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Java Foundations

9-3
Graphics, Audio, and MouseEvents

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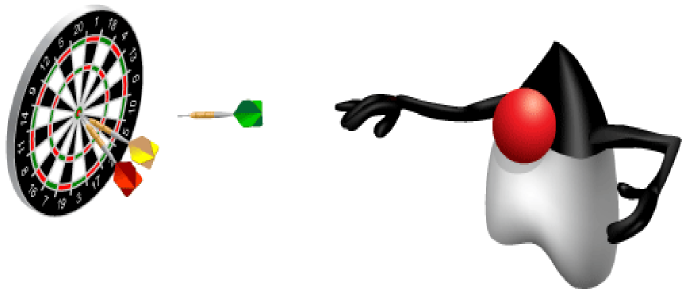
Objectives

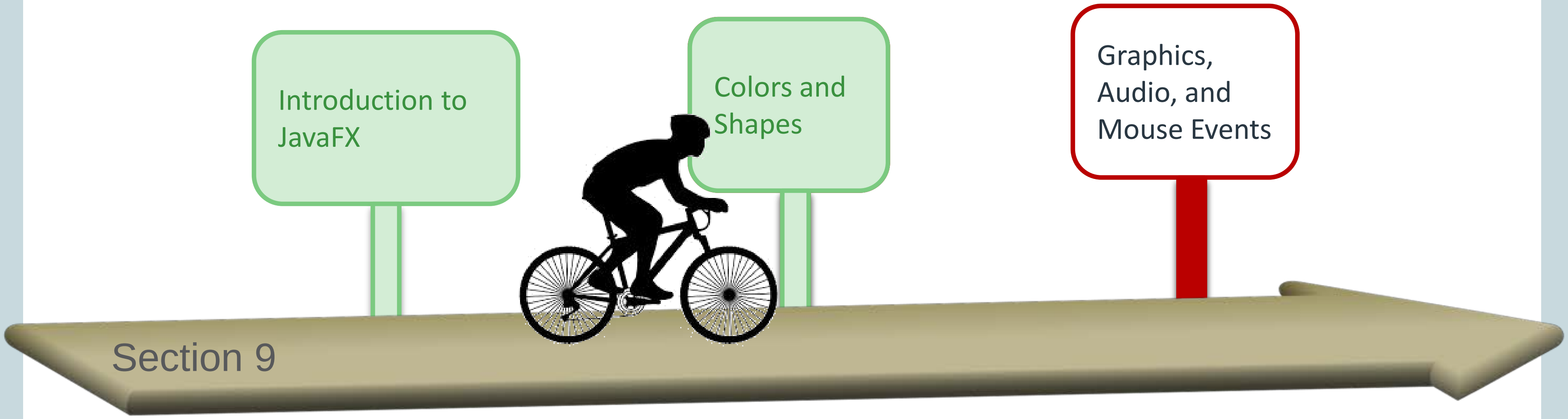
This lesson covers the following objectives:

- Create and use a JavaFX image and ImageView
- Create and use JavaFX audio
- Create and use MouseEvents
- Understand Lambda expressions in GUI applications



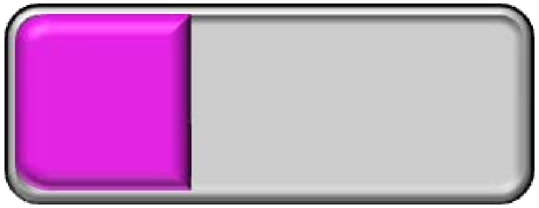
Topics

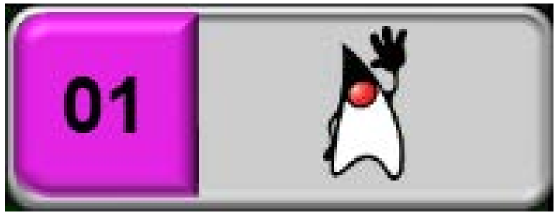
- Graphics
- Audio
- Mouse Events



Using Your Own Graphics

- JavaFX can provide UI elements, shapes, and text.
  - But if you have a talent for art, you can use your own graphics in place of those that JavaFX provides.
- For example:





  - The art for the level-select button wasn't created by JavaFX.
  - But we used JavaFX to procedurally add level numbers, text, and the graphic of Duke.

