

Object-Oriented Programming

Session: Week 4 Session 1

Instructor: Eric Pogue



Agenda:

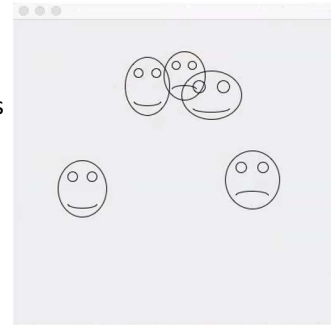
1. Discuss last week's FaceDraw Assignment
2. Review this week's Mosaic Assignment
3. Introduce our Learning Objectives for the week
4. Review each Learning Objective
5. Closing comments and next steps

Discuss FaceDraw Assignment

FaceDraw and Learning Objectives: FaceDraw will be a challenging assignment this week. Our Learning Objects, Discussion, Lecture, and Examples will all be focused on helping you complete the assignment and learn the key concepts through delivering a concrete example.

In FaceDraw we will:

1. Create an application in Java that draws random faces on a window
2. Generate a random number between 3 & 10 and draw that many faces
3. Randomly generate reasonable and visually appealing face
4. Position itself to a reasonable size and location
5. Draw all faces so they are entirely within the window.
6. Draw each face with two eyes and a mouth.
7. The mouth should be randomly smiling, frowning, or in-between



I'm looking for your feedback!

Review Mosaic Assignment

Mosaic and Learning Objectives: Mosaic will likely not be as challenging for you as FaceDraw was last week. Most of the elements that we will need for Mosaic we already learned last week. Therefore, this week's objectives will be more forward looking.

In Mosaic we will:

1. Draw a set of random tiles
2. Draw random shapes, letters, and colors
3. Respond to a "Randomize" button
4. Display a new set of random tiles when the button is pushed
5. Implement a interesting and unique feature of our own choosing

Note: More details are available our W4Assignment document.



Less theory and more practical development...

Learning Objectives – Week 4

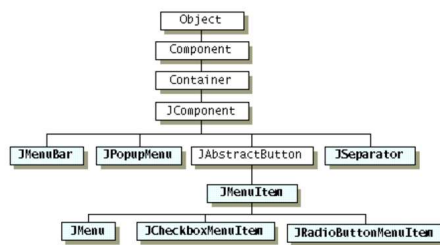
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Any of these items would be a good candidate for your “interesting and unique” feature to add to your Mosaic assignment.

Menu Bars, Menus, and Menu Items

Java Menus are implemented with three related classes:

- **JMenuBar**: the horizontal component across the top of the frame that contains Menus
- **JMenu**: the user interface element that implements “File” in the image below
- **JMenuItem**: the sub-items that can be selected from a Menu like “New” and “Exit” in the example below
- The inheritance hierarchy for menu-related classes:



Overview:

You create the **JMenuBar**. You create **JMenu** items that have captions (like File, Edit, etc.). You create **JMenuItem** objects that have captions (like Open, Close, Save, etc.) and add them to the **JMenu**'s. You associate **ActionListener** objects with each **JMenuItem** to describe what should happen when the **JMenuItem** is clicked. You add each **JMenuItem** to the **JMenu**. You add the **JMenu** to the **JMenuBar**. You then tell the frame to set its **JMenuBar** using **setJMenuBar**.

Mouse Clicking, Mouse Dragging, and Keystrokes

Nearly all graphical applications respond to Mouse Clicking and Keystrokes. Many applications also implement special behavior for Mouse Dragging. With Java in order to respond to these events we implement ActionListeners including:

- **MouseListener:** Interface to implement to respond to Mouse Clicking
- **MouseMotionListener:** Interface to implement to respond to Mouse Dragging
- **KeyListener:** Interface to implement to respond to Keystrokes

MouseListener Interface

The MouseListener interface requires five methods to be implemented:

- `mouseClicked(MouseEvent e)`: Invoked when the mouse button has been clicked on a component
- `mouseEntered(MouseEvent e)`: Invoked when the mouse enters a component
- `mouseExited(MouseEvent e)`: Invoked when the mouse exits a component
- `mousePressed(MouseEvent e)`: Invoked when a mouse button has been pressed on a component
- `mouseReleased(MouseEvent e)`: Invoked when a mouse button has been released on a component

Adapter Classes are an alternative to implementing all five methods. For our examples, I will be implementing all five, even if some of them seem unnecessary. You are welcome to use Adapters in your assignments if you prefer.

