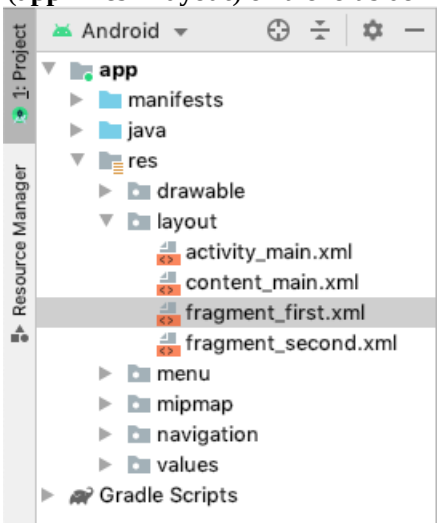
Solution Walkthrough

1. Explore the Layout Editor

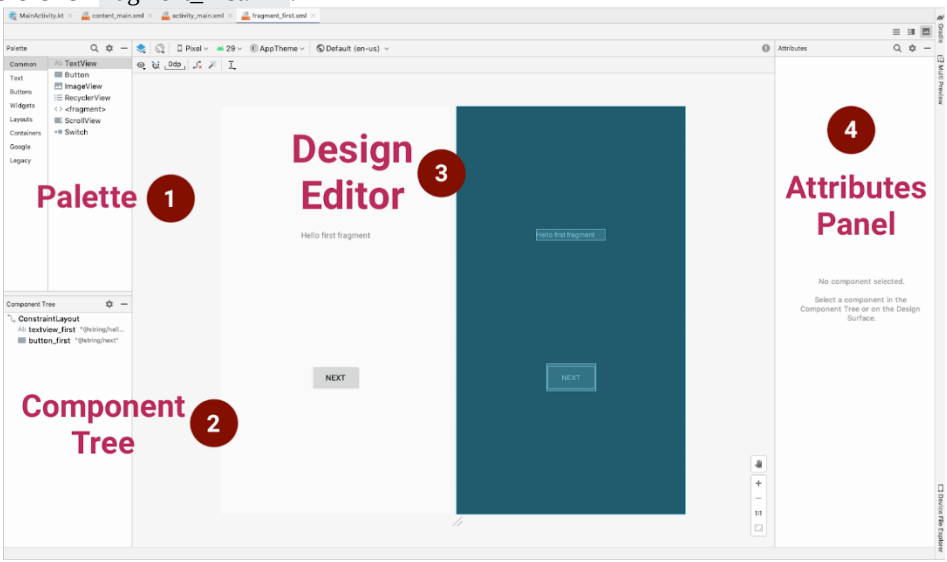
Generally, each screen in your Android app is associated with one or more *fragments*. The single screen displaying "Hello first fragment" is created by one fragment, called `FirstFragment`. This was generated for you when you created your new project. Each visible fragment in an Android app has a layout that defines the user interface for the fragment. Android Studio has a layout editor where you can create and define layouts. Layouts are defined in XML. The layout editor lets you define and modify your layout either by coding XML or by using the interactive visual editor. Every element in a layout is a view. In this task, you will explore some of the panels in the layout editor, and you will learn how to change property of views.

Step 1: Open the layout editor

1. Find and open the **layout** folder (**app > res > layout**) on the left side in the **Project** panel.



2. Double-click `fragment_first.xml`.



The panels to the right of the Project view comprise the *Layout Editor*. They may be arranged differently in your version of Android Studio, but the function is the same.

On the left is a **Palette (1)** of views you can add to your app.

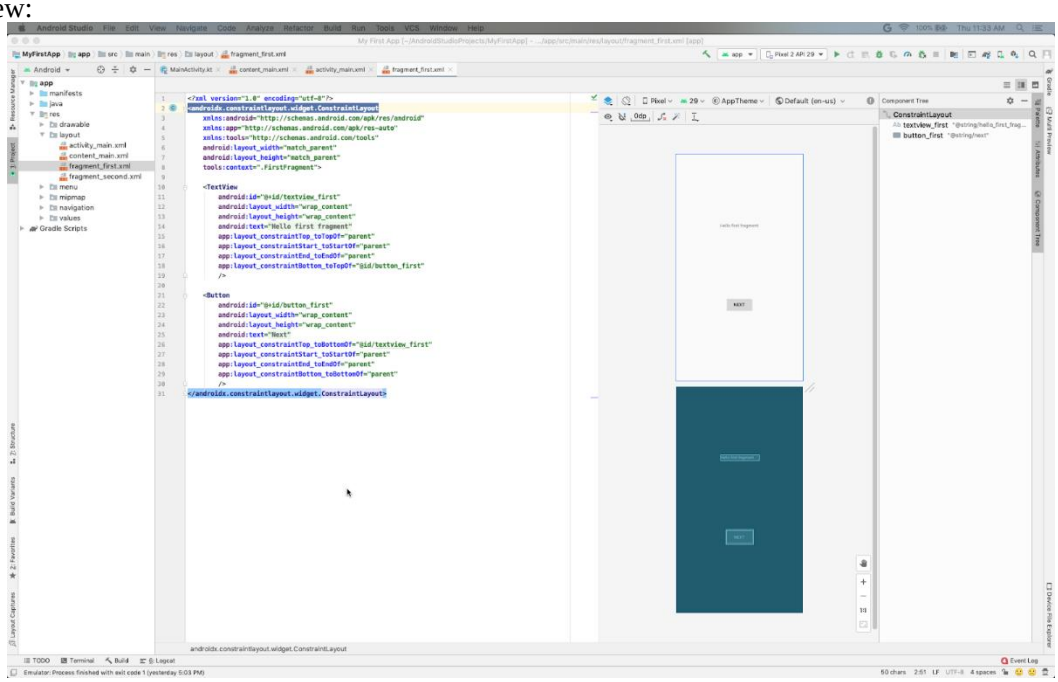
Below that is a **Component Tree (2)** showing the views currently in this file, and how they are arranged in relation to each other.

In the center is the *Design editor* **(3)**, which shows a visual representation of what the contents of the file will look like when compiled into an Android app. You can view the visual representation, the XML code, or both.

3. In the upper right corner of the Design editor, above **Attributes (4)**, find the three icons that look like this: These represent **Code** (code only), **Split** (code + design), and **Design** (design only) views.

4. Try selecting the different modes. Depending on your screen size and work style, you may prefer switching between **Code** and **Design**, or staying in **Split** view. If your **Component Tree** disappears, hide and show the **Palette**.

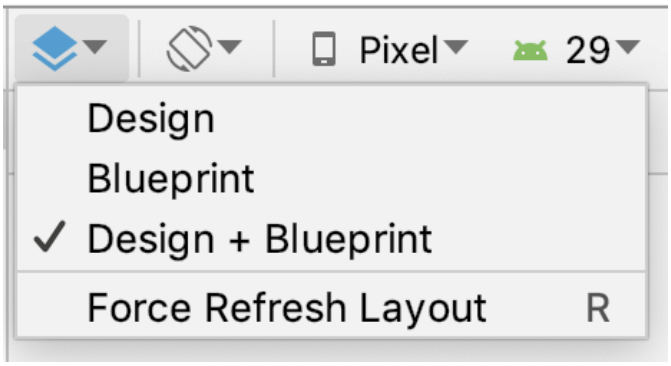
Split view:



5. At the lower right of the Design editor you see + and - buttons for zooming in and out. Use these buttons to adjust the size of what you see, or click the zoom-to-fit button so that both panels fit on your screen.

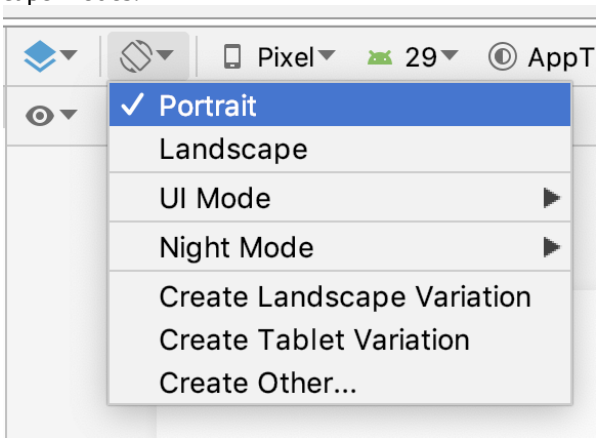
The *Design layout* on the left shows how your app appears on the device. The *Blueprint layout*, shown on the right, is a schematic view of the layout.

6. Practice using the layout menu in the top left of the design toolbar to display the design view, the blueprint view, and both views side by side.

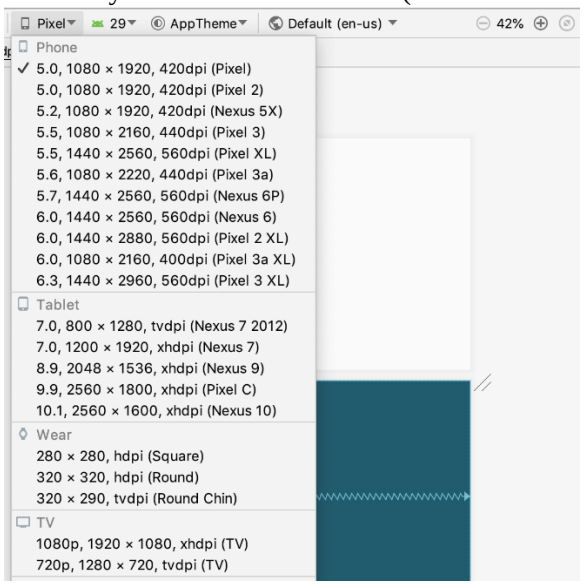


Depending on the size of your screen and your preference, you may wish to only show the **Design** view or the **Blueprint** view, instead of both.

7. Use the orientation icon to change the orientation of the layout. This allows you to test how your layout will fit portrait and landscape modes.



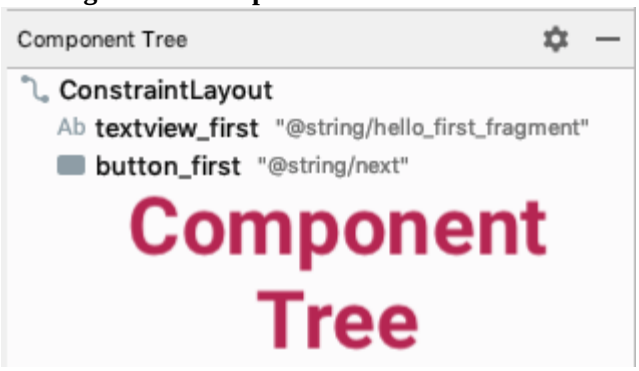
8. Use the device menu to view the layout on different devices. (This is extremely useful for testing!)



On the right is the **Attributes** panel. You'll learn about that later.

Step 2: Explore and resize the Component Tree

1. In fragment_first.xml, look at the **Component Tree**. If it's not showing, switch the mode to **Design** instead of **Split** or **Code**.



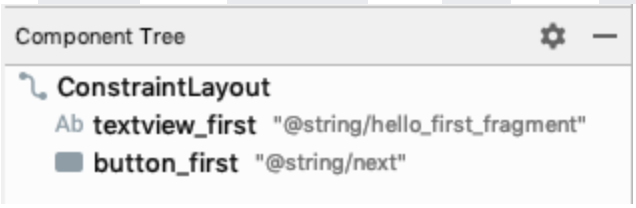
This panel shows the *view hierarchy* in your layout, that is, how the views are arranged in relation to each other. 2. If necessary, resize the **Component Tree** so you can read at least part of the strings. 3. Click the **Hide** icon at the top right of the **Component Tree**.

The **Component Tree** closes. 4. Bring back the **Component Tree** by clicking the vertical label **Component Tree** on the left.

Step 3: Explore view hierarchies

1. In the **Component Tree**, notice that the root of the view hierarchy is a ConstraintLayout view.

Every layout must have a root view that contains all the other views. The root view is always a *view group*, which is a view that contains other views. A ConstraintLayout is one example of a view group. 2. Notice that the ConstraintLayout contains a TextView, called textview_first and a Button, called button_first.



