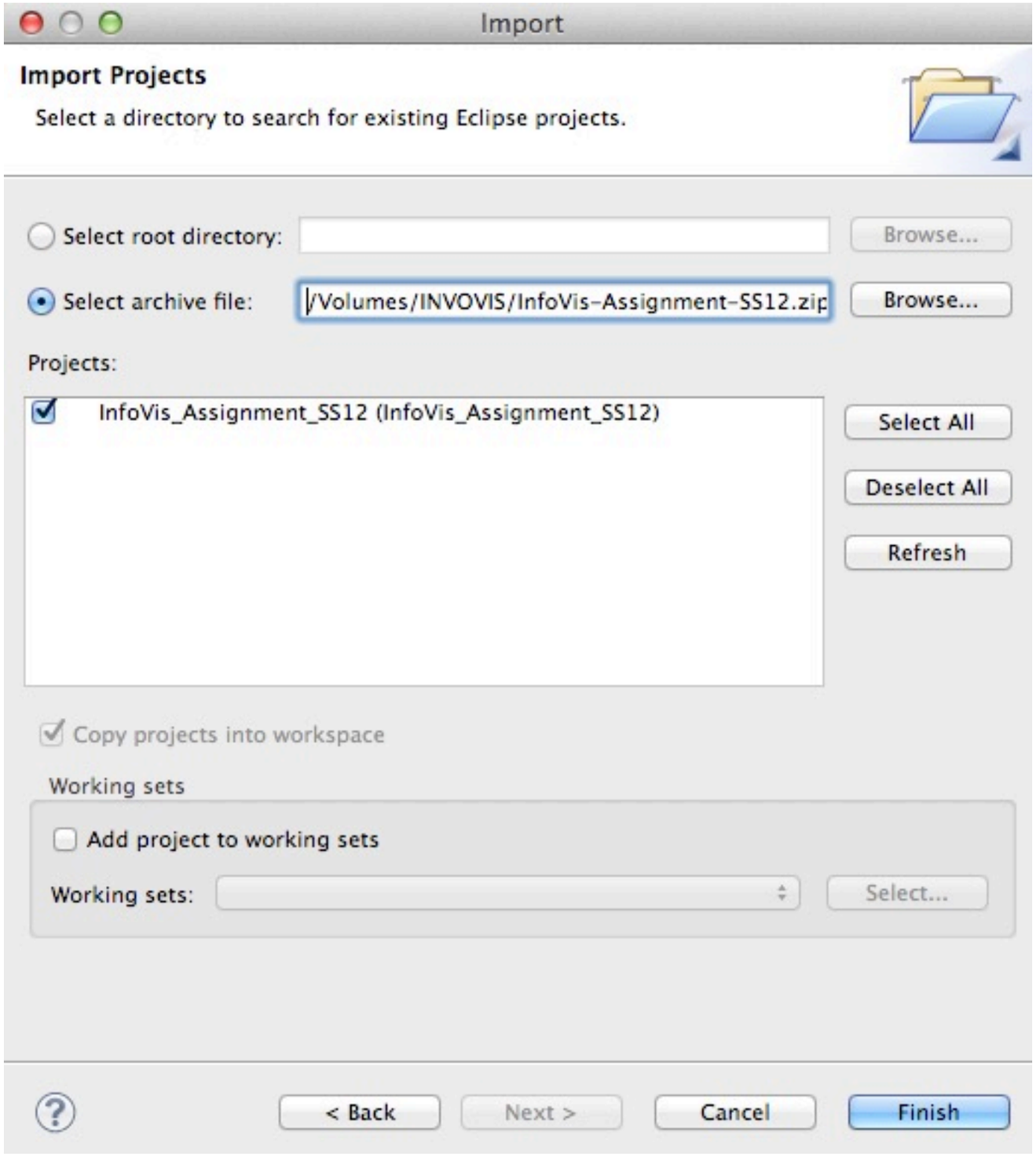
- 4 Assignments with overall 10 points
- Requirements
  - JDK 6
  - Eclipse
- Due to ...

