JavaFX

Transformations, Animations, and Visual Effects

Release 8

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This document describes transformations, timeline animations, and visual effects available in JavaFX.

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A Xylophone.java

Preface

This preface describes the document accessibility features and conventions used in this tutorial - *Transformations, Animations, and Visual Effects*.

About This Document

This tutorial describes transformations, timeline animations, and visual effects available in JavaFX.

Audience

This document is intended for JavaFX developers.

Documentation Accessibility

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Related Documents

For more information, see the following documents in the JavaFX documentation set:

- *Getting Started with JavaFX*

Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.

Convention	Meaning
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
`monospace`	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

Part I

Applying Transformations in JavaFX

This tutorial describes transformations supported in JavaFX and contains the following chapters:

1

Transformations Overview

This chapter introduces transformations supported in JavaFX.

All transformations are located in the `javafx.scene.transform` package and are subclasses of the `Transform` class.

Introducing Transformations

A transformation changes the place of a graphical object in a coordinate system according to certain parameters. The following types of transformations are supported in JavaFX:

- Translation
- Rotation
- Scaling
- Shearing

These transformations can be applied to either a standalone node or to groups of nodes. You can apply one transformation at a time or you can combine transformations and apply several transformations to one node.

The `Transform` class implements the concepts of affine transformations. The `Affine` class extends the `Transform` class and acts as a superclass to all transformations. Affine transformations are based on euclidean algebra, and perform a linear mapping (through the use of matrixes) from initial coordinates to other coordinates while preserving the straightness and parallelism of lines. Affine transformations can be constructed using observableArrayLists rotations, translations, scales, and shears.

> **Note:** Usually, do not use the `Affine` class directly, but instead, use the specific Translate, Scale, Rotate, or Shear transformations.

Transformations in JavaFX can be performed along three coordinates, thus enabling users to create three-dimensional (3-D) objects and effects. To manage the display of objects with depth in 3-D graphics, JavaFX implements z-buffering. Z-buffering ensures that the perspective is the same in the virtual world as it is in the real one: a solid object in the foreground blocks the view of one behind it. Z-buffering can be enabled by using the `setDepthTest` class. You can try to disable z-buffering (`setDepthTest(DepthTest.DISABLE)`) in the sample application to see the effect of the z-buffer.

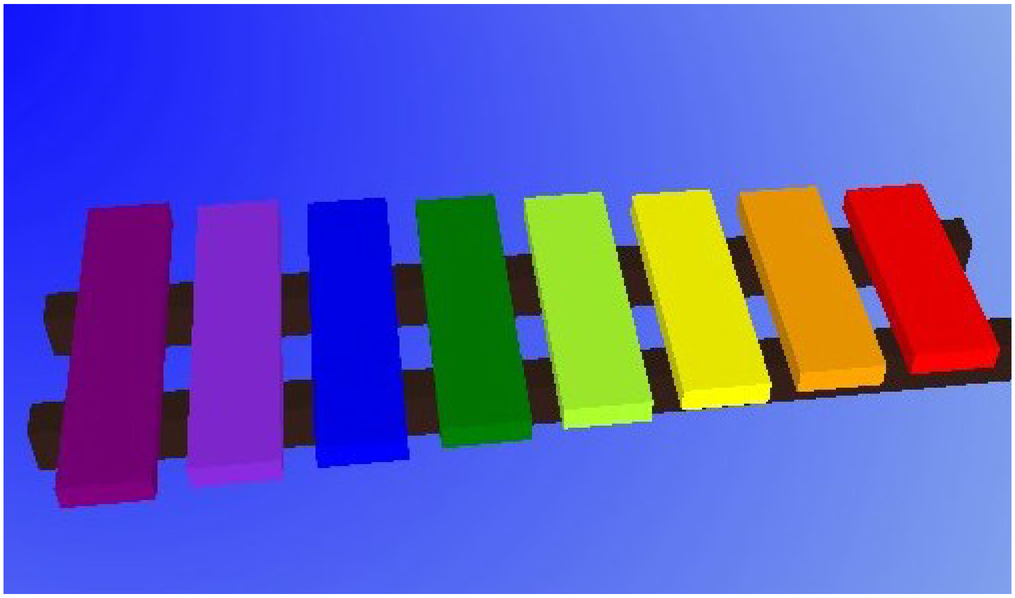
To simplify transformation usage, JavaFX implements transformation constructors with the x-axis and y-axis along with the x, y, and z axes. If you want to create a two-dimensional (2-D) effect, you can specify only the x and y coordinates. If you want to create a 3-D effect, specify all three coordinates.

To be able to see 3-D objects and transformation effects in JavaFX, users must enable the perspective camera.

Though knowing the underlying concepts can help you use JavaFX more effectively, you can start using transformations by studying the example provided with this document and trying different transformation parameters. For more information about particular classes, methods, or additional features, see the API documentation.

In this document, a Xylophone application is used as a sample to illustrate all the available transformations. You can download its source code by clicking the transformations.zip link.

Figure 1–1 A Xylophone application



2

Transformation Types and Examples

This document describes specific transformations and provides code examples.

Translation

The translation transformation shifts a node from one place to another along one of the axes relative to its initial position. The initial position of the xylophone bar is defined by x, y, and z coordinates. In Example 2–1, the initial position values are specified by the `xStart`, `yPos`, and `zPos` variables. Some other variables are added to simplify the calculations when applying different transformations. Each bar of the xylophone is based on one of the base bars. The example then translates the base bars with different shifts along the three axes to correctly locate them in space.

Example 2–1 shows a code snippet from the sample application with the translation transformation.

Example 2–1 Translation

```
Group rectangleGroup = new Group();
rectangleGroup.setDepthTest(DepthTest.ENABLE);

double xStart = 260.0;
double xOffset = 30.0;
double yPos = 300.0;
double zPos = 0.0;
double barWidth = 22.0;
double barDepth = 7.0;

// Base1
Cube base1Cube = new Cube(1.0, new Color(0.2, 0.12, 0.1, 1.0), 1.0);
base1Cube.setTranslateX(xStart + 135);
base1Cube.setTranslateZ(yPos+20.0);
base1Cube.setTranslateY(11.0);
```

Rotation

The rotation transformation moves the node around a specified pivot point of the scene. You can use the `rotate` method of the `Transform` class to perform the rotation.

To rotate the camera around the xylophone in the sample application, the rotation transformation is used, although technically, it is the xylophone itself that is moving when the mouse rotates the camera.

Example 2–2 shows the code for the rotation transformation.

Example 2–2 Rotation

```
    class Cam extends Group {
        Translate t  = new Translate();
        Translate p  = new Translate();
        Translate ip = new Translate();
        Rotate rx = new Rotate();
        { rx.setAxis(Rotate.X_AXIS); }
        Rotate ry = new Rotate();
        { ry.setAxis(Rotate.Y_AXIS); }
        Rotate rz = new Rotate();
        { rz.setAxis(Rotate.Z_AXIS); }
        Scale s = new Scale();
        public Cam() { super(); getTransforms().addAll(t, p, rx, rz, ry, s, ip); }
    }
...
        scene.setOnMouseDragged(new EventHandler<MouseEvent>() {
            public void handle(MouseEvent me) {
                mouseOldX = mousePosX;
                mouseOldY = mousePosY;
                mousePosX = me.getX();
                mousePosY = me.getY();
                mouseDeltaX = mousePosX - mouseOldX;
                mouseDeltaY = mousePosY - mouseOldY;
                if (me.isAltDown() && me.isShiftDown() &&
me.isPrimaryButtonDown()) {
                    cam.rz.setAngle(cam.rz.getAngle() - mouseDeltaX);
                }
                else if (me.isAltDown() && me.isPrimaryButtonDown()) {
                    cam.ry.setAngle(cam.ry.getAngle() - mouseDeltaX);
                    cam.rx.setAngle(cam.rx.getAngle() + mouseDeltaY);
                }
                else if (me.isAltDown() && me.isSecondaryButtonDown()) {
                    double scale = cam.s.getX();
                    double newScale = scale + mouseDeltaX*0.01;
                    cam.s.setX(newScale); cam.s.setY(newScale);
cam.s.setZ(newScale);
                }
                else if (me.isAltDown() && me.isMiddleButtonDown()) {
                    cam.t.setX(cam.t.getX() + mouseDeltaX);
                    cam.t.setY(cam.t.getY() + mouseDeltaY);
                }
            }
        });
```

Note that the pivot point and the angle define the destination point the image is moved to. Carefully calculate values when specifying the pivot point. Otherwise, the image might appear where it is not intended to be. For more information, see the API documentation.

Scaling

The scaling transformation causes a node to either appear larger or smaller, depending on the scaling factor. Scaling changes the node so that the dimensions along its axes are multiplied by the scale factor. Similar to the rotation transformations, scaling transformations are applied at a pivot point. This pivot point is considered the point around which scaling occurs.

To scale, use the `Scale` class and the `scale` method of the `Transform` class.

In the Xylophone application, you can scale the xylophone using the mouse while pressing Alt and the right mouse button. The scale transformation is used to see the scaling.

Example 2–3 shows the code for the scale transformation.

Example 2–3 Scaling

```
      else if (me.isAltDown() && me.isSecondaryButtonDown()) {
          double scale = cam.s.getX();
          double newScale = scale + mouseDeltaX*0.01;
          cam.s.setX(newScale); cam.s.setY(newScale); cam.s.setZ(newScale);
                }
...
```

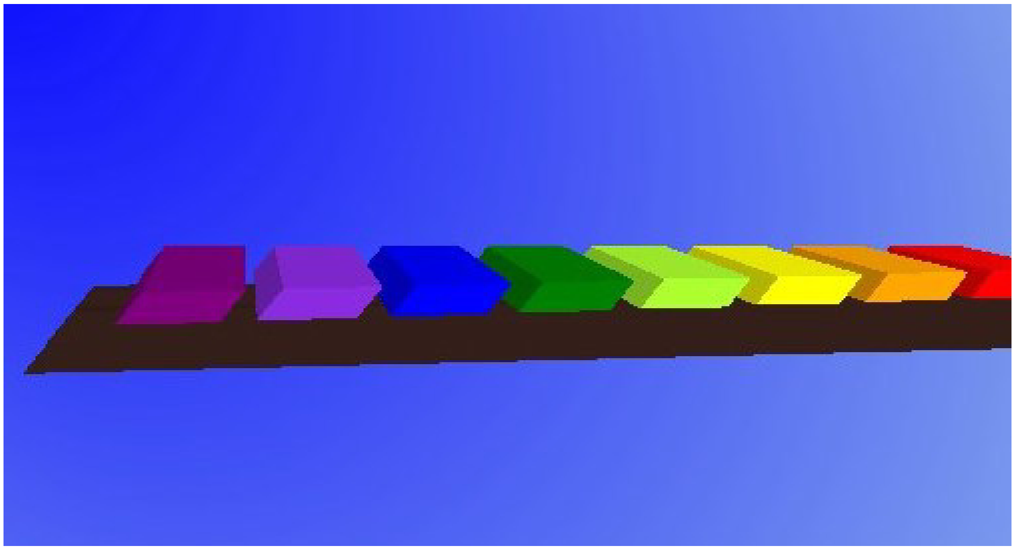
Shearing

A shearing transformation rotates one axis so that the x-axis and y-axis are no longer perpendicular. The coordinates of the node are shifted by the specified multipliers.

