Testing, Layouts (and dynamic view switching)

CE881: Mobile and Social Application Programming

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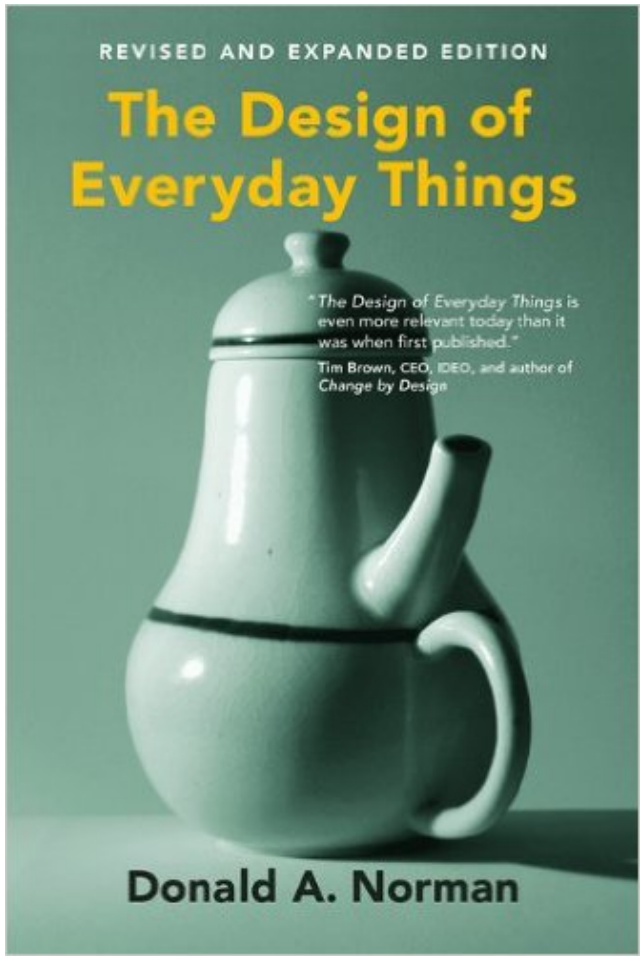
Movies, Books and Websites

- Design of everyday things
  - Great book on usability
- http://androidniceties.tumblr.com/
  - Collection of screenshots of good looking apps
- Minority Report
  - User Interface
  - Augmented reality app?



Keyboard propaganda (1)

IntelliJ IDEA Default Keymap

Editing

Ctrl + Space	Basic code completion (the name of any class, method or variable)
Ctrl + Shift + Space	Smart code completion (filters the list of methods and variables by expected type)
Ctrl + Shift + Enter	Complete statement
Ctrl + P	Parameter info (within method call arguments)
Ctrl + Q	Quick documentation lookup
Shift + F1	External Doc
Ctrl + mouse over code	Brief Info
Ctrl + F1	Show descriptions of error or warning at caret
Alt + Insert	Generate code... (Getters, Setters, Constructors, hashCode/equals, toString)
Ctrl + O	Override methods
Ctrl + I	Implement methods
Ctrl + Alt + T	Surround with... (if..else, try..catch, for, synchronized, etc.)
Ctrl + /	Comment/uncomment with line comment
Ctrl + Shift + /	Comment/uncomment with block comment
Ctrl + W	Select successively increasing code blocks
Ctrl + Shift + W	Decrease current selection to previous state
Alt + Q	Context info
Alt + Enter	Show intention actions and quick-fixes
Ctrl + Alt + L	Reformat code
Ctrl + Alt + O	Optimize imports
Ctrl + Alt + I	Auto-indent line(s)
Tab / Shift + Tab	Indent/unindent selected lines
Ctrl + X, Shift + Delete	Cut current line or selected block to clipboard
Ctrl + C, Ctrl + Insert	Copy current line or selected block to clipboard
Ctrl + V, Shift + Insert	Paste from clipboard
Ctrl + Shift + V	Paste from recent buffers...
Ctrl + D	Duplicate current line or selected block
Ctrl + Y	Delete line at caret
Ctrl + Shift + J	Smart line join
Ctrl + Enter	Smart line split
Shift + Enter	Start new line
Ctrl + Shift + U	Toggle case for word at caret or selected block
Ctrl + Shift +]/[	Select till code block end/start
Ctrl + Delete	Delete to word end
Ctrl + Backspace	Delete to word start
Ctrl + NumPad+/-	Expand/collapse code block
Ctrl + Shift + NumPad+	Expand all
Ctrl + Shift + NumPad-	Collapse all
Ctrl + F4	Close active editor tab