3. If the code isn't showing, switch to **Code** or **Split** view using the icons in the upper right corner.
4. In the XML code, notice that the root element is `<androidx.constraintlayout.widget.ConstraintLayout>`. The root element contains a `<TextView>` element and a `<Button>` element.

```
<androidx.constraintlayout.widget.ConstraintLayout
  ... >
   <TextView
      ...  />
   <Button
      ...  />
</androidx.constraintlayout.widget.ConstraintLayout>
```

Step 4: Change property values

1. In the code editor, examine the properties in the `TextView` element.

```
<TextView
   android:layout_width="wrap_content"
   android:layout_height="wrap_content"
   android:text="Hello first fragment"
   ... />
```

2. Click on the string in the **text** property, and you'll notice it refers to a string resource, `hello_first_fragment`.

```
android:text="@string/hello_first_fragment"
```

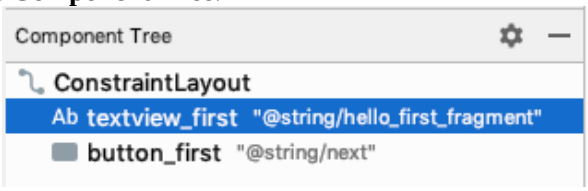
3. Right-click on the property and click **Go To > Declaration or Usages** `values/strings.xml` opens with the string highlighted.

```
<string name="hello_first_fragment">Hello first fragment</string>
```

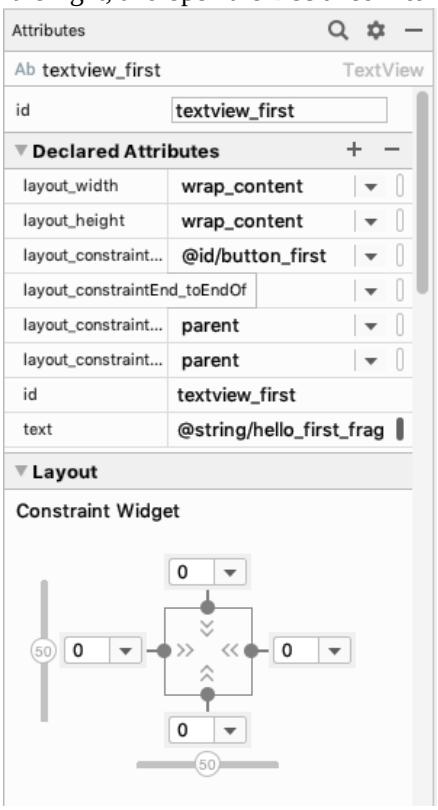
4. Change the value of the `string` property to `Hello World!`.

5. Switch back to `fragment_first.xml`.

6. Select `textview_first` in the **Component Tree**.



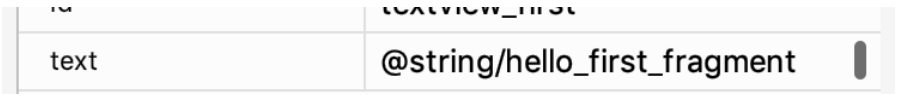
7. Look at the **Attributes** panel on the right, and open the **Declared Attributes** section if needed.



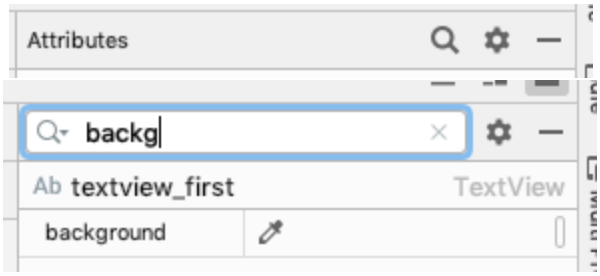
Troubleshooting this step:

- If the **Attributes** panel is not visible, click the vertical **Attributes** label at the top right.

9. In the **text** field of the `TextView` in **Attributes**, notice it still refers to the string resource `@string/hello_first_fragment`. Having the strings in a resource file has several advantages. You can change the value of string without having to change any other code. This simplifies translating your app to other languages, because your translators don't have to know anything about the app code.



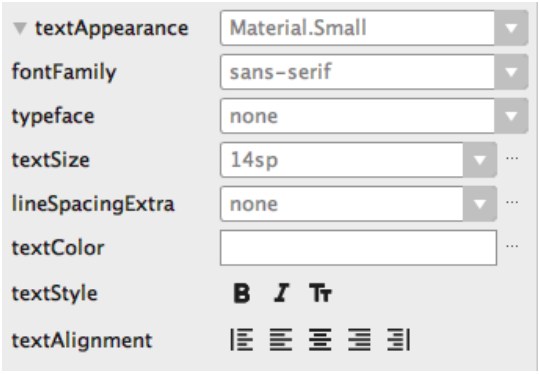
Tip: To find a property in the list of all the properties, click on the magnifying glass icon to the right of **Attributes**, and begin typing the name of the property. Android Studio will show just the properties that contain that string.



10. Run the app to see the change you made in **strings.xml**. Your app now shows "Hello World!".

Step 5: Change text display properties

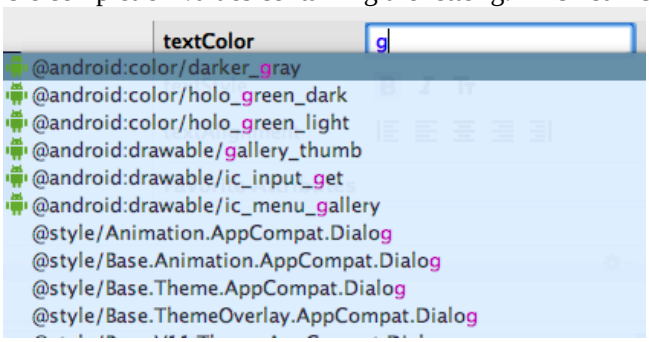
1. With `textview_first` still selected in the **Component Tree**, in the layout editor, in the list of attributes, under **Common Attributes**, expand the **textAppearance** field. (You may need to scroll down to find it.)



2. Change some of the text appearance properties. For example, change the font family, increase the text size, and select bold style. (You might need to scroll the panel to see all the fields.)

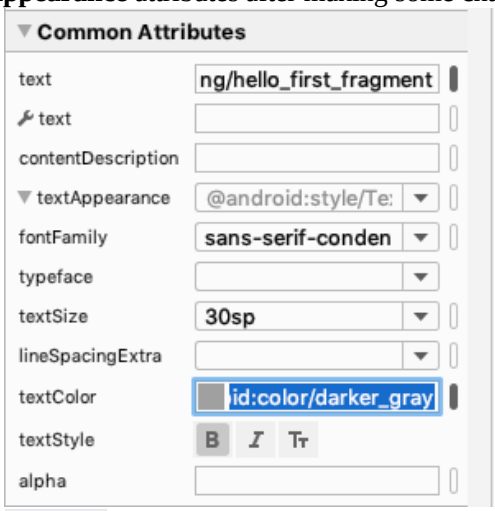
3. Change the text color. Click in the **textColor** field, and enter g.

A menu pops up with possible completion values containing the letter g. This list includes predefined colors.



4. Select **@android:color/darker_gray** and press **Enter**.

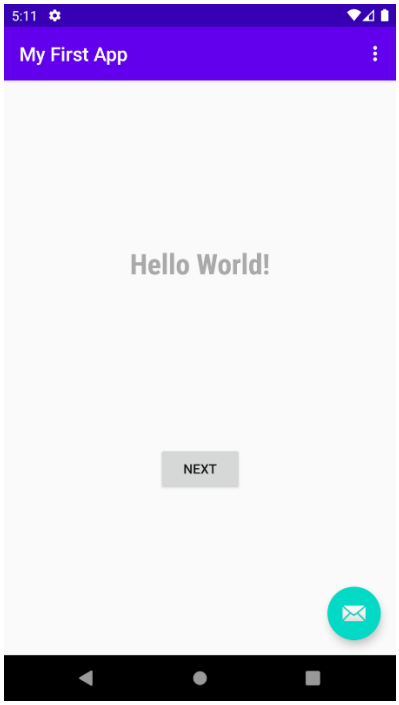
Below is an example of the **textAppearance** attributes after making some changes.



5. Look at the XML for the TextView. You see that the new properties have been added.

```
<TextView
   android:id="@+id/textview_first"
   android:layout_width="wrap_content"
   android:layout_height="wrap_content"
   android:fontFamily="sans-serif-condensed"
   android:text="@string/hello_first_fragment"
   android:textColor="@android:color/darker_gray"
   android:textSize="30sp"
   android:textStyle="bold"
```

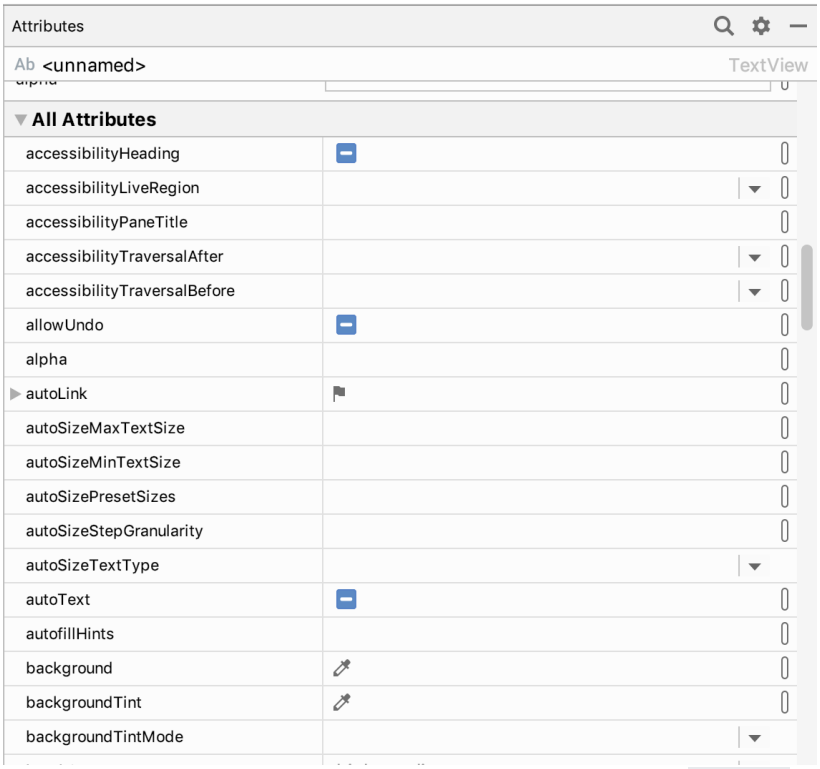
6. Run your app again and see the changes applied to your Hello World! string



Step 6: Work with the Attributes

1. In the **Attributes** panel, scroll down until you find **All Attributes**.

If you don't see any attributes in the **Attributes** panel, make sure textview_first is still selected in the **Component Tree**.



2. Scroll through the list to get an idea of the attributes you could set for a TextView.

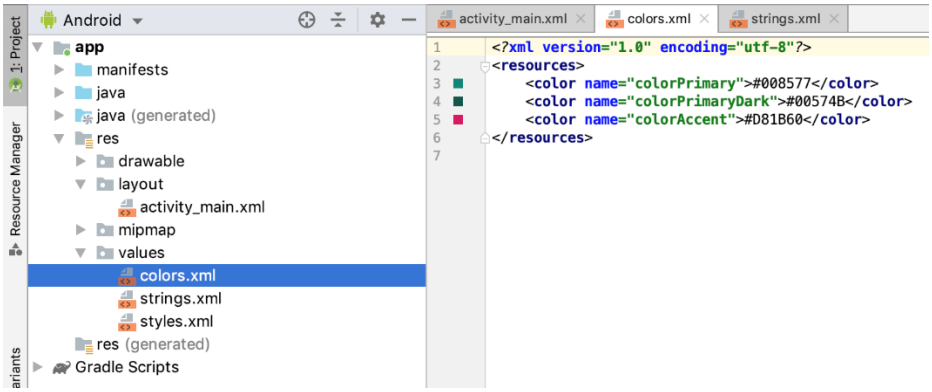
2. Add Color Resources

So far you have learned how to change property values. Next, you will learn how to create more resources like the string resources you worked with earlier. Using resources enables you to use the same values in multiple places, or to define values and have the UI update automatically whenever the value is changed.