To shear, use the `Shear` class or the `shear` method of the `Transform` class.

In the Xylophone application, you can shear the xylophone by dragging the mouse while holding Shift and pressing the left mouse button.

Figure 2–1 Shearing Transformation



Example 2–4 shows the code snippet for the shear transformation.

Example 2–4 Shearing

```
else if (me.isShiftDown() && me.isPrimaryButtonDown()) {
    double yShear = shear.getY();
    shear.setY(yShear + mouseDeltaY/1000.0);
    double xShear = shear.getX();
    shear.setX(xShear + mouseDeltaX/1000.0);
}
```

Multiple Transformations

You can construct multiple transformations by specifying an ordered chain of transformations. For example, you can scale an object and then apply a shearing transformation to it, or you can translate an object and then scale it.

Example 2–5 shows multiple transformations applied to an object to create a xylophone bar.

Example 2–5 Multiple Transformations

```
Cube base1Cube = new Cube(1.0, new Color(0.2, 0.12, 0.1, 1.0), 1.0);
base1Cube.setTranslateX(xStart + 135);
base1Cube.setTranslateZ(yPos+20.0);
base1Cube.setTranslateY(11.0);
base1Cube.setScaleX(barWidth*11.5);
base1Cube.setScaleZ(10.0);
base1Cube.setScaleY(barDepth*2.0);
```

Application Files

Source Code

- `Xylophone.java`

NetBeans Projects

- transformations.zip

Part II

Creating Transitions and Timeline Animations

This tutorial contains information that you can use to create animation in JavaFX and contains the following chapters.

Animation Basics provides basic animation concepts and contains the following parts:

- Transitions
- Timeline Animation
- Interpolators

The Tree Animation Example chapter contains a description of the Tree Animation sample and provides some tips and tricks about animation in JavaFX.

3

Animation Basics

Animation in JavaFX can be divided into timeline animation and transitions. This chapter provides examples of each animation type.

`Timeline` and `Transition` are subclasses of the `javafx.animation.Animation` class. For more information about particular classes, methods, or additional features, see the API documentation.

Transitions

Transitions in JavaFX provide the means to incorporate animations in an internal timeline. Transitions can be composed to create multiple animations that are executed in parallel or sequentially. See the Parallel Transition and Sequential Transition sections for details. The following sections provide some transition animation examples.

Fade Transition

A fade transition changes the opacity of a node over a given time.

Example 3–1 shows a code snippet for a fade transition that is applied to a rectangle. First a rectangle with rounded corners is created, and then a fade transition is applied to it.

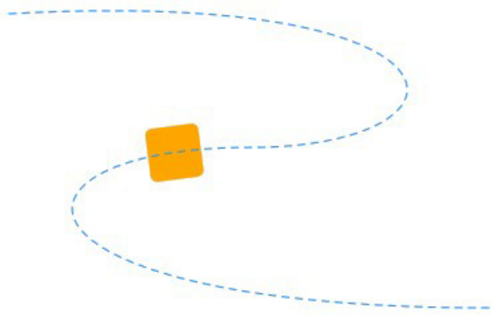
Example 3–1 Fade Transition

```
final Rectangle rect1 = new Rectangle(10, 10, 100, 100);
rect1.setArcHeight(20);
rect1.setArcWidth(20);
rect1.setFill(Color.RED);
...
FadeTransition ft = new FadeTransition(Duration.millis(3000), rect1);
ft.setFromValue(1.0);
ft.setToValue(0.1);
ft.setCycleCount(Timeline.INDEFINITE);
ft.setAutoReverse(true);
ft.play();
```

Path Transition

A path transition moves a node along a path from one end to the other over a given time.

Figure 3–1 Path Transition



Example 3–2 shows a code snippet for a path transition that is applied to a rectangle. The animation is reversed when the rectangle reaches the end of the path. In code, first a rectangle with rounded corners is created, and then a new path animation is created and applied to the rectangle.

Example 3–2 Path Transition

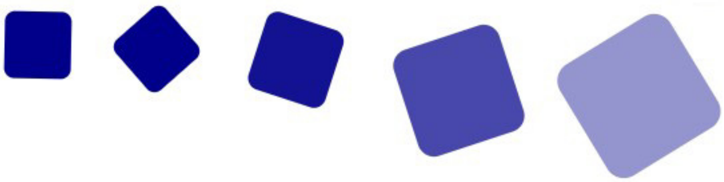
```
final Rectangle rectPath = new Rectangle (0, 0, 40, 40);
rectPath.setArcHeight(10);
rectPath.setArcWidth(10);
rectPath.setFill(Color.ORANGE);
...
Path path = new Path();
path.getElements().add(new MoveTo(20,20));
path.getElements().add(new CubicCurveTo(380, 0, 380, 120, 200, 120));
path.getElements().add(new CubicCurveTo(0, 120, 0, 240, 380, 240));
PathTransition pathTransition = new PathTransition();
pathTransition.setDuration(Duration.millis(4000));
pathTransition.setPath(path);
pathTransition.setNode(rectPath);
pathTransition.setOrientation(PathTransition.OrientationType.ORTHOGONAL_TO_
TANGENT);
pathTransition.setCycleCount(Timeline.INDEFINITE);
pathTransition.setAutoReverse(true);
pathTransition.play();
```

Parallel Transition

A parallel transition executes several transitions simultaneously.

Example 3–3 shows the code snippet for the parallel transition that executes fade, translate, rotate, and scale transitions applied to a rectangle.

Figure 3–2 Parallel Transition



Example 3–3 Parallel Transition

```
Rectangle rectParallel = new Rectangle(10,200,50, 50);
```

```
rectParallel.setArcHeight(15);
rectParallel.setArcWidth(15);
rectParallel.setFill(Color.DARKBLUE);
rectParallel.setTranslateX(50);
rectParallel.setTranslateY(75);
...
        FadeTransition fadeTransition = 
            new FadeTransition(Duration.millis(3000), rectParallel);
        fadeTransition.setFromValue(1.0f);
        fadeTransition.setToValue(0.3f);
        fadeTransition.setCycleCount(2);
        fadeTransition.setAutoReverse(true);
        TranslateTransition translateTransition =
            new TranslateTransition(Duration.millis(2000), rectParallel);
        translateTransition.setFromX(50);
        translateTransition.setToX(350);
        translateTransition.setCycleCount(2);
        translateTransition.setAutoReverse(true);
        RotateTransition rotateTransition = 
            new RotateTransition(Duration.millis(3000), rectParallel);
        rotateTransition.setByAngle(180f);
        rotateTransition.setCycleCount(4);
        rotateTransition.setAutoReverse(true);
        ScaleTransition scaleTransition = 
            new ScaleTransition(Duration.millis(2000), rectParallel);
        scaleTransition.setToX(2f);
        scaleTransition.setToY(2f);
        scaleTransition.setCycleCount(2);
        scaleTransition.setAutoReverse(true);

        parallelTransition = new ParallelTransition();
        parallelTransition.getChildren().addAll(
                fadeTransition,
                translateTransition,
                rotateTransition,
                scaleTransition
        );
        parallelTransition.setCycleCount(Timeline.INDEFINITE);
        parallelTransition.play();
```

Sequential Transition

A sequential transition executes several transitions one after another.

Example 3–4 shows the code for the sequential transition that executes one after another. Fade, translate, rotate, and scale transitions that are applied to a rectangle.

Example 3–4 Sequential Transition

```
Rectangle rectSeq = new Rectangle(25,25,50,50);
rectSeq.setArcHeight(15);
rectSeq.setArcWidth(15);
rectSeq.setFill(Color.CRIMSON);
rectSeq.setTranslateX(50);
rectSeq.setTranslateY(50);

...

         FadeTransition fadeTransition = 
            new FadeTransition(Duration.millis(1000), rectSeq);
```

```
        fadeTransition.setFromValue(1.0f);
        fadeTransition.setToValue(0.3f);
        fadeTransition.setCycleCount(1);
        fadeTransition.setAutoReverse(true);

        TranslateTransition translateTransition =
            new TranslateTransition(Duration.millis(2000), rectSeq);
        translateTransition.setFromX(50);
        translateTransition.setToX(375);
        translateTransition.setCycleCount(1);
        translateTransition.setAutoReverse(true);

        RotateTransition rotateTransition =
            new RotateTransition(Duration.millis(2000), rectSeq);
        rotateTransition.setByAngle(180f);
        rotateTransition.setCycleCount(4);
        rotateTransition.setAutoReverse(true);

        ScaleTransition scaleTransition =
            new ScaleTransition(Duration.millis(2000), rectSeq);
        scaleTransition.setFromX(1);
        scaleTransition.setFromY(1);
        scaleTransition.setToX(2);
        scaleTransition.setToY(2);
        scaleTransition.setCycleCount(1);
        scaleTransition.setAutoReverse(true);

sequentialTransition = new SequentialTransition();
sequentialTransition.getChildren().addAll(
        fadeTransition,
        translateTransition,
        rotateTransition,
        scaleTransition);
sequentialTransition.setCycleCount(Timeline.INDEFINITE);
sequentialTransition.setAutoReverse(true);

sequentialTransition.play();
```

For more information about animation and transitions, see the API documentation and the Animation section in the Ensemble project in the SDK.

Timeline Animation

An animation is driven by its associated properties, such as size, location, and color etc. `Timeline` provides the capability to update the property values along the progression of time. JavaFX supports key frame animation. In key frame animation, the animated state transitions of the graphical scene are declared by start and end snapshots (key frames) of the state of the scene at certain times. The system can automatically perform the animation. It can stop, pause, resume, reverse, or repeat movement when requested.

