

CSCI 136: Fundamentals of Computer Science II

17 – Graphics Review, Swing

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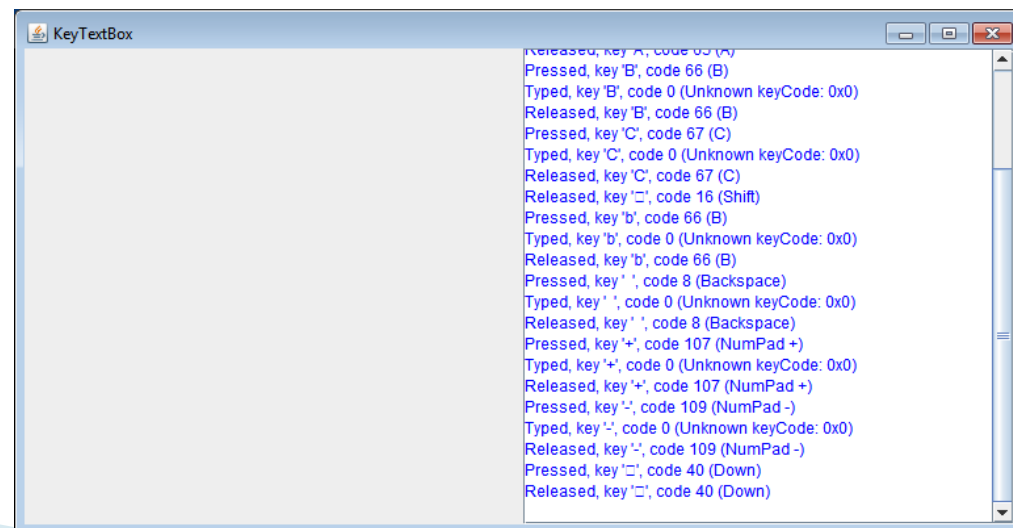
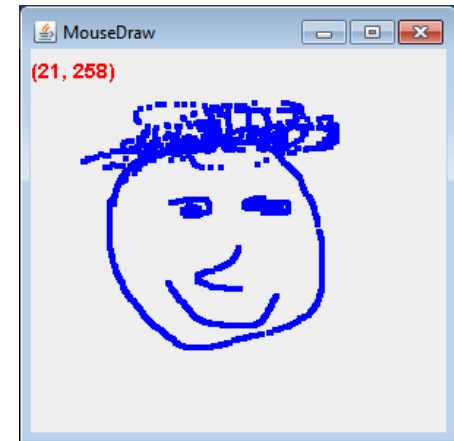
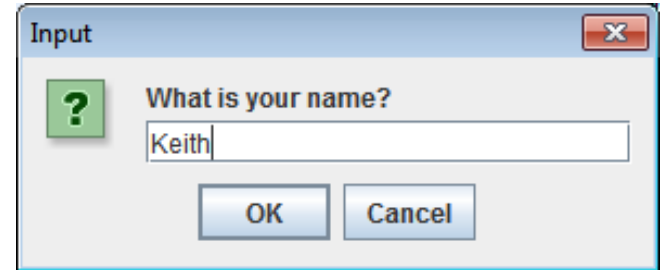
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Outline

- ▶ Extending JFrame
- ▶ Dialog boxes
 - Getting user input
 - Displaying message or error
- ▶ Drawing shapes and images
 - JPanel
- ▶ Listening for input
 - Mouse
 - Keyboard



Extending JFrame

- ▶ **Approach 1:** (last lecture)
 - `main()` creates instance of the class
 - Runs instance method, e.g. `go()`
 - Creates a `JFrame` and associated GUI elements
 - How Head First Java does it
 - **Preferred method**
- ▶ **Approach 2:**
 - Create a class that **extends `JFrame`**
 - Constructor handles GUI setup
 - **No need to create a `JFrame`**
 - Main program class instantiates the class

```
import javax.swing.*;
import java.awt.event.*;

public class ButtonCount implements ActionListener
{
    private int count = 0;
    private JButton button;

    public void actionPerformed(ActionEvent event)
    {
        count++;
        button.setText("count = " + count);
    }

    public void go()
    {
        JFrame frame = new JFrame("ButtonCount");
        button = new JButton("count = " + count);
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        frame.getContentPane().add(button);
        frame.setSize(300,300);
        frame.setVisible(true);
        button.addActionListener(this);
    }

    public static void main(String [] args)
    {
        ButtonCount gui = new ButtonCount();
        gui.go();
    }
}
```

