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Week 5: App Lifecycle and UI/UX Design

UFCF7H-15-3 Mobile Applications

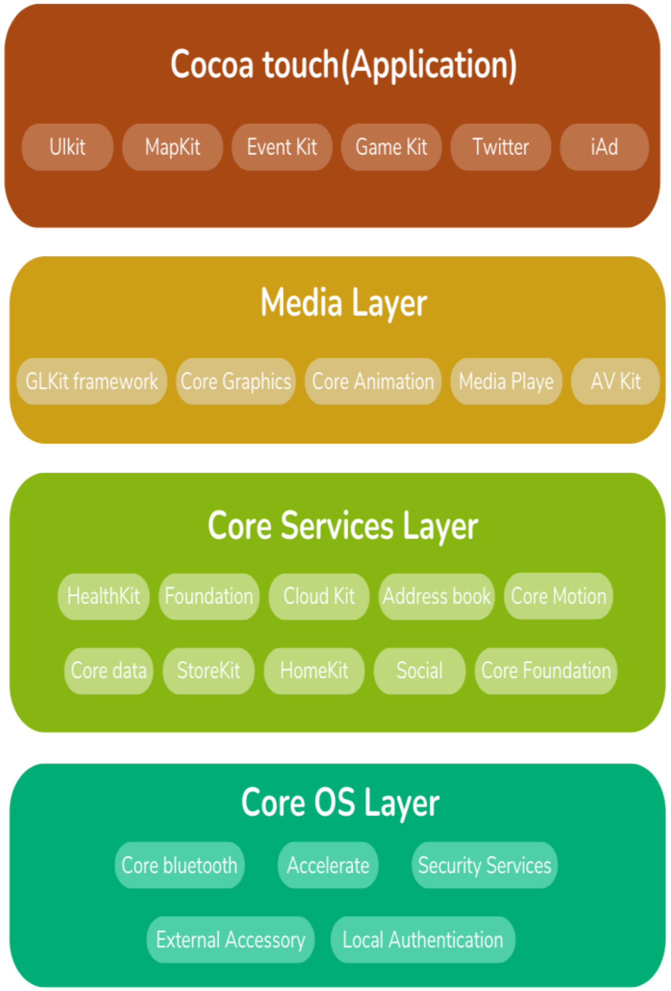
Dr Kun Wei

So you want to build an app?

- Broadly speaking there are many approaches to app building but pretty much everyone agrees the following stages:
  - Generate an app idea
  - Do competitive market research
  - Write out the features for your app
  - Make design mock-ups of your app
  - Create your app's graphic design
  - ~~Put together an app marketing plan~~
  - Now build the app from your plans
  - ~~Submit your app to the Software Store~~

iOS architecture (1)

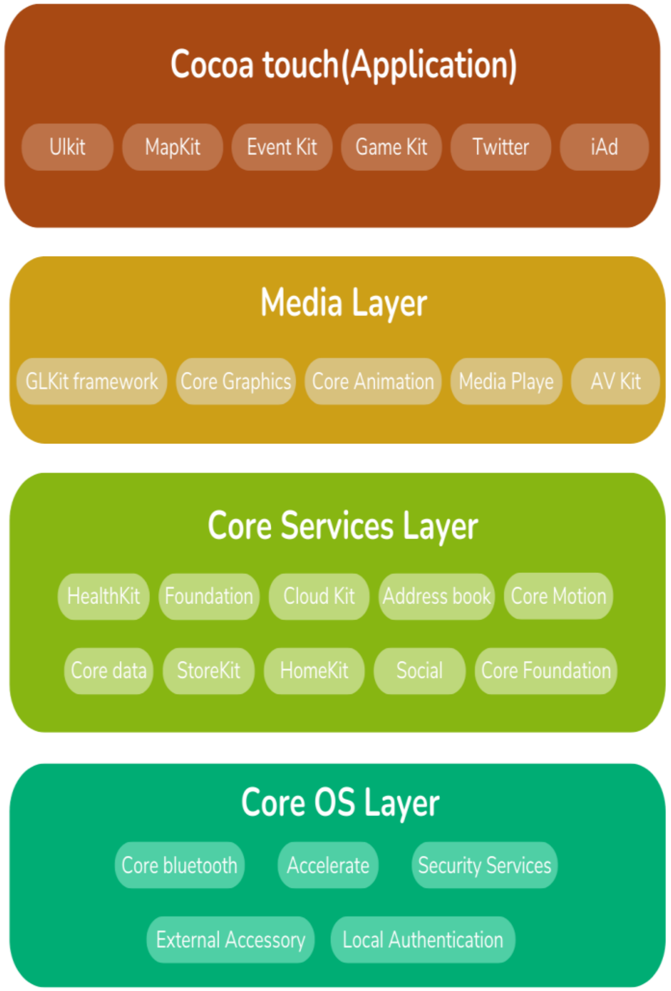
- App Layer
  - The layer where individual iOS apps reside
  - Each app runs in its own sandboxed environment for security and resource isolation.
  - Apps interact with the Cocoa Touch layer for creating user interfaces and Core Services for access to system-level services.
- Cocoa Touch Layer
  - The topmost layer of the iOS architecture, responsible for the user interface and app development.
  - Contains frameworks like UIKit for creating the user interface, MapKit for mapping and location services, and Core Location for GPS-based functionalities.
  - Provides app-level abstractions for common tasks.



iOS architecture (2)