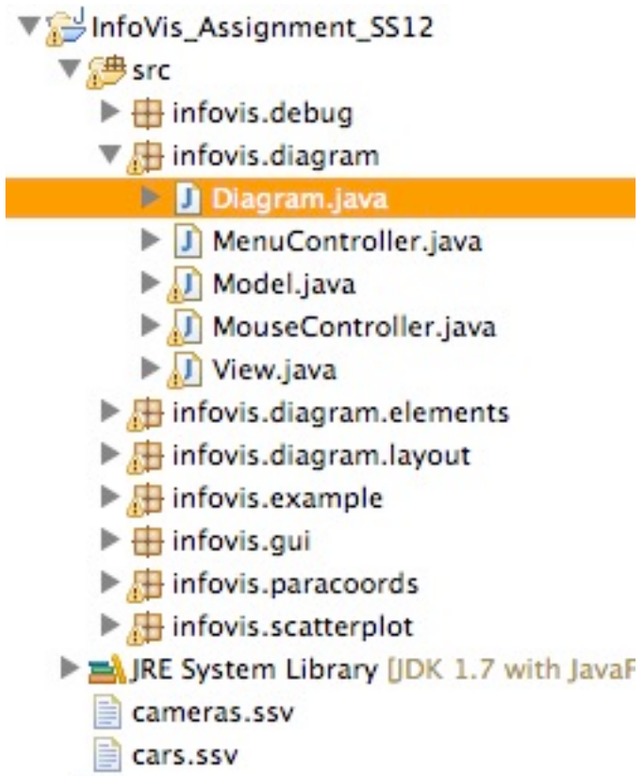
Import Project





Import Project



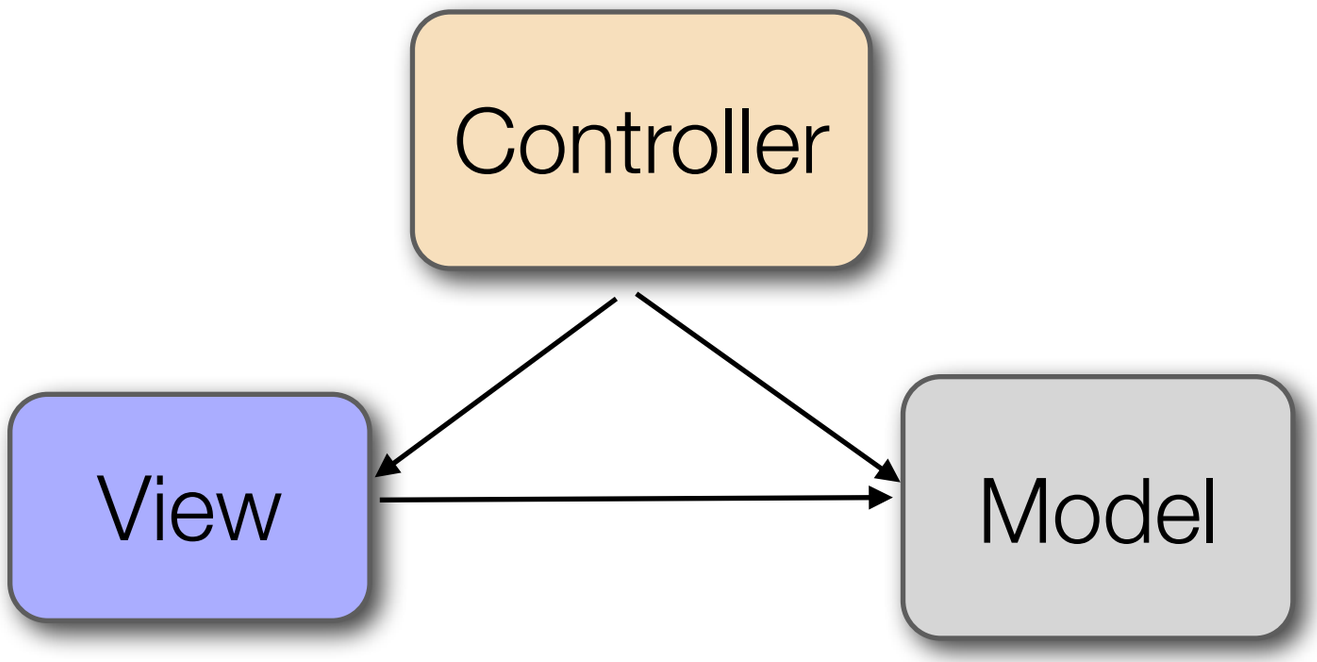


Drawing 2D in Java

- Java2D / Swing
  - Backend:
    - OpenGL (OSX, Linux - Treiber!!)
      - “-Dsun.java2d.opengl=True”
    - DirectX (Windows, generally enabled since 1.6)
  - No canvas class in Swing
    - Create a subclass of *JPanel* class
    - Override *paint(Graphics g)*