Step 1: Add color resources

First, you'll learn how to add new color resources.

1. In the **Project** panel on the left, double-click on **res** > **values** > **colors.xml** to open the color resource file.



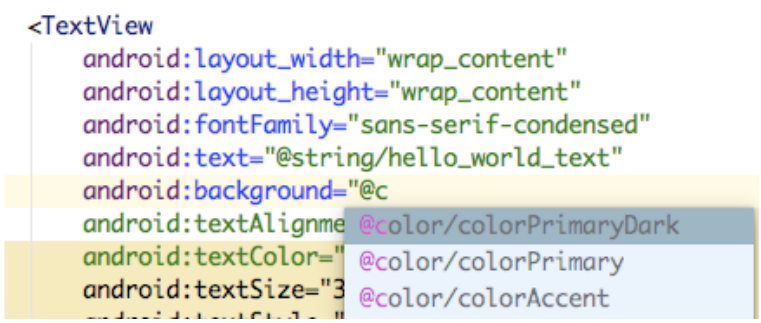

```
<resources>
    <color name="colorPrimary">#6200EE</color>
    <color name="colorPrimaryDark">#3700B3</color>
    <color name="colorAccent">#03DAC5</color>
</resources>
```

The `colors.xml` file opens in the editor. So far, three colors have been defined. These are the colors you can see in your app layout, for example, purple for the app bar.

Note: Different versions of Android Studio use different values for these colors, so you may see other colors here.

2. Go back to `fragment_first.xml` so you can see the XML code for the layout.
3. Add a new property to the `TextView` called `android:background`, and start typing to set its value to `@color`. You can add this property anywhere inside the `TextView` code.

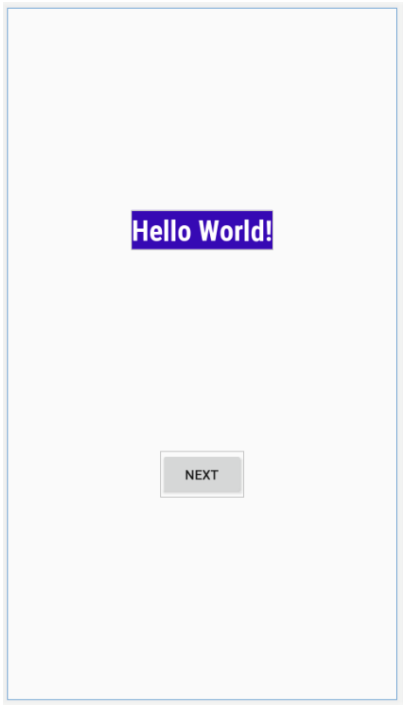
A menu pops up offering the predefined color resources:



4. Choose **@color/colorPrimaryDark.**

5. Change the property `android:textColor` and give it a value of `@android:color/white`.

The Android framework defines a range of colors, including white, so you don't have to define white yourself.
6. In the layout editor, you can see that the `TextView` now has a dark blue background, and the text is displayed in white.



Step 2: Add a new color to use as the screen background color

1. Back in `colors.xml`, create a new color resource called `screenBackground`:

```
<color name="screenBackground">#FFEE58</color>
```

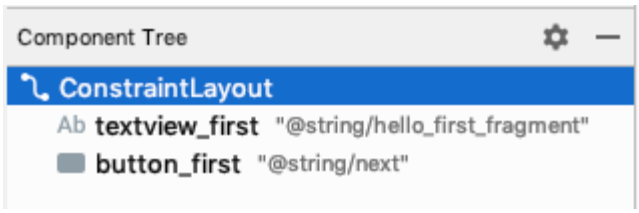
A Color can be defined as 3 hexadecimal numbers (#00-#FF, or 0-255) representing the red, blue, and green (RGB) components. The color you just added is yellow. Notice that the colors corresponding to the code are displayed in the left margin of the editor.

```
3    <color name="colorPrimary">#6200EE</color>
4    <color name="colorPrimaryDark">#3700B3</color>
5    <color name="colorAccent">#03DAC5</color>
6    <color name="screenBackground">#FFEE58</color>
```

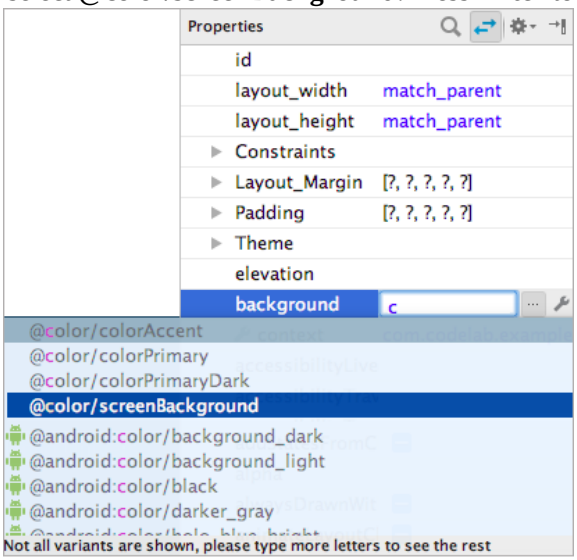
Note that a color can also be defined including an alpha value (#00-#FF) which represents the transparency (#00 = 0% = fully transparent, #FF = 100% = fully opaque). When included, the alpha value is the first of 4 hexadecimal numbers (ARGB).

The alpha value is a measure of transparency. For example, #88FFEE58 makes the color semi-transparent, and if you use #00FFEE58, it's fully transparent and disappears from the left-hand bar.

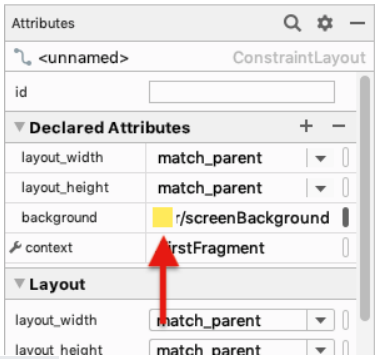
2. Go back to `fragment_first.xml`.
3. In the **Component Tree**, select the `ConstraintLayout`.



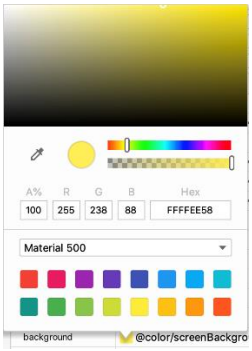
4. In the **Attributes** panel, select the **background** property and press **Enter**. Type "c" in the field that appears.
5. In the menu of colors select **@color/screenBackground**. Press **Enter** to complete the selection.



6. Click on the yellow patch to the left of the color value in the **background** field.



It shows a list of colors defined in colors.xml. Click the **Custom** tab to choose a custom color with an interactive color chooser.

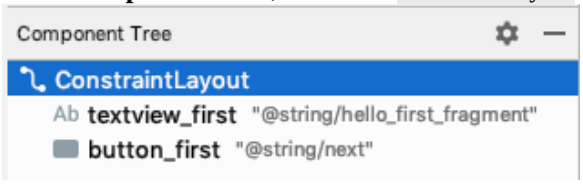


7. Feel free to change the value of the **screenBackground** color, but make sure that the final color is noticeably different from the `colorPrimary` and `colorPrimaryDark` colors.

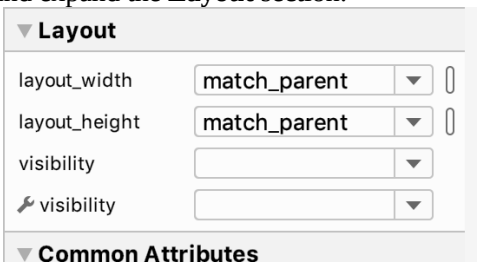
Step 3: Explore width and height properties

Now that you have a new screen background color, you will use it to explore the effects of changing the width and height properties of views.

1. In `fragment_first.xml`, in the **Component Tree**, select the `ConstraintLayout`.



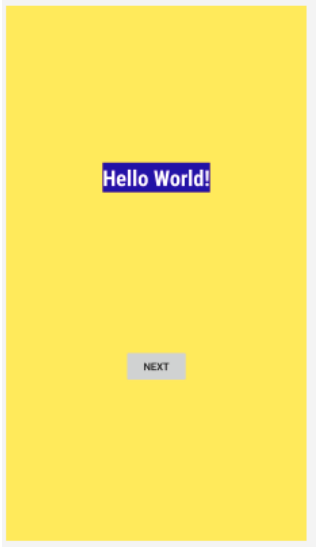
2. In the **Attributes** panel, find and expand the **Layout** section.



The **layout_width** and **layout_height** properties are both set to **match_parent**. The `ConstraintLayout` is the root view of this `Fragment`, so the "parent" layout size is effectively the size of your screen.

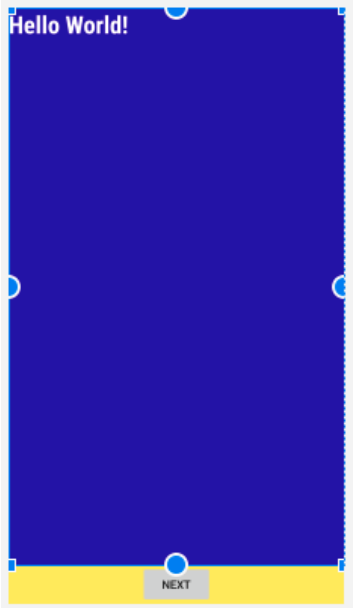
Tip: All views must have **layout_width** and **layout_height** properties.

3. Notice that the entire background of the screen uses the **screenBackground** color.



4. Select `textview_first`. Currently the layout width and height are **wrap_content**, which tells the view to be just big enough to enclose its content (plus padding)
5. Change both the layout width and layout height to **match_constraint**, which tells the view to be as big as whatever it's constrained to.

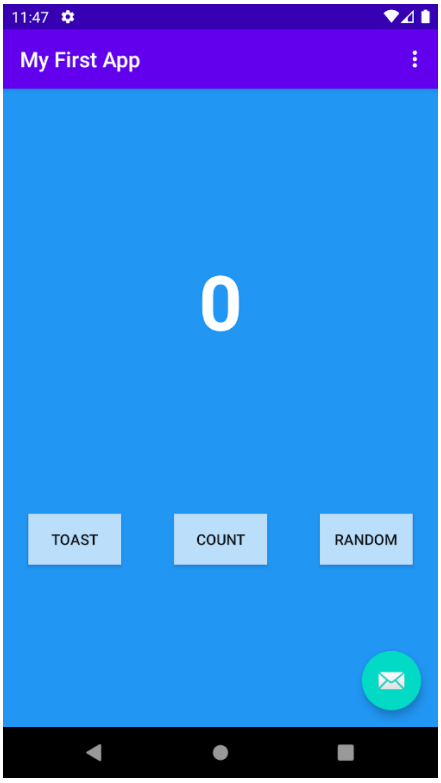
The width and height show **0dp**, and the text moves to the upper left, while the `TextView` expands to match the `ConstraintLayout` except for the button. The button and the text view are at the same level in the view hierarchy inside the constraint layout, so they share space.



6. Explore what happens if the width is **match_constraint** and the height is **wrap_content** and vice versa. You can also change the width and height of the button_first.
7. Set both the width and height of the `TextView` and the `Button` back to **wrap_content**.

3. Add Views and Constraints

In this task, you will add two more buttons to your user interface, and update the existing button, as shown below.