Basic Timeline Animation

The code in Example 3–5 animates a rectangle horizontally and moves it from its original position `X=100` to `X=300` in 500 ms. To animate an object horizontally, alter the x-coordinates and leave the y-coordinates unchanged.

Figure 3–3 Horizontal Movement

Example 3–5 shows the code snippet for the basic timeline animation.

Example 3–5 Timeline Animation

```
final Rectangle rectBasicTimeline = new Rectangle(100, 50, 100, 50);
rectBasicTimeline.setFill(Color.RED);
...
final Timeline timeline = new Timeline();
timeline.setCycleCount(Timeline.INDEFINITE);
timeline.setAutoReverse(true);
final KeyValue kv = new KeyValue(rectBasicTimeline.xProperty(), 300);
final KeyFrame kf = new KeyFrame(Duration.millis(500), kv);
timeline.getKeyFrames().add(kf);
timeline.play();
```

Timeline Events

JavaFX provides the means to incorporate events that can be triggered during the timeline play. The code in Example 3–6 changes the radius of the circle in the specified range, and `KeyFrame` triggers the random transition of the circle in the x-coordinate of the scene.

Example 3–6 Timeline Events

```
import javafx.application.Application;
import javafx.stage.Stage;
import javafx.animation.AnimationTimer;
import javafx.animation.KeyFrame;
import javafx.animation.KeyValue;
import javafx.animation.Timeline;
import javafx.event.ActionEvent;
import javafx.event.EventHandler;
import javafx.scene.Group;
import javafx.scene.Scene;
import javafx.scene.effect.Lighting;
import javafx.scene.layout.StackPane;
import javafx.scene.paint.Color;
import javafx.scene.shape.Circle;
import javafx.scene.text.Text;
import javafx.util.Duration;

public class TimelineEvents extends Application {

    //main timeline
    private Timeline timeline;
    private AnimationTimer timer;

    //variable for storing actual frame
    private Integer i=0;
```

```
    @Override public void start(Stage stage) {
        Group p = new Group();
        Scene scene = new Scene(p);
        stage.setScene(scene);
        stage.setWidth(500);
        stage.setHeight(500);
        p.setTranslateX(80);
        p.setTranslateY(80);

        //create a circle with effect
        final Circle circle = new Circle(20,  Color.rgb(156,216,255));
        circle.setEffect(new Lighting());
        //create a text inside a circle
        final Text text = new Text (i.toString());
        text.setStroke(Color.BLACK);
        //create a layout for circle with text inside
        final StackPane stack = new StackPane();
        stack.getChildren().addAll(circle, text);
        stack.setLayoutX(30);
        stack.setLayoutY(30);

        p.getChildren().add(stack);
        stage.show();

        //create a timeline for moving the circle
        timeline = new Timeline();
        timeline.setCycleCount(Timeline.INDEFINITE);
        timeline.setAutoReverse(true);

//You can add a specific action when each frame is started.
        timer = new AnimationTimer() {
            @Override
            public void handle(long l) {
                text.setText(i.toString());
                i++;
            }

        };

        //create a keyValue with factory: scaling the circle 2times
        KeyValue keyValueX = new KeyValue(stack.scaleXProperty(), 2);
        KeyValue keyValueY = new KeyValue(stack.scaleYProperty(), 2);

        //create a keyFrame, the keyValue is reached at time 2s
        Duration duration = Duration.millis(2000);
        //one can add a specific action when the keyframe is reached
        EventHandler onFinished = new EventHandler<ActionEvent>() {
            public void handle(ActionEvent t) {
                 stack.setTranslateX(java.lang.Math.random()*200-100);
                 //reset counter
                 i = 0;
            }
        };

  KeyFrame keyFrame = new KeyFrame(duration, onFinished , keyValueX, keyValueY);

        //add the keyframe to the timeline
        timeline.getKeyFrames().add(keyFrame);

        timeline.play();
```

```
        timer.start();
    }


    public static void main(String[] args) {
        Application.launch(args);
    }
}
```

Interpolators

Interpolation defines positions of the object between the start and end points of the movement. You can use various built-in implementations of the Interpolator class or you can implement your own Interpolator to achieve custom interpolation behavior.

Built-in Interpolators

JavaFX provides several built-in interpolators that you can use to create different effects in your animation. By default, JavaFX uses linear interpolation to calculate the coordinates.

Example 3–7 shows a code snippet where the EASE_BOTH interpolator instance is added to the KeyValue in the basic timeline animation. This interpolator creates a spring effect when the object reaches its start point and its end point.

Example 3–7 Built-in Interpolator

```
final Rectangle rectBasicTimeline = new Rectangle(100, 50, 100, 50);
rectBasicTimeline.setFill(Color.BROWN);
...
final Timeline timeline = new Timeline();
timeline.setCycleCount(Timeline.INDEFINITE);
timeline.setAutoReverse(true);
final KeyValue kv = new KeyValue(rectBasicTimeline.xProperty(), 300,
 Interpolator.EASE_BOTH);
final KeyFrame kf = new KeyFrame(Duration.millis(500), kv);
timeline.getKeyFrames().add(kf);
timeline.play();
```

Custom Interpolators

Apart from built-in interpolators, you can implement your own interpolator to achieve custom interpolation behavior. A custom interpolator example consists of two java files. Example 3–8 shows a custom interpolator that is used to calculate the y-coordinate for the animation. Example 3–9 shows the code snippet of the animation where the AnimationBooleanInterpolator is used.

Example 3–8 Custom Interpolator

```
public class AnimationBooleanInterpolator extends Interpolator {
    @Override
    protected double curve(double t) {
        return Math.abs(0.5-t)*2 ;
    }
}
```

Example 3–9 Animation with Custom Interpolator

```
final KeyValue keyValue1 = new KeyValue(rect.xProperty(), 300);
AnimationBooleanInterpolator yInterp = new AnimationBooleanInterpolator();
final KeyValue keyValue2 = new KeyValue(rect.yProperty(), 0., yInterp);
```

Application Files

NetBeans Projects

- `animations.zip`

4

Tree Animation Example

This chapter provides details about the Tree Animation example. You will learn how all the elements on the scene were created and animated.

Figure 4–1 shows the scene with a tree.

Figure 4–1 Tree Animation

Project and Elements

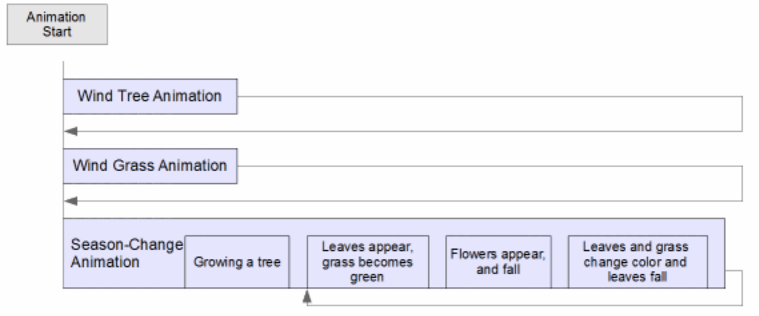
The Tree Animation project consists of several files. Each element, like leaves, grass blades, and others are created in separate classes. The `TreeGenerator` class creates a tree from all the elements. The `Animator` class contains all animation except grass animation that resides in the `GrassWindAnimation` class.

The scene in the example contains the following elements:

- Tree with branches, leaves, and flowers
- Grass

Each element is animated in its own fashion. Some animations run in parallel, and others run sequentially. The tree-growing animation is run only once, whereas the season-change animation is set to run infinitely.

Figure 4–2 Animation Timeline



The season-change animation includes the following parts:

- Leaves and flowers appear on the tree
- Flower petals fall and disappear
- Leaves and grass change color
- Leaves fall to the ground and disappear

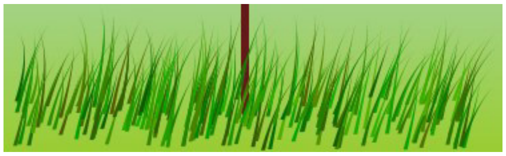
Grass

This section describes how the grass is created and animated.

Creating Grass

In the Tree Animation example, the grass, shown in Figure 4–3 consists of separate grass blades, each of which is created using `Path` and added to the list. Each blade is then curved and colored. An algorithm is used to randomize the height, curve, and color of the blades, and to distribute the blades on the "ground." You can specify the number of blades and the size of the "ground" covered with grass.

Figure 4–3 Grass



Example 4–1 Creating a Grass Blade

```
public class Blade extends Path {

    public final Color SPRING_COLOR = Color.color(random() * 0.5, random() * 0.5
 + 0.5, 0.).darker();
    public final Color AUTUMN_COLOR = Color.color(random() * 0.4 + 0.3, random()
 * 0.1 + 0.4, random() * 0.2);
    private final static double width = 3;
    private double x = RandomUtil.getRandom(170);
    private double y = RandomUtil.getRandom(20) + 20;
    private double h = (50 * 1.5 - y / 2) * RandomUtil.getRandom(0.3);
    public SimpleDoubleProperty phase = new SimpleDoubleProperty();

    public Blade() {
```

```
        getElements().add(new MoveTo(0, 0));
        final QuadCurveTo curve1;
        final QuadCurveTo curve2;
        getElements().add(curve1 = new QuadCurveTo(-10, h, h / 4, h));
        getElements().add(curve2 = new QuadCurveTo(-10, h, width, 0));

        setFill(AUTUMN_COLOR); //autumn color of blade
        setStroke(null);

        getTransforms().addAll(Transform.translate(x, y));

        curve1.yProperty().bind(new DoubleBinding() {

            {
                super.bind(curve1.xProperty());
            }

            @Override
            protected double computeValue() {

                final double xx0 = curve1.xProperty().get();
                return Math.sqrt(h * h - xx0 * xx0);
            }
        }); //path of top of blade is circle

        //code to bend blade
        curve1.controlYProperty().bind(curve1.yProperty().add(-h / 4));
        curve2.controlYProperty().bind(curve1.yProperty().add(-h / 4));

        curve1.xProperty().bind(new DoubleBinding() {

            final double rand = RandomUtil.getRandom(PI / 4);

            {
                super.bind(phase);
            }

            @Override
            protected double computeValue() {
                return (h / 4) + ((cos(phase.get() + (x + 400.) * PI / 1600 +
rand) + 1) / 2.) * (-3. / 4) * h;
            }
        });
    }
}
```

Creating Timeline Animation for Grass Movement

Timeline animation that changes the x-coordinate of the top of the blade is used to create grass movement.