Approach 1:
Create an object and
run a method that
explicitly creates
JFrame

```

import javax.swing.*;
import java.awt.event.*;

public class ButtonCount2 extends JFrame implements ActionListener
{
    private int count = 0;
    private JButton button;

    public void actionPerformed(ActionEvent event)
    {
        count++;
        button.setText("count = " + count);
    }

    public ButtonCount2()
    {
        super("ButtonCount2");

        button = new JButton("count = 0");
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        getContentPane().add(button);
        setSize(300,300);
        setVisible(true);
        button.addActionListener(this);
    }

    public static void main(String [] args)
    {
        ButtonCount2 gui = new ButtonCount2();
    }
}

```

Approach 2:
**Make a class that
 extends JFrame**









**Calls JFrame
 constructor that
 takes the window
 title as a parameter.**

**These are instance methods of
 JFrame, but we are a JFrame, so
 no need to put anything before
 method name.**

Dialog boxes

▶ Dialog boxes

- Asks a **question**
- Or gives an **error**, **information**, etc.
- Typically *modal*
 - **Blocks rest of GUI until closed**
- Displays different icons depending on parameter

Constant	Java look and feel	Windows look and feel
JOptionPane.ERROR_MESSAGE		
JOptionPane.INFORMATION_MESSAGE		
JOptionPane.WARNING_MESSAGE		
JOptionPane.QUESTION_MESSAGE		
JOptionPane.PLAIN_MESSAGE		

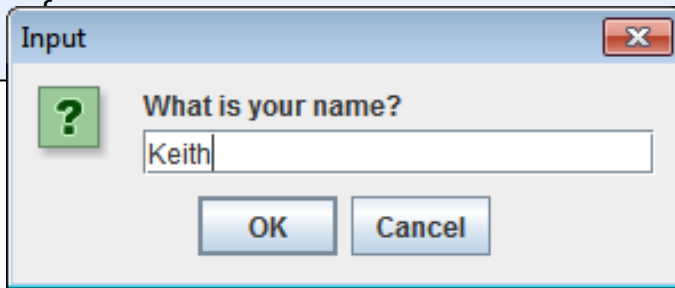
```

public class NameDialog
{
    public static void main(String [] args)
    {
        String name = JOptionPane.showInputDialog("What is your name?");

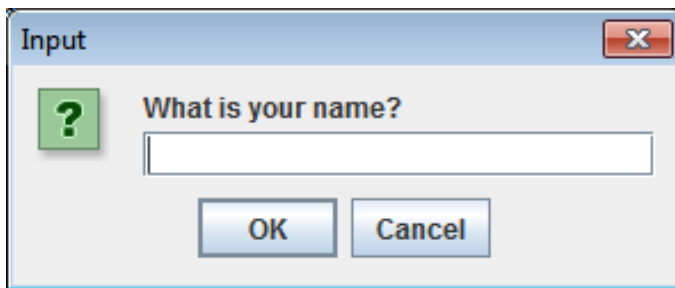
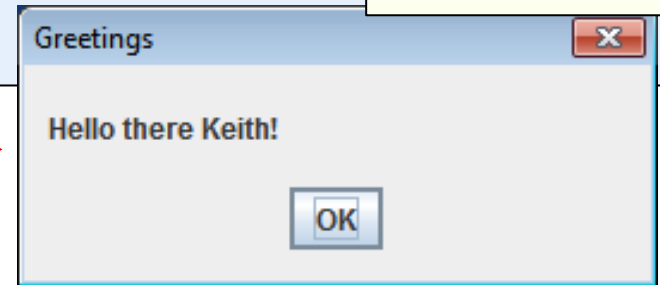
        JOptionPane.showMessageDialog(null,
        "Hello there " + name + "!",
        "Greetings",
        JOptionPane.PLAIN_MESSAGE);
    }
}