MouseMotionListener Interface

The MouseMotionListener interface includes the following methods:

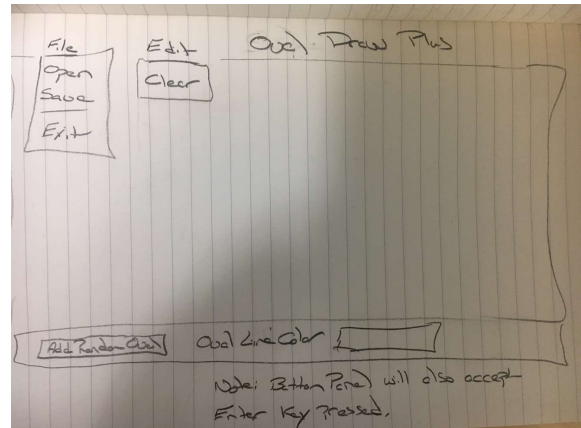
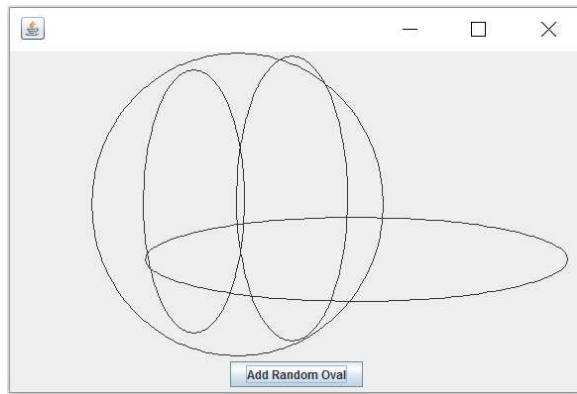
- `mouseDragged(MouseEvent e)`: Invoked when a mouse button is pressed on a component and then dragged
- `mouseMoved(MouseEvent e)`: Invoked when the mouse cursor has been moved onto a component but no buttons have been pushed

KeyListener Interface

The KeyListener interface includes the following methods:

- `keyPressed(KeyEvent e)`: Invoked when a key has been pressed
- `keyReleased(KeyEvent e)`: Invoked when a key has been released
- `keyTyped(KeyEvent e)`: Invoked when a key has been typed

OvalDraw Plus User Interface Design



Yes, this is often what a UI design looks like. In our first coding example this week, we are going to enhance the OvalDraw application to include menu elements to OvalDraw File|Exit and Edit|Clear. In addition, we will implement adding new random ovals with either a line color or a line weight. Finally, we will add file saving and opening and add the related Open and Save menu items to the application... more on that later.

I anticipate that we will also implement something with mouse clicking, mouse dragging, and timer also, but am uncertain what form that may take.

Timers

Timers are pretty straight forward to implement:

- Implement the ActionListener Interface
- Create a new timer passing in the object that implemented the ActionListener

```
// =====  
// Timer  
  
import java.util.Timer  
  
class DrawPanel extends JPanel implements ActionListener {  
    private Timer myTimer;  
  
    public DrawPanel {  
        myTimer = new Timer(1000,this);  
    }  
  
    public void actionPerformed(ActionEvent e) {  
        // Do timer stuff.  
    }  
}
```

We will likely have a final programming example that will show some animation using timers. I'm not sure what form that example will take.

Model-View-Controller

Throughout our design and development activates we are working to create applications that segregate our View from our their Model & Data.

- The Java environment makes this more challenging than it should be at times
- Design tradeoffs need to be considered
- The most import aspect of Model-View-Controller is that the Model has no visibility to the View

Learning Objectives – Week 4

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Serialization and Reading/Writing Text Files

Serialization is an object-oriented programming term that means converting an object to a byte stream usually to be written to or read from a file.