Search/Replace

Double Shift	Search everywhere
Ctrl + F	Find
F3	Find next
Shift + F3	Find previous
Ctrl + R	Replace
Ctrl + Shift + F	Find in path
Ctrl + Shift + R	Replace in path
Ctrl + Shift + S	Search structurally (Ultimate Edition only)
Ctrl + Shift + M	Replace structurally (Ultimate Edition only)

www.jetbrains.com/idea

IntelliJ IDEA Default Keymap

Usage Search

Alt + F7 / Ctrl + F7	Find usages / Find usages in file
Ctrl + Shift + F7	Highlight usages in file
Ctrl + Alt + F7	Show usages

Compile and Run

Ctrl + F9	Make project (compile modifed and dependent)
Ctrl + Shift + F9	Compile selected file, package or module
Alt + Shift + F10	Select configuration and run
Alt + Shift + F9	Select configuration and debug
Shift + F10	Run
Shift + F9	Debug
Ctrl + Shift + F10	Run context configuration from editor

Debugging

F8	Step over
F7	Step into
Shift + F7	Smart step into
Shift + F8	Step out
Alt + F9	Run to cursor
Alt + F8	Evaluate expression
F9	Resume program
Ctrl + F8	Toggle breakpoint
Ctrl + Shift + F8	View breakpoints

Navigation

Ctrl + N	Go to class
Ctrl + Shift + N	Go to file
Ctrl + Alt + Shift + N	Go to symbol
Alt + Right/Left	Go to next/previous editor tab
F12	Go back to previous tool window
Esc	Go to editor (from tool window)
Shift + Esc	Hide active or last active window
Ctrl + Shift + F4	Close active run/messages/find/... tab
Ctrl + G	Go to line
Ctrl + E	Recent files popup
Ctrl + Alt + Left/Right	Navigate back/forward
Ctrl + Shift + Backspace	Navigate to last edit location
Alt + F1	Select current file or symbol in any view
Ctrl + B, Ctrl + Click	Go to declaration
Ctrl + Alt + B	Go to implementation(s)
Ctrl + Shift + I	Open quick definition lookup
Ctrl + Shift + B	Go to type declaration
Ctrl + U	Go to super-method/super-class
Alt + Up/Down	Go to previous/next method
Ctrl +]/[	Move to code block end/start
Ctrl + F12	File structure popup
Ctrl + H	Type hierarchy
Ctrl + Shift + H	Method hierarchy
Ctrl + Alt + H	Call hierarchy
F2 / Shift + F2	Next/previous highlighted error
F4 / Ctrl + Enter	Edit source / View source
Alt + Home	Show navigation bar
F11	Toggle bookmark
Ctrl + F11	Toggle bookmark with mnemonic
Ctrl + #[0-9]	Go to numbered bookmark
Shift + F11	Show bookmarks

blogs.jetbrains.com/idea

IntelliJ IDEA Default Keymap

Refactoring

F5	Copy
F6	Move
Alt + Delete	Safe Delete
Shift + F6	Rename
Ctrl + F6	Change Signature
Ctrl + Alt + N	Inline
Ctrl + Alt + M	Extract Method
Ctrl + Alt + V	Extract Variable
Ctrl + Alt + F	Extract Field
Ctrl + Alt + C	Extract Constant
Ctrl + Alt + P	Extract Parameter

VCS/Local History

Ctrl + K	Commit project to VCS
Ctrl + T	Update project from VCS
Alt + Shift + C	View recent changes
Alt + BackQuote (`)	'VCS' quick popup

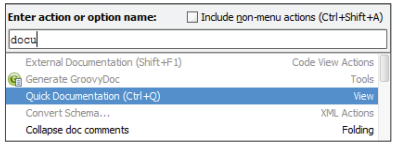
Live Templates

Ctrl + Alt + J	Surround with Live Template
Ctrl + J	Insert Live Template
iter	Iteration according to Java SDK 1.5 style
inst	Check object type with instanceof and downcast it
itco	Iterate elements of java.util.Collection
itit	Iterate elements of java.util.Iterator
itli	Iterate elements of java.util.List
psf	public static final
thr	throw new

General

Alt + #[0-9]	Open corresponding tool window
Ctrl + S	Save all
Ctrl + Alt + Y	Synchronize
Ctrl + Shift + F12	Toggle maximizing editor
Alt + Shift + F	Add to Favorites
Alt + Shift + I	Inspect current file with current profile
Ctrl + BackQuote (`)	Quick switch current scheme
Ctrl + Alt + S	Open Settings dialog
Ctrl + Alt + Shift + S	Open Project Structure dialog
Ctrl + Shift + A	Find Action
Ctrl + Tab	Switch between tabs and tool window