Several algorithms are used to make the movement look natural. For example, the top of each blade is moved in a circle instead of a straight line, and side curve of the blade make the blade look as if it bends under the wind. Random numbers are added to separate each blade movement.

Example 4–2 Grass Animation

```
class GrassWindAnimation extends Transition {
```

```
    final private Duration animationTime = Duration.seconds(3);
    final private DoubleProperty phase = new SimpleDoubleProperty(0);
    final private Timeline tl = new Timeline(Animation.INDEFINITE);

    public GrassWindAnimation(List<Blade> blades) {

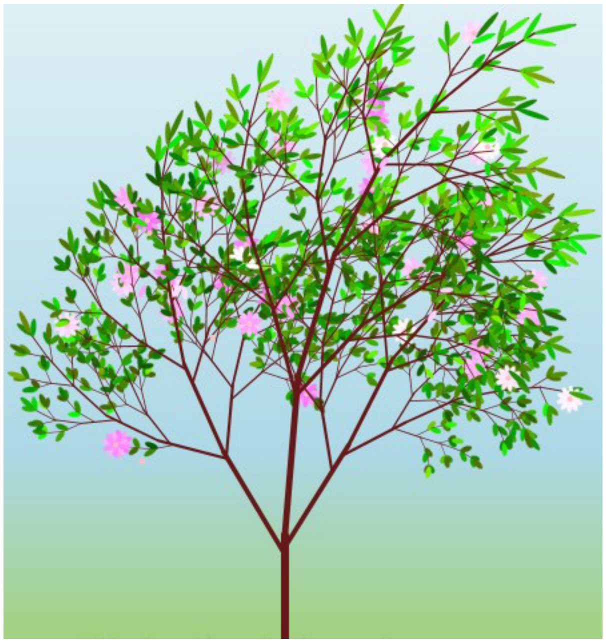
        setCycleCount(Animation.INDEFINITE);
        setInterpolator(Interpolator.LINEAR);
        setCycleDuration(animationTime);
        for (Blade blade : blades) {
            blade.phase.bind(phase);
        }
    }

    @Override
    protected void interpolate(double frac) {
        phase.set(frac * 2 * PI);
    }
}
```

Tree

This section explains how the tree shown in Figure 4–4 is created and animated.

Figure 4–4 Tree



Branches

The tree consists of branches, leaves, and flowers. Leaves and flowers are drawn on the top branches of the tree. Each branch generation consists of three branches (one top and two side branches) drawn from a parent branch. You can specify the number of generations in the code using the `NUMBER_OF_BRANCH_GENERATIONS` passed in the constructor of TreeGenerator in the Main class. Example 4–3 shows the code in the TreeGenerator class that creates the trunk of the tree (or the root branch) and adds three branches for the following generations.

Example 4–3 Root Branch

```
private List<Branch> generateBranches(Branch parentBranch, int depth) {
    List<Branch> branches = new ArrayList<>();
    if (parentBranch == null) { // add root branch
        branches.add(new Branch());
    } else {
        if (parentBranch.length < 10) {
            return Collections.emptyList();
        }
        branches.add(new Branch(parentBranch, Type.LEFT, depth));
        branches.add(new Branch(parentBranch, Type.RIGHT, depth));
        branches.add(new Branch(parentBranch, Type.TOP, depth));
    }

    return branches;
}
```

To make the tree look more natural, each child generation branch is grown at an angle to the parent branch, and each child branch is smaller than its parent. The child angle is calculated using random values. Example 4–4 provides a code for creating child branches.

Example 4–4 Child Branches

```
   public Branch(Branch parentBranch, Type type, int depth) {
       this();
       SimpleDoubleProperty locAngle = new SimpleDoubleProperty(0);
       globalAngle.bind(locAngle.add(parentBranch.globalAngle.get()));
       double transY = 0;
       switch (type) {
           case TOP:
               transY = parentBranch.length;
               length = parentBranch.length * 0.8;
               locAngle.set(getRandom(10));
               break;
           case LEFT:
           case RIGHT:
               transY = parentBranch.length - getGaussianRandom(0,
parentBranch.length, parentBranch.length / 10, parentBranch.length / 10);
               locAngle.set(getGaussianRandom(35, 10) * (Type.LEFT == type ? 1 :
-1));
               if ((0 > globalAngle.get() || globalAngle.get() > 180) && depth <
4) {
                   length = parentBranch.length * getGaussianRandom(0.3, 0.1);
               } else {
                   length = parentBranch.length * 0.6;
               }
               break;
       }
       setTranslateY(transY);
       getTransforms().add(new Rotate(locAngle.get(), 0, 0));
       globalH = getTranslateY() * cos(PI / 2 - parentBranch.globalAngle.get() *
PI / 180) + parentBranch.globalH;
       setBranchStyle(depth);
       addChildToParent(parentBranch, this);
   }
```

Leaves and Flowers

Leaves are created on top branches. Because the leaves are created at the same time as the branches of the tree, leaves are scaled to 0 by `leaf.setScaleX(0)` and `leaf.setScaleY(0)` to hide them before the tree is grown as shown in the Example 4–5. The same trick is used to hide the leaves when they fall. To create a more natural look, leaves have slightly different shades of green. Also, the leaf color changes depending on the location of the leaf; the darker shades are applied to the leaves located below the middle of the tree crown.

Example 4–5 Leaf Shape and Placement

```
public class Leaf extends Ellipse {

    public final Color AUTUMN_COLOR;
    private final int N = 5;
    private List<Ellipse> petals = new ArrayList<>(2 * N + 1);

    public Leaf(Branch parentBranch) {
        super(0, parentBranch.length / 2., 2, parentBranch.length / 2.);
        setScaleX(0);
        setScaleY(0);

        double rand = random() * 0.5 + 0.3;
        AUTUMN_COLOR = Color.color(random() * 0.1 + 0.8, rand, rand / 2);

        Color color = new Color(random() * 0.5, random() * 0.5 + 0.5, 0, 1);
        if (parentBranch.globalH < 400 && random() < 0.8) { //bottom leaf is
darker
            color = color.darker();
        }
        setFill(color);
    }
}
```

Flowers are created in the Flower class and then added to the top branches of the tree in the TreeGenerator class. You can specify the number of petals in a flower. Petals are ellipses distributed in a circle with some overlapping. Similar to grass and leaves, the flower petals are colored in different shades of pink.

Animating Tree Elements

This section explains techniques employed in the Tree Animation example to animate the tree and season change. Parallel transition is used to start all the animations in the scene as shown in Example 4–6.

Example 4–6 Main Animation

```
final Transition all = new ParallelTransition(new GrassWindAnimation(grass),
treeWindAnimation, new SequentialTransition(branchGrowingAnimation,
seasonsAnimation(tree, grass)));
        all.play();
```

Growing a Tree

Tree growing animation is run only once, at the beginning of the Tree Animation example. The application starts a sequential transition animation to grow branches one generation after another as shown in Example 4–7. Initially length is set to 0. The root branch size and angle are specified in the `TreeGenerator` class. Currently each generation is grown during two seconds.

Example 4–7 Sequential Transition to Start Branch Growing Animation

```
SequentialTransition branchGrowingAnimation = new SequentialTransition();
```

The code in Example 4–8 creates the Tree growing animation:

Example 4–8 Branch Growing Animation

```
    private Animation animateBranchGrowing(List<Branch> branchGeneration) {

        ParallelTransition sameDepthBranchAnimation = new ParallelTransition();
        for (final Branch branch : branchGeneration) {
            Timeline branchGrowingAnimation = new Timeline(new KeyFrame(duration,
 new KeyValue(branch.base.endYProperty(), branch.length)));
            PauseTransition pauseTransition = new PauseTransition();
            pauseTransition.setOnFinished(t ->
branch.base.setStrokeWidth(branch.length / 25));
            sameDepthBranchAnimation.getChildren().add(
                    new SequentialTransition(
                            pauseTransition,
                            branchGrowingAnimation));
        }
        return sameDepthBranchAnimation;

    }
```

Because all the branch lines are calculated and created simultaneously, they could appear on the scene as dots. The code introduces a few tricks to hide the lines before they grow. In Example the code `duration.one millisecond` pauses transition for an unnoticeable time. In the Example 4–9, the `base.setStrokeWidth(0)` code sets branches width to 0 before the grow animation starts for each generation.

Example 4–9 Tree Growing Animation Optimization

```
    private void setBranchStyle(int depth) {
        base.setStroke(Color.color(0.4, 0.1, 0.1, 1));

        if (depth < 5) {
            base.setStrokeLineJoin(StrokeLineJoin.ROUND);
            base.setStrokeLineCap(StrokeLineCap.ROUND);
        }
        base.setStrokeWidth(0);
    }
}
```

Creating Tree Crown Movement

In parallel with growing a tree, wind animation starts. Tree branches, leaves, and flowers are moving together.

Tree wind animation is similar to grass movement animation, but it is simpler because only the angle of the branches changes. To make the tree movement look natural, the bend angle is different for different branch generations. The higher the generation of the branch (that is the smaller the branch), the more it bends. Example 4–10 provides code for wind animation.

Example 4–10 Wind Animation

```
private Animation animateTreeWind(List<Branch> branchGeneration, int depth) {
    ParallelTransition wind = new ParallelTransition();
    for (final Branch brunch : branchGeneration) {
        final Rotate rotation = new Rotate(0);
        brunch.getTransforms().add(rotation);
```

```
        Timeline windTimeline = new Timeline(new KeyFrame(WIND_CYCLE_DURATION,
new KeyValue(rotation.angleProperty(), depth * 2)));
        windTimeline.setAutoReverse(true);
        windTimeline.setCycleCount(Animation.INDEFINITE);
        wind.getChildren().add(windTimeline);
    }
        return wind;
}
```

Animating Season Change

Season-change animation actually starts after the tree has grown, and runs infinitely. The code in Example 4–11 calls all the season animations:

Example 4–11 Starting Season Animation

```
private Transition seasonsAnimation(final Tree tree, final List<Blade> grass) {

        Transition spring = animateSpring(tree.leafage, grass);
        Transition flowers = animateFlowers(tree.flowers);
        Transition autumn = animateAutumn(tree.leafage, grass);

        SequentialTransition sequentialTransition = new
SequentialTransition(spring, flowers, autumn);
        return sequentialTransition;
    }

    private Transition animateSpring(List<Leaf> leafage, List<Blade> grass) {
        ParallelTransition springAnimation = new ParallelTransition();
        for (final Blade blade : grass) {
springAnimation.getChildren().add(new FillTransition(GRASS_BECOME_GREEN_DURATION,
blade,
        (Color) blade.getFill(), blade.SPRING_COLOR));
        }
        for (Leaf leaf : leafage) {
            ScaleTransition leafageAppear = new ScaleTransition(LEAF_APPEARING_
DURATION, leaf);
            leafageAppear.setToX(1);
            leafageAppear.setToY(1);
            springAnimation.getChildren().add(leafageAppear);
        }
        return springAnimation;
    }
```

Once all the tree branches are grown, leaves start to appear as directed in Example 4–12.