To write to a text file:

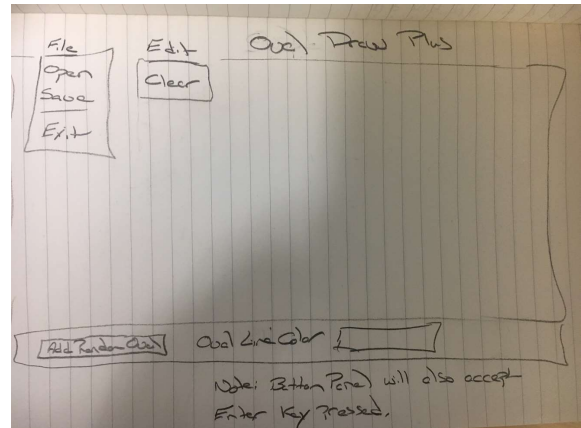
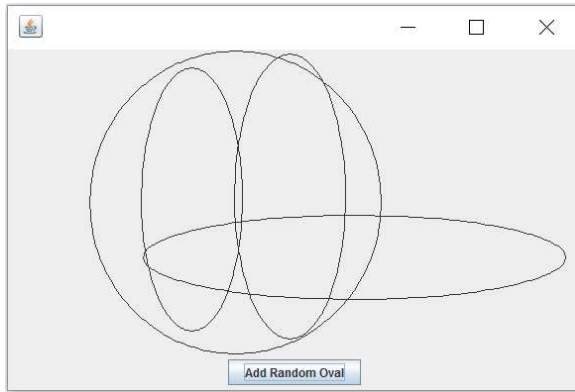
- Create a File object, feeding the file's path to the File class constructor
- Create a FileWriter to access the File
- Create a BufferedWriter to write data to the FileWriter efficiently
- Use BufferedWriter's write and newLine functions to commit the data to the file.

To read from a text file:

- Create a File object, feeding the file's path to the File class constructor
- Attach a Scanner object to it
- Use Scanner's readLine and hasNextLine functions to read the file

A buffered writer or buffered stream efficiently organizes reads and writes for optimal disk performance. The danger is that if there is a power failure (or someone accidentally kicks your power strip) you could lose data. It is good to "flush the buffer" at critical times when using a buffered writer on mission critical projects. There is little or no danger in using a buffered reader.

OvalDraw Plus User Interface Design



Our second programming example this week will be implementing Save & Open in our OvalDraw application.

Closing Comments & Next Steps

- As promised, less theory and more development
- Look for three follow-up development examples this week:
 - OvalDraw with User Experience Enhancements
 - OvalDraw reading and writing files
 - Something with Timers and Animation

End of Session

Course Number: CPSC-24500

Week: 4

Session: 1

Instructor: Eric Pogue

Object-Oriented Programming

Session: Week 4 Session 2
Subject: More Interactive User Interfaces
Instructor: Eric Pogue



Agenda:

1. Quick Review Learning Objectives we covered in Session 1
2. Overview of Session 2 Live Coding example and related Learning Objectives
3. Live User Interface Coding example
4. Review what we learned
5. Closing comments and next steps

Quick note: I have changed the resolution of our videos starting with this session. I was using 1366x768 which made for more manageable video downloads, etc. As we head toward using Visual Studio and C#, I would like to move toward 1920x1080 to better allow us to see the integrated development environment (IDE). Let me know if the increased resolution causes difficulty in accessing or viewing the videos.

