Carmen Delessio
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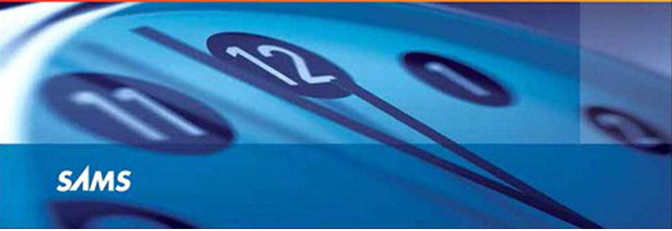
Fourth Edition

Features Android Release 5.0

Sams **Teach Yourself** Android™ Application Development in 24 Hours



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Praise for *Sams Teach Yourself Android™ Application Development in 24 Hours*, Fourth Edition

"This latest edition of *Sams Teach Yourself Android Application Development in 24 Hour*s is just what you've been waiting for if you've been waiting to get into Android development. Freshly updated with what you need to know for developing applications using Android Studio for Android Lollipop (Android 5) with Material Design, this book covers what you need to know to get started building applications for Android."

—**Ray Rischpater**, Author and Engineering Manager at Microsoft

"The new edition of *Sams Teach Yourself Android Application Development in 24 Hours* covers a lot of new features. The book takes you from the beginning through to uploading your own app into the store. All the screen shots in this edition use the new and official Android IDE (the amazing Android Studio IDE)."

—**Fady A. M. Ibrahim**, Android Instructor, Benha Faculty of Computer and Information

"Any developer who wants to get up to speed quickly on Android will appreciate this introduction. Beyond the SDK fundamentals, there's plenty of good information on the things real-world Android apps are made of, such as maps, images, and navigation. This is a great way to dive head-first into Android development, or just to become Android-literate in record time."

—**Jonathan Taylor**, VP, Mobile Technology, Priceline.com

The authors knock it out of the park for new Android developers and experienced ones who want to extend their prowess. This book is perfectly set-up for a sports technology oriented person like me to teach me the basic principles, give me design knowledge, and then cap that off with how to add and manipulate data. Data-driven applications are the life's blood of every fantasy sports player and the authors' ability to break down the path to success with real-life exercises to put these principles into action is a Grand Slam!"

—**Rick Wolf**, President, Fantasy Alarm, and Co-Founder, Fantasy Sports Trade Association

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Carmen Delessio
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Sams Teach Yourself Android™ Application Development

Fourth Edition

in 24 Hours

SAMS 800 East 96th Street, Indianapolis, Indiana, 46240 USA

Sams Teach Yourself Android™ Application Development in 24 Hours, Fourth Edition

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Preface

What I wish I knew when I started Android development....

Android has become a leading platform for smartphones, tablets, and other devices. The goal of this book is to introduce the Android platform and start you on the path to creating professional-grade apps.

In 24 hours of topic-based material, you learn the concepts of Android development and move on to specific topics like working with data in the cloud, handling bitmaps and videos in an app, and using new features (such as `CardView` in the Lollipop versions of Android). The coverage of material design and Lollipop features will take you far. The Lollipop version of Android will give way to Android M in the future. Android M will focus on performance improvements.

In the early days of Android, author Carmen Delessio worked on a significant Android project for a large media company. The app launched and was a success. But, it could have been built in a more "Android way." With the authors having built many Android apps since then, the material in this book is largely guided by the idea of including "what I wish I knew then."

This book is not intended to be an encyclopedia of all things Android. Plenty of Android resources are available, and the documentation on the Android developer site has never been better. This book starts you on the path to developing professional Android apps and can be used as a guide to the additional material.

New in the Fourth Edition

There are two major changes from the third edition to the fourth edition of this book.

New features in Android are covered. The updates include significant coverage of material design, including `RecyclerView` and `CardView`. New notification features are covered. An introduction to Android Wear and Android TV is included. Significantly, this edition uses Android Studio throughout rather than Eclipse. All development screenshots and examples use Android Studio.

The second change is this book starts by covering four important components of Android. In the first hour, you learn about activities, intents, intent services, and broadcast receivers. Subsequent hours drill more deeply into these broad concepts. This change highlights what is happening when an app runs and puts even more emphasis on doing things the "Android way."

Who This Book Is For

The examples in this book are created so that someone with programming knowledge can understand them, but Android apps are developed in Java. You will find the book much more valuable and useful if you are familiar with Java concepts and syntax. If you are knowledgeable in C or C# and understand object-oriented concepts, you should be able to understand the level of Java code in this book. You should know what classes and methods are.

If you are a Java programmer with an interest in Android development, this book introduces you to Android and gets you on track for professional Android development.

If you have started Android development, but have not proceeded past the basic examples, this book is for you. It covers topics such as downloading data, using a database, and creating content providers. This book can take you from the basics to real development in a series of understandable steps.

How This Book Is Organized

The book is organized into four broad sections:

Part I, "Android Fundamentals." This first part introduces Android concepts and uses examples to show how to start activities, pass data, and handle core functionality. It covers activities, intents, resources, and background processing.

Part II, "Creating the User Interface." When you create the user interface, you learn about components and layouts. You cover bitmaps and video views. You also learn about navigation within an app, and you cover material design—the new design from Google that is used in Android.

Part III, "Working with Data." Working with data means both retrieving data over a network and storing it. You learn about using a SQLite database and using content providers.

Part IV, "Next Steps." This last part covers other features to investigate further, open source projects of interest, and how to publish your app.

You can find online updates, contact the author, and ask questions about this book on http://talkingandroid.com/. Links to source code are posted there.