A JavaFX **Image** and **ImageView**

- An **Image** is an object that describes the location of a graphics file (.png, .jpg, .gif …).

```
Image image;
String imagePath = "Images/Fan1.png";
image = new Image(getClass().getResource(imagePath).toString);
```

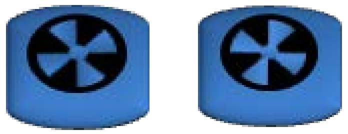
- An **ImageView** is the actual Node.
  - Calling its constructor requires an Image argument.

```
ImageView imageView = new ImageView(image);
```

  - An ImageView also contains the same properties as any other node: x-position, y-position, width, height …

Why Have Both an Image and ImageView?

- One big advantage is **animation**.
  - Images can be swapped in and out of the same ImageView.
- The Fan in Java Puzzle Ball takes advantage of this.
  - The fan cycles through 2 images when it's blowing.



- Custom buttons also benefit.
  - You could use different images for buttons depending on their state:
    - Is the mouse hovering over the button?
    - Is the user clicking the button?

ImageView Hints

- How to create Images:

```
Image image1= new Image(getClass().getResource("Images/fan1.png").toString());
Image image2= new Image(getClass().getResource("Images/fan2.png").toString());
```

- How to create an ImageView:

```
ImageView imageView = new ImageView(image1);
```

- How to swap an Image into an ImageView:

```
imageView.setImage(image2);
```

  - `imageView` retains its properties, such as positioning.

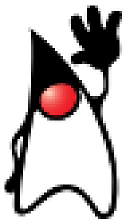
Remember to import
javafx.scene.image.Image; and
javafx.scene.image.ImageView;

Creating Objects with Node Properties

- So far, we've written all JavaFX code in the `start()` method.
  - This is similar to the beginning of the course, where most code was written in the `main()` method.
- Object-oriented code shouldn't be written this way.
  - Instead, objects should have Node fields.
- The `start()` and `main()` methods are intended to be drivers.

Example: The Goal Class

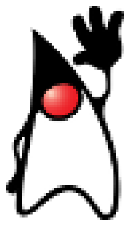
- Fields
  - `private Image dukeImage;`
  - `private ImageView dukeImageView;`



- Constructor
  - Takes arguments for `x` and `y` positions.
  - Assigns the image to its respective ImageView.
  - Positions `dukeImageView` according to the `x` and `y` arguments.

Exercise 1

- Import and open the `GoalTest` project. Notice that …
  - The Root Node is publically available.
  - There's a package with several graphic files.
  - The `Goal` class is an ordinary Java class file type.
- Write the `Goal` class according to the specifications on the previous slide.
  - You'll also need to add this class's ImageView to the Root Node.
- Instantiate a few `Goal` objects from the `start()` method.



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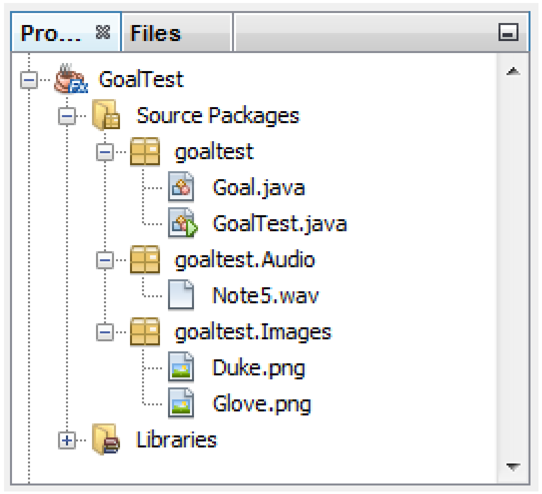
File Locations