```

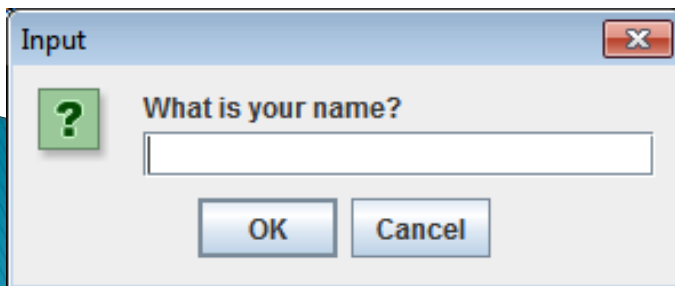
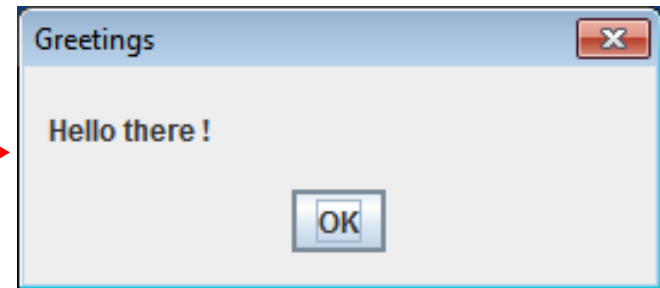
Normally a reference to the JFrame object



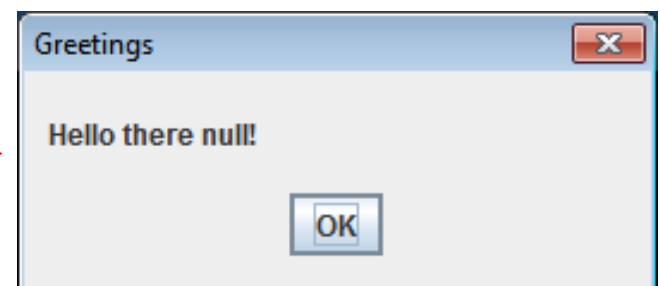
OK
(text entered)



OK
(no text entered)



Cancel

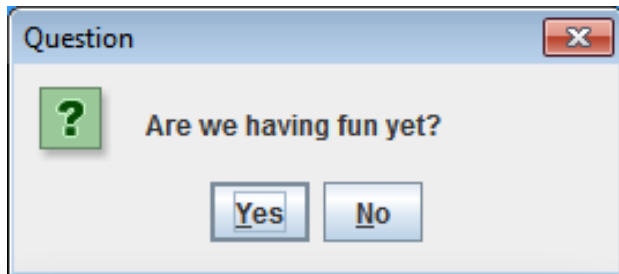


```

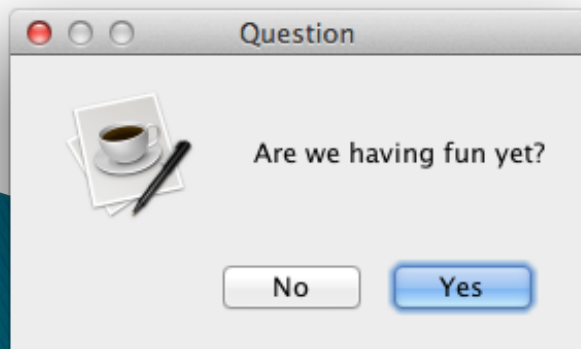
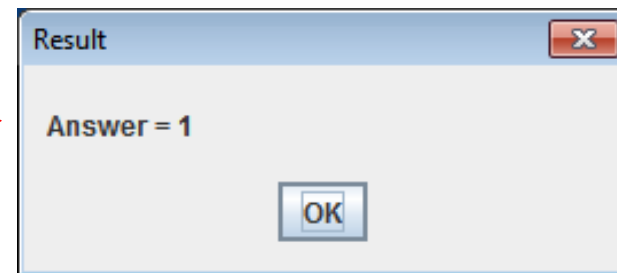
public class YesNoDialog
{
    public static void main(String [] args)
    {
        int result = JOptionPane.showConfirmDialog(null,
                                                    "Are we having fun yet?",
                                                    "Question",
                                                    JOptionPane.YES_NO_OPTION);

        JOptionPane.showMessageDialog(null,
                                      "Answer = " + result,
                                      "Result",
                                      JOptionPane.PLAIN_MESSAGE);
    }
}

```



No
(Windows 7)



Lots of other dialog
related options, see:

<http://docs.oracle.com/javase/tutorial/uiswing/components/dialog.html#dialogdemo>