Example 4–12 Parallel Transition to Start Spring Animation and Show Leaves

```
private Transition animateSpring(List<Leaf> leafage, List<Blade> grass) {
    ParallelTransition springAnimation = new ParallelTransition();
    for (final Blade blade : grass) {
        springAnimation.getChildren().add(new FillTransition(GRASS_BECOME_GREEN_
DURATION, blade,
                (Color) blade.getFill(), blade.SPRING_COLOR));
    }
    for (Leaf leaf : leafage) {
        ScaleTransition leafageAppear = new ScaleTransition(LEAF_APPEARING_
DURATION, leaf);
        leafageAppear.setToX(1);
```

```
        leafageAppear.setToY(1);
        springAnimation.getChildren().add(leafageAppear);
        }
    return springAnimation;
    }
```

When all leaves are visible, flowers start to appear as shown in Example 4–13. The sequential transition is used to show flowers gradually. The delay in flower appearance is set in the sequential transition code of Example 4–13. Flowers appear only in the tree crown.

Example 4–13 Showing Flowers

```
    private Transition animateFlowers(List<Flower> flowers) {

        ParallelTransition flowersAppearAndFallDown = new ParallelTransition();

        for (int i = 0; i < flowers.size(); i++) {
            final Flower flower = flowers.get(i);
            for (Ellipse pental : flower.getPetals()) {

                FadeTransition flowerAppear = new FadeTransition(FLOWER_APPEARING_
DURATION, petal);
                flowerAppear.setToValue(1);
                flowerAppear.setDelay(FLOWER_APPEARING_
DURATION.divide(3).multiply(i + 1));
                flowersAppearAndFallDown.getChildren().add(new
SequentialTransition(new SequentialTransition(
                       flowerAppear,
                       fakeFallDownAnimation(petal))));
        }
    }
    return flowersAppearAndFallDown;
}
```

Once all the flowers appear on the screen, their petals start to fall. In the code in Example 4–14 the flowers are duplicated and the first set of them is hidden to show it later.

Example 4–14 Duplicating Petals

```
    private Ellipse copyEllipse(Ellipse petalOld, Color color) {
        Ellipse ellipse = new Ellipse();
        ellipse.setRadiusX(petalOld.getRadiusX());
        ellipse.setRadiusY(petalOld.getRadiusY());
        if (color == null) {
            ellipse.setFill(petalOld.getFill());
        } else {
            ellipse.setFill(color);
        }
        ellipse.setRotate(petalOld.getRotate());
        ellipse.setOpacity(0);
        return ellipse;
    }
```

Copied flower petals start to fall to the ground one by one as shown in Example 4–15. The petals disappear after five seconds on the ground. The fall trajectory of a petal is not a straight line, but rather a calculated sine curve, so that petals seem to be whirling as they fall.

Example 4–15 Shedding Flowers

```
Animation fakeLeafageDown = fakeFallDownEllipseAnimation(leaf, leaf.AUTUMN_COLOR,
```

```
node -> {
    node.setScaleX(0);
    node.setScaleY(0);
});
```

The next season change starts when all the flowers disappear from the scene. The leaves and grass become yellow, and the leaves fall and disappear. The same algorithm used in Example 4–15 to make the flower petals fall is used to show falling leaves. The code in Example 4–16 enables autumn animation.

Example 4–16 Animating Autumn Changes

```
private Transition animateAutumn(List<Leaf> leafage, List<Blade> grass) {
    ParallelTransition autumn = new ParallelTransition();

    ParallelTransition yellowLeafage = new ParallelTransition();
    ParallelTransition dissappearLeafage = new ParallelTransition();

    for (final Leaf leaf : leafage) {

    final FillTransition toYellow =
new FillTransition(LEAF_BECOME_YELLOW_DURATION, leaf, null, leaf.AUTUMN_COLOR);

    Animation fakeLeafageDown = fakeFallDownEllipseAnimation(leaf,
leaf.AUTUMN_COLOR,node -> {
        node.setScaleX(0);
        node.setScaleY(0);
    });
    dissappearLeafage.getChildren().add(fakeLeafageDown);
    }

    ParallelTransition grassBecomeYellowAnimation = new ParallelTransition();
    for (final Blade blade : grass) {
        final FillTransition toYellow =new
FillTransition(GRASS_BECOME_YELLOW_DURATION, blade, (Color) blade.getFill(),
blade.AUTUMN_COLOR);
        toYellow.setDelay(Duration.seconds(1 * random()));
        grassBecomeYellowAnimation.getChildren().add(toYellow);
        }

        autumn.getChildren().addAll(grassBecomeYellowAnimation, new
 SequentialTransition(yellowLeafage, dissappearLeafage));
        return autumn;
}
```

After all leaves disappear from the ground, spring animation starts by coloring grass in green and showing leaves.

Application Files

NetBeans Projects

- `tree_animation.zip`

Part III

Creating Visual Effects

This tutorial contains the following topics:

5

Applying Effects

This tutorial describes how to use visual effects to enhance the look of your JavaFX application.

All effects are located in the `javafx.scene.effect` package and are subclasses of the `Effect` class. For more information about particular classes, methods, or additional features, see the API documentation.

Blend Effect

Blend is an effect that combines two inputs together using one of the predefined blending modes.

In the case of a node blending (`node.setBlendMode()`), the two inputs are:

- The node being rendered (a top input)
- Everything underneath the node (a bottom input)

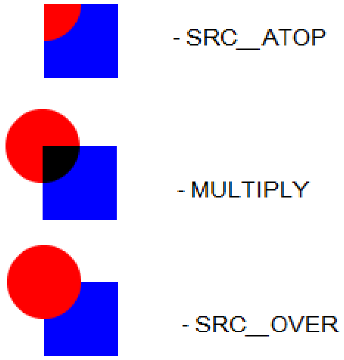
The determination of the bottom input is based on the following rules:

- All lower Z-order siblings in the same group are included.
- If the group has a defined blend mode, then the process stops, and the bottom input is defined.
- If the group has the default blend mode, then everything underneath the group is included, recursively using this same rule.
- If the process recursively gets back to the root node, then the background paint of the scene is included.

> **Note:** If the background paint of the scene, which is usually an opaque color, is included in the bottom input, then the `SRC_ATOP` mode renders on a completely opaque bottom source and has no effect. In this case, the `SRC_ATOP` mode is equivalent to `SRC_OVER`.

A blending mode defines the manner in which the objects are mixed together. For example, in Figure 5–1, you can see examples of some blending modes applied to a circle that is grouped with a square.

Figure 5–1 Different Blending Modes



Example 5–1 shows a code snippet for the blend effect in the sample application.

Example 5–1 Blend Effect

```
static Node blendMode() {
    Rectangle r = new Rectangle();
    r.setX(590);
    r.setY(50);
    r.setWidth(50);
    r.setHeight(50);
    r.setFill(Color.BLUE);

    Circle c = new Circle();
    c.setFill(Color.RED);
    c.setCenterX(590);
    c.setCenterY(50);
    c.setRadius(25);
    c.setBlendMode(BlendMode.SRC_ATOP);

    Group g = new Group();
    g.setBlendMode(BlendMode.SRC_OVER);
    g.getChildren().add(r);
    g.getChildren().add(c);
    return g;
}
```

Bloom Effect

The bloom effect makes brighter portions an image appear to glow, based on a configurable threshold. The threshold varies from 0.0 to 1.0. By default, the threshold is set to 0.3.

Figure 5–2 shows the bloom effect at the default threshold and at a threshold of 1.0.

Figure 5–2 Bloom Effect

Example 5–2 shows a code snippet from the sample application that is using the bloom effect.

Example 5–2 Bloom Example

```
static Node bloom() {
    Group g = new Group();

    Rectangle r = new Rectangle();
    r.setX(10);
    r.setY(10);
    r.setWidth(160);
    r.setHeight(80);
    r.setFill(Color.DARKBLUE);

    Text t = new Text();
    t.setText("Bloom!");
    t.setFill(Color.YELLOW);
    t.setFont(Font.font("null", FontWeight.BOLD, 36));
    t.setX(25);
    t.setY(65);

    g.setCache(true);
    //g.setEffect(new Bloom());
    Bloom bloom = new Bloom();
    bloom.setThreshold(1.0);
    g.setEffect(bloom);
    g.getChildren().add(r);
    g.getChildren().add(t);
    g.setTranslateX(350);
    return g;
}
```

Blur Effects

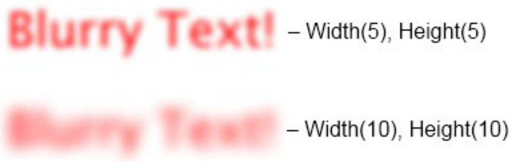
Blurring are common effects that can be used to provide more focus to selected objects. With JavaFX you can apply a boxblur, a motion blur, or a gaussian blur.

BoxBlur

The BoxBlur is a blur effect that uses a simple box filter kernel, with separately configurable sizes in both dimensions that control the amount of blur applied to an object, and an `Iterations` parameter that controls the quality of the resulting blur.

Figure 5–3 shows two samples of blurred text.

Figure 5–3 BoxBlur Effect



Example 5–3 is a code snippet that uses the BoxBlur effect.

Example 5–3 BoxBlur Example

```
static Node boxBlur() {
    Text t = new Text();
    t.setText("Blurry Text!");
    t.setFill(Color.RED);
    t.setFont(Font.font("null", FontWeight.BOLD, 36));
    t.setX(10);
    t.setY(40);

    BoxBlur bb = new BoxBlur();
    bb.setWidth(5);
    bb.setHeight(5);
    bb.setIterations(3);

    t.setEffect(bb);
    t.setTranslateX(300);
    t.setTranslateY(100);

    return t;
}
```

Motion Blur

A motion blur effect uses a Gaussian blur, with a configurable radius and angle to create the effect of a moving object.

Figure 5–4 shows the effect of the motion blur on a text.