- Make sure files are in the correct location.

```
Image image = new Image(getClass().getResource("Images/Duke.png"));
```

- `Images/Duke.png` refers to a folder within the `GoalTest` folder.
  - $\ldots\backslash\underbrace{\textit{GoalTest}}_{\text{Project Folder}}\backslash\underbrace{\textit{src}}_{\text{Source}}\backslash\underbrace{\textit{goaltest}}_{\text{Primary Package}}\backslash\underbrace{\textit{Images}}_{\text{Another Package}}$
  - Or a package within a package

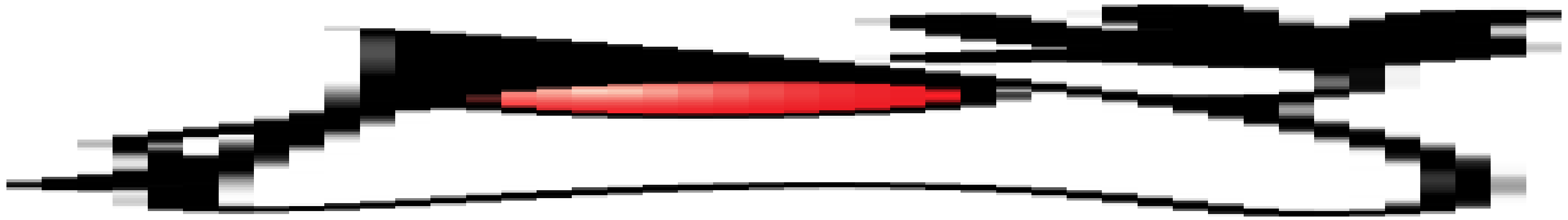


```
Pro...  Files
GoalTest
  Source Packages
    goaltest
      Goal.java
      GoalTest.java
    goaltest.Audio
      Note5.wav
    goaltest.Images
      Duke.png
      Glove.png
  Libraries
```

Scaling a Node

- It’s very easy to make a rectangle wider:

- But if you try the same thing with an ImageView …
  - It might look awful!



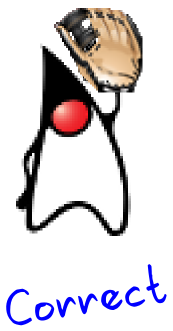
Scaling a Node the Right Way

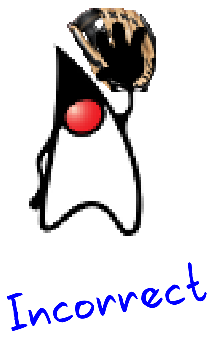
- JavaFX is very good at scaling graphics.
  - The quality of the image is less likely to deteriorate
- You have the option to preserve the aspect ratio of an ImageView.
  - An ImageView's width and height scale together.
  - This avoids distortion.

```
imageView.setPreserveRatio(true);
imageView.setFitWidth(25);
```

Ordering Nodes

- Sometimes, testers of Java Puzzle Ball didn’t realize that their goal was to get the ball to Duke.
- We thought adding a baseball glove would help solve the problem.
- Duke and the glove are two separate ImageViews.
  - These needed to be ordered properly so that the glove doesn’t display behind the hand.

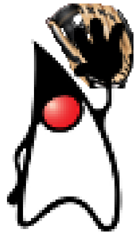




Ordering Nodes the Right Way

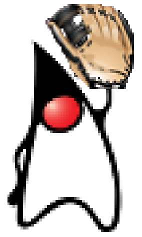
- The order that Nodes are added to the Root Node determines the order that they are displayed.
- Nodes added early are buried under nodes added later.

```
root.getChildren().addAll(gloveImageView, dukeImageView);
```



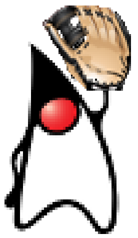
- To fix this you could …
  - Change the order that Nodes are added to the Root Node.
  - Bring an ImageView to the front or back.

```
gloveImageView.toFront();     //Either one of these
dukeImageView.toBack();       //will solve the problem
```