Source Code for the Book

Nearly every chapter in this book includes an example that has source code available online. The code is on GitHub and organized by chapter. You will find the code here: https://github.com/CarmenDelessio. Code for an individual chapter should be easy to find. For example, the complete project code for Hour 10 is here: https://github.com/CarmenDelessio/Hour10application.

About the Authors

Carmen Delessio is an experienced application developer who has worked as a developer, technical architect, and CTO in large and small organizations. Carmen began his online development career at Prodigy, where he worked on early Internet applications, shopping apps, and fantasy baseball. He is a graduate of Manhattanville College and lives in Pound Ridge, New York, with his wife, Amy, and daughter, Natalie.

Lauren Darcey is responsible for the technical leadership and direction of a small software company specializing in mobile technologies, including Android and iOS consulting services. With more than two decades of experience in professional software production, Lauren is a recognized authority in application architecture and the development of commercial-grade mobile applications. Lauren received a BS in computer science from the University of California, Santa Cruz.

Shane Conder has extensive application development experience and has focused his attention on mobile and embedded development for well over a decade. He has designed and developed many commercial applications for Android, iOS, BREW, BlackBerry, J2ME, Palm, and Windows Mobile—some of which have been installed on millions of phones worldwide. Shane has written extensively about the tech industry and is known for his keen insights regarding mobile development platform trends. Shane received a BS in computer science from the University of California, Santa Cruz.

Dedication

For ASL and NMLD.

"To the Valiant of heart, nothing is impossible." – Jeanne d'Albret
—Carmen Delessio

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This book would not exist without the help and guidance of the team at Pearson (Sams Publishing). Thanks to Laura Lewin for constant encouragement and Olivia Basegio for her incredible work on the project. Sheri Cain helped take this book to another level with her feedback. Her diligence and hard work kept this project constantly moving forward.

Technical editors are an important part of every book. Ray Rischpater was an incredible help. Valerie Shipbaugh did her technical review by placing herself in the role of a reader who was new to Android. The feedback and guidance from Ray and Valerie make this a better book.

We Want to Hear from You

As the reader of this book, you are our most important critic and commentator. We value your opinion and want to know what we're doing right, what we could do better, what areas you'd like to see us publish in, and any other words of wisdom you're willing to pass our way.

We welcome your comments. You can email or write directly to let us know what you did or didn't like about this book—as well as what we can do to make our books better.

Please note that we cannot help you with technical problems related to the topic of this book.

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HOUR 11
ImageViews and Bitmaps

What You'll Learn in This Hour:

- Examining `ImageView` Bitmaps
- Using `Bitmaps` and `Canvas`
- Introducing Picasso

Images and media can play an important role in creating an exceptional Android app. In this chapter, you look at the details of handling images and bitmaps, including creating bitmaps, using drawing commands, and handling very large images.

Examining ImageView

You learned about different types of views in Hour 10, "More Views and Controls." An `ImageView` is a view that displays an image, but you will find that there are unique aspects to working with images. An `ImageView` can display any drawable image. The source of the image can be a resource, a drawable, or a bitmap.

Displaying an Image

There are four methods available for setting an image in an `ImageView`. They differ by how the image to display is defined. The image can be a `bitmap`, `drawable`, `Uri`, or resource `id`. The methods are as follows:

- **`setImageDrawable()`**: Set a drawable as the content of the `ImageView`.
- **`setImageBitmap()`**: Set a `Bitmap` as the content of the `ImageView`.
- **`setImageResource()`**: Use a resource `id` to set the content of the `ImageView`.
- **`setImageUri()`**: Use a URI to set the content of the `ImageView`.

To set an `ImageView` to an image resource defined by `R.drawable.mainImage`, you use the following:

```
ImageView mainImage = (ImageView) findViewById(R.id.imageView1);
mainImage.setImageResource(R.drawable.mainImage)
```

To populate a `Drawable` object from a resource, use the `getResources.getDrawable()` method:

```
Drawable myDrawable = getResources().getDrawable(R.drawable.ic_launcher);
```

In this hour, you populate an `ImageView` using a resource `id` as the source and then explore several properties of how an `ImageView` can display an image.

Using ScaleTypes in ImageView

`ImageViews` include a `ScaleType` property. The `ScaleType` defines how the image will be displayed within the `ImageView`. Using `ScaleType`, you can have an image fill the entire `ImageView`, be centered in the `ImageView`, or be cropped and centered in the `ImageView`.

The options for `ScaleType` are defined in `ImageView.ScaleType`. For example, `ImageView.ScaleType.CENTER` refers to a scale type in which the image is centered in the `ImageView`. The complete set of `ScaleTypes` are as follows:

- **`ImageView.ScaleType.CENTER`**: Center the image with no scaling. The image dimensions are unchanged.
- **`ImageView.ScaleType.CENTER_CROP`**: Scales the image and keeps the aspect ratio until either the width of height of the image is the same as the width or height of the `ImageView`. For a small image, this has the effect of enlarging the entire image. For a large image, this has the effect of showing the center of the image.
- **`ImageView.ScaleType.CENTER_INSIDE`**: The image is scaled, and the aspect ratio is maintained. The width and height of the image fit within the `ImageView`.
- **`ImageView.ScaleType.FIT_CENTER`**: Maintain aspect ratio and fit the image in the center of the `ImageView`.
- **`ImageView.ScaleType.FIT_START`**: Maintain aspect ratio and fit the image in the left and top edge of the `ImageView`.
- **`ImageView.ScaleType.FIT_END`**: Maintain aspect ratio and fit the image in the right and bottom edge of the `ImageView`.
- **`ImageView.ScaleType.FIT_END`**: Maintain aspect ratio and fit the image in the right and bottom edge of the `ImageView`.
- **`ImageView.ScaleType.MATRIX`**: Scale using a matrix.