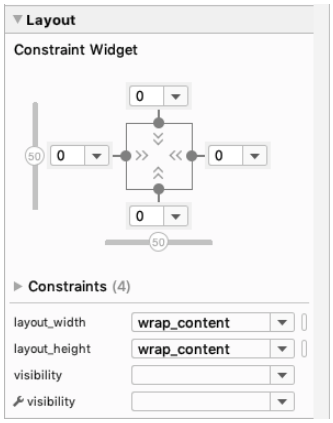
Step 1: View constraint properties

1. In fragment_first.xml, look at the constraint properties for the TextView.

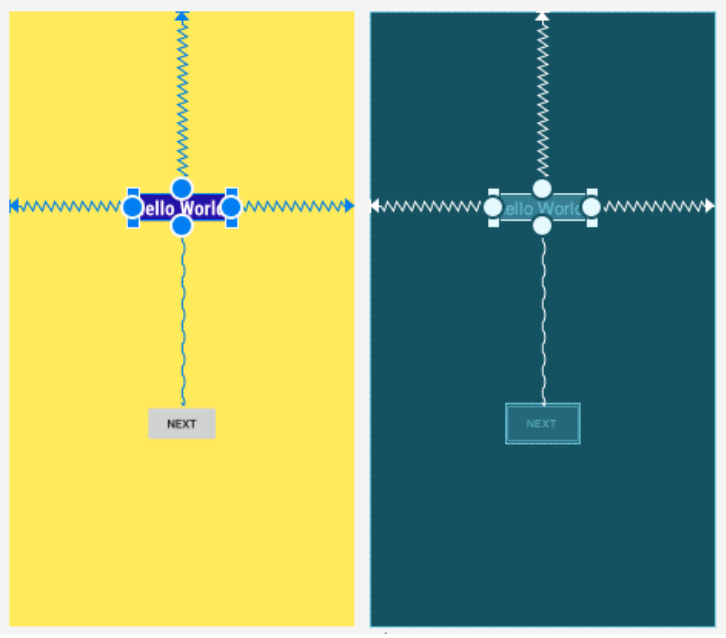
```
app:layout_constraintBottom_toTopOf="@id/button_first"
app:layout_constraintEnd_toEndOf="parent"
app:layout_constraintStart_toStartOf="parent"
app:layout_constraintTop_toTopOf="parent"
```

These properties define the position of the TextView. Read them carefully.
You can constrain the top, bottom, left, and right of a view to the top, bottom, left, and right of other views.

2. Select textview_first in the **Component Tree** and look at the **Constraint Widget** in the **Attributes** panel.



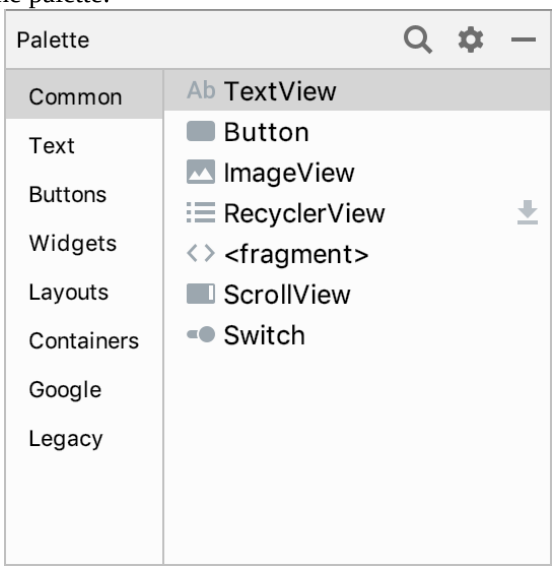
The square represents the selected view. Each of the grey dots represents a constraint, to the top, bottom, left, and right; for this example, from the TextView to its parent, the ConstraintLayout, or to the **Next** button for the bottom constraint. 3. Notice that the blueprint and design views also show the constraints when a particular view is selected. Some of the constraints are jagged lines, but the one to the **Next** button is a squiggle, because it's a little different. You'll learn more about that in a bit.



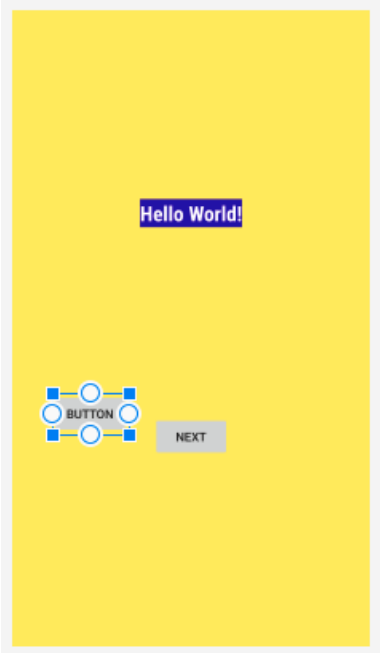
Step 2: Add buttons and constrain their positions

To learn how to use constraints to connect the positions of views to each other, you will add buttons to the layout. Your first goal is to add a button and some constraints, and change the constraints on the **Next** button.

1. Notice the **Palette** at the top left of the layout editor. Move the sides if you need to, so that you can see many of the items in the palette.



2. Click on some of the categories, and scroll the listed items if needed to get an idea of what's available.
3. Select **Button**, which is near the top, and drag and drop it onto the design view, placing it underneath the `TextView` near the other button.

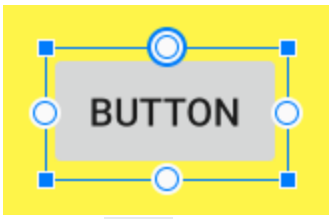


Notice that a `Button` has been added to the **Component Tree** under `ConstraintLayout`.

Step 3: Add a constraint to the new button

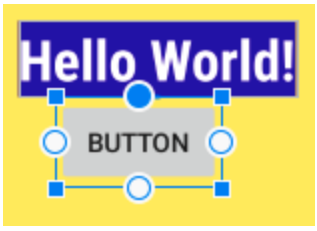
You will now constrain the top of the button to the bottom of the `TextView`.

1. Move the cursor over the circle at the top of the `Button`.



2. Click and drag the circle at the top of the `Button` onto the circle at the bottom of the `TextView`.

The `Button` moves up to sit just below the `TextView` because the top of the button is now *constrained* to the bottom of the `TextView`.



4. Take a look at the **Constraint Widget** in the **Layout** pane of the **Attributes** panel. It shows some constraints for the `Button`, including **Top -> BottomOf textView**.
5. Take a look at the XML code for the button. It now includes the attribute that constrains the top of the button to the bottom of the `TextView`.

   ```
   app:layout_constraintTop_toBottomOf="@+id/textview_first"
   ```

   You may see a warning, "**Not Horizontally Constrained**". To fix this, add a constraint from the left side of the button to the left side of the screen.
6. Also add a constraint to constrain the bottom of the button to the bottom of the screen.

Before adding another button, relabel this button so things are a little clearer about which button is which.

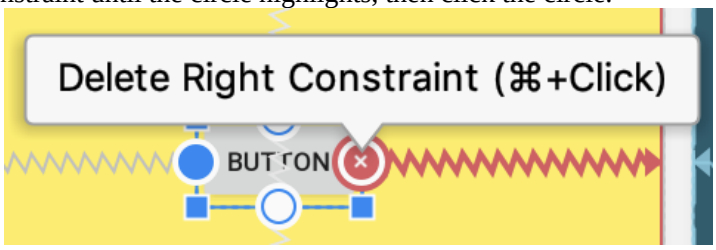
1. Click on the button you just added in the design layout.
2. Look at the **Attributes** panel on the right, and notice the **id** field.
3. Change the **id** from `button` to `toast_button`.

Step 4: Adjust the Next button

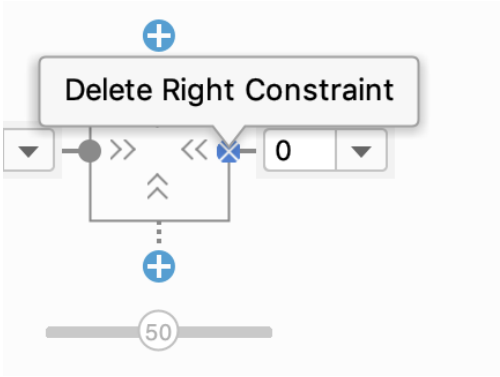
You will adjust the button labeled **Next**, which Android Studio created for you when you created the project. The constraint between it and the `TextView` looks a little different, a wavy line instead of a jagged one, with no arrow. This indicates a *chain*, where the constraints link two or more objects to each other, instead of just one to another. For now, you'll delete the chained constraints and replace them with regular constraints.

To delete a constraint:

- In the design view or blueprint view, hold the Ctrl key (Command on a Mac) and move the cursor over the circle for the constraint until the circle highlights, then click the circle.



- Or click on one of the constrained views, then right-click on the constraint and select **Delete** from the menu.
- Or in the **Attributes** panel, move the cursor over the circle for the constraint until it shows an x, then click it.



If you delete a constraint and want it back, either undo the action, or create a new constraint.

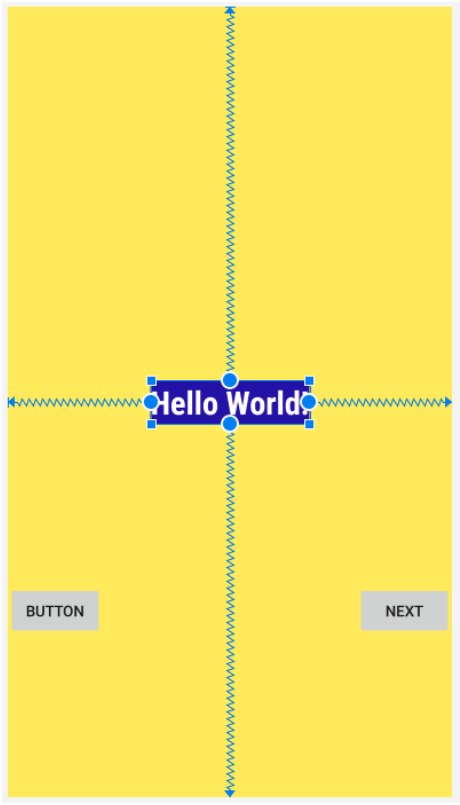
Step 5: Delete the chain constraints

1. Click on the **Next** button, and then delete the constraint from the top of the button to the TextView.
2. Click on the TextView, and then delete the constraint from the bottom of the text to the **Next** button.

Step 6: Add new constraints

1. Constrain the right side of the **Next** button to the right of the screen if it isn't already.
2. Delete the constraint on the left side of the **Next** button.
3. Now constrain the top and bottom of the **Next** button so that the top of the button is constrained to the bottom of the TextView and the bottom is constrained to the bottom of the screen. The right side of the button is constrained to the right side of the screen.
4. Also constrain the TextView to the bottom of the screen.

It may seem like the views are jumping around a lot, but that's normal as you add and remove constraints.
Your layout should now look something like this.



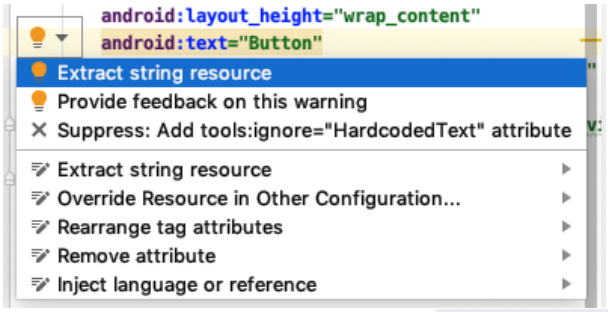
Step 7: Extract string resources

1. In the `fragment_first.xml` layout file, find the text property for the `toast_button` button.

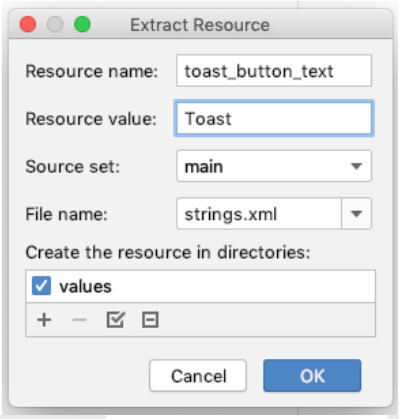
```
<Button
    android:id="@+id/toast_button"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="Button"
```

2. Notice that the text `"Button"` is directly in the layout field, instead of referencing a string resource as the `TextView` does. This will make it harder to translate your app to other languages.
3. To fix this, click the highlighted code. A light bulb appears on the left.