The Goal Class

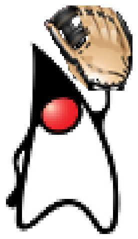
- Fields
  - `private Image dukeImage;`
  - `private ImageView dukeImageView;`
  - `private Image gloveImage;`
  - `private ImageView gloveImageView;`



- Constructor
  - Takes arguments for `x` and `y` positions.
  - Assigns each Image to its respective ImageView.
  - Positions `dukeImageView` according to the `x` and `y` arguments.
  - Positions and scales `gloveImageView` relative to `dukeImageView`.

Exercise 2

- Continue editing the `GoalTest` project.
- Write the Goal class according to the specifications on the previous slide.
  - The constructor should still take only two arguments.
  - A glove should appear on top of Duke’s hand.
- Hint: Nodes, including ImageViews, have getter and setter methods for properties like position.



Topics

- Graphics
- Audio
- Mouse Events

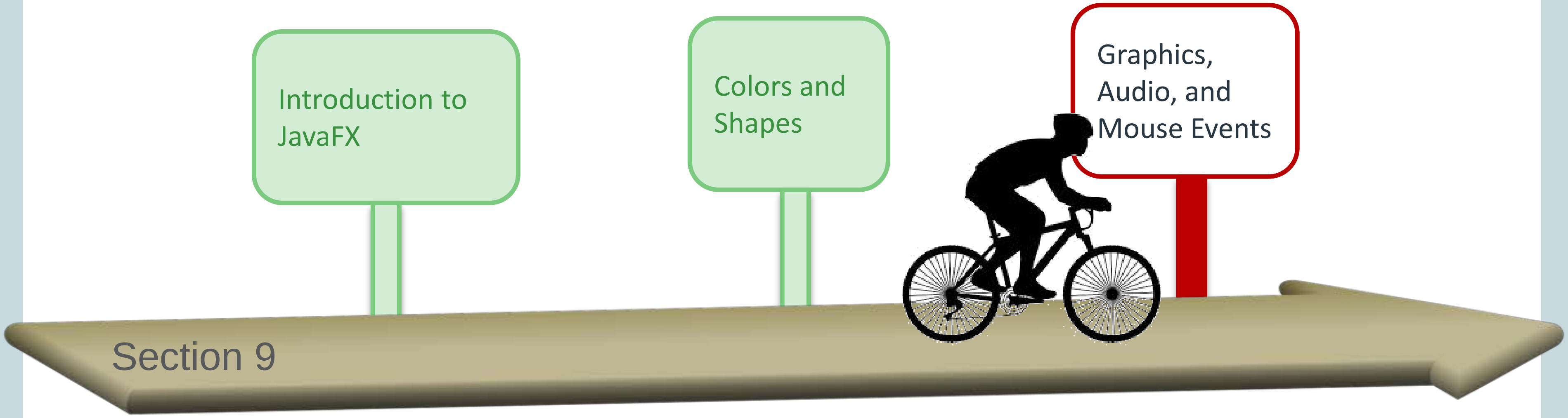


Image and Audio Similarities

- Creating a JavaFX Image object …

```
Image image = new Image(getClass().getResource("Images/fan1.png").toString());
```

- Is very similar to creating a JavaFX **Audio** object.

```
Audio audio = new  Audio(getClass().getResource("Audio/Note5.wav").toString());
```

- It’s common to store images and audio in their own packages/folders.