You can change scaleType dynamically in your code. Listing 11.1 show the code for an app that displays an ImageView and includes a RadioGroup and set of RadioButtons for changing the scale type. When a radio button is selected, the scaleType for the ImageView is updated.

LISTING 11.1 Changing ScaleType Programatically

```
package com.talkingandroid.hour11application;
import android.app.Activity;
import android.os.Bundle;
import android.widget.ImageView;
import android.widget.RadioGroup;

public class ScaleActivity extends Activity {
    RadioGroup radioGroup;
    ImageView imageView;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_scale);
        radioGroup = (RadioGroup) findViewById(R.id.radioGroup);
        imageView = (ImageView) findViewById(R.id.imageView);
        radioGroup.setOnCheckedChangeListener(new
                         RadioGroup.OnCheckedChangeListener() {
            @Override
            public void onCheckedChanged(RadioGroup group, int checkedId) {
                switch (checkedId){
                  case R.id.radioCenter:
                    imageView.setScaleType(ImageView.ScaleType.CENTER);
                    break;
                  case R.id.radioCenterCrop:
                    imageView.setScaleType(ImageView.ScaleType.CENTER_CROP);
                    break;
                  case R.id.radioCenterInside:
                    imageView.setScaleType(ImageView.ScaleType.CENTER_INSIDE);
                    break;
                  case R.id.radioFitCenter:
                    imageView.setScaleType(ImageView.ScaleType.FIT_CENTER);
                    break;
                  case R.id.radioFitStart:
                    imageView.setScaleType(ImageView.ScaleType.FIT_START);
                    break;
                  case R.id.radioFitEnd:
                    imageView.setScaleType(ImageView.ScaleType.FIT_END);
                    break;
                  case R.id.radioFitXY:
```

```
41:                      imageView.setScaleType(ImageView.ScaleType.FIT_XY);
42:                      break;
43:                }
44:            }
45:        });
46:    }
47:}
```

On line 17 of Listing 11.1, an `OnCheckChangeListener()` is set for the `RadioGroup`. When the change is detected, the select `RadioButton id` is checked, and the appropriate `scaleType` is set on the image.

The image used in the code for Listing 11.1 is shown in Figure 11.1. The image is 900 pixels wide and 200 pixels high. It is used in several other examples in this chapter.

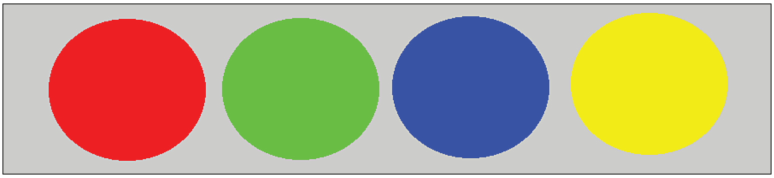


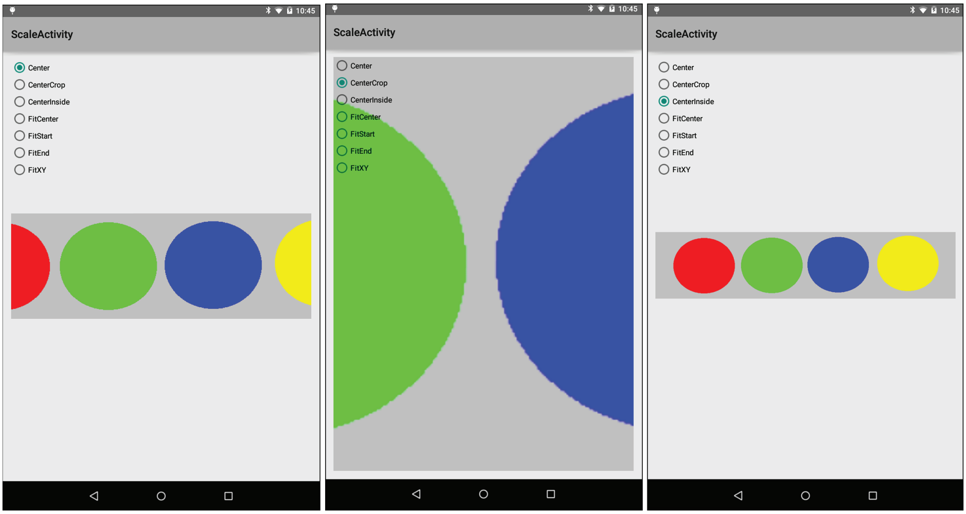
FIGURE 11.1
Base image for showing `ScaleType` (scaletest.png).

By using this simple image with four circles of different colors, it is easy to see the effect of the changing `ScaleType`.

The `ImageView` is set to match the parent width and height. When the image `scaleType` is set to `CENTER_INSIDE`, the image is shown taking the full width of the `ImageView` and is centered with a height that is proportional to the width.

Figure 11.2 shows the base image using the `scaleTypes` set to `CENTER`, `CENTER_CROP`, and `CENTER_INSIDE`. Using `CENTER` shows the image in actual size. Because the size of the image is larger than the `ImageView`, the green and blue circles in the center are shown. `CENTER_CROP` shows half of the green and blue circle. The height of the image fills the `ImageView`. `CENTER_INSIDE` shows the entire image centered in the `ImageView`.