Panels

▶ JPanel

- Purpose 1: **Container** for other widgets
 - Allows more control of layout
- Purpose 2: **Place to draw** lines, circles, images, etc.
 - Like StdDraw
- Needs to be added to a JFrame
- Class that **extends JPanel**, drawing done by:
 - `public void paintComponent(Graphics g)`
 - **Called automatically** when needed
 - e.g. window resized
 - Or by **calling repaint()** on JFrame

```

public class MyDrawPanel extends JPanel
{
    public void paintComponent(Graphics g)
    {
        g.setColor(Color.ORANGE);
        g.fillRect(20,50,100,100);

        g.setColor(new Color(1.0f, 0.0f, 1.0f));
        g.drawLine(0, 0, 100, 100);

        g.setColor(Color.BLUE);
        g.fillOval(200, 100, 50, 25);

        BufferedImage image = null;
        try
        {
            image = ImageIO.read(new File("cat.jpg"));
        }
        catch (IOException e)
        {
            e.printStackTrace();
        }
        g.drawImage(image, 70, 170, null);
    }
}

```

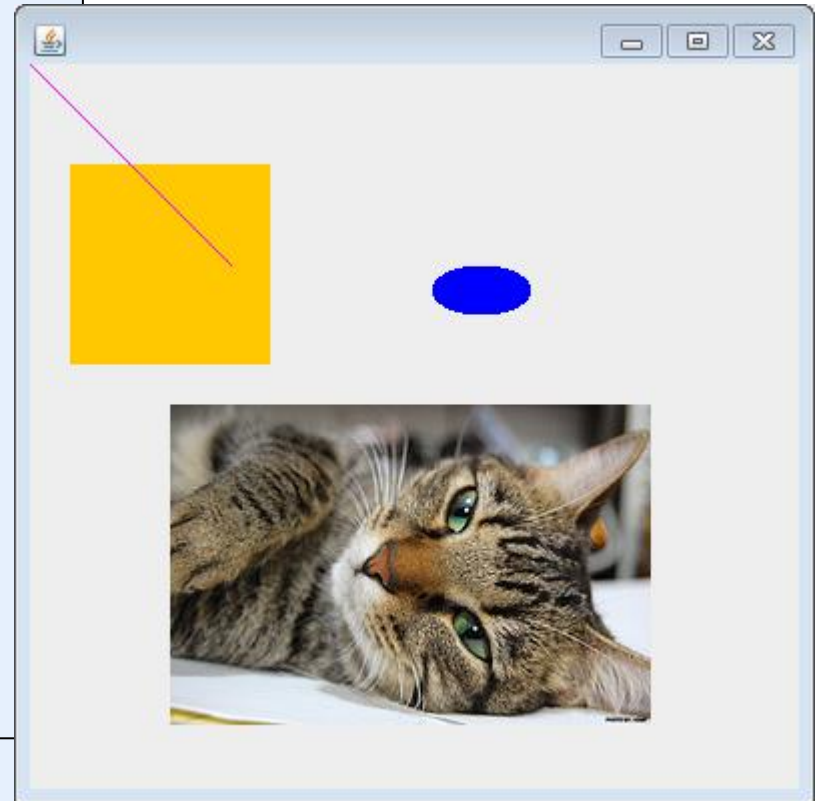
```

public class Panel
{
    public static void main(String [] args)
    {
        JFrame frame = new JFrame();

        MyDrawPanel panel = new MyDrawPanel();
        frame.getContentPane().add(BorderLayout.CENTER, panel);

        frame.setSize(400, 400);
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        frame.setVisible(true);
    }
}

```



Drawing images

► Loading a JPG, PNG, GIF:

- Construct BufferedImage using static method
- Pass it a File object constructed using filename
- Will be null on error
- ImageIO.read can throw IOException

Special static method that constructs an object of type BufferedImage.


```
BufferedImage image = ImageIO.read(new File("cat.jpg"));  
if (image != null)  
{  
    int width = image.getWidth();  
    int height = image.getHeight();  
}
```

Drawing images

► Drawing on a panel

- In the `paintComponent(Graphics g)` method
 - `g.drawImage(Image image, int x, int y, ImageObserver obs)`
- NOTE: (x, y) is the **upper-left corner of image**
- Keep the `BufferedImage` object around
 - Avoid loading from disk each time you need it

```
g.drawImage(image, 0, 0, null);
```



The component (e.g. `JFrame`, `JPanel`) that gets notified if image was not completely loaded when `drawImage` was first called. We can just say `null` since we always load image from disk before calling.