4. Click the lightbulb. In the menu that pops up, select **Extract string resource**.



5. In the dialog box that appears, change the resource name to `toast_button_text` and the resource value to `Toast` and click **OK**.



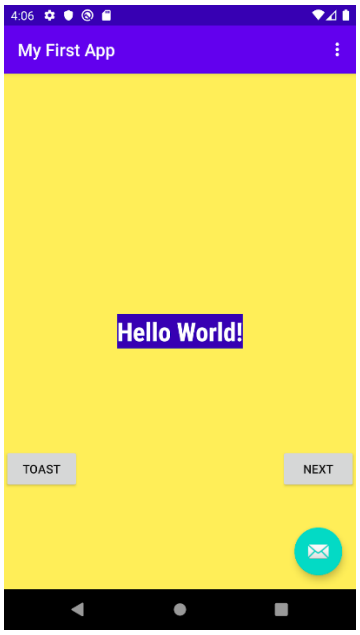
6. Notice that the value of the `android:text` property has changed to `@string/toast_button_text`.

```
<Button
    android:id="@+id/button"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="@string/toast_button_text"
```

7. Go to the **res** > **values** > **strings.xml** file. Notice that a new string resource has been added, named `toast_button_text`**.**

```
<resources>
    ...
    <string name="toast_button_text">Toast</string>
</resources>
```

8. Run the app to make sure it displays as you expect it to.



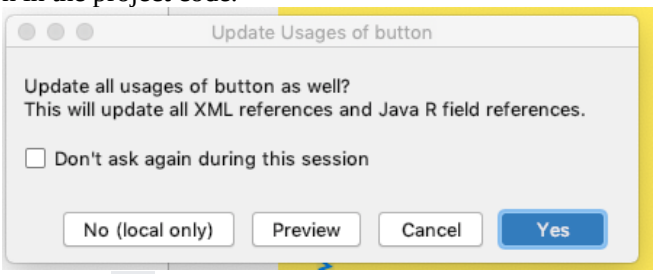
You now know how to create new string resources by extracting them from existing field values. (You can also add new resources to the strings.xml file manually.) And you know how to change the id of a view.

Note: The id for a view helps you identify that view distinctly from other views. You'll use this later to find particular views using the findViewById() method in your Java code.

Step 8: Update the Next button

The **Next** button already has its text in a string resource, but you'll make some changes to the button to match its new role, which will be to generate and display a random number.

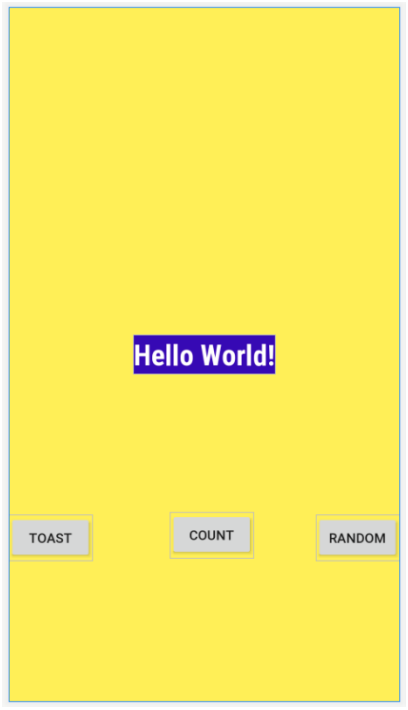
1. As you did for the **Toast** button, change the id of the **Next** button from button_first to random_button in the **Attributes** panel.
2. If you get a dialog box asking to update all usages of the button, click **Yes**. This will fix any other references to the button in the project code.



3. In strings.xml, right-click on the next string resource.
4. Select **Refactor > Rename...** and change the name to random_button_text.
5. Click **Refactor** to rename your string and close the dialog.
6. Change the value of the string from Next to Random.
7. If you want, move random_button_text to below toast_button_text.

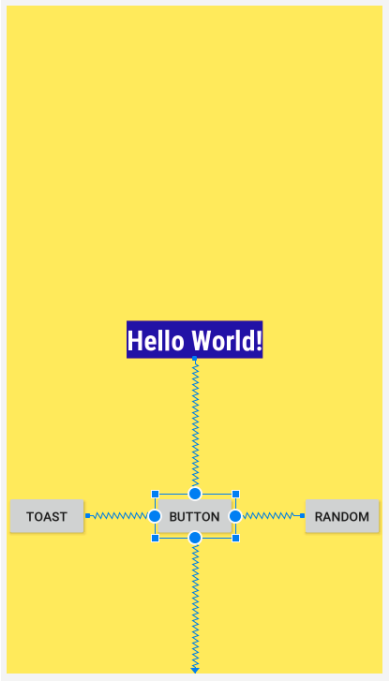
Step 9: Add a third button

Your final layout will have three buttons, vertically constrained the same, and evenly spaced from each other.



1. In fragment_first.xml, add another button to the layout, and drop it somewhere between the **Toast** button and the **Random** button, below the TextView.
2. Add vertical constraints the same as the other two buttons. Constrain the top of the third button to the bottom of TextView; constrain the bottom of the third button to the bottom of the screen.
3. Add horizontal constraints from the third button to the other buttons. Constrain the left side of the third button to the right side of the **Toast** button; constrain the right side of the third button to the left side of the **Random** button.

Your layout should look something like this:



5. Examine the XML code for `fragment_first.xml`. Do any of the buttons have the attribute `app:layout_constraintVertical_bias`? It's OK if you do not see that constraint.

The "bias" constraints allows you to tweak the position of a view to be more on one side than the other when both sides are constrained in opposite directions. For example, if both the top and bottom sides of a view are constrained to the top and bottom of the screen, you can use a vertical bias to place the view more towards the top than the bottom. Here is the XML code for the finished layout. Your layout might have different margins and perhaps some different vertical or horizontal bias constraints.The exact values of the attributes for the appearance of the `TextView` might be different for your app.

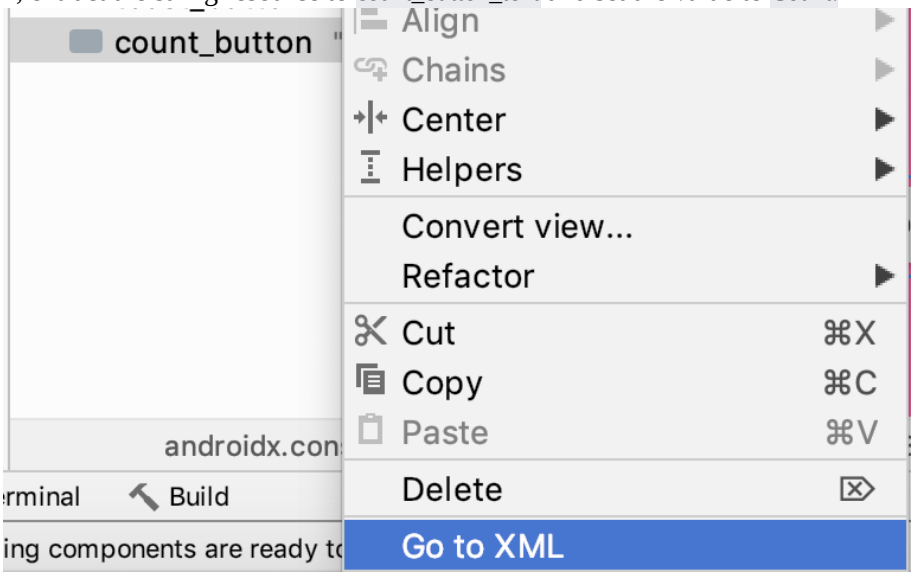
```
<?xml version="1.0" encoding="utf-8"?>
<androidx.constraintlayout.widget.ConstraintLayout <?xml version="1.0"
encoding="utf-8"?>
<androidx.constraintlayout.widget.ConstraintLayout
xmlns:android="http://schemas.android.com/apk/res/android"
   xmlns:app="http://schemas.android.com/apk/res-auto"
   xmlns:tools="http://schemas.android.com/tools"
   android:layout_width="match_parent"
   android:layout_height="match_parent"
   android:background="@color/screenBackground"
   tools:context=".FirstFragment">

   <TextView
       android:id="@+id/textview_first"
       android:layout_width="wrap_content"
       android:layout_height="wrap_content"
       android:background="@color/colorPrimaryDark"
       android:fontFamily="sans-serif-condensed"
       android:text="@string/hello_first_fragment"
       android:textColor="@android:color/white"
       android:textSize="30sp"
       android:textStyle="bold"
       app:layout_constraintBottom_toBottomOf="parent"
       app:layout_constraintEnd_toEndOf="parent"
       app:layout_constraintStart_toStartOf="parent"
       app:layout_constraintTop_toTopOf="parent" />

   <Button
       android:id="@+id/random_button"
       android:layout_width="wrap_content"
       android:layout_height="wrap_content"
       android:text="@string/random_button_text"
       app:layout_constraintBottom_toBottomOf="parent"
       app:layout_constraintEnd_toEndOf="parent"
```

```
            app:layout_constraintTop_toBottomOf="@+id/textview_first" />

        <Button
            android:id="@+id/toast_button"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="@string/toast_button_text"
            app:layout_constraintBottom_toBottomOf="parent"
            app:layout_constraintStart_toStartOf="parent"
            app:layout_constraintTop_toBottomOf="@+id/textview_first" />

        <Button
            android:id="@+id/button2"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="Button"
            app:layout_constraintBottom_toBottomOf="parent"
            app:layout_constraintEnd_toStartOf="@+id/random_button"
            app:layout_constraintStart_toEndOf="@+id/toast_button"
            app:layout_constraintTop_toBottomOf="@+id/textview_first" />
    </androidx.constraintlayout.widget.ConstraintLayout>
```

Step 10: Get your UI ready for the next task

The next task is to make the buttons do something when they are pressed. First, you need to get the UI ready.

1. Change the text of the `TextView` to show **0** (the number zero).
2. Change the `id` of the last button you added, `button2`, to `count_button` in the **Attributes** panel in the design editor.
3. In the XML, extract the string resource to `count_button_text` and set the value to `Count`.



The buttons should now have the following text and ids:

Button	**text**	**id**
Left button	Toast	@+id/toast_button
Middle button	Count	@+id/count_button
Right button	Random	@+id/random_button

5. Run the app.

Step 11: Fix errors if necessary

If you edited the XML for the layout directly, you might see some errors.

```
app:layout_constraintEnd_toStartOf="@+id/button"
app:layout_constraintStart_toEndOf="@+id/button2"
```

The errors occur because the buttons have changed their id and now these constraints are referencing non-existent views. If you have these errors, fix them by updating the id of the buttons in the constraints that are underlined in red.

```
app:layout_constraintEnd_toStartOf="@+id/random_button"
app:layout_constraintStart_toEndOf="@+id/toast_button"
```

4. Appearance of Buttons and the TextView

Your app's layout is now basically complete, but its appearance can be improved with a few small changes.