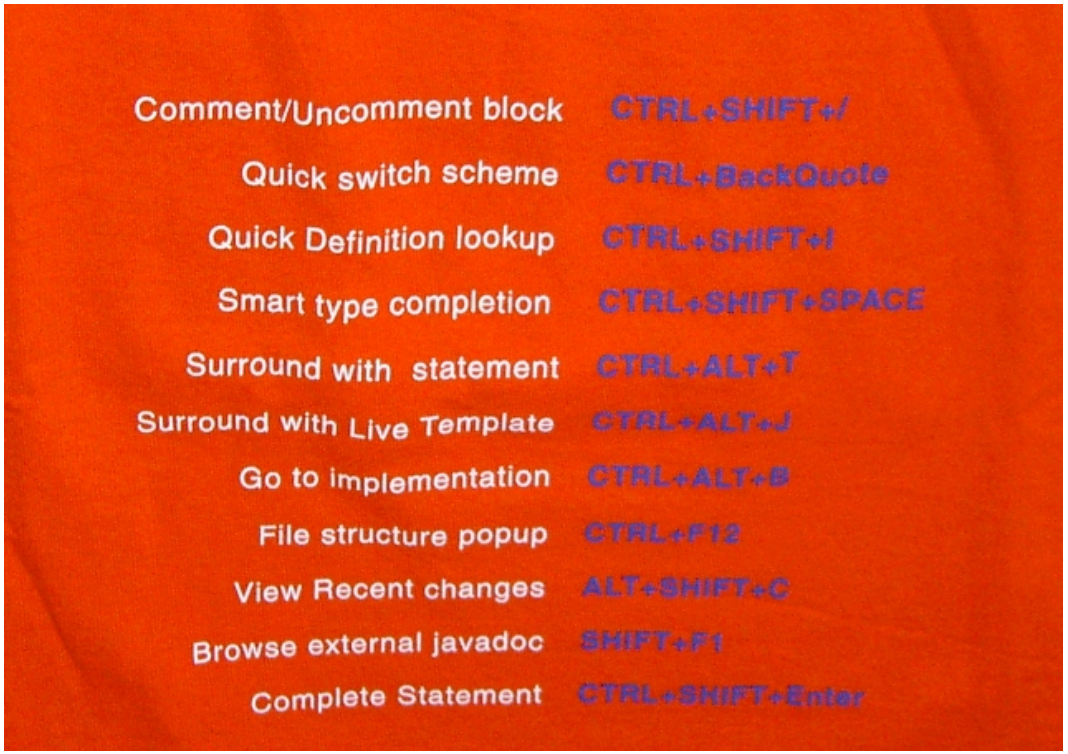
To find any action inside the IDE use Find Action (**Ctrl+Shift+A** / **⇧ ⌘ A**)



@intellijidea

Keyboard propaganda (2)

- Learn how to touch type
- Ctrl+Shift+A (Meta - search for shortcut/action)
- Ctrl+B (Go to declaration)
- Ctrl+U (Go to superclass)
- Ctrl+J (Insert template)



http://stackoverflow.com/questions/294167/what-are-the-most-useful-intellij-idea-keyboard-

Apps

- Apps that (I think) look great
  - Cookbook - Beautiful Recipes
  - Uber
  - DuoLingo
  - Inbox by Gmail
  - Reddit News Pro

Testing?

- An app is not considered complete before testing
- A method of confirming that your code does what it is expected to do
- Broadly, three kinds of tests
  - Functional tests
  - Unit tests
  - Integration tests
- But these are ad-hoc categories

Why Unit tests?

- How do you know if what you have done works or not?
  - Buggy apps going to full deployment
- Multiple platforms to deploy to - how do you know if your app works in all of them?
  - Mostly commercial tools to address this
- What impact does a change in one part of the code have in the rest?
  - Good software is tested exhaustively
- Ideally one would have a fully automated cycle of development-testing-deployment

Android/Junit

- The standard method of unit testing in Java is JUnit

```
@RunWith(AndroidJUnit4.class)
@LargeTest
public class MainActivityInstrumentationTest {

    @Rule
    public ActivityTestRule mActivityRule = new ActivityTestRule<>(
            MainActivity.class);

    @Test
    public void sayHello(){
        onView(withText("Say hello!")).perform(click());

        onView(withId(R.id.textView)).check(matches(withText("Hello, World!")));
    }
}
```

JUNIT

- Notice the heavy use of Aspect Oriented Programming (AOP) features
- "Interceptors"
  http://developer.android.com/reference/android/support/test/rule/ActivityTestRule.html
- Again, apps that have no automated testing break often
- Embrace change!