Mouse input

▶ **MouseListener**

- Watches for **mouse entry/exit** from component
- Watches for **button events**
- **No events if moving** mouse inside component
- **Only if inside** the listening component!

Method	Purpose
<code>mousePressed(MouseEvent)</code>	After the user presses a mouse button while the cursor is over the component.
<code>mouseReleased(MouseEvent)</code>	After the user releases a mouse button after a mouse press over the component.
<code>mouseClicked(MouseEvent)</code>	After the user clicks the component (after the user has pressed and released).
<code>mouseEntered(MouseEvent)</code>	After the cursor enters bounds of the component.
<code>mouseExited(MouseEvent)</code>	After the cursor exits bounds of the component.

Mouse input

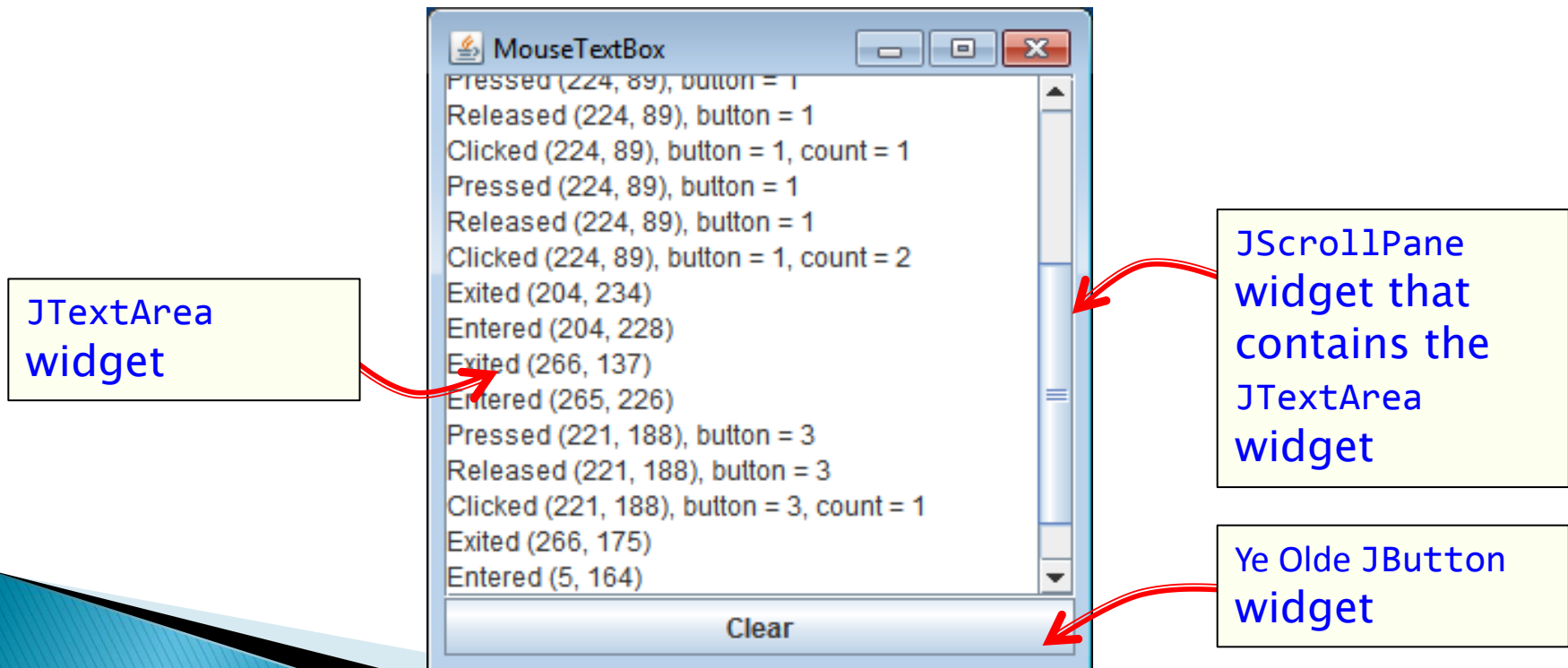
► MouseEvent

- (x, y) pixel coordinate: (0,0) is upper-left
- Number of consecutive clicks
- Button that changed state (pushed, released, clicked)

Method	Purpose
<code>int getClickCount()</code>	Number of quick, consecutive clicks (including this event). For example, returns 2 for a double click.
<code>int getX()</code>	Get the x-coordinate at which event occurred
<code>int getY()</code>	Get the y-coordinate at which event occurred
<code>Point getPoint()</code>	Return a Point object containing event location
<code>int getButton()</code>	Which button changed state: NOBUTTON, BUTTON1, BUTTON2, or BUTTON3.