Figure 11.3 shows the base image using the `ScaleTypes FIT_CENTER`, `FIT_START`, `FIT_END`, and `FIT_XY`. The aspect ratio is maintained in the first three, but when using `FIT_XY`, the image fills the `ImageView` and “stretches” the image to fit.



ScaleActivity

● Center
○ CenterCrop
○ CenterInside
○ FitCenter
○ FitStart
○ FitEnd
○ FitXY

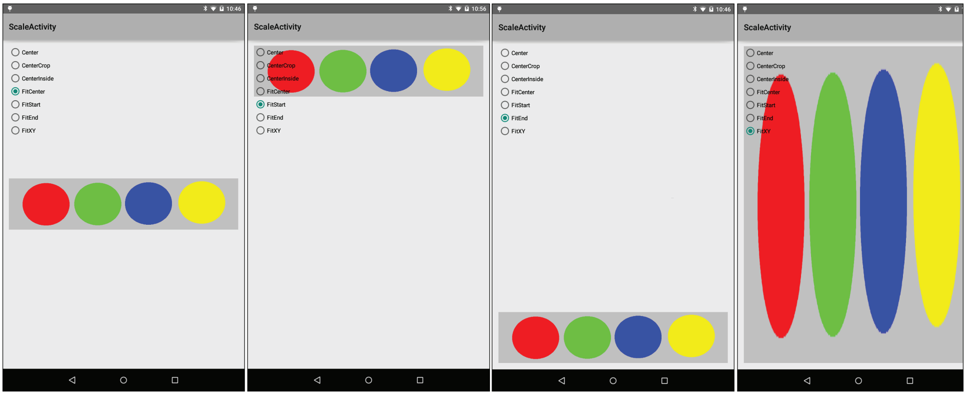
ScaleActivity

○ Center
● CenterCrop
○ CenterInside
○ FitCenter
○ FitStart
○ FitEnd
○ FitXY

ScaleActivity

○ Center
○ CenterCrop
● CenterInside
○ FitCenter
○ FitStart
○ FitEnd
○ FitXY

FIGURE 11.2
`ScaleTypes CENTER`, `CENTER_CROP`, and `CENTER_INSIDE`.



ScaleActivity

○ Center
○ CenterCrop
○ CenterInside
● FitCenter
○ FitStart
○ FitEnd
○ FitXY

ScaleActivity

○ Center
○ CenterCrop
○ CenterInside
○ FitCenter
● FitStart
○ FitEnd
○ FitXY

ScaleActivity

○ Center
○ CenterCrop
○ CenterInside
○ FitCenter
○ FitStart
● FitEnd
○ FitXY

ScaleActivity

○ Center
○ CenterCrop
○ CenterInside
○ FitCenter
○ FitStart
○ FitEnd
● FitXY

FIGURE 11.3
`ScaleTypes FIT_CENTER`, `FIT_START`, `FIT_END`, and `FIT_XY`.

Rotating an Image

An `ImageView` contains several methods for rotating an image. When you rotate an image, you must set the point in the image to rotate around. That is the *pivot point*. The method `setPivotX()` and `setPivotY()` are used to set the pivot point.

Once the pivot point is set, you can call the `setRotation()` method to make the image actually rotate.

The idea in Listing 11.2 is to set the pivot point to the center of the ImageView and to rotate the image 30 degrees each time the button is clicked. The ImageView is defined to have height and width set to match_parent. The ImageView occupies the entire screen.

To get the center of the ImageView, the width and height are divided by 2. To continuously rotate, the number of clicks count is kept. The angle to rotate is 30 times the number of clicks. So, if the button is clicked twice, the image is rotated 60 degrees.

Figure 11.4 shows the rotated image.

LISTING 11.2 Rotating an Image

```
package com.talkingandroid.hour11application;
import android.app.Activity;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.ImageView;

public class RotateActivity extends Activity {
    Button rotateButton;
    ImageView imageView;
    int numClicks = 1;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_rotate);
        imageView = (ImageView)findViewById(R.id.imageView);
        rotateButton = (Button) findViewById(R.id.button);
        rotateButton.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                imageView.setPivotX(imageView.getWidth()/2);
                imageView.setPivotY(imageView.getHeight() / 2);
                imageView.setRotation(30*numClicks);
                numClicks++;
            }
        });
    }
}
```

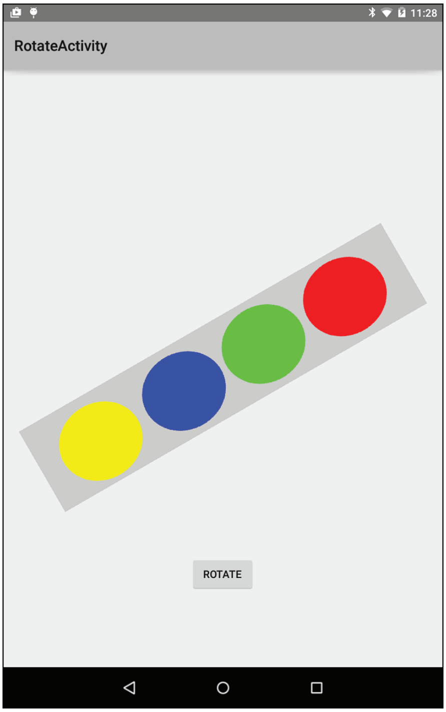


FIGURE 11.4
Rotated image.

NOTE

Considering a Matrix

As an alternative to using the built-in rotation method, you can use a matrix with an `ImageView`. In graphics programming, a matrix is used to transform an image. Simple transformations include scaling, translating, or rotating an image. Android includes a `Matrix` class `(android.graphics.Matrix)` to support these graphic transformations.