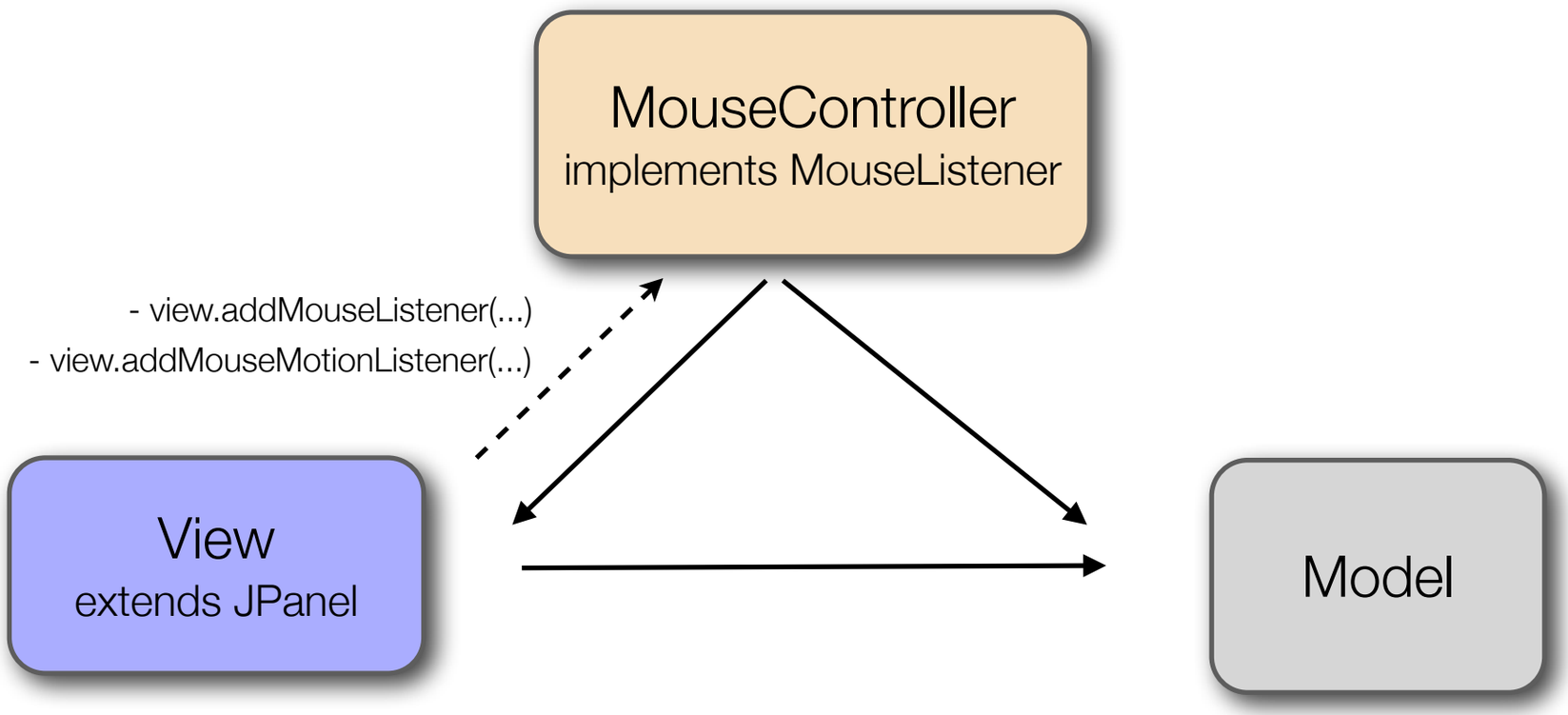
Example

- Model-View-Controller



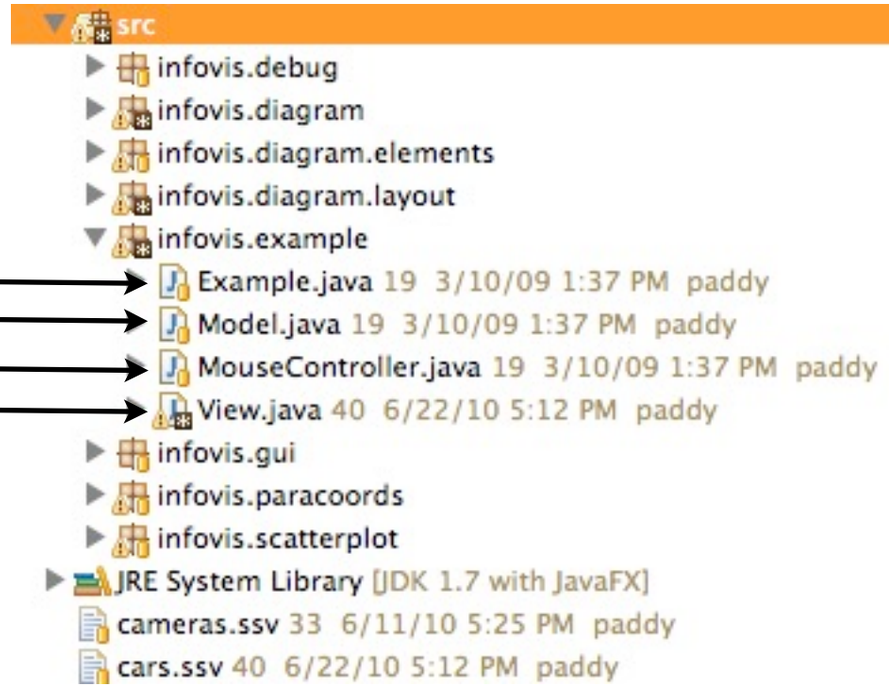
Add Listener to View

- Model-View-Controller



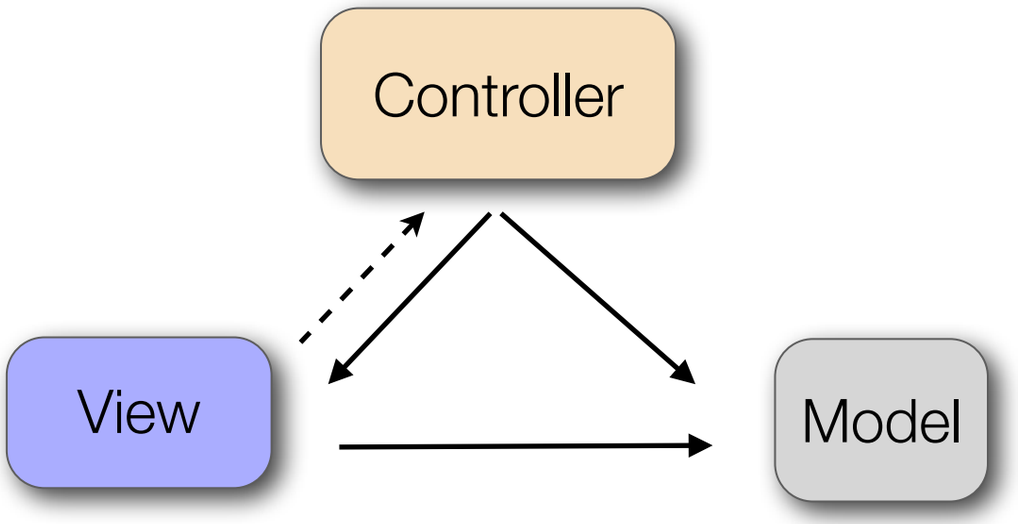
Example Package

Start class of example application
Model (Stub)
Implement Listeners
Override *paint()* method



Drawing Example

```
public class View extends JPanel{
    private Model model;

    public void paint(Graphics g){
        Graphics2D g2D = (Graphics2D) g; // cast explicitly
        for(Iterator i = model.iterator();i.hasNext();){
            ...
        }
    }
}
```




```
public class MouseController implements MouseListener, MouseMotionListener {
      private View view;
      private Model model;

      public void mouseClicked(MouseEvent e) {
      }

      public void mousePressed(MouseEvent e) {
          int x = e.getX();
          int y = e.getY();
          ...
      }

      public void mouseReleased(MouseEvent e) {
      }

      public void mouseDragged(MouseEvent e) {
      }
}
```

Drawing Example

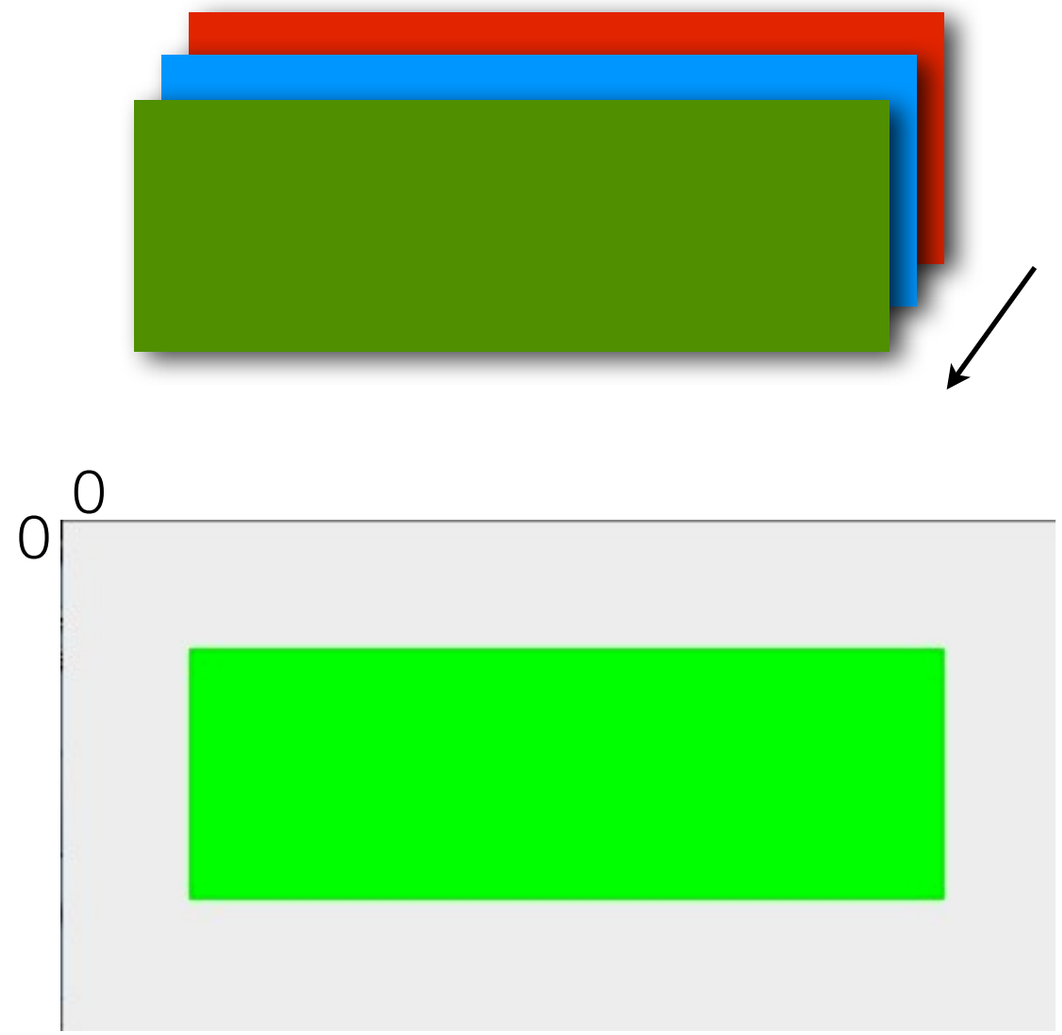
- Graphics Context
  - Graphics2D extends Graphics
    - `g2D.setStroke(...);`
    - `g2D.setColor(Color);`
    - `g2D.draw(shape);`
    - `g2D.fill(shape);`
    - `g2D.translate(...);`
    - `g2D.rotate(...);`
    - `g2D.scale(...);`
    -

```
public class View extends JPanel{
    private Model model;

    public void paint(Graphics g){
        Graphics2D g2D = (Graphics2D) g; // cast explicitly
        for(Iterator i = model.iterator();i.hasNext();)
            ...
        }
    }
}
```

```
...
Rectangle2D rect = new Rectangle2D.Double(1,1,300,100);
g2D.setColor(Color.RED);
g2D.fill(rect);
g2D.setColor(Color.BLACK);
g2D.draw(rect);
...
```