Figure 5–4 Motion Blur Effect

Example 5–4 shows a code snippet that creates a motion blur effect with radius set to 15 and angle set to 45 in the sample application.

Example 5–4 Motion Blur Example

```
static Node motionBlur() {
    Text t = new Text();
    t.setX(20.0f);
    t.setY(80.0f);
    t.setText("Motion Blur");
    t.setFill(Color.RED);
    t.setFont(Font.font("null", FontWeight.BOLD, 60));
```

```
        MotionBlur mb = new MotionBlur();
        mb.setRadius(15.0f);
        mb.setAngle(45.0f);

        t.setEffect(mb);

        t.setTranslateX(300);
        t.setTranslateY(150);

        return t;
    }
```

Gaussian Blur

The Gaussian blur is an effect that uses a Gaussian algorithm with a configurable radius to blur objects.

Figure 5–5 shows the effect of the Gaussian blur on a text.

Figure 5–5 Gaussian Blur

Example 5–5 shows a code snippet that blurs the text using Gaussian blur effect.

Example 5–5 Gaussian Blur

```
    static Node gaussianBlur() {
        Text t2 = new Text();
        t2.setX(10.0f);
        t2.setY(140.0f);
        t2.setCache(true);
        t2.setText("Gaussian Blur");
        t2.setFill(Color.RED);
        t2.setFont(Font.font("null", FontWeight.BOLD, 36));
        t2.setEffect(new GaussianBlur());
        return t2;
    }
```

Drop Shadow Effect

A drop shadow is an effect that renders a shadow of the content to which it is applied. You can specify the color, the radius, the offset, and some other parameters of the shadow.

Figure 5–6 shows the shadow effect on different objects.

Figure 5–6 Drop Shadow Example

Example 5–6 shows how to create a drop shadow on text and a circle.

Example 5–6 Text and Circle With Shadows

```
import javafx.collections.ObservableList;
import javafx.application.Application;
import javafx.scene.*;
import javafx.stage.*;
import javafx.scene.shape.*;
import javafx.scene.effect.*;
import javafx.scene.paint.*;
import javafx.scene.text.*;

public class HelloEffects extends Application {

    Stage stage;
    Scene scene;

    @Override
    public void start(Stage stage) {
        stage.show();

        scene = new Scene(new Group(), 840, 680);
        ObservableList<Node> content = ((Group)scene.getRoot()).getChildren();

        content.add(dropShadow());
        stage.setScene(scene);
    }

    static Node dropShadow() {
        Group g = new Group();

        DropShadow ds = new DropShadow();
        ds.setOffsetY(3.0);
        ds.setOffsetX(3.0);
        ds.setColor(Color.GRAY);

        Text t = new Text();
        t.setEffect(ds);
        t.setCache(true);
        t.setX(20.0f);
        t.setY(70.0f);
        t.setFill(Color.RED);
        t.setText("JavaFX drop shadow effect");
        t.setFont(Font.font("null", FontWeight.BOLD, 32));

        DropShadow ds1 = new DropShadow();
        ds1.setOffsetY(4.0f);
        ds1.setOffsetX(4.0f);
        ds1.setColor(Color.CORAL);

        Circle c = new Circle();
        c.setEffect(ds1);
        c.setCenterX(50.0f);
        c.setCenterY(325.0f);
        c.setRadius(30.0f);
        c.setFill(Color.RED);
        c.setCache(true);

        g.getChildren().add(t);
```

```
        g.getChildren().add(c);
        return g;
    }
    public static void main(String[] args) {
        Application.launch(args);
    }
}
```

Tip:

- Making the drop shadow too wide gives the element the look of heaviness. The color of the shadow should be realistic, usually a few shades lighter than the background color.
- If you have multiple objects with drop shadows, orient the drop shadow the same for all of the objects. A drop shadow gives the appearance of a light coming from one direction and casting a shadow on objects.

Inner Shadow Effect

An inner shadow is an effect that renders a shadow inside the edges of the given content with the specified color, radius, and offset.

Figure 5–7 shows plain text and the same text with the inner shadow effect applied.

Figure 5–7 Inner Shadow

Example 5–7 shows how to create an inner shadow on text.

Example 5–7 Inner Shadow

```
 static Node innerShadow() {
        InnerShadow is = new InnerShadow();
        is.setOffsetX(2.0f);
        is.setOffsetY(2.0f);

        Text t = new Text();
        t.setEffect(is);
        t.setX(20);
        t.setY(100);
        t.setText("Inner Shadow");
        t.setFill(Color.RED);
        t.setFont(Font.font("null", FontWeight.BOLD, 80));

        t.setTranslateX(300);
        t.setTranslateY(300);
```

```
        return t;
    }
```

Reflection

Reflection is an effect that renders a reflected version of the object below the actual object.

Note: The reflection of a node with a reflection effect will not respond to mouse events or the containment methods on the node.

Figure 5–8 shows a reflection applied to text. Use the `setFraction` method to specify the amount of visible reflection.

Figure 5–8 Reflection Effect

Reflection in JavaFX...

Example 5–8 shows how to create the reflection effect on text.

Example 5–8 Text With Reflection

```
import javafx.scene.text.*;
import javafx.scene.paint.*;
import javafx.scene.effect.*;
public class HelloEffects extends Application {

    Stage stage;
    Scene scene;

    @Override public void start(Stage stage) {
        stage.show();

        scene = new Scene(new Group(), 840, 680);
        ObservableList<Node> content = ((Group)scene.getRoot()).getChildren();
        content.add(reflection());
        stage.setScene(scene);
    }
    static Node reflection() {
        Text t = new Text();
        t.setX(10.0f);
        t.setY(50.0f);
        t.setCache(true);
        t.setText("Reflection in JavaFX...");
        t.setFill(Color.RED);
        t.setFont(Font.font("null", FontWeight.BOLD, 30));

        Reflection r = new Reflection();
        r.setFraction(0.9);

        t.setEffect(r);

        t.setTranslateY(400);
        return t;
```

```
    }
    public static void main(String[] args) {
        Application.launch(args);
    }
}
```

Lighting Effect

The lighting effect simulates a light source shining on the given content, which can be used to give flat objects a more realistic three-dimensional appearance.

Figure 5–9 shows the lighting effect on text.

Figure 5–9 Lighting Effect

Example 5–9 shows how to create a lighting effect on text.

Example 5–9 Text with Applied Lighting Effect

```
import javafx.application.Application;
import javafx.collections.ObservableList;
import javafx.geometry.VPos;
import javafx.scene.effect.Light.Distant;
import javafx.scene.*;
import javafx.stage.*;
import javafx.scene.shape.*;
import javafx.scene.effect.*;
import javafx.scene.paint.*;
import javafx.scene.text.*;

public class HelloEffects extends Application {
    Stage stage;
    Scene scene;

    @Override public void start(Stage stage) {
        stage.show();

        scene = new Scene(new Group());
        ObservableList<Node> content = ((Group)scene.getRoot()).getChildren();

        content.add(lighting());
        stage.setScene(scene);
    }
    static Node lighting() {
        Distant light = new Distant();
        light.setAzimuth(-135.0f);

        Lighting l = new Lighting();
        l.setLight(light);
        l.setSurfaceScale(5.0f);
```

```
        Text t = new Text();
        t.setText("JavaFX"+"\n"+"Lighting!");
        t.setFill(Color.RED);
        t.setFont(Font.font("null", FontWeight.BOLD, 70));
        t.setX(10.0f);
        t.setY(10.0f);
        t.setTextOrigin(VPos.TOP);

        t.setEffect(l);

        t.setTranslateX(0);
        t.setTranslateY(320);

        return t;
    }
    public static void main(String[] args) {
        Application.launch(args);
    }
}
```

Perspective Effect

The perspective effect creates a three-dimensional effect of otherwise two-dimensional object.

Figure 5–10 shows the perspective effect.

Figure 5–10 Perspective Effect

A perspective transformation can map any square to another square, while preserving the straightness of the lines. Unlike affine transformations, the parallelism of lines in the source is not necessarily preserved in the output.

Note: This effect does not adjust the coordinates of input events or any methods that measure containment on a node. Mouse clicking and the containment methods are undefined if a perspective effect is applied to a node.

Example 5–10 is a code snippet from the sample application that shows how to create a perspective effect.

Example 5–10 Perspective Effect

```
    static Node perspective() {
        Group g = new Group();
        PerspectiveTransform pt = new PerspectiveTransform();
        pt.setUlx(10.0f);
        pt.setUly(10.0f);
        pt.setUrx(210.0f);
        pt.setUry(40.0f);
```

```
        pt.setLrx(210.0f);
        pt.setLry(60.0f);
        pt.setLlx(10.0f);
        pt.setLly(90.0f);

        g.setEffect(pt);
        g.setCache(true);

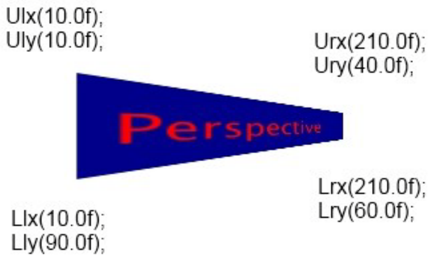
        Rectangle r = new Rectangle();
        r.setX(10.0f);
        r.setY(10.0f);
        r.setWidth(280.0f);
        r.setHeight(80.0f);
        r.setFill(Color.DARKBLUE);

        Text t = new Text();
        t.setX(20.0f);
        t.setY(65.0f);
        t.setText("Perspective");
        t.setFill(Color.RED);
        t.setFont(Font.font("null", FontWeight.BOLD, 36));

        g.getChildren().add(r);
        g.getChildren().add(t);
        return g;
    }
```

Figure 5–11 shows which coordinates affect the resulting image.

Figure 5–11 Coordinates for Perspective Effect

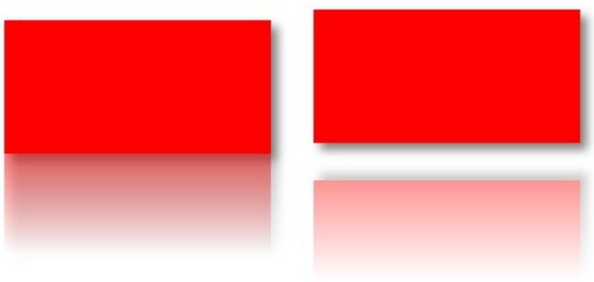


Creating a Chain of Effects

Some of the effects have an input property that you can use to create a chain of effects. The chain of effects can be a tree-like structure, because some effects have two inputs and some do not have any.