Setting Alpha

Alpha level indicates the opacity of an image. An image can be completely transparent, completely opaque, or somewhere in the middle. The alpha level can be set on an `ImageView` using the `setAlpha()` method or, since API level 11, the `setImageAlpha()` method. These methods take an integer parameter. A parameter of 0 indicates complete transparency and 255 for complete opacity.

▼ TRY IT YOURSELF

Using a SeekBar to Dynamically Change Alpha Values

You'll create an Activity with a SeekBar and an ImageView. The range of the SeekBar will be from 0 to 255. As the SeekBar moves, set the alpha value for the ImageView and watch the change:

1. Create a new project with an Activity.
2. Change the XML layout file to include a SeekBar and an ImageView.
3. The ImageView should have the src value set to an existing image.
4. Use setOnSeekBarChangeListener() to set an OnSeekBarChangeListener for the SeekBar.
5. In the OnSeekBarChangeListener, you implement three methods: onProgressChanged(), onStartTrackingTouch(), and onEndTrackingTouch(). If you are using Android Studio, these methods are created for you if you type "new OnSeekBarChangeListener()" as a parameter to the setOnSeekBarChangeListener() method.
6. The onProgressChanged() method includes a parameter called progress that indicates the value on the SeekBar. Use that value to change the alpha level of the ImageView. You will use imageView.setImageAlpha(progress);.

Using Bitmaps and Canvas

The Bitmap(android.graphics.Bitmap) class represents a bitmap image. Bitmaps are created via the BitmapFactory(android.graphics.BitmapFactory) class.

Three typical ways use BitmapFactory to create Bitmaps are to create a bitmap from a resource, file, or InputStream. To create a Bitmap from a resource, use the BitmapFactory method decodeResource():

```
Bitmap = BitmapFactory.decodeResource(getResources(), R.drawable.someImage);
```

The other two methods are similar to decodeResource(): decodeFile() and decodeStream().

Handling Large Images

There are techniques for avoiding the dreaded out-of-memory (OOM) exception. Large images can have a significant impact on memory use in your app. To demonstrate this, you'll create an unrealistically large image to display in an ImageView. If the unmodified image is loaded into an ImageView, the app fails with an OOM error. A java.lang.OutOfMemory exception occurs. You'll fix the memory error for this case by checking the image size and display side.

The idea is to display the image at an appropriate size for the device. There is no point in showing a 10-foot mural in a 6-inch frame. Similarly, there is no point in showing a 20-inch image on a 3-inch device screen. You will scale down the image size and save memory.

The details of your app will influence your memory usage and the techniques that will work best in your case. This example shows how to handle a single large image.

To demonstrate this, you'll start with an image and increase it to an *unrealistic* size. You will use a photo that is 72 inches x 54 inches and that has a 28MB file size.

The image is in the drawable resource folder and has the id R.drawable.largeimage.

You can cause the app to fail with an OOM error by trying to set an ImageView to this resource. You have an ImageView named imageView. This line of code that causes the app to fail is this:

```
imageView.setImageResource(R.drawable.largeimage);
```

Some work is required, but it is possible to handle an image this large. In all cases, it would be better to work with appropriately sized images, but that does not always happen.

The approach is to get the dimensions of the underlying Bitmap without actually rendering it. Getting those dimensions is not a memory-intensive activity. Once you have the Bitmap, you can determine an appropriate size for the Bitmap that will fit in our display. If you have a 20-inch image and a 4-inch display, you'll request that the Bitmap that is created in memory fill the 4-inch display.

Using BitmapFactory.Options

The BitmapFactory.Options class is used with the BitmapFactory class. It is essential for handling large bitmaps.

You'll use the following options from the BitmapFactoryOptions class:

- **inJustDecodeBounds:** If set to true, this option indicates that the Bitmap dimensions should be determined by the BitmapFactory but that the Bitmap itself should not be created. This is the key to getting the Bitmap dimensions without the memory overhead of creating the Bitmap.
- **outWidth:** The width of the image set when inJustDecodeBounds is used.
- **outHeight:** The height of the image set when inJustDecodeBounds is used.
- **inSampleSize:** This integer indicates how much the dimensions of the Bitmap should be reduced. Given an image of 1000x400, an inSampleSize of 4 will result in a Bitmap of 250x100. The dimensions are reduced by a factor of 4.

Listing 11.3 shows the code to address this.

LISTING 11.3 Displaying a Large Image

```
 1: package com.talkingandroid.hour11application;
 2: import android.app.Activity;
 3: import android.graphics.Bitmap;
 4: import android.graphics.BitmapFactory;
 5: import android.os.Bundle;
 6: import android.view.Display;
 7: import android.widget.ImageView;
 8:
 9: public class LargeImageActivity extends Activity {
10:
11:     @Override
12:     protected void onCreate(Bundle savedInstanceState) {
13:         super.onCreate(savedInstanceState);
14:         setContentView(R.layout.activity_large_image);
15:         ImageView imageView = (ImageView) findViewById(R.id.imageView);
16:         Display display = getWindowManager().getDefaultDisplay();
17:         int displayWidth = display.getWidth();
18:         BitmapFactory.Options options = new BitmapFactory.Options();
19:         options.inJustDecodeBounds = true;
20:         BitmapFactory.decodeResource(getResources(), R.drawable.largeimage,
21:              options);
22:         int width = options.outWidth;
23:         if (width > displayWidth) {
24:             int widthRatio = Math.round((float) width / (float) displayWidth);
25:             options.inSampleSize = widthRatio;
26:         }
27:        options.inJustDecodeBounds = false;
28:        Bitmap scaledBitmap =  BitmapFactory.decodeResource(getResources(),
29:                               R.drawable.largeimage, options);
30:        imageView.setImageBitmap(scaledBitmap);
31:    }
32: }
```

On lines 16 and 17, you get the size of the device display. You'll use this as the target size for reducing the image size.