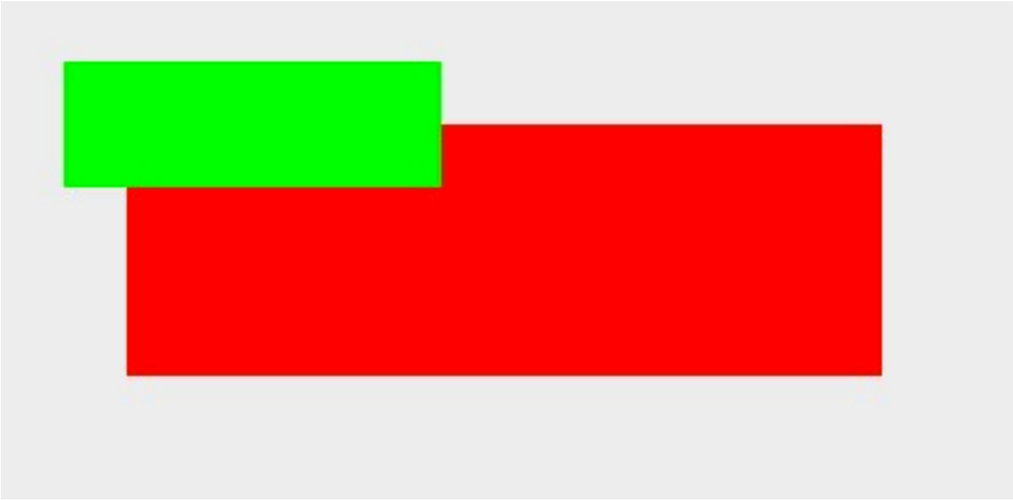
Z-Order Example

```
//Back To Front

...
Rectangle2D rect =
     new Rectangle2D.Double(150,150,300,100);
g2D.setColor(Color.RED);
g2D.fill(rect);

g2D.setColor(Color.BLUE);
g2D.fill(rect);

g2D.setColor(Color.GREEN);
g2D.fill(rect);
...
```

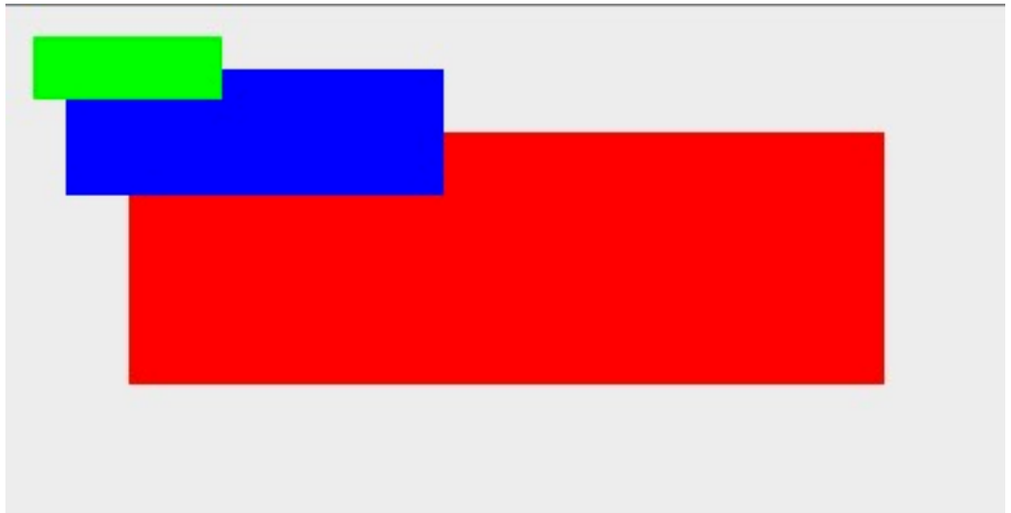


Scale

```
...
Rectangle2D rect =
     new Rectangle2D.Double(50,50,300,100);
g2D.setColor(Color.RED);
g2D.fill(rect);
g2D.scale(0.5, 0.5);
g2D.setColor(Color.GREEN);
g2D.fill(rect);
...
```

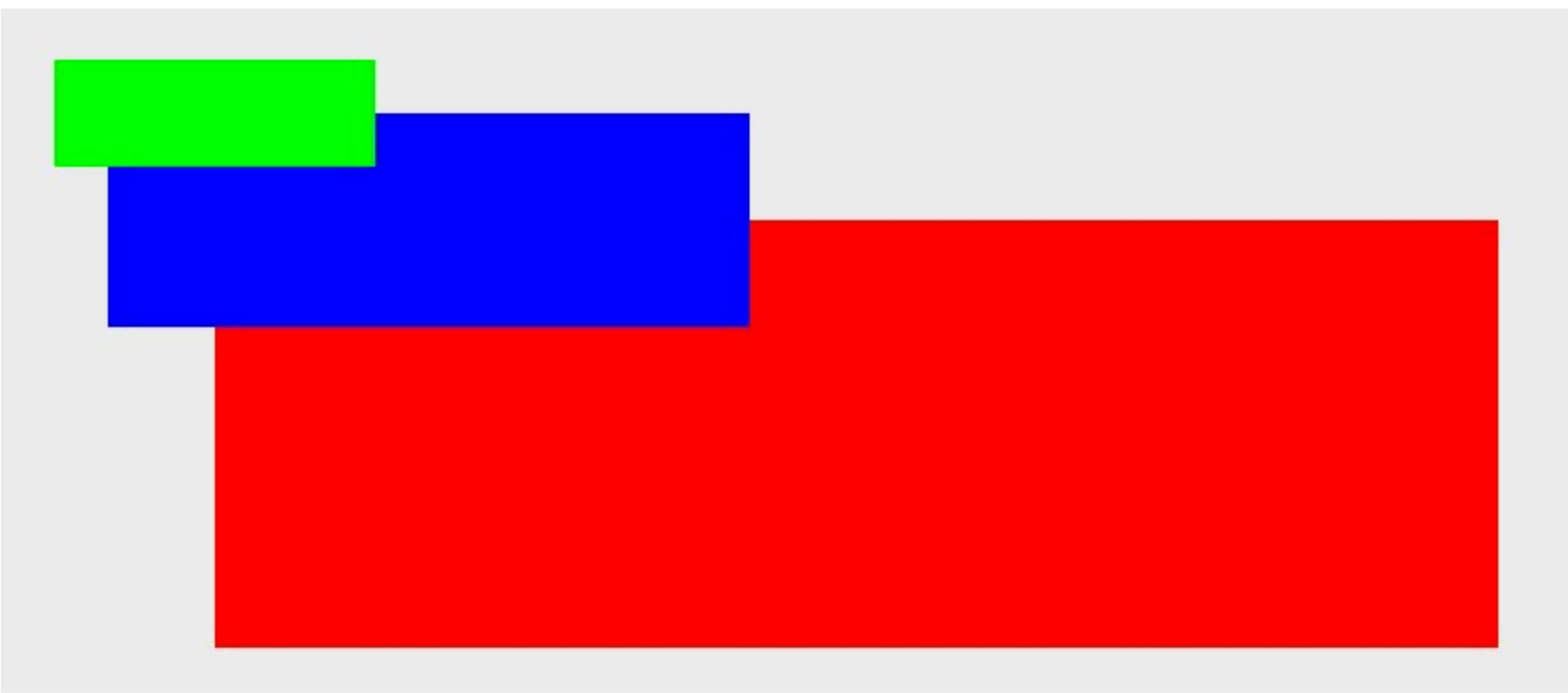


```
...
Rectangle2D rect =
     new Rectangle2D.Double(50,50,300,100);
g2D.setColor(Color.RED);
g2D.fill(rect);
g2D.scale(0.5, 0.5);
g2D.setColor(Color.BLUE);
g2D.fill(rect);
g2D.scale(0.5, 0.5);
g2D.setColor(Color.GREEN);
g2D.fill(rect);
...
```