In Figure 5–12 the reflection effect is used as an input for the drop shadow effect, which means that first the rectangle is reflected by the reflection effect and then the drop shadow effect is applied to the result.

Figure 5–12 Shadow and Reflection



Example 5–11 Rectangle with a Shadow and Reflection Sequentially Applied

```
import javafx.application.Application;
import javafx.collections.ObservableList;
import javafx.scene.*;
import javafx.stage.*;
import javafx.scene.shape.*;
import javafx.scene.effect.*;
import javafx.scene.paint.*;
import javafx.scene.text.*;

public class HelloEffects extends Application {

    Stage stage;
    Scene scene;

    @Override public void start(Stage stage) {
        stage.show();

        scene = new Scene(new Group());
        ObservableList<Node> content = ((Group)scene.getRoot()).getChildren();

        content.add(chainEffects());
        stage.setScene(scene);
    }
    static Node chainEffects() {

        Rectangle rect = new Rectangle();
        rect.setFill(Color.RED);
        rect.setWidth(200);
        rect.setHeight(100);
        rect.setX(20.0f);
        rect.setY(20.0f);

        DropShadow ds = new DropShadow();
        ds.setOffsetY(5.0);
        ds.setOffsetX(5.0);
        ds.setColor(Color.GRAY);


        Reflection reflection = new Reflection();

        ds.setInput(reflection);
        rect.setEffect(ds);

        return rect;
    }
```

```
    public static void main(String[] args) {
        Application.launch(args);
    }
}
```

> **Note:** If you change the last two lines in the `chainEffects()` method to `reflection.setInput(ds);` and `rect.setEffect(reflection);`, first the drop shadow will be applied to the rectangle, and then the result will be reflected by the reflection effect.

For more information about particular classes, methods, or additional features, see the API documentation.

Application Files

NetBeans Projects

- `visual_effects.zip`

Part IV

Source Code for the Transformations, Animations, and Visual Effects Tutorial

The following table lists the demo applications in this document with their associated source code files.

Tutorial	**Source Code**	**NetBeans Project File**
Transformations Overview	`Xylophone.java`	`transformations.zip`
Animation Basics		`animations.zip`
Tree Animation Example		`tree_animation.zip`
Creating Visual Effects		`visual_effects.zip`

A

Xylophone.java

For a description, see Transformation Types and Examples.

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 * (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE
 * OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.
 */
```

Code

```
package xylophone;

import javafx.application.Application;
import javafx.event.EventHandler;
import javafx.geometry.Bounds;
import javafx.scene.DepthTest;
import javafx.scene.Group;
import javafx.scene.PerspectiveCamera;
```

```
import javafx.scene.Scene;
import javafx.scene.input.KeyCode;
import javafx.scene.input.KeyEvent;
import javafx.scene.input.MouseEvent;
import javafx.scene.media.AudioClip;
import javafx.scene.paint.Color;
import javafx.scene.paint.CycleMethod;
import javafx.scene.paint.RadialGradient;
import javafx.scene.paint.Stop;
import javafx.scene.shape.Rectangle;
import javafx.scene.transform.Rotate;
import javafx.scene.transform.Scale;
import javafx.scene.transform.Shear;
import javafx.scene.transform.Translate;
import javafx.stage.Stage;

public class Xylophone extends Application {

    double mousePosX;
    double mousePosY;
    double mouseOldX;
    double mouseOldY;
    double mouseDeltaX;
    double mouseDeltaY;

    final Cam camOffset = new Cam();
    final Cam cam = new Cam();

    final Shear shear = new Shear();

    class Cam extends Group {
        Translate t  = new Translate();
        Translate p  = new Translate();
        Translate ip = new Translate();
        Rotate rx = new Rotate();
        { rx.setAxis(Rotate.X_AXIS); }
        Rotate ry = new Rotate();
        { ry.setAxis(Rotate.Y_AXIS); }
        Rotate rz = new Rotate();
        { rz.setAxis(Rotate.Z_AXIS); }
        Scale s = new Scale();
        public Cam() { super(); getTransforms().addAll(t, p, rx, rz, ry, s, ip); }
    }

    @Override public void start(final Stage stage) {
        stage.setTitle("Xylophone");

        camOffset.getChildren().add(cam);
        resetCam();

        final Scene scene = new Scene(camOffset, 800, 600, true);
        scene.setFill(new RadialGradient(225, 0.85, 300, 300, 500, false,
                                         CycleMethod.NO_CYCLE, new Stop[]
                                         { new Stop(0f, Color.BLUE),
                                           new Stop(1f, Color.LIGHTBLUE) }));
        scene.setCamera(new PerspectiveCamera());

        final AudioClip bar1Note =
            new
AudioClip(Xylophone.class.getResource("audio/Note1.wav").toString());
```

```
        final AudioClip bar2Note =
            new
AudioClip(Xylophone.class.getResource("audio/Note2.wav").toString());
        final AudioClip bar3Note =
            new
AudioClip(Xylophone.class.getResource("audio/Note3.wav").toString());
        final AudioClip bar4Note =
            new
AudioClip(Xylophone.class.getResource("audio/Note4.wav").toString());
        final AudioClip bar5Note =
            new
AudioClip(Xylophone.class.getResource("audio/Note5.wav").toString());
        final AudioClip bar6Note =
            new
AudioClip(Xylophone.class.getResource("audio/Note6.wav").toString());
        final AudioClip bar7Note =
            new
AudioClip(Xylophone.class.getResource("audio/Note7.wav").toString());
        final AudioClip bar8Note =
            new
AudioClip(Xylophone.class.getResource("audio/Note8.wav").toString());

        Group rectangleGroup = new Group();
        rectangleGroup.getTransforms().add(shear);
        rectangleGroup.setDepthTest(DepthTest.ENABLE);

        double xStart = 260.0;
        double xOffset = 30.0;
        double yPos = 300.0;
        double zPos = 0.0;
        double barWidth = 22.0;
        double barDepth = 7.0;

        // Base1
        Cube base1Cube = new Cube(1.0, new Color(0.2, 0.12, 0.1, 1.0), 1.0);
        base1Cube.setTranslateX(xStart + 135);
        base1Cube.setTranslateZ(yPos+20.0);
        base1Cube.setTranslateY(11.0);
        base1Cube.setScaleX(barWidth*11.5);
        base1Cube.setScaleZ(10.0);
        base1Cube.setScaleY(barDepth*2.0);

        // Base2
        Cube base2Cube = new Cube(1.0, new Color(0.2, 0.12, 0.1, 1.0), 1.0);
        base2Cube.setTranslateX(xStart + 135);
        base2Cube.setTranslateZ(yPos-20.0);
        base2Cube.setTranslateY(11.0);
        base2Cube.setScaleX(barWidth*11.5);
        base2Cube.setScaleZ(10.0);
        base2Cube.setScaleY(barDepth*2.0);

        // Bar1
        Cube bar1Cube = new Cube(1.0, Color.PURPLE, 1.0);
        bar1Cube.setTranslateX(xStart + 1*xOffset);
        bar1Cube.setTranslateZ(yPos);
        bar1Cube.setScaleX(barWidth);
        bar1Cube.setScaleZ(100.0);
        bar1Cube.setScaleY(barDepth);

        // Bar2
```

```
Cube bar2Cube = new Cube(1.0, Color.BLUEVIOLET, 1.0);
bar2Cube.setTranslateX(xStart + 2*xOffset);
bar2Cube.setTranslateZ(yPos);
bar2Cube.setScaleX(barWidth);
bar2Cube.setScaleZ(95.0);
bar2Cube.setScaleY(barDepth);

// Bar3
Cube bar3Cube = new Cube(1.0, Color.BLUE, 1.0);
bar3Cube.setTranslateX(xStart + 3*xOffset);
bar3Cube.setTranslateZ(yPos);
bar3Cube.setScaleX(barWidth);
bar3Cube.setScaleZ(90.0);
bar3Cube.setScaleY(barDepth);

// Bar4
Cube bar4Cube = new Cube(1.0, Color.GREEN, 1.0);
bar4Cube.setTranslateX(xStart + 4*xOffset);
bar4Cube.setTranslateZ(yPos);
bar4Cube.setScaleX(barWidth);
bar4Cube.setScaleZ(85.0);
bar4Cube.setScaleY(barDepth);

// Bar5
Cube bar5Cube = new Cube(1.0, Color.GREENYELLOW, 1.0);
bar5Cube.setTranslateX(xStart + 5*xOffset);
bar5Cube.setTranslateZ(yPos);
bar5Cube.setScaleX(barWidth);
bar5Cube.setScaleZ(80.0);
bar5Cube.setScaleY(barDepth);

// Bar6
Cube bar6Cube = new Cube(1.0, Color.YELLOW, 1.0);
bar6Cube.setTranslateX(xStart + 6*xOffset);
bar6Cube.setTranslateZ(yPos);
bar6Cube.setScaleX(barWidth);
bar6Cube.setScaleZ(75.0);
bar6Cube.setScaleY(barDepth);

// Bar7
Cube bar7Cube = new Cube(1.0, Color.ORANGE, 1.0);
bar7Cube.setTranslateX(xStart + 7*xOffset);
bar7Cube.setTranslateZ(yPos);
bar7Cube.setScaleX(barWidth);
bar7Cube.setScaleZ(70.0);
bar7Cube.setScaleY(barDepth);

// Bar8
Cube bar8Cube = new Cube(1.0, Color.RED, 1.0);
bar8Cube.setTranslateX(xStart + 8*xOffset);
bar8Cube.setTranslateZ(yPos);
bar8Cube.setScaleX(barWidth);
bar8Cube.setScaleZ(65.0);
bar8Cube.setScaleY(barDepth);

bar1Cube.setOnMousePressed(new EventHandler<MouseEvent>() {
    @Override
    public void handle(MouseEvent me) { bar1Note.play(); }
});
bar2Cube.setOnMousePressed(new EventHandler<MouseEvent>() {
```