On lines 18–22, you determine the size of the current `Bitmap`. You do that by creating a `BitmapFactory.Options` class and setting the `inJustDecodeBounds` value to `true`. On line 20, the `Bitmap` is decoded to get the dimensions. Using this method, you get the dimensions without the memory overhead of creating the `Bitmap`. The result is available in `options.outWidth`. On line 22, you assign `options.outWidth` to the `int` variable `width`.

In this example, you use a simple test for the size of the image. On line 23, you check whether the width of the `Bitmap` is greater than the size of the display. If that is the case, you must determine the `inSampleSize` to use. That is done on lines 24 and 25. If the width of the `Bitmap` is 1000 pixels and the size of the display is 250 pixels, you get an `inSampleSize` of 4 by dividing the width of the `Bitmap` by the width of the display. For simplicity, you are not checking the height.

With the `imSampleSize` set to an appropriate value, you can render the image.

`On` line 27, the `inJustDecodeBounds` value is set to false. That means the image will be decoded and a `Bitmap` object will be created.

Lines 28 and 29 use the `BitmapFactory.decodeResource()` method to actually decode the image and create the `Bitmap`. The bitmap is assigned to the variable `scaledBitmap`. It is important to note that in this call, the `BitmapFactory.Options` variable `options` is passed as a parameter. That is how you indicate to the `BitmapFactory` what `inSampleSize` to use. The value for `options.inSampleSize` was set on line 25.

It is certainly not recommended to display a 72-inch image on a device, but Figure 11.5 shows that it can be done!

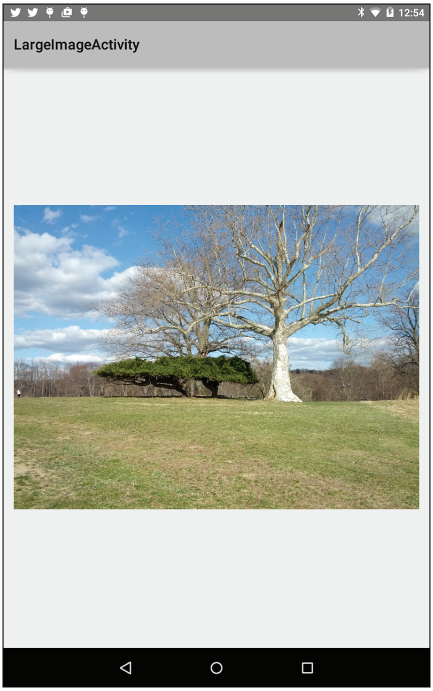


FIGURE 11.5
Very large photo displayed on device.

Drawing Directly on a Canvas

There is one more thing that you can do with an ImageView and Bitmap. You'll create a Bitmap and draw directly on the Canvas that is associated with the Bitmap. A Canvas is an object that you can draw on by calling drawing commands.

You will use an ImageView to display the Bitmap. You will also use an ImageView to determine the dimensions when creating the Bitmap and for drawing. In Listing 11.4, you draw the word "Hello" in the center of the screen.

LISTING 11.4 Drawing on a Canvas

```
package com.talkingandroid.hour11application;
import android.app.Activity;
import android.graphics.Bitmap;
import android.graphics.Canvas;
import android.graphics.Color;
import android.graphics.Paint;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.ImageView;

public class DrawActivity extends Activity {
    ImageView imageView;
    Button drawButton;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_draw);
        imageView = (ImageView) findViewById(R.id.imageView);
        drawButton = (Button)findViewById(R.id.button);
        drawButton.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                Bitmap imageBitmap = Bitmap.createBitmap(imageView.getWidth(),
                       imageView.getHeight(), Bitmap.Config.ARGB_8888);
                Canvas canvas = new Canvas(imageBitmap);
                float scale = getResources().getDisplayMetrics().density;
                Paint p = new Paint();
                p.setColor(Color.BLUE);
                p.setTextSize(48*scale);
                canvas.drawText("Hello", imageView. getWidth()/2,
                                 imageView.getHeight()/2, p);
                imageView.setImageBitmap(imageBitmap);
            }
        });
    }
}
```

A new Bitmap is created on lines 25 and 26 by using the method Bitmap.createBitmap(). Note that the width and height of the bitmap are set using the width and height of the ImageView. The Bitmap.Config (android.graphics.Bitmap.Config) is set to Bitmap.Config.ARGB_8888.

When looking at the documentation for the Bitmap class, there are a number of createBitmap() methods that take different parameters. These methods may return a *mutable* or an *immutable* Bitmap. That is important; only a mutable Bitmap can be used for drawing.

On line 27, a Canvas is instantiated based on the Bitmap that you created.

Simple drawing commands are applied to the canvas in lines 28–33. You create a Paint object and set the Color to blue and set the text size. Line 28 gets the density of the display. That is used to set the text size properly. Recall that you previously learned about converting density independent pixels to pixels. On line 32, you draw the word "Hello" in the center of the Canvas.

On line 34, you update the ImageView to show your generated Bitmap.

Figure 11.6 shows the result.