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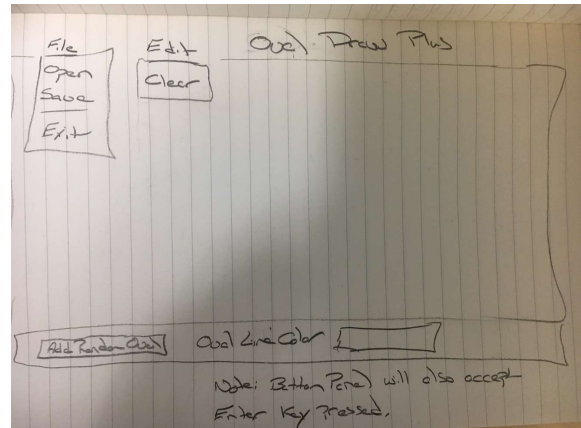
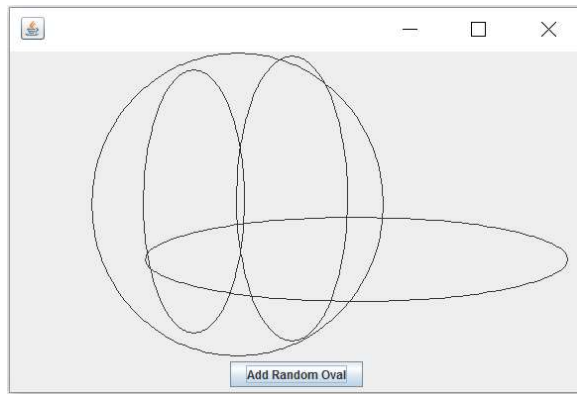
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Closing Comments & Next Steps

- I'm trying to get ups in a learning pattern where we:
 1. See the concepts and patterns (theory)
 2. Watch them being used in a "real-life" example
 3. Implement a solution using what we have learned
- Let me know how this is working, and how we can continue to improve

End of Session

Course Number: CPSC-24500

Week: 4

Session: 2

Instructor: Eric Pogue

Object-Oriented Programming

Session: Week 4 Session 3

Subject: Clicks, Drags, Timers, and Animations

Instructor: Eric Pogue



Agenda:

1. Quick Review Learning Objectives we covered in Session 1
2. Overview of Session 3 Live Coding example and related Learning Objectives
3. Clicks and drags... with FaceDraw-ish solution
4. Short break
5. Timers and animation
6. Review what we learned and week 4 assignment as time allows
7. Final comment & questions

Start Recording!

Learning Objectives – Week 4

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9. **Review week 4 assignment as time allows**

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MouseListener Interface

The MouseListener interface requires five methods to be implemented:

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- mouseExited(MouseEvent e): Invoked when the mouse exits a component
- mousePressed(MouseEvent e): Invoked when a mouse button has been pressed on a component
- mouseReleased(MouseEvent e): Invoked when a mouse button has been released on a component

Adapter Classes are an alternative to implementing all five methods. For our examples, I will be implementing all five, even if some of them seem unnecessary. You are welcome to use Adapters in your assignments if you prefer.

The mouseClicked method is the most often overridden. The mousePressed and mouseReleased are most often used with dragging.

```
import java.awt.event.MouseListener;
import java.awt.event.MouseEvent;

public void mousePressed(MouseEvent e) {}
public void mouseReleased(MouseEvent e) {}
public void mouseEntered(MouseEvent e) {}
public void mouseExited(MouseEvent e) {}
public void mouseClicked(MouseEvent e) {}

addMouseListener(this);

MouseEvent:
int getX();
int getY();
```

MouseMotionListener Interface

The MouseMotionListener interface includes the following methods:

- `mouseDragged(MouseEvent e)`: Invoked when a mouse button is pressed on a component and then dragged
- `mouseMoved(MouseEvent e)`: Invoked when the mouse cursor has been moved onto a component but no buttons have been pushed