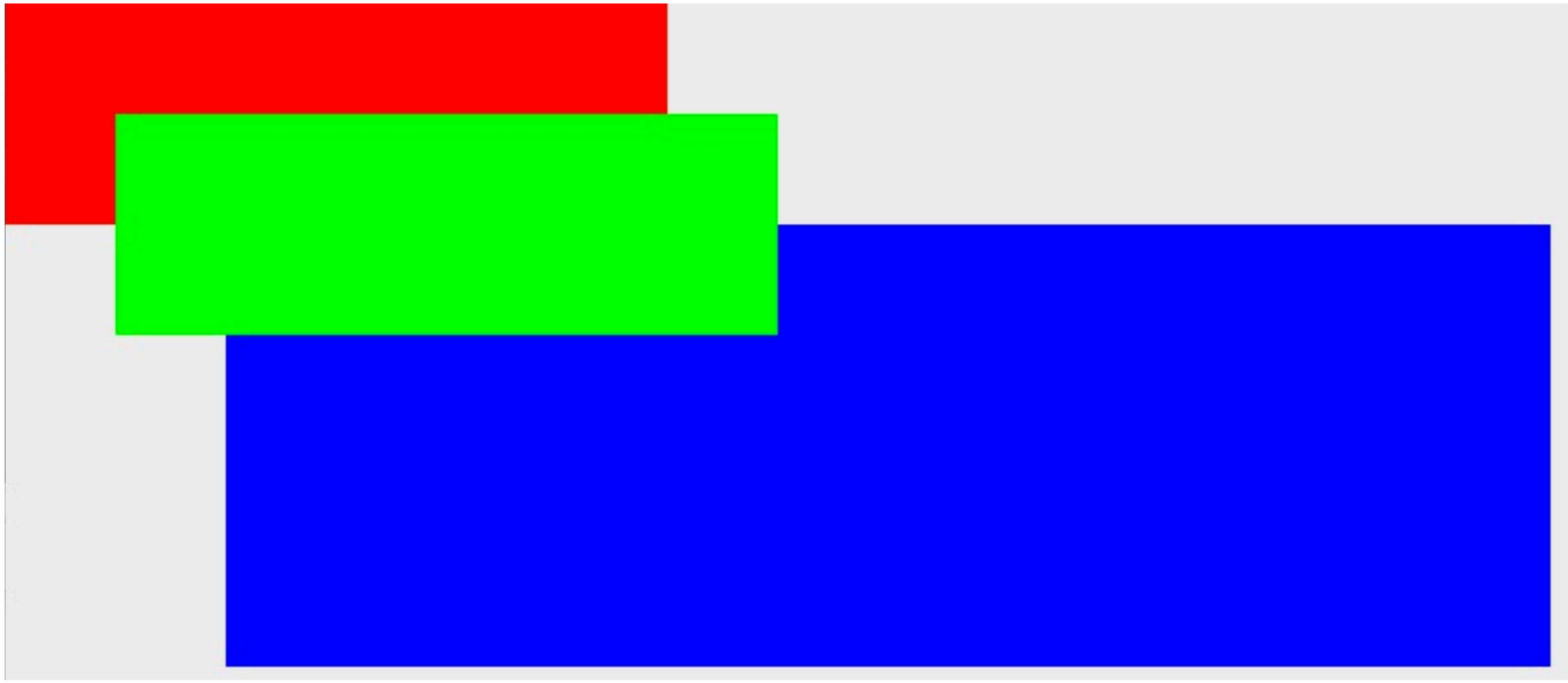
Scale

```
Rectangle2D rect =
     new Rectangle2D.Double(50,50,300,100);

g2D.scale(2, 2);
g2D.setColor(Color.RED);
g2D.fill(rect);
g2D.scale(0.5, 0.5);
g2D.setColor(Color.BLUE);
g2D.fill(rect);
g2D.scale(0.5, 0.5);
g2D.setColor(Color.GREEN);
g2D.fill(rect);
```



Scale and Transform

```
Rectangle2D rect =
     new Rectangle2D.Double(50,50,300,100);

g2D.translate(-50, -50);
g2D.setColor(Color.RED);
g2D.fill(rect);
g2D.scale(2, 2);
g2D.translate(25,25);
g2D.setColor(Color.BLUE);
g2D.fill(rect);
g2D.scale(0.5, 0.5);
g2D.setColor(Color.GREEN);
g2D.fill(rect);
```



Assignment 1 - Detail And Overview

1. Extend the *paint()* method of *infovis.diagram.View* to draw an overview frame on top of the diagram that show a smaller version of the diagram. Use the the *scale* member to zoom in and out within the main view. The overview frame remains with its size and shows always the entire diagram.
   [1 Point]

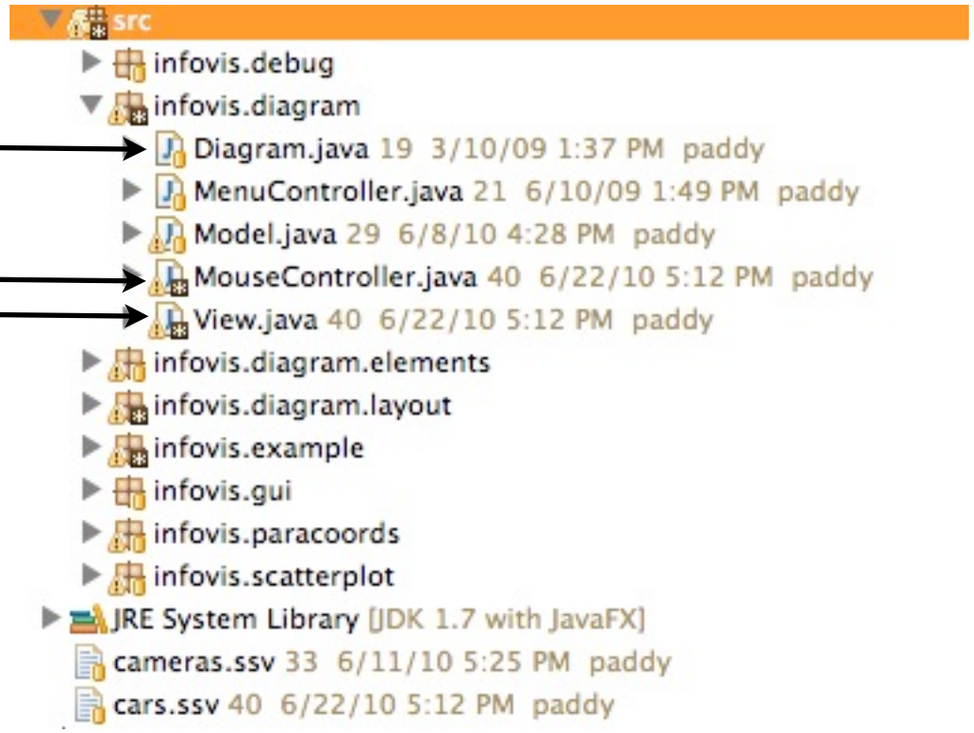
2. Implement a marker rectangle, which highlights the current viewable area of the main view within the overview frame. Extend the *infovis.diagram.MouseController* class for navigating the viewable area of the main view by moving the marker rectangle. Use the *translateX* and *translateY* member variables.
   [[1 Point]