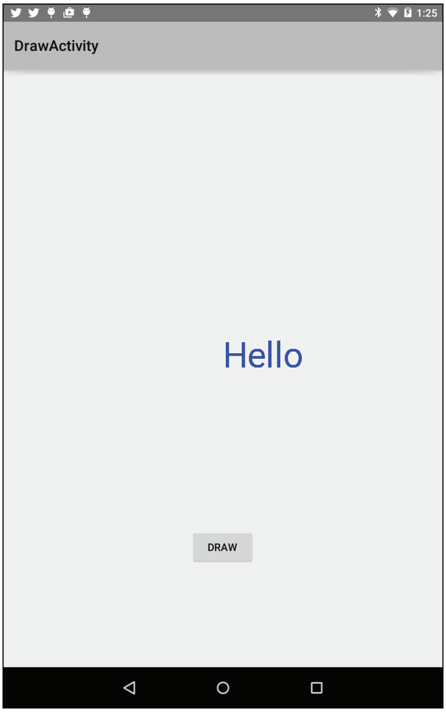


FIGURE 11.6
Drawing on a Canvas.

Introducing Picasso

Picasso is an open source Android library from the team at Square. Picasso is an image downloading and caching library. When you use Picasso to download and display an image, the library keeps track of whether it has a copy of the image in memory or stored locally on the disk. The response time for retrieving and showing images in Picasso is very fast.

Picasso uses a context that is often your current `Activity`. In this example, the context is indicated by `this`, which refers to the `Activity`. Basic usage for displaying an image from a resource file into an `ImageView` is as follows:

```
Picasso.with(this).load(R.drawable.ic_launcher).into(imageView);
```

There are many other methods for Picasso; you can learn more at http://square.github.io/picasso/.

▼ TRY IT YOURSELF

Installing and Using Picasso

Picasso enhances your app when you work with images and bitmaps. These are the steps to download and use Picasso:

1. Go to http://square.github.io/picasso/ to learn more about Picasso.
2. In Android Studio, in Project view, find the app folder and locate the build.gradle file.
3. Add the line **compile** ‘**com.squareup.picasso:picasso:2.5.0**’ to the dependencies. That adds the Picasso library to the project.
4. Create an `Activity` with an `ImageView`.
5. Display an image from the drawable resources folder into the `ImageView` using Picasso.

Summary

In this hour, you looked at `ImageViews` and `Bitmaps`. You learned how `ScaleType` is used to change how images display in `ImageViews` and saw how rotation can be used in `ImageViews`. You learned about the `Matrix` class. You handled the display of an unrealistically large image by reading the dimensions of the bitmap before displaying it. You drew the word “Hello” on `Canvas` and displayed it in an `ImageView` to learn about the relationship between an `ImageView`, `Canvas`, and `Bitmap`. Picasso, an open source image library, was introduced.

Q&A

Q. If I am developing an app that displays images in a `ListView`, should I use `BitmapFactory.Options` to check the size of each image?

A. If you do not have control of the size of the images coming from the server, it is important to check size. If you do have control over the images, the ideal scenario is to have appropriately sized images. You can also use Picasso for handling images in code.

Workshop

Quiz

1. What is the purpose of `inJustDecodeBounds`?
2. What does mutable mean?
3. What is a pivot point?

Answers

1. In `BitmapFactory.Options`, `inJustDecodeBounds` is used to decode a `Bitmap` to get the dimensions but not actually create a `Bitmap` in memory.
2. Mutable means changeable, and that is important when you create `Bitmaps`. Some methods return mutable `Bitmaps` and others return immutable `Bitmaps`.
3. When you rotate an image, there must be a point to rotate around. That is the pivot point.

Exercise

For this exercise, use your own images or images that you find on the web. Create an `Activity` that includes two `ImageViews`. The first `ImageView` will take up the whole screen, with width and height set to `match_parent`. The second `ImageView` will have a fixed size. It will be smaller than the first `ImageView` and will appear over the first `ImageView` aligned on the bottom of the first `ImageView`. The goal is to use `scaleTypes` to display one image full size in the large view and to create a good thumbnail image in the smaller view. This exercise is an opportunity to experiment with displaying modified images. Try making the smaller image a set square size and use `CENTER_CROP` for the `scaleType`.

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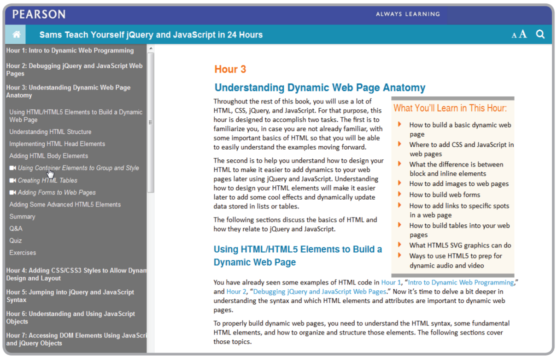
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Hour 6: Understanding and Using JavaScript Objects
Hour 7: Accessing DOM Elements Using JavaScri and jQuery Objects

Hour 3

Understanding Dynamic Web Page Anatomy

Throughout the rest of this book, you will use a lot of HTML, CSS, jQuery, and JavaScript. For that purpose, this hour is designed to accomplish two tasks. The first is to familiarize you, in case you are not already familiar, with some important basics of HTML so that you will be able to easily understand the examples moving forward.

The second is to help you understand how to design your HTML to make it easier to add dynamics to your web pages later using jQuery and JavaScript. Understanding how to design your HTML elements will make it easier later to add some cool effects and dynamically update data stored in lists or tables.

The following sections discuss the basics of HTML and how they relate to jQuery and JavaScript.