More than GUIs

- You can simulate most events:
  - Swipes
  - Clicks
  - Text input
- Should be part of your gradle lifecycle
- What about external resources?
- https://coveralls.io/ - Coverage?

http://developer.android.com/tools/testing/testing_android.html
http://developer.android.com/tools/testing/testing-tools.html

Continuous Integration

- Git commit
- Compilation
- Test Run
- Report
- Travis CI

Test-Driven development

- Might a good idea to write tests first
- Why?

Layouts

- Layouts are concerned with organising component views
  - i.e. allocating each child component a rectangular area of the parent view
  - The parent view could be fixed or scrollable
  - Each rectangular area is normally non-overlapping
- We've already used a LinearLayout
  - Let's look at this in a bit more detail
  - And also some other Layout types

Importance of Layouts (1)

- Very important
- Difficult to get right
- Challenge: must cope with
  - Different screen resolutions and aspect ratios
  - Different device orientations

Importance of Layouts (2)

- MUST be functional in all cases
  - No missing components
- SHOULD look good too
  - Evenly spaced child views
- Be appropriately sized
  - Text not too big or too tiny

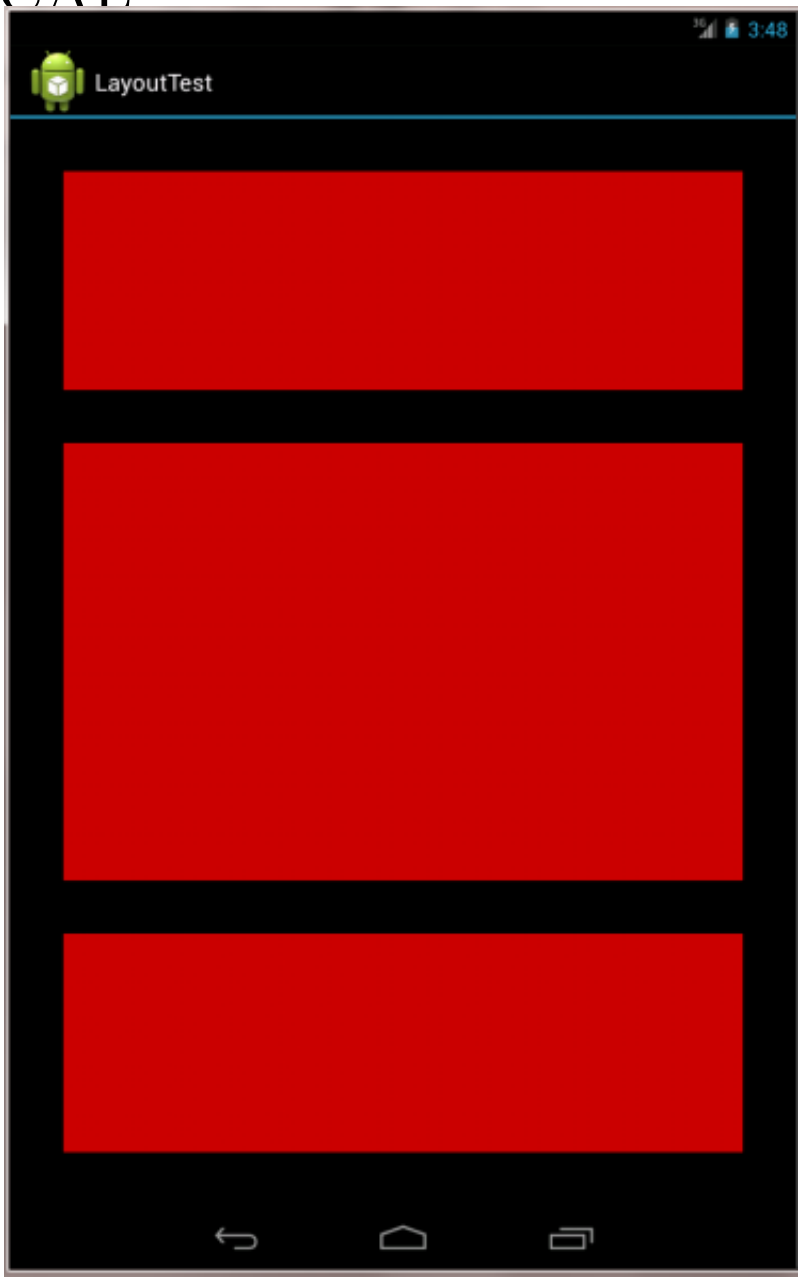
LinearLayout Concepts

- LinearLayout Orientation: vertical or horizontal
  - This is distinct from device orientation
  - You may or may not want to make it dependent on device orientation
- Child View properties:
  - Width and Height
    - wrap_content or match_parent
    - set number in units of **px** or **dp**
  - Gravity
    - Each child view within a view can specify it's gravity, which is where it is attracted to (e.g. left, centre or right for a horizontal orientation)
    - Margins: set child margins to provide clear separation and better appearence