Mouse input example 1

- ▶ GUI with a single big text area
 - Add line of text to area on MouseListener event
 - Output event type and mouse (x, y)
 - Events only triggered in JTextArea not JButton



MouseTextBox.java

Mouse motion

▶ `MouseListener`

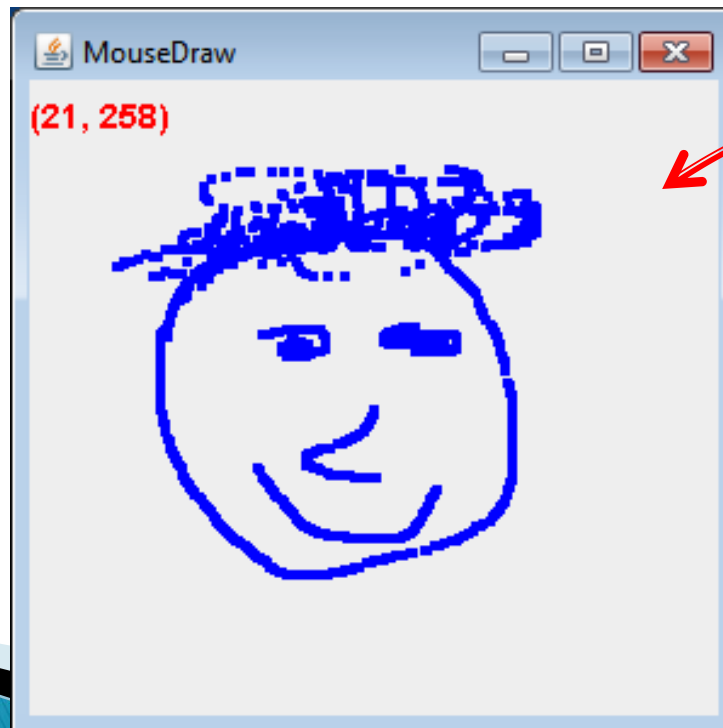
- Detects movement of mouse inside a component
- With or without the mouse pressed

Method	Purpose
<code>mouseMoved(MouseEvent)</code>	User is moving the mouse with no mouse button pressed.
<code>mouseDragged(MouseEvent)</code>	User is moving the mouse while holding a mouse button down (i.e. a dragging action). Always preceded by call to <code>mousePressed</code> event.

Mouse motion example 2

► Simple drawing application

- During **MouseDragged event**, add Point objects
- Requires a custom JPanel that draws all the points
 - Override paintComponent(Graphics g) method
- Also display current mouse (x, y) in upper-left



MouseDrawPanel
extends JPanel

MouseDraw.java
MouseDrawPanel.java

Keyboard input

▶ `KeyListener`

- When a key **is pressed, released, or typed**
 - Typed event only for **printable characters**
 - Not arrow keys, etc.
 - Numeric key codes for all event types
- Component **must have focus** to fire event
 - For custom components (e.g. game drawing panel):
 - Ensure it can accept focus: `setFocusable(true)`
 - `mouseClicked()` handler that calls `requestFocusInWindow()`
 - Or make all other UI widgets not focusable

Method	Purpose
<code>keyTyped(KeyEvent)</code>	Called just after user types a Unicode character
<code>keyPressed(KeyEvent)</code>	Called just after the user presses a key
<code>keyReleased(KeyEvent)</code>	Called just after the user releases a key