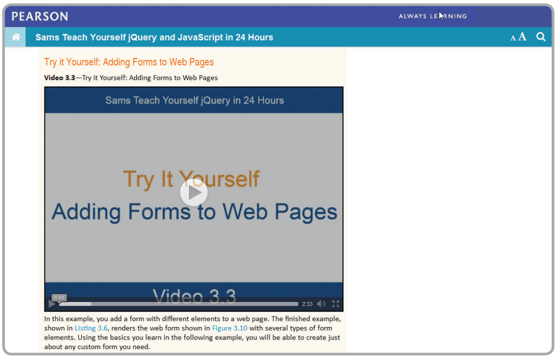
What You'll Learn in This Hour:

- How to build a basic dynamic web page
- Where to add CSS and JavaScript in web pages
- What the difference is between block and inline elements
- How to add images to web pages
- How to build web forms
- How to add links to specific spots in a web page
- How to build tables into your web pages
- What HTML5 SVG graphics can do
- Ways to use HTML5 to prep for dynamic audio and video

Using HTML/HTML5 Elements to Build a Dynamic Web Page

You have already seen some examples of HTML code in Hour 1, "Intro to Dynamic Web Programming," and Hour 2, "Debugging jQuery and JavaScript Web Pages." Now it's time to delve a bit deeper in understanding the syntax and which HTML elements and attributes are important to dynamic web pages.

To properly build dynamic web pages, you need to understand the HTML syntax, some fundamental HTML elements, and how to organize and structure those elements. The following sections cover those topics.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Try it Yourself: Adding Forms to Web Pages

Video 3.3—Try it Yourself: Adding Forms to Web Pages

In this example, you add a form with different elements to a web page. The finished example, shown in Listing 3.6, renders the web form shown in Figure 3.10 with several types of form elements. Using the basics you learn in the following example, you will be able to create just about any custom form you need.

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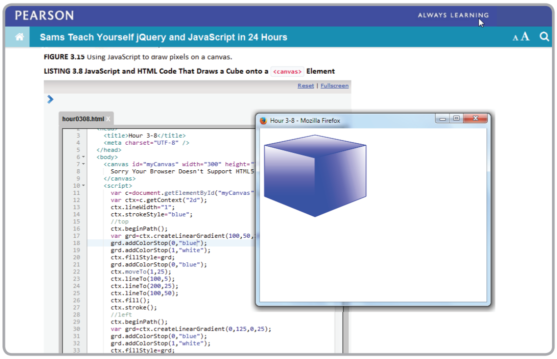
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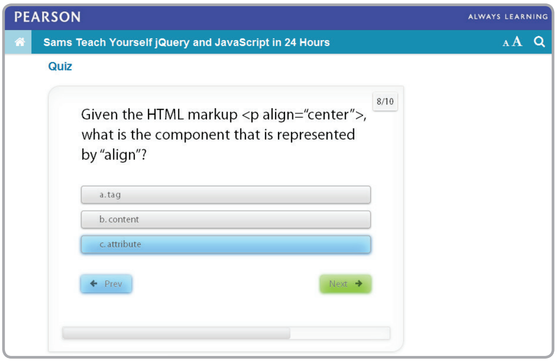
FIGURE 3.15 Using JavaScript to draw pixels on a canvas.

LISTING 3.8 JavaScript and HTML Code That Draws a Cube onto a `<canvas>` Element

```
    <title>Hour 3-8</title>
    <meta charset="UTF-8" />
  </head>
  <body>
    <canvas id="myCanvas" width="300" height="
      Sorry Your Browser Doesn't Support HTML5
    </canvas>
    <script>
      var c=document.getElementById("myCanvas"
      var ctx=c.getContext("2d");
      ctx.lineWidth="1";
      ctx.strokeStyle="blue";
      //top
      ctx.beginPath();
      var grd=ctx.createLinearGradient(100,50,
      grd.addColorStop(0,"blue");
      grd.addColorStop(1,"white");
      ctx.fillStyle=grd;
      grd.addColorStop(0,"blue");
      ctx.moveTo(1,25);
      ctx.lineTo(100,5);
      ctx.lineTo(200,25);
      ctx.lineTo(100,50);
      ctx.fill();
      ctx.stroke();
      //left
      ctx.beginPath();
      var grd=ctx.createLinearGradient(0,125,0,25);
      grd.addColorStop(0,"blue");
      grd.addColorStop(1,"white");
      ctx.fillStyle=grd;
```



Quiz

8/10

Given the HTML markup <p align="center">, what is the component that is represented by "align"?

a. tag
b. content
c. attribute

- **Try** your hand at coding in an interactive code-editing sandbox in select products
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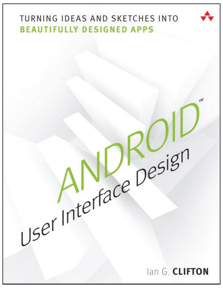

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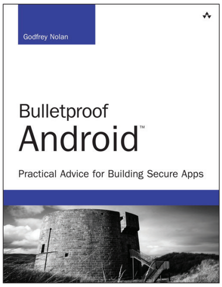

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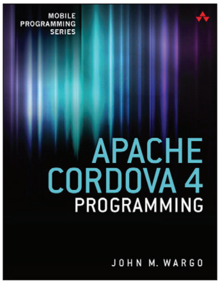

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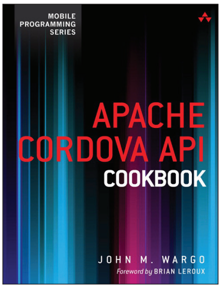

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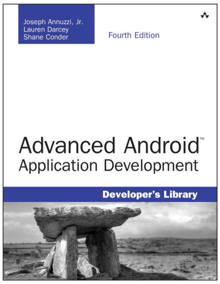

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