Example: Evenly Spaced Children

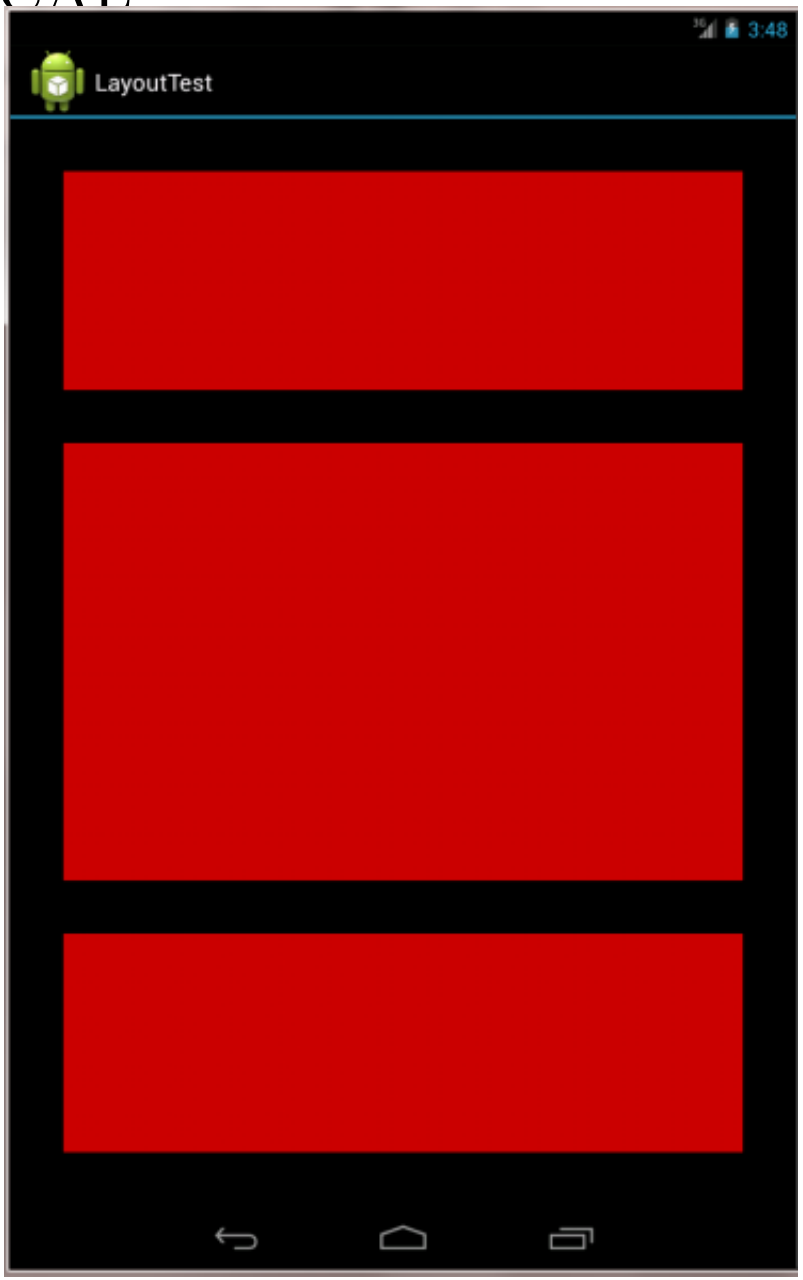
- We'll work through a common case: we want the children in the layout to fill the available space
- Each one should have a defined proportion of the space; proportions do not have to be equal
- In this case we'll have three components make the middle component twice the size of the others
- We'll use the default View class
- And set it's background color in the XML layout file

LinearLayout (1): Vertical



- On the next side we'll see the XML for this
- Set height of each child to zero (0dp)
- Set weight of each one in proportion to vertical space it takes

LinearLayout (2): Vertical



- In this case 1 : 2 : 1
- Set width to the **match_parent** (aka **fill_parent**)
- Use margins to make it look good
- But if used naively in a landscape mode it may lead to poor proportions as we'll see ...