```
            @Override
            public void handle(MouseEvent me) { bar2Note.play(); }
        });
        bar3Cube.setOnMousePressed(new EventHandler<MouseEvent>() {
            @Override
            public void handle(MouseEvent me) { bar3Note.play(); }
        });
        bar4Cube.setOnMousePressed(new EventHandler<MouseEvent>() {
            @Override
            public void handle(MouseEvent me) { bar4Note.play(); }
        });
        bar5Cube.setOnMousePressed(new EventHandler<MouseEvent>() {
            @Override
            public void handle(MouseEvent me) { bar5Note.play(); }
        });
        bar6Cube.setOnMousePressed(new EventHandler<MouseEvent>() {
            @Override
            public void handle(MouseEvent me) { bar6Note.play(); }
        });
        bar7Cube.setOnMousePressed(new EventHandler<MouseEvent>() {
            @Override
            public void handle(MouseEvent me) { bar7Note.play(); }
        });
        bar8Cube.setOnMousePressed(new EventHandler<MouseEvent>() {
            @Override
            public void handle(MouseEvent me) { bar8Note.play(); }
        });

        rectangleGroup.getChildren().addAll(base1Cube, base2Cube,
                                            bar1Cube, bar2Cube, bar3Cube,
                                            bar4Cube, bar5Cube, bar6Cube,
                                            bar7Cube, bar8Cube);
        rectangleGroup.setScaleX(2.5);
        rectangleGroup.setScaleY(2.5);
        rectangleGroup.setScaleZ(2.5);
        cam.getChildren().add(rectangleGroup);

        frameCam(stage, scene);

        scene.setOnMousePressed(new EventHandler<MouseEvent>() {
            @Override
            public void handle(MouseEvent me) {
                mousePosX = me.getX();
                mousePosY = me.getY();
                mouseOldX = me.getX();
                mouseOldY = me.getY();
                //System.out.println("scene.setOnMousePressed " + me);
            }
        });
        scene.setOnMouseDragged(new EventHandler<MouseEvent>() {
            @Override
            public void handle(MouseEvent me) {
                mouseOldX = mousePosX;
                mouseOldY = mousePosY;
                mousePosX = me.getX();
                mousePosY = me.getY();
                mouseDeltaX = mousePosX - mouseOldX;
                mouseDeltaY = mousePosY - mouseOldY;
                if (me.isAltDown() && me.isShiftDown() &&
me.isPrimaryButtonDown()) {
```

```
                double rzAngle = cam.rz.getAngle();
                cam.rz.setAngle(rzAngle - mouseDeltaX);
            }
            else if (me.isAltDown() && me.isPrimaryButtonDown()) {
                double ryAngle = cam.ry.getAngle();
                cam.ry.setAngle(ryAngle - mouseDeltaX);
                double rxAngle = cam.rx.getAngle();
                cam.rx.setAngle(rxAngle + mouseDeltaY);
            }
            else if (me.isShiftDown() && me.isPrimaryButtonDown()) {
                double yShear = shear.getY();
                shear.setY(yShear + mouseDeltaY/1000.0);
                double xShear = shear.getX();
                shear.setX(xShear + mouseDeltaX/1000.0);
            }
            else if (me.isAltDown() && me.isSecondaryButtonDown()) {
                double scale = cam.s.getX();
                double newScale = scale + mouseDeltaX*0.01;
                cam.s.setX(newScale);
                cam.s.setY(newScale);
                cam.s.setZ(newScale);
            }
            else if (me.isAltDown() && me.isMiddleButtonDown()) {
                double tx = cam.t.getX();
                double ty = cam.t.getY();
                cam.t.setX(tx + mouseDeltaX);
                cam.t.setY(ty + mouseDeltaY);
            }
        }
    });
    scene.setOnKeyPressed(new EventHandler<KeyEvent>() {
        @Override
        public void handle(KeyEvent ke) {
            if (KeyCode.A.equals(ke.getCode())) {
                resetCam();
                shear.setX(0.0);
                shear.setY(0.0);
            }
            if (KeyCode.F.equals(ke.getCode())) {
                frameCam(stage, scene);
                shear.setX(0.0);
                shear.setY(0.0);
            }
            if (KeyCode.SPACE.equals(ke.getCode())) {
                if (stage.isFullScreen()) {
                    stage.setFullScreen(false);
                    frameCam(stage, scene);
                } else {
                    stage.setFullScreen(true);
                    frameCam(stage, scene);
                }
            }
        }
    });

    stage.setScene(scene);
    stage.show();
}

//=========================================================================
```

```
// CubeSystem.frameCam
//==========================================================================
public void frameCam(final Stage stage, final Scene scene) {
    setCamOffset(camOffset, scene);
    // cam.resetTSP();
    setCamPivot(cam);
    setCamTranslate(cam);
    setCamScale(cam, scene);
}

//==========================================================================
// CubeSystem.setCamOffset
//==========================================================================
public void setCamOffset(final Cam camOffset, final Scene scene) {
    double width = scene.getWidth();
    double height = scene.getHeight();
    camOffset.t.setX(width/2.0);
    camOffset.t.setY(height/2.0);
}

//==========================================================================
// setCamScale
//==========================================================================
public void setCamScale(final Cam cam, final Scene scene) {
    final Bounds bounds = cam.getBoundsInLocal();
    final double pivotX = bounds.getMinX() + bounds.getWidth()/2;
    final double pivotY = bounds.getMinY() + bounds.getHeight()/2;
    final double pivotZ = bounds.getMinZ() + bounds.getDepth()/2;

    double width = scene.getWidth();
    double height = scene.getHeight();

    double scaleFactor = 1.0;
    double scaleFactorY = 1.0;
    double scaleFactorX = 1.0;
    if (bounds.getWidth() > 0.0001) {
        scaleFactorX = width / bounds.getWidth(); // / 2.0;
    }
    if (bounds.getHeight() > 0.0001) {
        scaleFactorY = height / bounds.getHeight(); //  / 1.5;
    }
    if (scaleFactorX > scaleFactorY) {
        scaleFactor = scaleFactorY;
    } else {
        scaleFactor = scaleFactorX;
    }
    cam.s.setX(scaleFactor);
    cam.s.setY(scaleFactor);
    cam.s.setZ(scaleFactor);
}

//==========================================================================
// setCamPivot
//==========================================================================
public void setCamPivot(final Cam cam) {
    final Bounds bounds = cam.getBoundsInLocal();
    final double pivotX = bounds.getMinX() + bounds.getWidth()/2;
    final double pivotY = bounds.getMinY() + bounds.getHeight()/2;
    final double pivotZ = bounds.getMinZ() + bounds.getDepth()/2;
    cam.p.setX(pivotX);
```

```
        cam.p.setY(pivotY);
        cam.p.setZ(pivotZ);
        cam.ip.setX(-pivotX);
        cam.ip.setY(-pivotY);
        cam.ip.setZ(-pivotZ);
    }

    //=========================================================================
    // setCamTranslate
    //=========================================================================
    public void setCamTranslate(final Cam cam) {
        final Bounds bounds = cam.getBoundsInLocal();
        final double pivotX = bounds.getMinX() + bounds.getWidth()/2;
        final double pivotY = bounds.getMinY() + bounds.getHeight()/2;
        cam.t.setX(-pivotX);
        cam.t.setY(-pivotY);
    }

    public void resetCam() {
        cam.t.setX(0.0);
        cam.t.setY(0.0);
        cam.t.setZ(0.0);
        cam.rx.setAngle(45.0);
        cam.ry.setAngle(-7.0);
        cam.rz.setAngle(0.0);
        cam.s.setX(1.25);
        cam.s.setY(1.25);
        cam.s.setZ(1.25);


        cam.p.setX(0.0);
        cam.p.setY(0.0);
        cam.p.setZ(0.0);

        cam.ip.setX(0.0);
        cam.ip.setY(0.0);
        cam.ip.setZ(0.0);

        final Bounds bounds = cam.getBoundsInLocal();
        final double pivotX = bounds.getMinX() + bounds.getWidth() / 2;
        final double pivotY = bounds.getMinY() + bounds.getHeight() / 2;
        final double pivotZ = bounds.getMinZ() + bounds.getDepth() / 2;

        cam.p.setX(pivotX);
        cam.p.setY(pivotY);
        cam.p.setZ(pivotZ);

        cam.ip.setX(-pivotX);
        cam.ip.setY(-pivotY);
        cam.ip.setZ(-pivotZ);
    }

    public class Cube extends Group {
        final Rotate rx = new Rotate(0, Rotate.X_AXIS);
        final Rotate ry = new Rotate(0, Rotate.Y_AXIS);
        final Rotate rz = new Rotate(0, Rotate.Z_AXIS);
        public Cube(double size, Color color, double shade) {
            getTransforms().addAll(rz, ry, rx);

//          back face
```

```
            Rectangle backFace = new Rectangle(size,size);
            backFace.setFill(color.deriveColor(0.0, 1.0, (1 - 0.5*shade), 1.0));
            backFace.setTranslateX(-0.5*size);
            backFace.setTranslateY(-0.5*size);
            backFace.setTranslateZ(-0.5*size);

            // bottom face
            Rectangle bottomFace = new Rectangle(size,size);
            bottomFace.setFill(color.deriveColor(0.0, 1.0, (1 - 0.4*shade), 1.0));
            bottomFace.setTranslateX(-0.5*size);
            bottomFace.setTranslateY(0);
            bottomFace.setRotationAxis(Rotate.X_AXIS);
            bottomFace.setRotate(90);

//          right face
            Rectangle rightFace = new Rectangle(size,size);
            rightFace.setFill(color.deriveColor(0.0, 1.0, (1 - 0.3*shade), 1.0));
            rightFace.setTranslateX(-1*size);
            rightFace.setTranslateY(-0.5*size);
            rightFace.setRotationAxis(Rotate.Y_AXIS);
            rightFace.setRotate(90);

//            leftFace
            Rectangle leftFace = new Rectangle(size,size);
            leftFace.setFill(color.deriveColor(0.0, 1.0, (1 - 0.2*shade), 1.0));
            leftFace.setTranslateX(0);
            leftFace.setTranslateY(-0.5*size);
            leftFace.setRotationAxis(Rotate.Y_AXIS);
            leftFace.setRotate(90);

//            topFace
            Rectangle topFace = new Rectangle(size,size);
            topFace.setFill(color.deriveColor(0.0, 1.0, (1 - 0.1*shade), 1.0));
            topFace.setTranslateX(-0.5*size);
            topFace.setTranslateY(-1*size);
            topFace.setRotationAxis(Rotate.X_AXIS);
            topFace.setRotate(90);

//          frontFace
            Rectangle frontFace = new Rectangle(size,size);
            frontFace.setFill(color);
            frontFace.setTranslateX(-0.5*size);
            frontFace.setTranslateY(-0.5*size);
            frontFace.setTranslateZ(-0.5*size);

            getChildren().addAll(backFace, bottomFace, rightFace, leftFace,
topFace,frontFace);

        }
    }


    public static void main(String[] args) {
        Application.launch(args);
    }
}
```