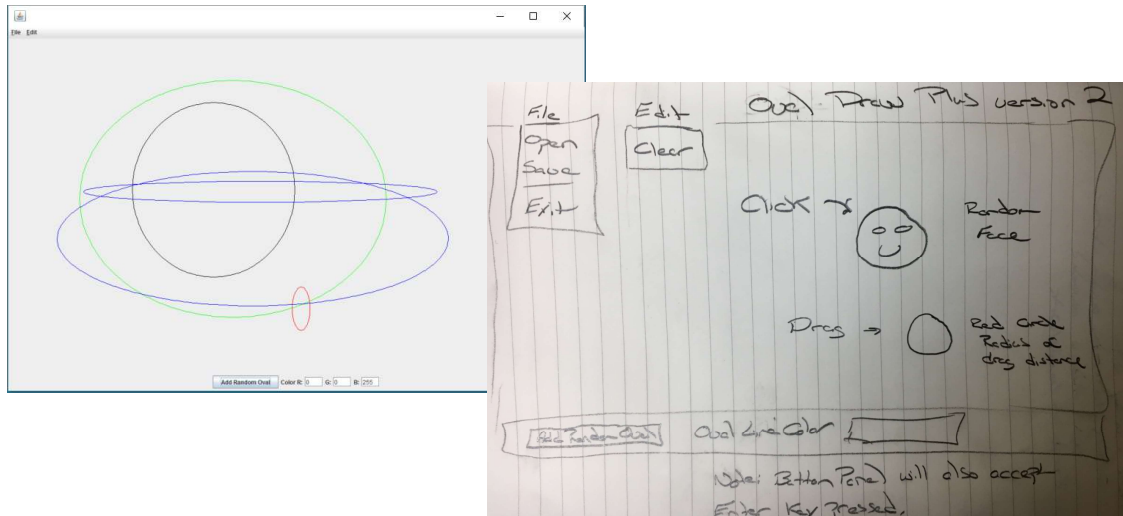
Note: Dragging is quite challenging to implement... and not that often utilized.

```
import java.awt.event.MouseMotionListener;  
import java.awt.event.MouseEvent;
```

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

```
addMouseMotionListener(this);
```

OvalDraw Plus With Clicking and Dragging



Enhance OvalDraw to include drawing a random face (similar to FaceDraw) with clicked and to draw a red circle with a radius of the drag distance when the mouse is dragged.

OvalDraw Plus Enhancements Steps

1. Clone our current Git repository
2. Copy original files over to OvalDrawPlus folder
3. Compile library and ShapeDraw code
4. Quickly test application
5. Review ShapeDraw code... focus on ShapeDrawPanel
6. Minor code cleanup... and “compress” classes that we will not be looking at today
7. Implement MouseListener Interface
8. Implement MouseMotionListener Interface
9. Add random oval on click
10. Implement red circle on mouse drag... this is challenging
11. Implement FaceDraw on click... and remove step nine’s random oval draw
12. Review, final question, and commit/push

Quick Break

Course Number: CPSC-24500

Week: 4

Session: 3

Instructor: Eric Pogue

Timers

Timers are pretty straight forward to implement:

- Implement the ActionListener Interface
- Create a new timer passing in the object that implemented the ActionListener

```
// Timer
import java.util.Timer

class DrawPanel extends JPanel implements ActionListener {
    private Timer myTimer;

    public DrawPanel {
        myTimer = new Timer(1000,this);
    }

    public void actionPerformed(ActionEvent e) {
        // Do timer stuff.
    }
}
```

We will likely have a final programming example that will show some animation using timers. I'm not sure what form that example will take.

```
import java.util.Timer;
```

```
private Timer animationTimer;
```

```
animationTimer = new Timer(1000,this);
```

```
public void actionPerformed(ActionEvent e) {
    System.out.println("actionPerformed(ActionEvent e)");
}
```

OvalDraw Plus Timer and Animated Faces

1. Implement ActionListener on ShapeDrawPanel
2. Implement Timer
3. Implement updateMouth in FaceDraw
4. Implement ArrayList for FaceDraw objects
5. Update FaceDraw mouths and redraw

Learning Objectives – Week 4

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9. **Review week 4 assignment as time allows**

End of Session

Course Number: CPSC-24500

Week: 4

Session: 3

Instructor: Eric Pogue

Object-Oriented Programming

Session: Week 4 Session 4

Subject: Thursday Lunch Discussion & Lecture

Instructor: Eric Pogue



Agenda – Thursday, April 13 from noon to 1pm:

1. Good natured chatting and banter ~10min
2. Quick introductions and how are you feeling about the course... start, stop, continue ~10min
3. Discussion, questions & answers
4. Week 4 Assignment Helpful Hints with MosaicLite

Start Recording!