LinearLayout (3): XML

```
<LinearLayout
        android:orientation="vertical"
        android:layout_width="fill_parent"
        android:layout_height="fill_parent"
        android:layout_margin="20dp"
        xmlns:android="http://schemas.android.com/apk/res/android">
    <View android:layout_width="fill_parent"
          android:layout_height="0dp"
          android:layout_margin="20dp"
          android:layout_weight="1"
          android:background="@android:color/holo_red_dark"
          android:layout_gravity="right|center_vertical"/>
    <View android:layout_width="fill_parent"
          android:layout_margin="20dp"
          android:layout_height="0dp"
          android:layout_weight="2"
          android:background="@android:color/holo_red_dark"
            />
    <View android:layout_width="fill_parent"...>
</LinearLayout>
```

The Vertical Layout in Device Landscape Mode

- This may or may not be what we need

Adding a Landscape XML file

- Place a layout file of the same name (e.g. linear.xml) in the res/land-Layout directory
- This might be a converse version of the original portrait one
  - E.g. swap width for height

Adding a Landscape XML file

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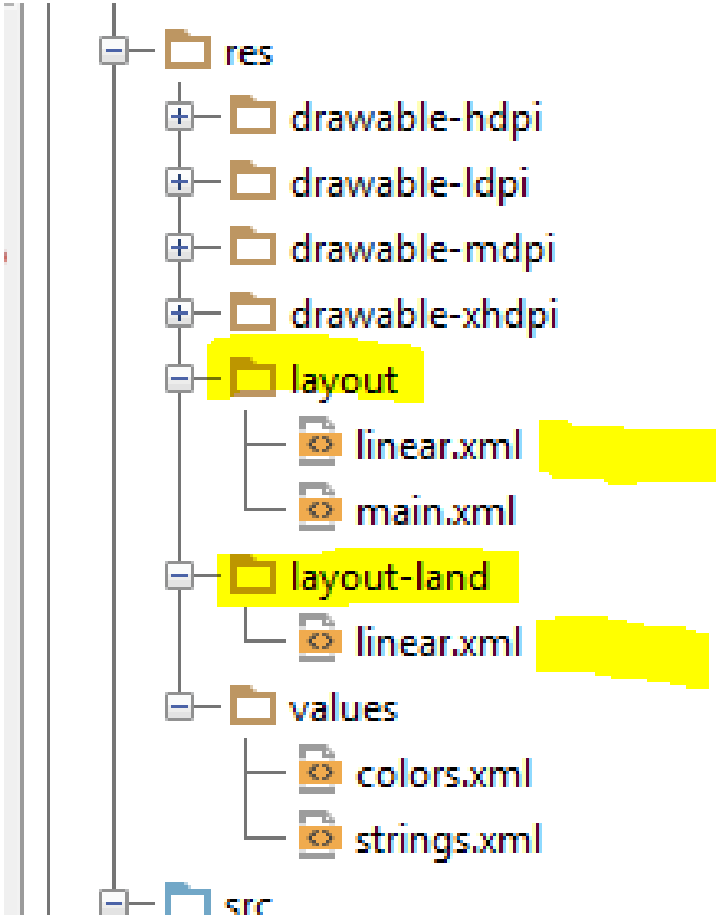


Note how we switched height and width declarations

```
<LinearLayout
        android:orientation="horizontal"
        android:layout_width="fill_parent"
        android:layout_height="fill_parent"
        android:layout_margin="20dp"
        xmlns:android="http://schemas.android.com/apk/res/android">
    <View android:layout_height="fill_parent"
          android:layout_width="0dp"
          android:layout_margin="20dp"
          android:layout_weight="1"
          android:background="@android:color/holo_red_dark"
          android:layout_gravity="right|center_vertical"/>
    <View android:layout_height="fill_parent"...>
    <View android:layout_height="fill_parent"...>
</LinearLayout>
```

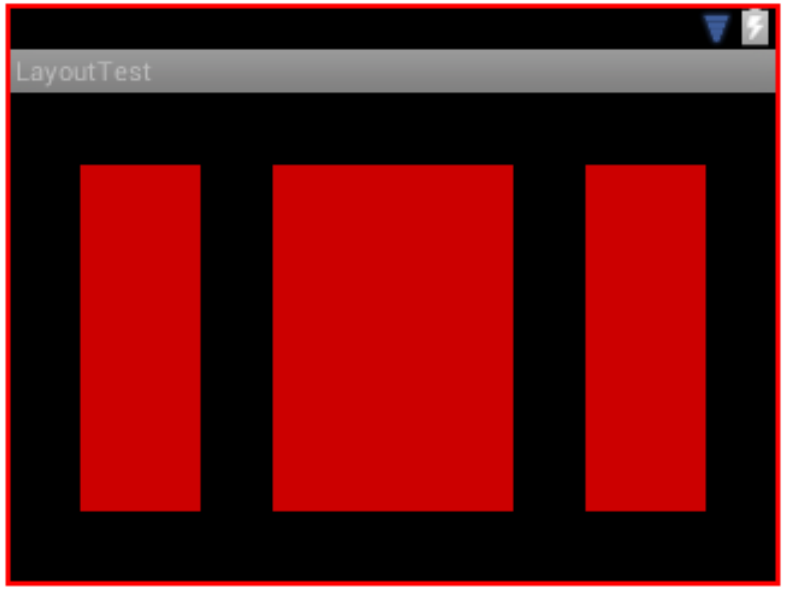
onCreate behaviour

- Note: the onCreate method will use the correct orientation automatically
- The call to setContentView will automatically choose the correct version of **R.layout.linear**

```
public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.linear);
}
```