Step 1: Add new color resources

1. In colors.xml, change the value of screenBackground to #2196F3, which is a blue shade in the Material Design palette.
2. Add a new color named buttonBackground. Use the value #BBDEFB, which is a lighter shade in the blue palette.

```
<color name="buttonBackground">#BBDEFB</color>
```

Step 2: Add a background color for the buttons

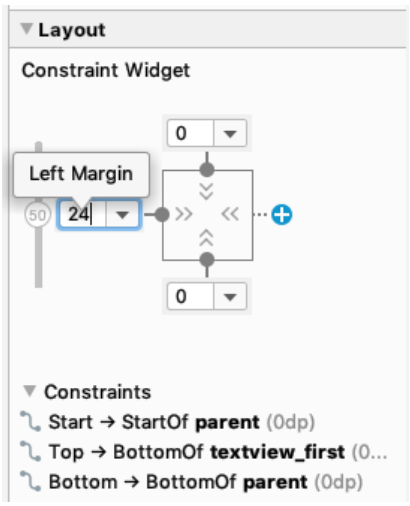
1. In the layout, add a background color to each of the buttons. (You can either edit the XML in fragment_first.xml or use the **Attributes** panel, whichever you prefer.)

```
android:background="@color/buttonBackground"
```

Step 3: Change the margins of the left and right buttons

1. Give the **Toast** button a left (start) margin of 24dp and give the **Random** button a right (end) margin of 24dp. (Using start and end instead of left and right makes these margins work for all language directions.)

One way to do this is to use the **Constraint Widget** in the **Attributes** panel. The number on each side is the margin on that side of the selected view. Type 24 in the field and press **Enter**.



Step 4: Update the appearance of the TextView

1. Remove the background color of the `TextView`, either by clearing the value in the **Attributes** panel or by removing the `android:background` attribute from the XML code.

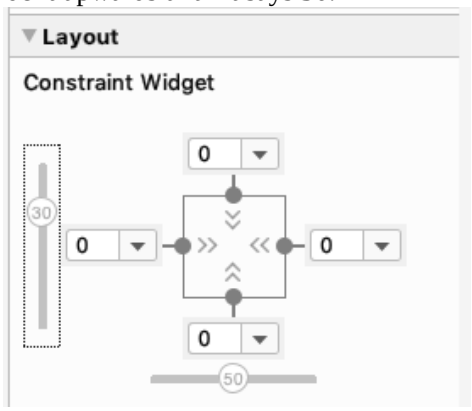
When you remove the background, the view background becomes transparent. 2. Increase the text size of the `TextView` to 72sp.

```
android:textSize="72sp"
```

3. Change the font-family of the `TextView` to `sans-serif` (if it's not already).
4. Add an `app:layout_constraintVertical_bias` property to the `TextView`, to bias the position of the view upwards a little so that it is more evenly spaced vertically in the screen. Feel free to adjust the value of this constraint as you like. (Check in the design view to see how the layout looks.)

   ```
   app:layout_constraintVertical_bias="0.3"
   ```

   You can also set the vertical bias using the **Constraint Widget**. Click and drag the number **50** that appears on the left side, and slide it upwards until it says **30**.



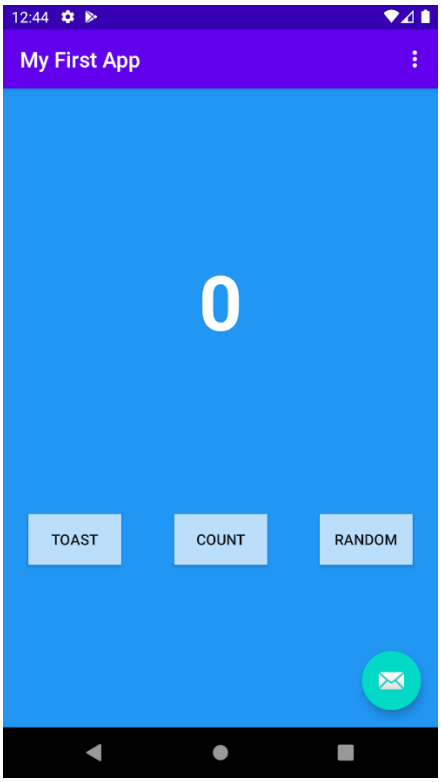
Tip: Using the bias attribute instead of margins or padding results in a more pleasing layout on different screen sizes and orientations.

- If a view is constrained to other views on both its top and bottom edges, use vertical bias to tweak its vertical position.
- If a view is constrained on both its left and right edges, use horizontal bias to tweak its horizontal position.

6. Make sure the **layout_width** is **wrap_content**, and the horizontal bias is 50 (`app:layout_constraintHorizontal_bias="0.5"` in XML).

Step 5: Run your app

If you implemented all the updates, your app will look like the following figure. If you used different colors and fonts, then your app will look a bit different.



5. Make the App Interactive

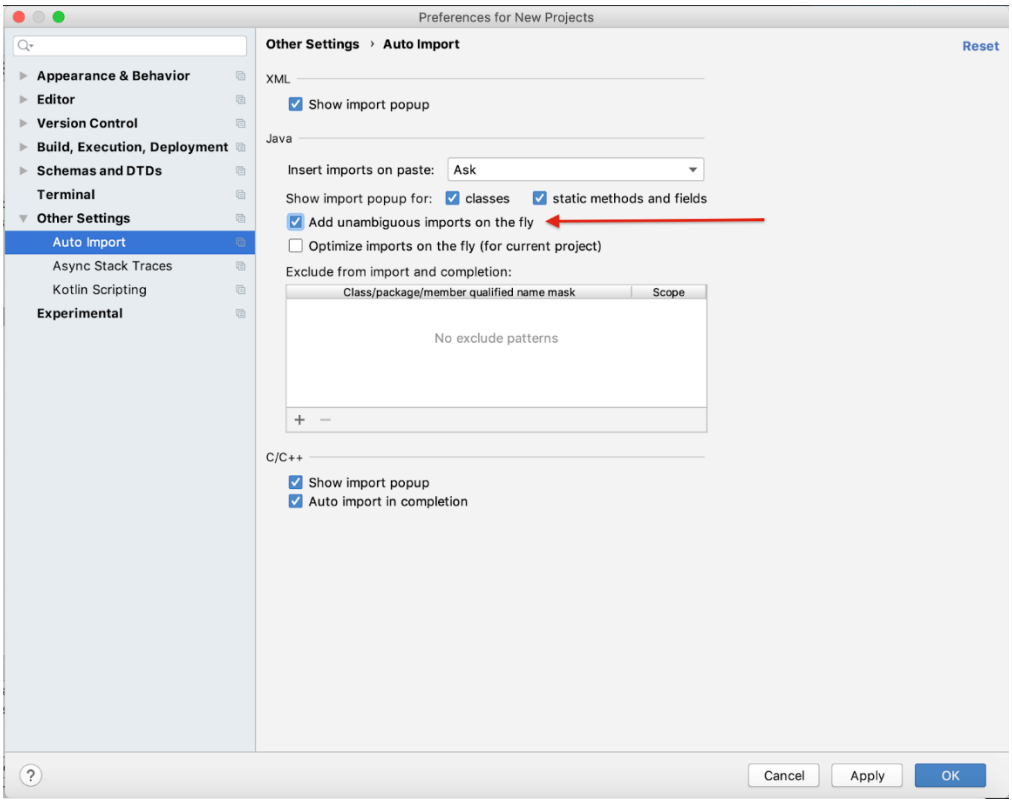
You have added buttons to your app's main screen, but currently the buttons do nothing. In this task, you will make your buttons respond when the user presses them.

First you will make the **Toast** button show a pop-up message called a *toast*. Next you will make the **Count** button update the number that is displayed in the `TextView`.

Step 1: Enable auto imports

To make your life easier, you can enable auto-imports so that Android Studio automatically imports any classes that are needed by the Java code.

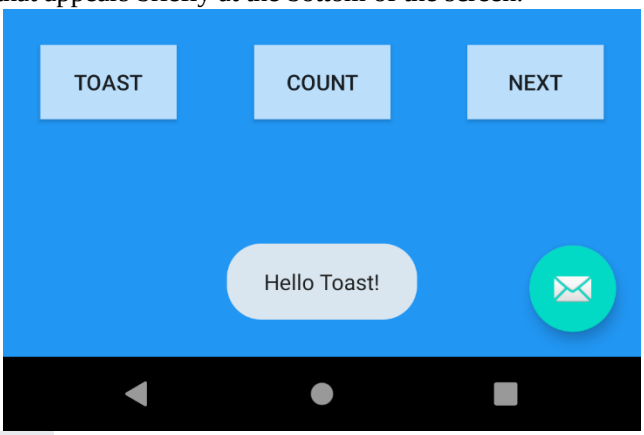
1. In Android Studio, open the settings editor by going to **File** > **Other Settings** > **Preferences for New Projects**.
2. Select **Auto Imports**. In the **Java** section, make sure **Add Unambiguous Imports on the fly** is checked.



3. Close the settings editor by pressing **OK**.

Step 2: Show a toast

In this step, you will attach a Java method to the **Toast** button to show a toast when the user presses the button. A toast is a short message that appears briefly at the bottom of the screen.



1. Open FirstFragment.java (**app** > **java** > **com.example.android.myfirstapp** > **FirstFragment**).

This class has only two methods, onCreateView() and onViewCreated(). These methods execute when the fragment starts. As mentioned earlier, the id for a view helps you identify that view distinctly from other views. Using the findViewByID() method, your code can find the random_button using its id, R.id.random_button.

2. Take a look at onViewCreated(). It sets up a click listener for the random_button, which was originally created as the **Next** button.

```
view.findViewById(R.id.random_button).setOnClickListener(new
View.OnClickListener() {
    @Override
    public void onClick(View view) {
        NavHostFragment.findNavController(FirstFragment.this)
                .navigate(R.id.action_FirstFragment_to_SecondFragment);
    }
});
```

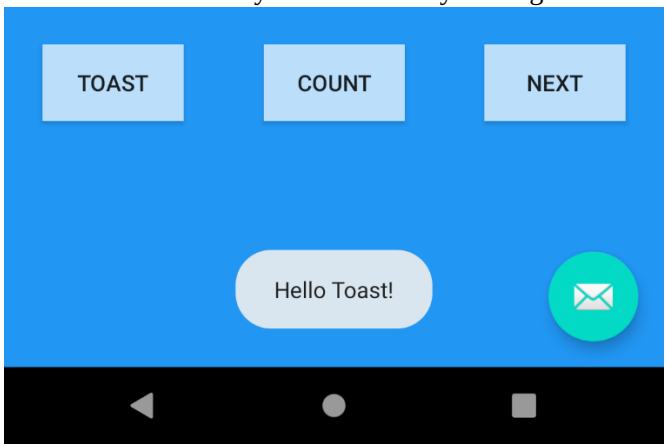
Here is what this code does:

- Use the findViewById() method with the id of the desired view as an argument, then set a click listener on that view.
- In the body of the click listener, use an action, which in this case is for navigating to another fragment, and navigate there. (You will learn about that later.)

3. Just below that click listener, add code to set up a click listener for the toast_button, which creates and displays a toast. Here is the code:

```
view.findViewById(R.id.toast_button).setOnClickListener(new
View.OnClickListener() {
    @Override
    public void onClick(View view) {
        Toast myToast = Toast.makeText(getActivity(), "Hello toast!",
Toast.LENGTH_SHORT);
        myToast.show();
    }
});
```

4. Run the app and press the **Toast** button. Do you see the toasty message at the bottom of the screen?



5. If you want, extract the message string into a resource as you did for the button labels.

You have learned that to make a view interactive you need to set up a click listener for the view which says what to do when the view (button) is clicked on. The click listener can either:

- Implement a small amount of code directly.
- Call a method that defines the desired click behavior in the activity.

Step 3: Make the Count button update the number on the screen

The method that shows the toast is very simple; it does not interact with any other views in the layout. In the next step, you add behavior to your layout to find and update other views.

Update the **Count** button so that when it is pressed, the number on the screen increases by 1.