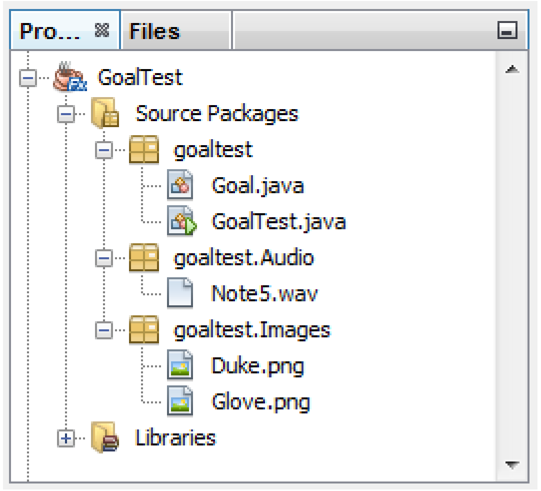


Image and Audio Differences

- An Audio object describes the location of an audio file (`.wav`, `.mp3` …).

```
Audio audio = new  Audio(getClass().getResource("Audio/Note5.wav").toString());
```

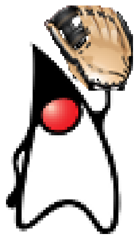
- And unlike an Image …
  - There is no Audio equivalent of an ImageView.
  - Audio can be played by referencing the Audio object directly.

```
audio.play();
```

  - There are many other Audio methods you can call.

The Goal Class

- Fields
  - `private Image dukeImage;`
  - `private ImageView dukeImageView;`
  - `private Image gloveImage;`
  - `private ImageView gloveImageView;`
  - `private Audio tone;`



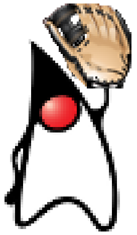
- The Goal class contains an Audio object as a field.
  - `tone` plays when the mouse is pressed on Duke.
  - We'll see how to implement this feature in the next part of this lesson.

Exercise 3

- Continue editing the `GoalTest` project.
- Declare an Audio object as a field.
- Instantiate the Audio object.
  - Use the `.wav` file in the project directory.

Remember to import

`javafx.scene.media.AudioClip;`



Topics

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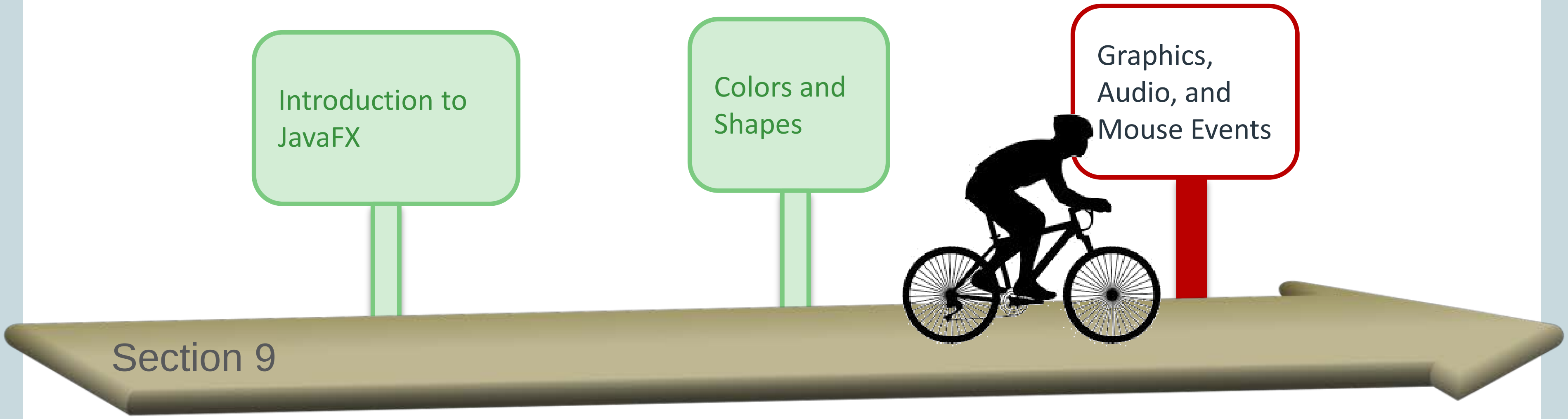