New Look

- Now with the layout-land/linear.xml
- The proportions look more natural, but not necessarily what we need
- This will be application specific
- Main point to note here is that we can define the appropriate layout in XML
- This will be automatically selected in the onCreate method when called by name



More pain

- Still Need to Be Careful!
- Suppose we now have Views that do something, such as buttons with text
- Be careful to avoid this, but how?
- DISCUSS!!!

Switching Layouts at Runtime

- Sometimes it may be necessary to switch a layout in response to some user activity
- Time-based application events can trigger layout changes
- After some elapsed time (e.g. show a Splash screen before the main app screen)
- After a file has loaded
- However, there is a problem to be overcome...

Threads...

- Threads are hard - really hard
- Hard to debug
- A necessary evil
- GUI events spawn new threads
- Users things apps have frozen if they wait too long

UI Thread

- The UI (User Interface) thread is what calls the onCreate() method of your main activity
- And also any event handling methods
- From this thread it is okay to "touch" a view (i.e. update or modify it in some way)
- This includes setting new content
- Consider the next example:
  - We now have two Layouts, **linear.xml**, and **button.xml**
  - And use event handling to switch between them

Content Switching (1)

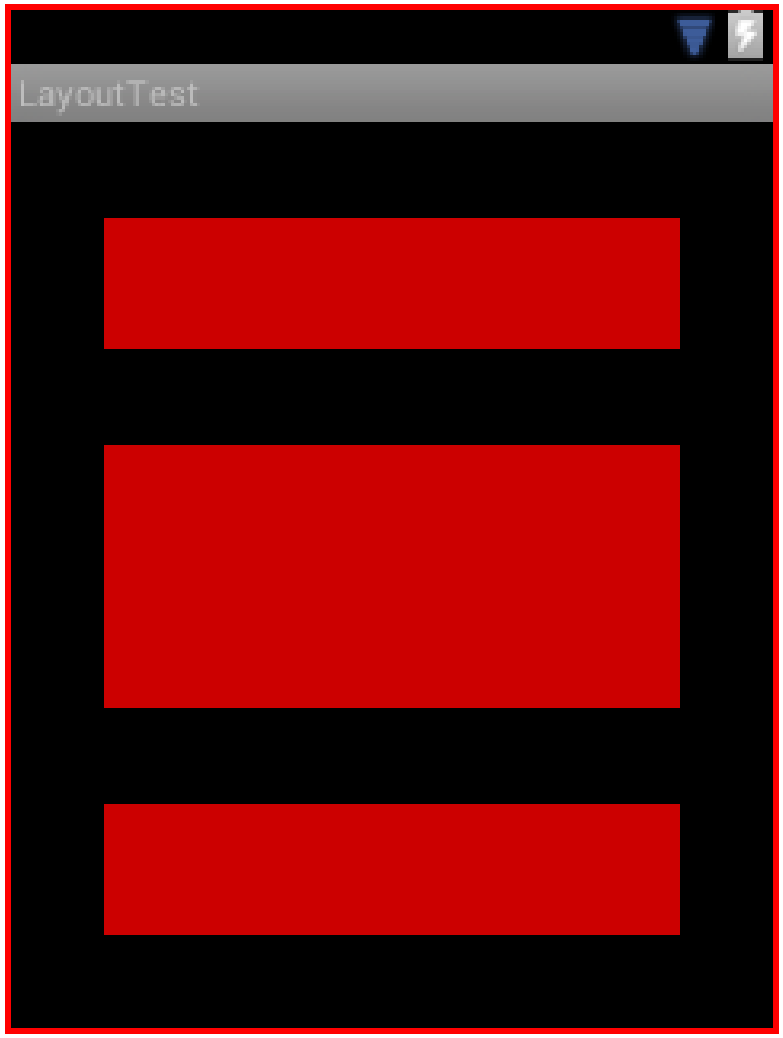
- Methods in myActivity

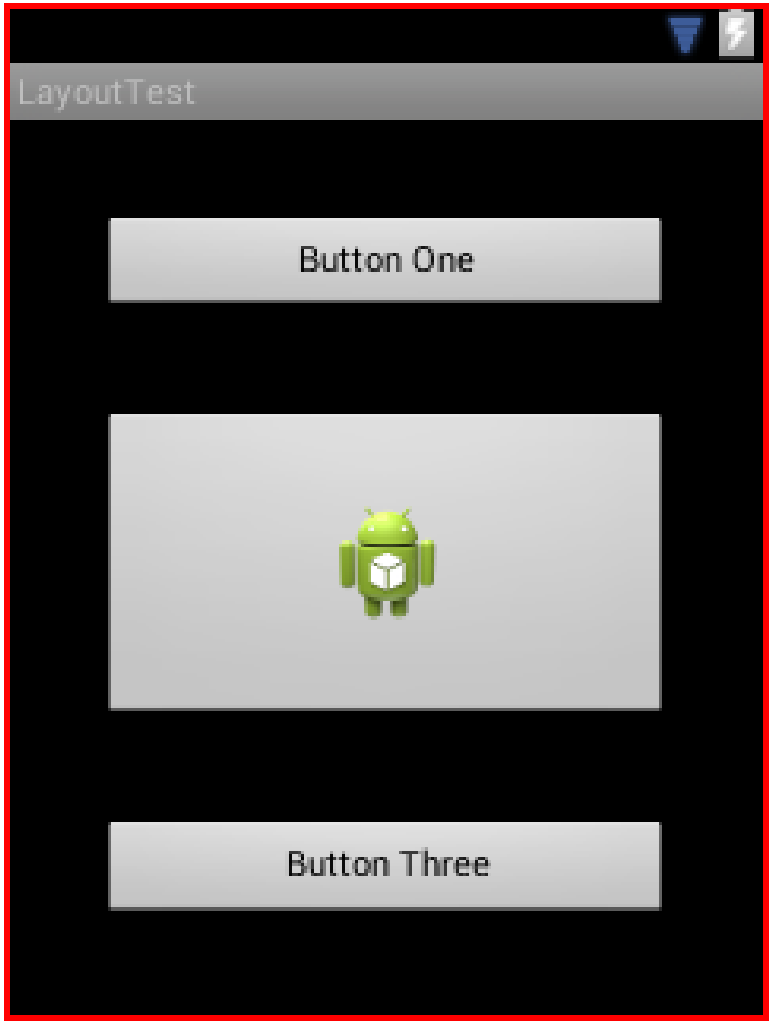
```
public void handleButtonOne(View view) {
    setContentView(R.layout.linear);
}

public void handleButtonTwo(View view) {
    setContentView(R.layout.buttons);
}
```

- With button clicks defined in the XML, e.g.

```
<Button android:layout_width="fill_parent"
        android:layout_height="0dp"
        android:onClick="handleButtonOne"
```

Content Switching (2)





Hacking **onCreate()**

```
try {
    Thread thread = new Thread() {
        @Override
        public void run() {
            try {
                Thread.sleep(2000);
                handleButtonOne(null);