3. Create a overview window that is arbitrarily placeable.
   [optional, 1 Point]

Start class of diagram application

Implement Listeners

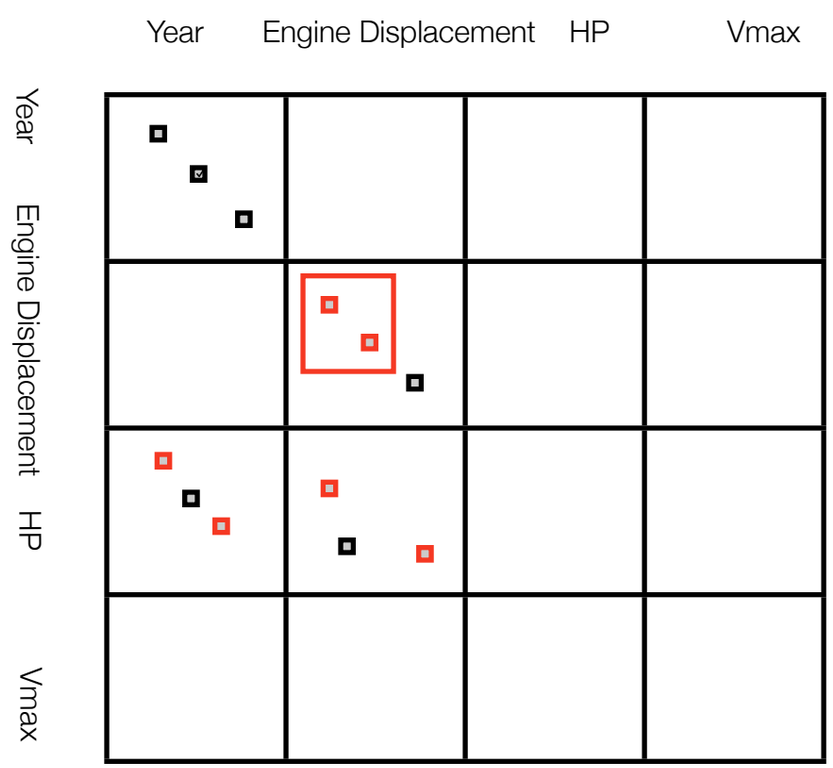
Override *paint()* method



Assignment 2 - Brushing And Linking

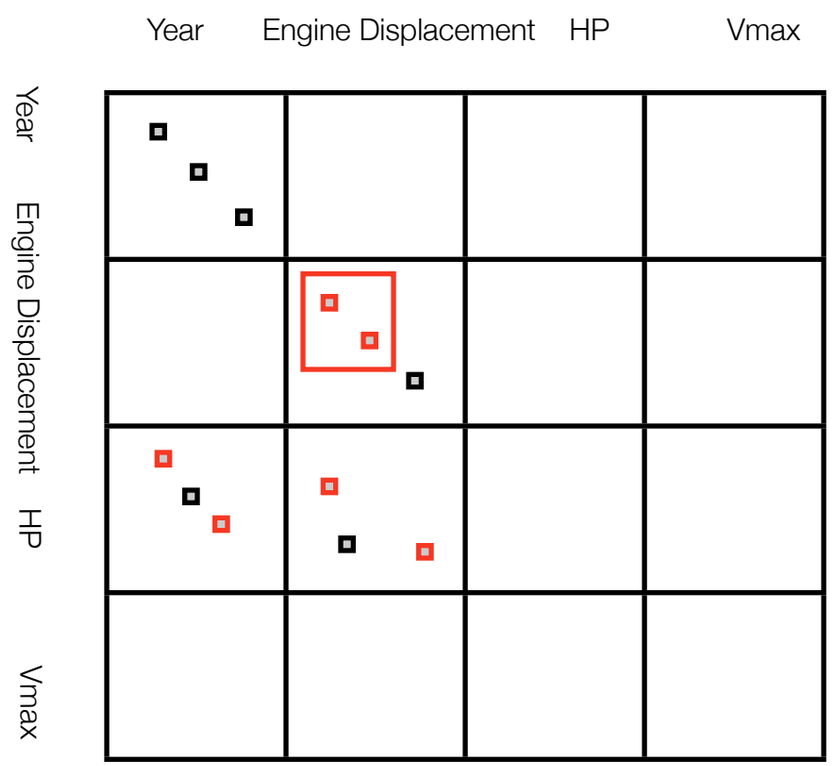
1. Realize a scatterplot matrix for depicting multi-dimensional data. Use the infovis.scatterplot. Data class, which contains a multidimensional record. Override the paint() -method of the *infovis.scatterplot.View class*. [1 Point]

2. Implement the “Brushing And Linking”- technique, to mark points in a single scatter plot for being highlighted in all plots. Override the methods of the class *infovis.scatterplot.MouseController*. [1 Point]




```
public class Model{

      private ArrayList<Data> data= new ArrayList<Data>();
      private ArrayList<Range> ranges = new ArrayList<Range>();  //dim
      private ArrayList<String> labels = new ArrayList<String>();//dim
      private int dim = 4; //dim=7

      public Iterator<Data> iteratorDate(){
            return list.iterator();
      }
      public ArrayList<Range> iteratorRanges() {
            return ranges.iterator();
      }
      public Iterator<String> iteratorLabels() {
            return labels.iterator();
      }
}
```

Assignment 2 - Brushing And Linking




```java
public class Model{

      private ArrayList<Data> data= new ArrayList<Data>();
      private ArrayList<Range> ranges = new ArrayList<Range>();  //dim
      private ArrayList<String> labels = new ArrayList<String>();//dim
      private int dim = 4; //dim = 7

      public Iterator<Data> iteratorDate(){
            return list.iterator();
      }
      public ArrayList<Range> iteratorRanges() {
            return ranges.iterator();
      }
      public Iterator<String> iteratorLabels() {
            return labels.iterator();
      }
}
```

```java
public class Data{

      private double [] values; //dim
      private Color color;
      private String label;

      public int getLength(){
          return values.length;
      }
      public double getValue(int i){
          return values[i];
      }
}
```

```java
public class Range{

      private double min;
      private double max;

      ...
}
```