Keyboard input

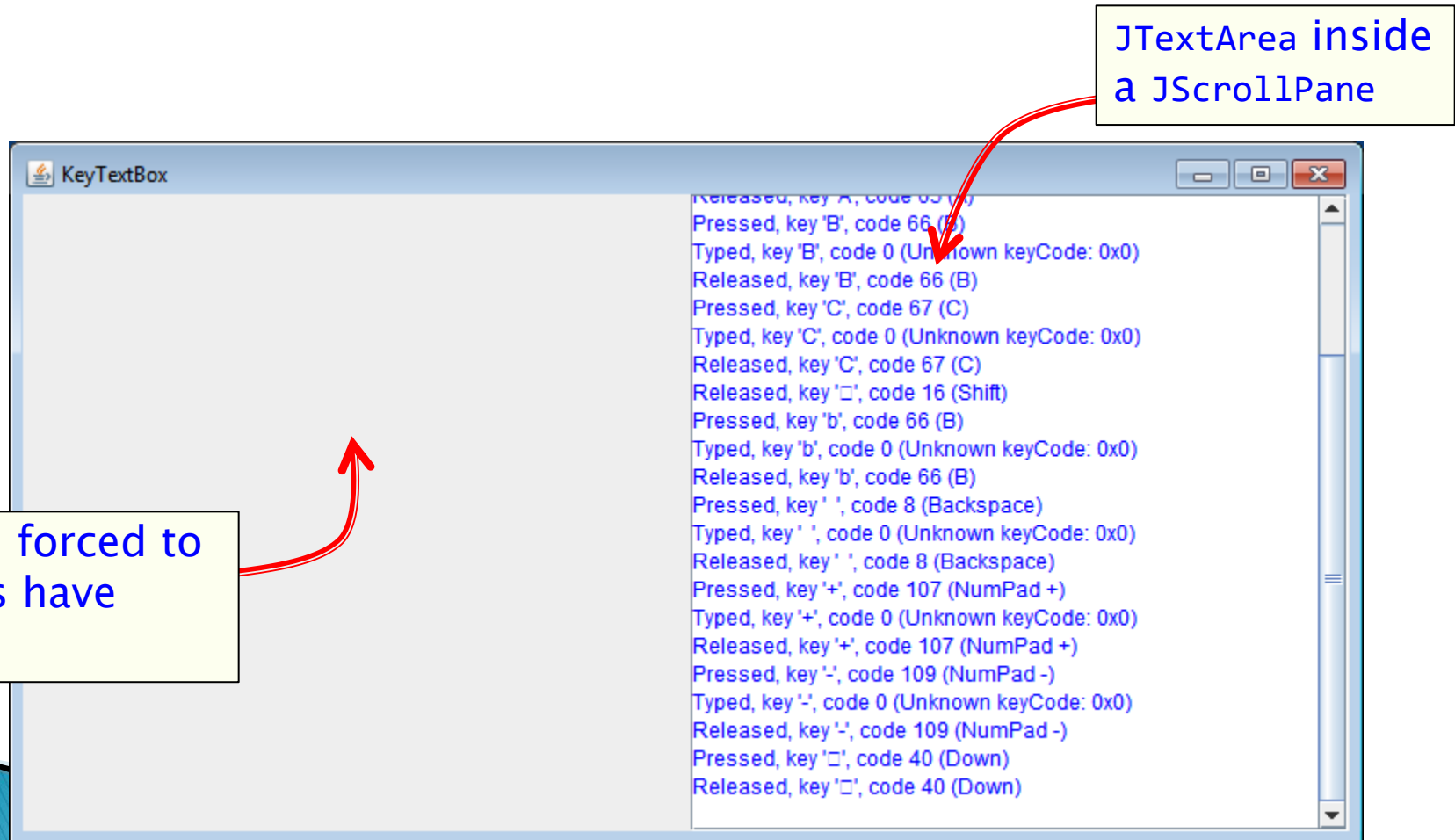
► KeyEvent

- Figure out what was typed or pressed
- Actual **character for typed events**
- Only **key code for pressed/released events**

Method	Purpose
<code>int getKeyChar()</code>	Return Unicode character of event, only use for key typed events.
<code>int getKeyCode()</code>	Return the key code associated with event. For example, <code>VK_A</code> = letter A, <code>VK_DOWN</code> = down arrow key.
<code>int getModifiersEx()</code>	Extended modifier mask for the event, such as whether shift or alt key was down.

Keyboard input example

- ▶ Listen for keyboard events
 - Output text about each event



KeyTextBox.java

Summary

- ▶ **Extending JFrame**
 - Constructor sets up the GUI widgets
- ▶ **Dialog boxes**
 - Collect a response, provide info or error
- ▶ **Drawing shapes and images**
 - Requires a JPanel
- ▶ **Responding to mouse and keyboard events**
 - MouseListener for click related events
 - MouseMotionListener for tracking mouse
 - KeyListener for keyboard events