Mouse and Keyboard Events

- Nodes can detect mouse and keyboard events.
  - This is true about ImageViews, too!
  - You aren't limited to buttons and other GUI components.
- Helpful methods to make this happen include:
  - `setOnMouseClicked()`
  - `setOnMouseDragged()`
  - `setOnMouseEntered()`
  - `setOnMouseExited()`
  - `setOnMouseMoved()`
  - `setOnMousePressed()`
  - `setOnMouseReleased()`

Remember to import
`javafx.scene.input.MouseEvent.`

Lambda Expressions

- These methods use a special argument, called a **Lambda expression**:

```
imageView.setOnMousePressed( /*Lambda Expression*/ );
```

- Lambda expressions use special syntax:

No semicolon

```
(MouseEvent me) -> System.out.println("Pressed")
```

- Curley braces allow Lambda expressions to contain multiple statements:

```
(MouseEvent me) -> {
        System.out.println("Statement 1");
        System.out.println("Statement 2");
}
```

semicolons

Lambda Expressions as Arguments

- When these are combined, we get the following:

```
imageView.setOnMousePressed( (MouseEvent me) -> {
        System.out.println("Statement 1");
        System.out.println("Statement 2");
} );
```

- What this code does:
  - Allows `imageView` to detect a mouse press at any time.
  - If that occurs, the two print statements are executed.
  - Otherwise, this code is ignored.

MouseEvent

- A MouseEvent object exists only within the scope of the Lambda expression.
- It contains many useful properties and methods:

```
imageView.setOnMousePressed( (MouseEvent me) -> {
        System.out.println(me.getSceneX());
        System.out.println(me.getSceneY());
} );
```

- In this example:
  - `me` is the MouseEvent object
  - `me` is accessed to print the x and y positions of the mouse cursor when `imageView` is pressed.

MouseEvent Methods

- **`getSceneX()`**
- **`getSceneY()`**
  - Returns a `double`.
  - Returns the position of the cursor within the JavaFX Scene.
  - The top-left corner of the Scene is position (0,0).

- **`getScreenX()`**
- **`getScreenY()`**
  - Returns a `double`.
  - Returns the position of the cursor on your computer's screen.
  - The top-left corner of your computer's screen is (0,0).

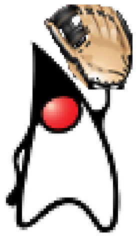
Event Listening

- When you write code for MouseEvents.
  - You're telling a Node to listen for a particular event.
  - But the events don't actually have to occur.
- As long as the Node is listening …
  - It can detect any event, at any time.
- A Node can listen for many events.

```
        imageView.setOnMousePressed( /*Lambda Expression*/ );
        imageView.setOnMouseDragged( /*Lambda Expression*/ );
        imageView.setOnMouseReleased(/*Lambda Expression*/ );
```

Exercise 4

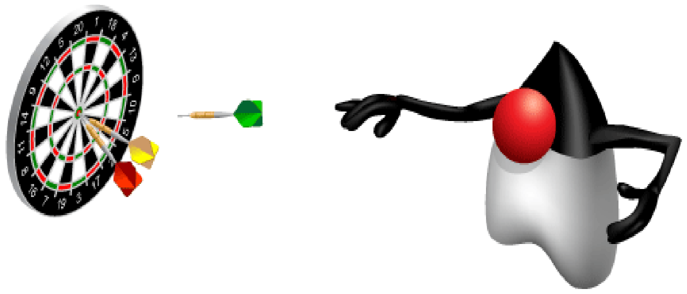
- Continue editing the `GoalTest` project.
- Complete the `interactions()` method so that …
  - Duke listens for a mouse press and mouse drag.
  - Play a sound when the mouse is pressed.
  - Print the x and y positions of the mouse dragged event. This will be helpful for the problem set.
- What if `interactions()` is never called?
  - Comment out this method call in the constructor.



Summary

In this lesson, you should have learned how to:

- Create and use a JavaFX image and ImageView
- Create and use JavaFX audio
- Create and use MouseEvents
- Understand Lambda expressions in GUI applications



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