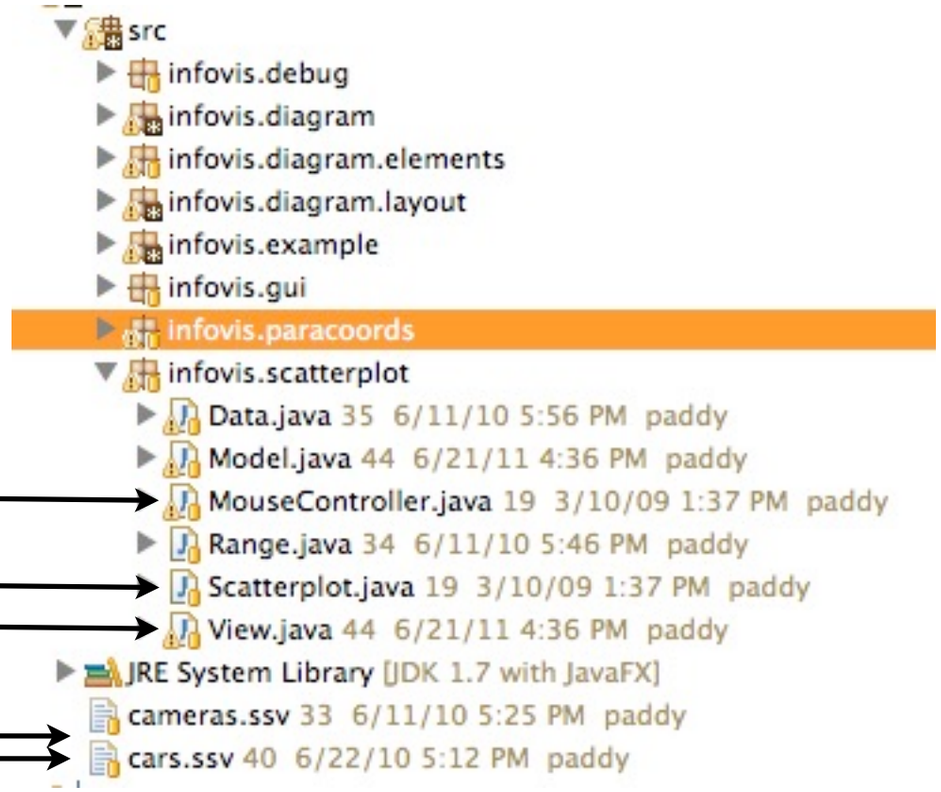
Remarks Assignment 2

Implement Listeners

Start class of scatterplot application

Override *paint()* method

Test the plot with both datasets (see *Model.importValues()*)



Assignment 3- Parallel Coordinates

1. Use the data set if assignment 2 for drawing a parallel coordinates display. Override the *paint()* -method of the *infovis.paracoords.View* class.
   [2 Points]

2. Implement a marking technique for highlighting paths. Override methods of the class *infovis.paracoords.MouseController*.
   [1 Point]

3. Create axes that are moveable in horizontal direction.
   [optional, 1 Point]

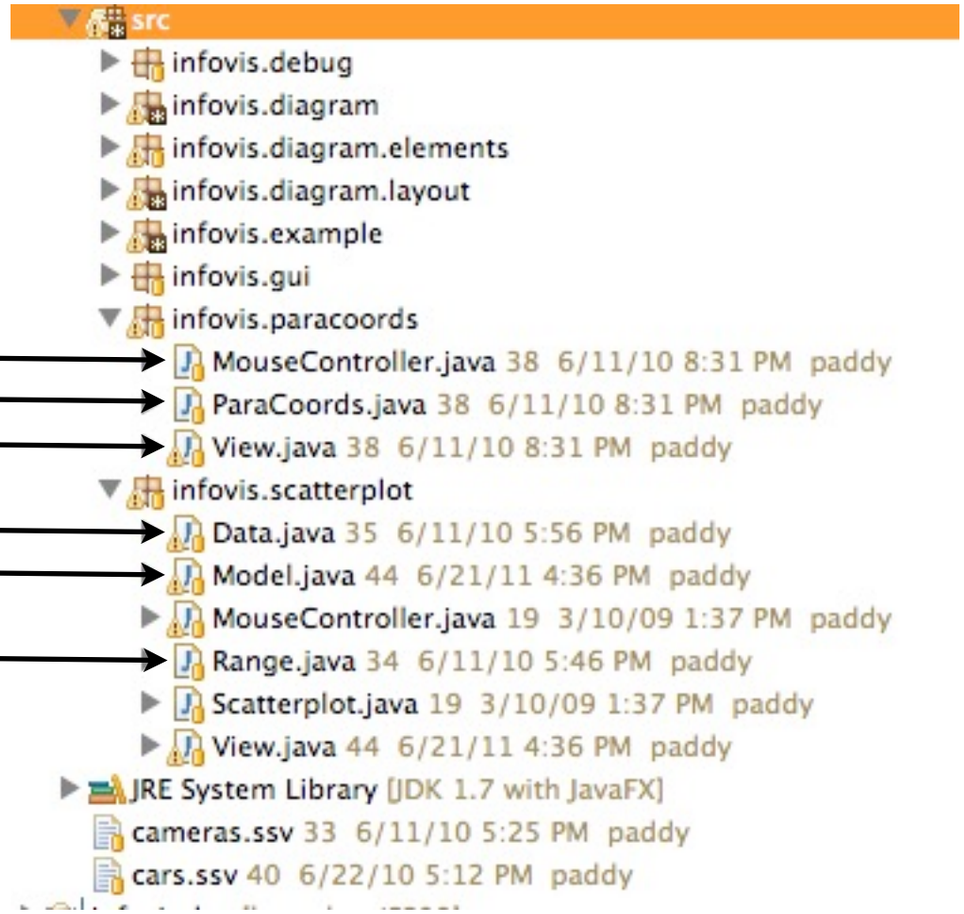
Remarks Assignment 3

Implement listeners

Start class of example application

Override *paint()* method

Use classes from previous assignment



Assignment 4 - Focus And Context

1. Override the method *transform()* of the class *infovis.diagramm.layout.Fisheye* to provide the geometry transformation for a “Graphical Fisheye View of Graphs”. Please read in preparation the Paper of Sarkar and Brown (till functions F1 und F2). Consider the preservation of the width height ratio of nodes.
   [2 Points]

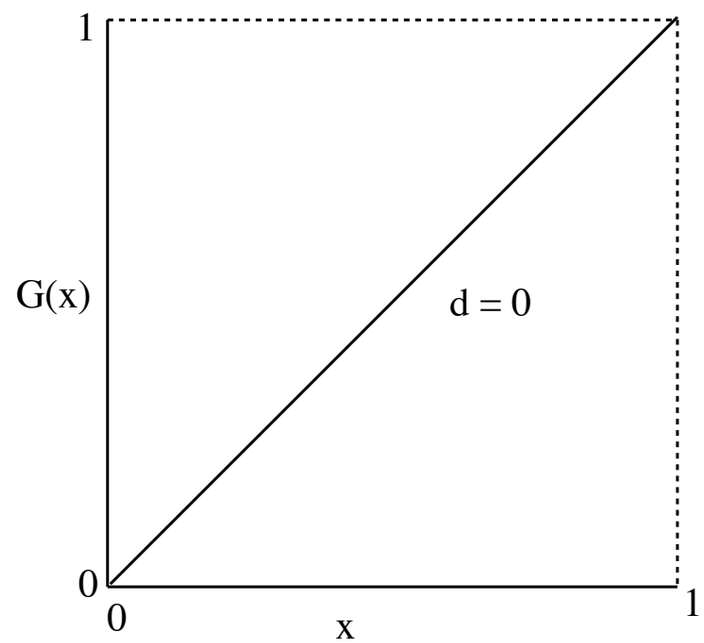
   - Graphical Fisheye Views of Graphs (1992):
     (accessible via Google Search)