            } catch (Exception e) {
                System.out.println("MyThreadTest Inner Exception: " + e);
            }
        }
    };
    thread.start();
} catch (Exception e) {
    System.out.println("MyThreadTest Outer Exception: " + e);
    e.printStackTrace();
}
```

Kabooooom!

- This results in an exception
- *MyThreadTest Inner Exception: android.view.ViewRootImpl$CalledFromWrongThreadException: Only the original thread that created a view hierarchy can touch its views.*

Solution: Run the task on the UI Thread

- Several ways of doing this
- Simplest (and probably best) is to use an AsyncTask
- Write a class that extends AsyncTask
  - Typically override at least:
    - **doInBackground()**
    - **onPostExecute()**
    - Can also override: **publishProgress()**
    - Useful to update progress bars when loading files

Example AsyncTask (inner class of MyActivity)

```
private class MyTask extends AsyncTask<Void, Void, Void> {
    @Override
    protected Void doInBackground(Void... voids) {
        try {
            Thread.sleep(2000);
        } catch ( Exception e) {}
        return null;
    }

    protected void onPostExecute(Void result) {
        // new Toast(this)
        handleButtonOne(null);
    }
}
```

The new onCreate method...

- Note how the argument types passed to the constructor must match the declared types (see previous slide)
- In this case they are never used, and null can be passed for each one

```
@Override
public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.buttons);
    new MyTask().execute(null, null, null);
```

Recap

- So far we can do some powerful things
  - We've defined custom views (lab 1 and (more) on lab 2)
- Learned how to lay them out effectively in linear layouts
- Handled onClick and onTouch events
- Switched views at runtime
- Used AsyncTask derived objects to perform tasks on the UI thread
- Next we need to gain a better understanding of good app design
- Knowledge of the Activity lifecycle will be needed for this
- Some of the slides based on Simon Lucas previous course