1. In the fragment_first.xml layout file, notice the id for the TextView:

```
<TextView
    android:id="@+id/textview_first"
```

2. In FirstFragment.java, add a click listener for the count_button below the other click listeners in onViewCreated(). Because it has a little more work to do, have it call a new method, countMe().

```
view.findViewById(R.id.count_button).setOnClickListener(new
View.OnClickListener() {
    @Override
    public void onClick(View view) {
        countMe(view);
    }
});
```

3. In the FirstFragment class, add the method countMe() that takes a single View argument. This method will be invoked when the **Count** button is clicked and the click listener called.

```
private void countMe(View view) {

}
```

4. Get the value of the showCountTextView. You will define that in the next step.

```
...
 // Get the value of the text view
 String countString = showCountTextView.getText().toString();
```

5. Convert the value to a number, and increment it.

```
...
 // Convert value to a number and increment it
 Integer count = Integer.parseInt(countString);
 count++;
```

6. Display the new value in the TextView by programmatically setting the text property of the TextView.

```
...
// Display the new value in the text view.
showCountTextView.setText(count.toString());
```

Here is the whole method:

```
private void countMe(View view) {
    // Get the value of the text view
```

```
    String countString = showCountTextView.getText().toString();
    // Convert value to a number and increment it
    Integer count = Integer.parseInt(countString);
    count++;
    // Display the new value in the text view.
    showCountTextView.setText(count.toString());
}
```

Step 4: Cache the TextView for repeated use

You could call findViewById() in countMe() to find showCountTextView. However, countMe() is called every time the button is clicked, and findViewById() is a relatively time consuming method to call. So it is better to find the view once and cache it.

1. In the FirstFragment class before any methods, add a member variable for showCountTextView of type TextView.
   ```
   TextView showCountTextView;
   ```

2. In onCreateView(), you will call findViewById() to get the TextView that shows the count. The findViewById() method must be called on a View where the search for the requested ID should start, so assign the layout view that is currently returned to a new variable, fragmentFirstLayout, instead.
   ```
   // Inflate the layout for this fragment
   View fragmentFirstLayout = inflater.inflate(R.layout.fragment_first, container,
   false);
   ```

3. Call findViewById() on fragmentFirstLayout, and specify the id of the view to find, textview_first. Cache that value in showCountTextView.
   ```
   ...
    // Get the count text view
    showCountTextView = fragmentFirstLayout.findViewById(R.id.textview_first);
   ```

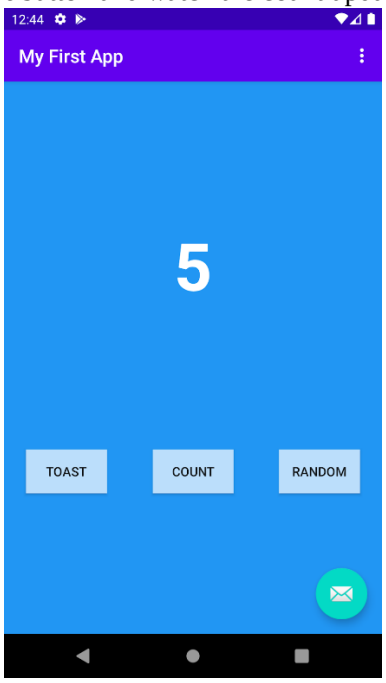
4. Return fragmentFirstLayout from onCreateView().
   ```
   return fragmentFirstLayout;
   ```

Here is the whole method and the declaration of showCountTextView:

```
TextView showCountTextView;
@Override
public View onCreateView(
       LayoutInflater inflater, ViewGroup container,
       Bundle savedInstanceState
) {
   // Inflate the layout for this fragment
   View fragmentFirstLayout = inflater.inflate(R.layout.fragment_first,
container, false);
```

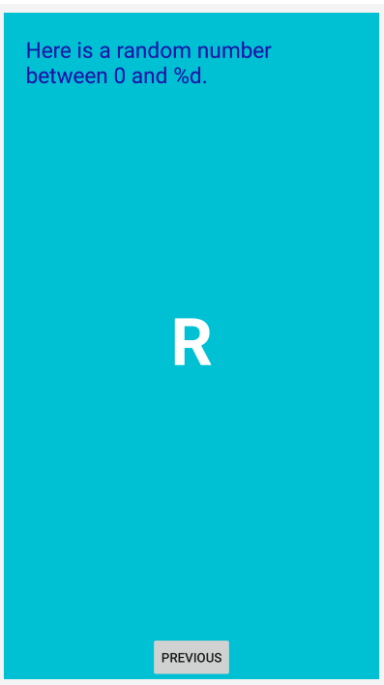
```
        // Get the count text view
        showCountTextView = fragmentFirstLayout.findViewById(R.id.textview_first);
        return fragmentFirstLayout;
    }
```

5. Run your app. Press the **Count** button and watch the count update.



6. Implement the Second Fragment

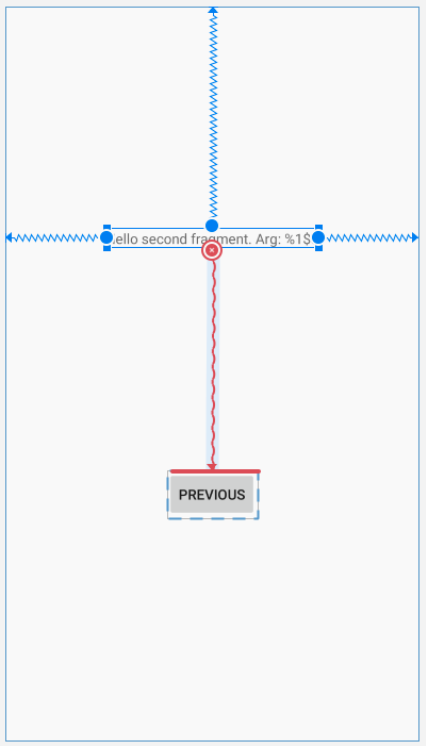
So far, you've focused on the first screen of your app. Next, you will update the **Random** button to display a random number between 0 and the current count on a second screen.



The screen for the new fragment will display a heading title and the random number. Here is what the screen will look like in the design view: The **%d** indicates that part of the string will be replaced with a number. The **R** is just a placeholder.

Step 1: Add a TextView for the random number

1. Open fragment_second.xml (**app > res > layout > fragment_second.xml**) and switch to **Design View** if needed. Notice that it has a ConstraintLayout that contains a TextView and a Button.
2. Remove the chain constraints between the TextView and the Button.



3. Add another TextView from the palette and drop it near the middle of the screen. This TextView will be used to display a random number between 0 and the current count from the first Fragment.
4. Set the id to @+id/textview_random (textview_random in the **Attributes** panel.)
5. Constrain the top edge of the new TextView to the bottom of the first TextView, the left edge to the left of the screen, and the right edge to the right of the screen, and the bottom to the top of the **Previous** button.
6. Set both width and height to **wrap_content**.
7. Set the **textColor** to **@android:color/white**, set the **textSize** to **72sp**, and the **textStyle** to **bold**.

8. Set the text to "R". This text is just a placeholder until the random number is generated.
9. Set the **layout_constraintVertical_bias** to **0.45**.

This TextView is constrained on all edges, so it's better to use a vertical bias than margins to adjust the vertical position, to help the layout look good on different screen sizes and orientations. 10. If you get a warning **"Not Horizontally Constrained,"** add a constraint from the start of the button to the left side of the screen and the end of the button to the right side of the screen.

Here is the XML code for the TextView that displays the random number:

```
<TextView
   android:id="@+id/textview_random"
   android:layout_width="wrap_content"
   android:layout_height="wrap_content"
   android:text="R"
   android:textColor="@android:color/white"
   android:textSize="72sp"
   android:textStyle="bold"
   app:layout_constraintBottom_toTopOf="@+id/button_second"
   app:layout_constraintEnd_toEndOf="parent"
   app:layout_constraintStart_toStartOf="parent"
   app:layout_constraintTop_toBottomOf="@+id/textview_second"
   app:layout_constraintVertical_bias="0.45" />
```

Step 2: Update the TextView to display the header

1. In fragment_second.xml, select textview_second, which currently has the text "Hello second fragment. Arg: %1$s" in the hello_second_fragment string resource.
2. If android:text isn't set, set it to the hello_second_fragment string resource.

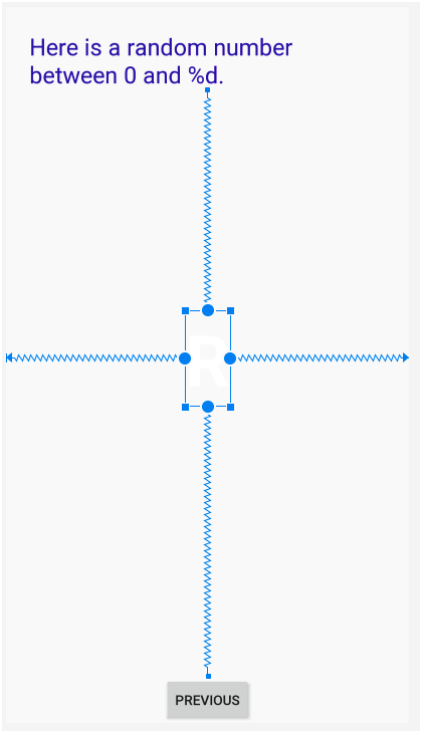
```
android:text="@string/hello_second_fragment"
```

3. Change the **id** to textview_header in the **Attributes** panel.
4. Set the width to **match_constraint**, but set the height to **wrap_content**, so the height will change as needed to match the height of the content.
5. Set top, left and right margins to 24dp. Left and right margins may also be referred to as "start" and "end" to support localization for right to left languages.
6. Remove any bottom constraint.
7. Set the text color to @color/colorPrimaryDark and the text size to 24sp.
8. In strings.xml, change hello_second_fragment to "Here is a random number between 0 and %d."
9. Use **Refactor > Rename...** to change the name of hello_second_fragment to random_heading.

Here is the XML code for the TextView that displays the heading:

```
<TextView
   android:id="@+id/textview_header"
   android:layout_width="0dp"
   android:layout_height="wrap_content"
   android:layout_marginStart="24dp"
```

```
android:layout_marginLeft="24dp"
android:layout_marginTop="24dp"
android:layout_marginEnd="24dp"
android:layout_marginRight="24dp"
android:text="@string/random_heading"
android:textColor="@color/colorPrimaryDark"
android:textSize="24sp"
app:layout_constraintEnd_toEndOf="parent"
app:layout_constraintStart_toStartOf="parent"
app:layout_constraintTop_toTopOf="parent" />
```



Step 3: Change the background color of the layout

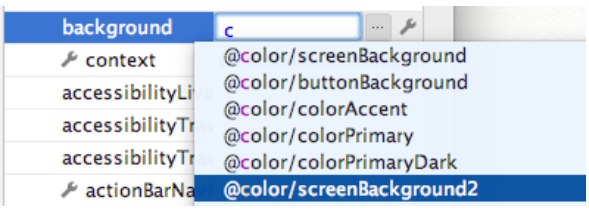
Give your new activity a different background color than the first activity:

1. In colors.xml, add a new color resource:

   ```
   <color name="screenBackground2">#26C6DA</color>
   ```

2. In the layout for the second activity, fragment_second.xml, set the background of the ConstraintLayout to the new color.

In the **Attributes** panel:



Or in XML:

```
android:background="@color/screenBackground2"
```

Your app now has a completed layout for the second fragment. But if you run your app and press the **Random** button, it may crash. The click handler that Android Studio set up for that button needs some changes. In the next task, you will explore and fix this error.