Note: I am looking forward to the discussion mostly and will continue to complete the MosaicLite activities after 1pm as needed. Don't hesitate to drop off as your schedule requires. I will send out the link to the session after it is complete.

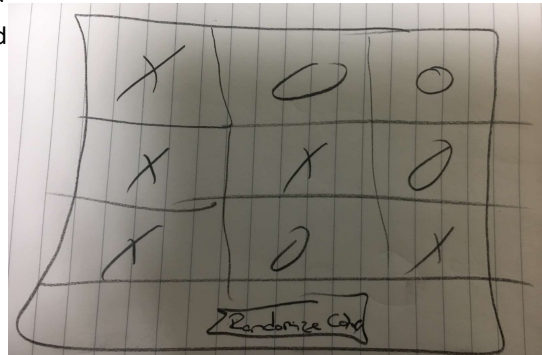
Introductions, Feedback, and Q&A

1. Name and one thing you are planning for the Easter weekend
2. Start, stop, continue:
 - What new thing should we start doing for the class?
 - What is one thing that we should stop doing?
 - What is one thing that we are doing that we should definitely keep doing?
3. Questions & Answers

This is your time... how can I help.

MosaicLite

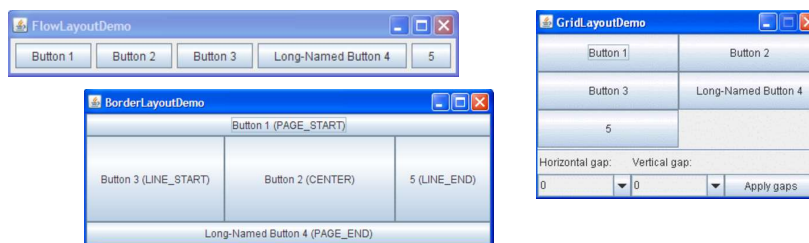
1. Implement a 3x3 grid of colored tiles
2. Implement tiles with a random background color
3. Paint an X or an O on the tile
4. Create a Randomize button
5. Randomize the colors when the button is pushed
6. Randomize the X or O when the button is pushed



Layout Managers (continued)

Layout Managers arrange controls on the screen so they are visually appealing. We will be focusing on three very common Layout Managers:

- **FlowLayout:** Arranges components left to right, top to bottom. When a FlowLayout runs out of room horizontally on a row, it places the next component as far left as it can go on the row below.
- **BorderLayout:** Arranges components in NORTH, SOUTH, EAST, WEST, and CENTER sections.
- **GridLayout:** Arranges components in an Excel-like table of rows and columns.



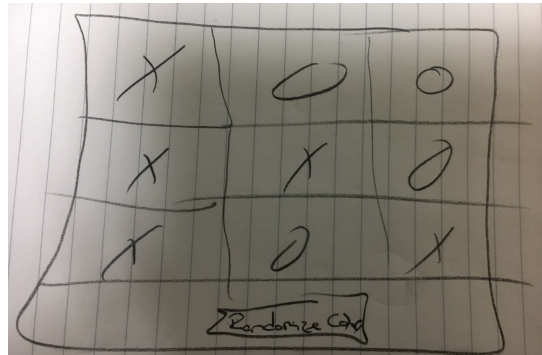
This is different from environments where developers (or designers) layout screens pixel by pixel (like Visual Basic for example). With modern UIs that need to fit in all types of sizes and orientations, layout managers are a necessity.

Several AWT and Swing classes provide layout managers for general use:

- BorderLayout
- BoxLayout
- CardLayout
- FlowLayout
- GridBagLayout
- GridLayout
- GroupLayout
- SpringLayout

MosaicLite

1. JFrame
2. JPanel... grid & tile
3. JButton
4. GridLayout
5. BorderLayout
6. FlowLayout
7. ActionListener & ActionEvent
8. Random
9. Graphics
10. Color
11. Font



See application source code!

Closing Comments

- I hope the example helps...
- Give the holiday weekend, I am going to delay our file writing & reading activities until week 5
- Have a great weekend!

End of Session

Course Number: CPSC-24500

Week: 4

Session: 4

Instructor: Eric Pogue