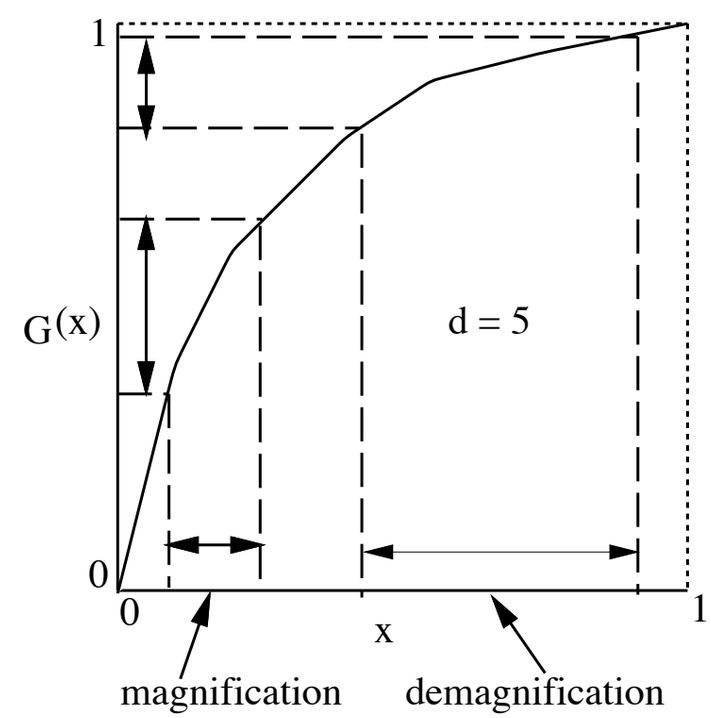
   - Graphical Fisheye Views (1993):
     (accessible via Google Search)

2. Extend the technique for using the current mouse coordinates as focus point while moving the pointer.
   [1 Point]

Remarks Assignment 4 - *F1*

$$G(x) = \frac{(d+1)x}{dx+1}$$





$$P_{fish_x} = P_{focus_x} \pm G(\frac{D_{norm_x}}{D_{max_x}})D_{max_x}$$

$$\mathrm{D}_{max_x} = \begin{cases} P_{boundary_x} - P_{focus_x}, & P_{norm_x} > P_{focus_x} \\ 0 - P_{focus_x}, & P_{norm_x} < P_{focus_x} \end{cases}$$

$$\mathrm{D}_{norm_x} = P_{norm_x} - P_{focus_x}$$

$$\mathrm{P}_{fish_y} = P_{focus_y} \pm G(\frac{D_{norm_y}}{D_{max_y}})D_{max_y}$$

Remarks Assignment 4 - *F2*

$$G(x) = \frac{(d+1)x}{dx+1}$$

$$P_{fish_x} = P_{focus_x} \pm G(\frac{D_{norm_x}}{D_{max_x}})D_{max_x}$$

$$\mathrm{P}_{fish_y} = P_{focus_y} \pm G(\frac{D_{norm_y}}{D_{max_y}})D_{max_y}$$

$$\mathrm{D}_{max_x} = \begin{cases} P_{boundary_x} - P_{focus_x}, & P_{norm_x} > P_{focus_x} \\ 0 - P_{focus_x}, & P_{norm_x} < P_{focus_x} \end{cases}$$

$$\mathrm{D}_{norm_x} = P_{norm_x} - P_{focus_x}$$

$$Q_{norm} = P_{norm} \pm S_{norm}/2$$

$$\mathrm{Q}_{fish} = F1(Q_{norm})$$

$$\mathrm{S}_{geom} = 2min(|Q_{fish_x} - P_{fish_x}|, |Q_{fish_y} - P_{fish_y}|)$$

! Breite / Höhe beachten !

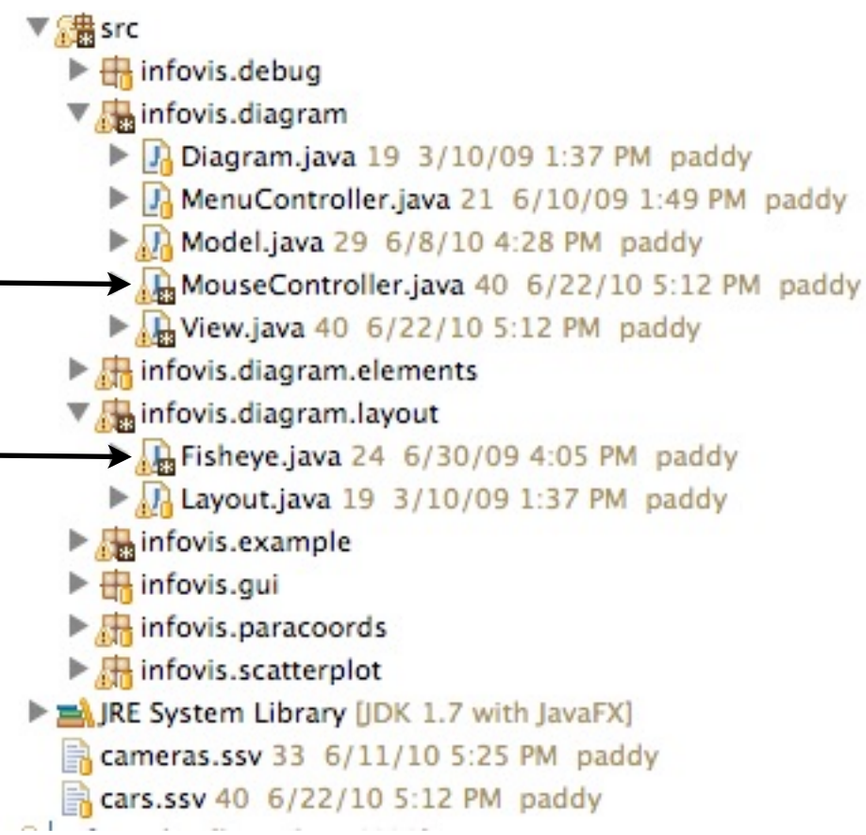
$$\mathrm{S}_{fish} = S_{geom}$$

keine API

Remarks Assignment 4

Change Listeners

Implement methods
transform(...)
setMouseCoords(...)



InfoVis Toolkits

- Protovis
- Prefuse
- d3
- JavaScript InfoVis Toolkit: http://thejit.org/
- PhiloGL: http://senchalabs.github.com/philogl/
- VTK
- Nodebox / Nodebox2
- ...

Data Sources

- VAST Challenge 2016: http://vacommunity.org/VAST+Challenge+2016
- DATA.GOV: http://explore.data.gov/catalog/raw/
- API Leipzig: http://www.apileipzig.de/wiki/show/Was-ist-die-API-LEIPZIG
- Open Platform: http://www.guardian.co.uk/open-platform
- Developer Network: http://developer.nytimes.com/
- London Datastore: http://data.london.gov.uk/
- Offene Daten Berlin: http://daten.berlin.de/
- .....