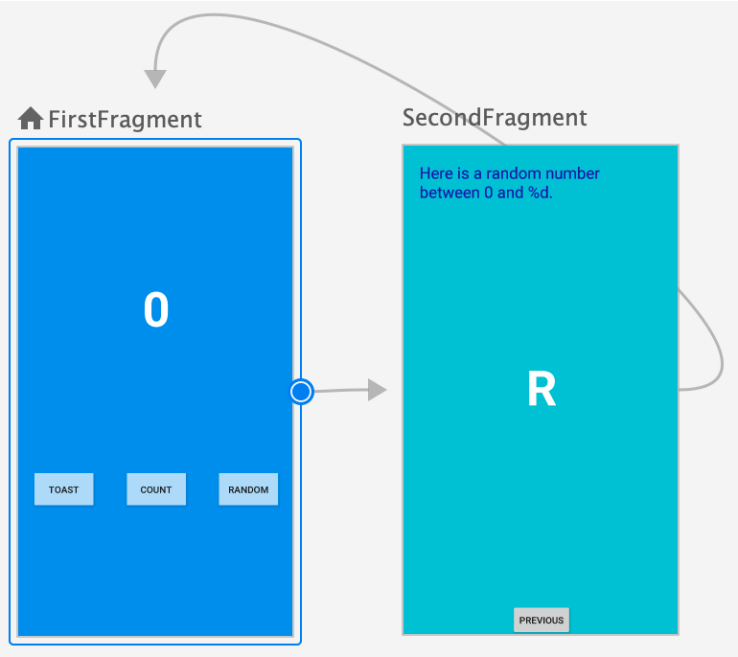
Step 4: Examine the navigation graph

When you created your project, you chose **Basic Activity** as the template for the new project. When Android Studio uses the **Basic Activity** template for a new project, it sets up two fragments, and a navigation graph to connect the two. It also set up a button to send a string argument from the first fragment to the second. This is the button you changed into the Random button. And now you want to send a number instead of a string.

1. Open `nav_graph.xml` (**app > res > navigation > nav_graph.xml**).

A screen similar to the **Layout Editor** in **Design** view appears. It shows the two fragments with some arrows between them. You can zoom with **+** and **-** buttons in the lower right, as you did with the **Layout Editor**.

2. You can freely move the elements in the navigation editor. For example, if the fragments appear with `SecondFragment` to the left, drag `FirstFragment` to the left of `SecondFragment` so they appear in the order you work with them.



Step 5: Enable SafeArgs

This will enable SafeArgs in Android Studio.

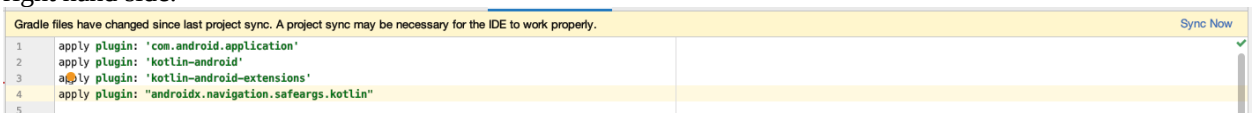
1. Open **Gradle Scripts > build.gradle (Project: My First App)**
2. Find the `dependencies` section In the `buildscript` section, and add the following lines after the other `classpath` entries:

```
def nav_version = "2.3.0-alpha04"
classpath "androidx.navigation:navigation-safe-args-gradle-plugin:$nav_version"
```

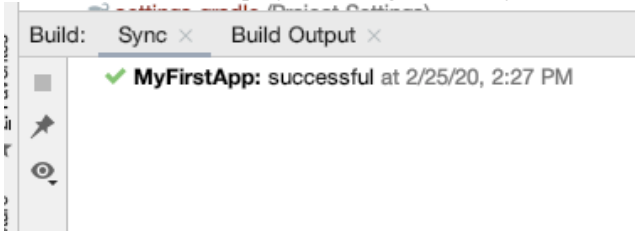
3. Open **Gradle Scripts > build.gradle (Module: app)**
4. Just below the other lines that begin with **apply plugin** add a line to enable SafeArgs:

```
apply plugin: 'androidx.navigation.safeargs'
```

5. Android Studio should display a message about the Gradle files being changed. Click **Sync Now** on the right hand side.



After a few moments, Android Studio should display a message in the Sync tab that it was successful:



6. Choose **Build > Make Project**. This should rebuild everything so that Android Studio can find FirstFragmentDirections.

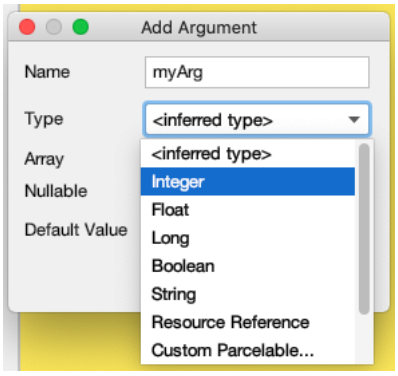
Troubleshooting: If the sync was not successful, confirm that you added the correct lines to the correct Gradle file. If there are still problems, check the developer's guide about Safe Args for an updated nav_version or other changes.

Step 6: Create the argument for the navigation action

1. In the navigation graph, click on FirstFragment, and look at the **Attributes** panel to the right. (If the panel isn't showing, click on the vertical **Attributes** label to the right.)
2. In the **Actions** section, it shows what action will happen for navigation, namely going to SecondFragment.
3. Click on SecondFragment, and look at the **Attributes** panel.

The **Arguments** section shows Nothing to show.

4. Click on the + in the **Arguments** section.
5. In the **Add Argument** dialog, enter myArg for the name and set the type to **Integer**, then click the **Add** button.



Step 7: Send the count to the second fragment

The **Next/Random** button was set up by Android Studio to go from the first fragment to the second, but it doesn't send any information. In this step you'll change it to send a number for the current count. You will get the current count from the text view that displays it, and pass that to the second fragment.

1. Open FirstFragment.java (**app > java > com.example.myfirstapp > FirstFragment**)
2. Find the method onViewCreated() and notice the code that sets up the click listener to go from the first fragment to the second.
3. Replace the code in that click listener with a line to find the count text view, textview_first.

```
int currentCount = Integer.parseInt(showCountTextView.getText().toString());
```

4. Create an action with currentCount as the argument to actionFirstFragmentToSecondFragment().

```
FirstFragmentDirections.ActionFirstFragmentToSecondFragment action =
FirstFragmentDirections.actionFirstFragmentToSecondFragment(currentCount);
```

5. Add a line to find the nav controller and navigate with the action you created.

```
NavHostFragment.findNavController(FirstFragment.this).navigate(action);
```

Here is the whole method, including the code you added earlier:

```
public void onViewCreated(@NonNull View view, Bundle savedInstanceState) {
   super.onViewCreated(view, savedInstanceState);

   view.findViewById(R.id.random_button).setOnClickListener(new
View.OnClickListener() {
       @Override
       public void onClick(View view) {
           int currentCount =
Integer.parseInt(showCountTextView.getText().toString());
           FirstFragmentDirections.ActionFirstFragmentToSecondFragment action =
FirstFragmentDirections.actionFirstFragmentToSecondFragment(currentCount);
           NavHostFragment.findNavController(FirstFragment.this).navigate(action
);
       }
   });

   view.findViewById(R.id.toast_button).setOnClickListener(new
View.OnClickListener() {
       @Override
       public void onClick(View view) {
           Toast myToast = Toast.makeText(getActivity(), "Hello toast!",
Toast.LENGTH_SHORT);
           myToast.show();
       }
   });

   view.findViewById(R.id.count_button).setOnClickListener(new
View.OnClickListener() {
       @Override
```

```
        public void onClick(View view) {
            countMe(view);
        }
    });
}
```

6. Run your app. Click the **Count** button a few times. Now when you press the **Random** button, the second screen shows the correct string in the header, but still no count or random number, because you need to write some code to do that.

Step 8: Update SecondFragment to compute and display a random number

You have written the code to send the current count to the second fragment. The next step is to add code to SecondFragment.java to retrieve and use the current count.

1. In SecondFragment.java, add an import for navArgs to the list of imported libraries.

```
import androidx.navigation.fragment.navArgs;
```

2. In the onViewCreated() method below the line that starts with super, add code to get the current count, get the string and format it with the count, and then set it for textview_header.

```
Integer count = SecondFragmentArgs.fromBundle(getArguments()).getMyArg();
String countText = getString(R.string.random_heading, count);
TextView headerView = view.getRootView().findViewById(R.id.textview_header);
headerView.setText(countText);
```

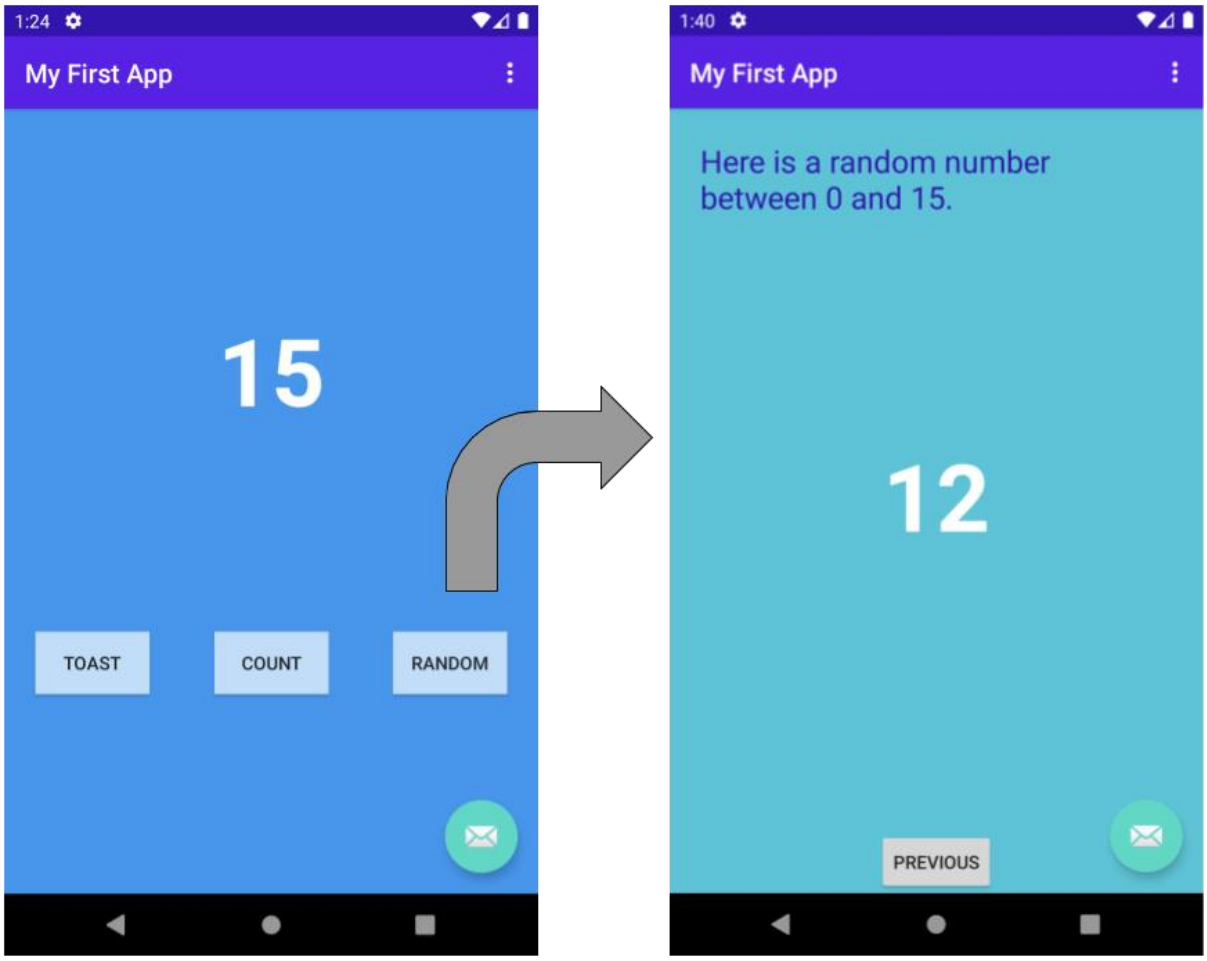
3. Get a random number between 0 and the count.

```
Random random = new java.util.Random();
Integer randomNumber = 0;
if (count > 0) {
   randomNumber = random.nextInt(count + 1);
}
```

4. Add code to convert that number into a string and set it as the text for textview_random.

```
TextView randomView = view.getRootView().findViewById(R.id.textview_random);
randomView.setText(randomNumber.toString());
```

5. Run the app. Press the **Count** button a few times, then press the **Random** button. Does the app display a random number in the new activity?


1:24
My First App
15
TOAST
COUNT
RANDOM
1:40
My First App
Here is a random number
between 0 and 15.
12
PREVIOUS