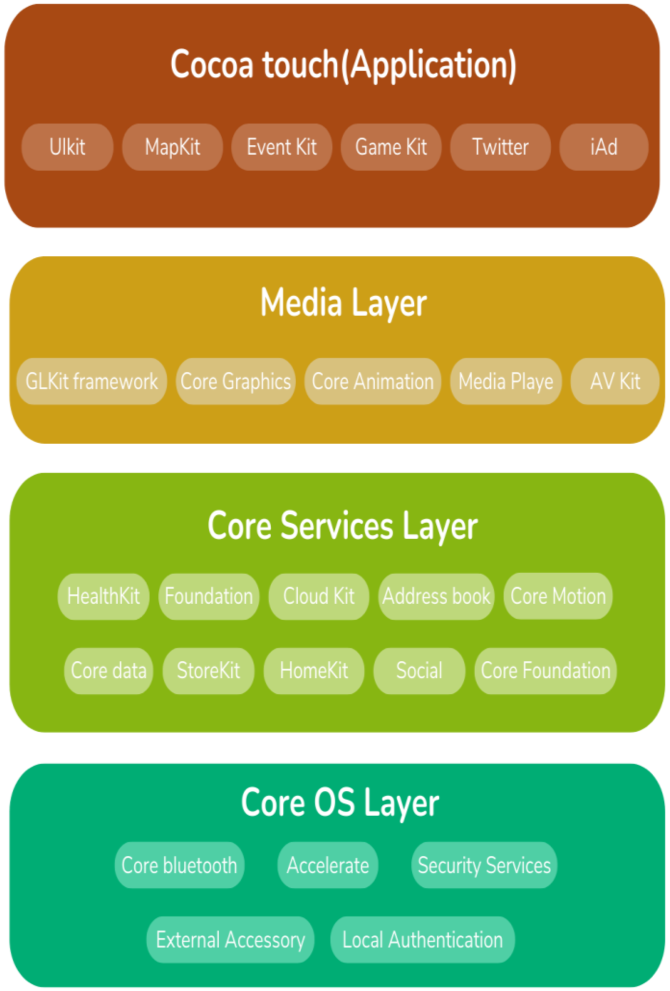
- **Media Layer**
  - Manages audio, video, and graphics processing.
  - Components like Core Audio, Core Animation, Core Graphics, and AV Foundation are part of this layer.
  - Supports multimedia and graphics-rich applications.

- **Core Services Layer**
  - Provides a wide range of high-level functionalities and services for app development.
  - Includes services like networking, SQLite database access, Grand Central Dispatch for multithreading, and Core Data for data storage.



iOS architecture (3)

- **Libraries Layer**
  - Contains system libraries that developers can use to interact with the iOS system.
  - Key libraries include the C library, Objective-C runtime, and CoreFoundation framework.
  - These libraries provide fundamental functionality for apps.
  - Cocoa Touch Layer
- **Kernel Layer**
  - Manages system resources, such as CPU, memory, and hardware drivers.
  - The XNU kernel is at the heart of the iOS operating system.
  - Provides essential services like multitasking, memory management, and hardware abstraction.
- **Core OS Layer**
  - The lowest layer, which interacts with the device's hardware.
  - Includes components for power management, security, file system, network sockets, and low-level system services.
  - Responsible for hardware abstraction and communication with device drivers.



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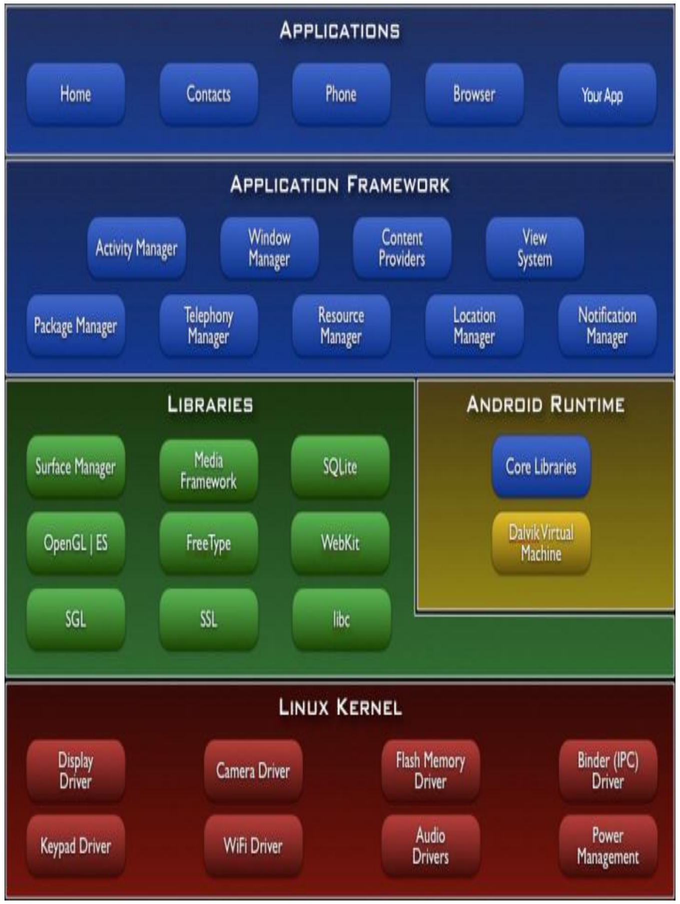
Android Architecture (1)

- **Linux Kernel**: It provides low-level hardware abstraction, device drivers, and essential system services like process management, memory management, and security.
- **Hardware Abstraction Layer (HAL):** Above the Linux kernel, the HAL provides a standardized interface between the operating system and the hardware components of the device.
- **Native Libraries:** Android includes a set of native libraries written in C and C++ that provide essential functionality, such as graphics rendering, multimedia processing, and networking.
- **Android Runtime (ART/Dalvik):** It is responsible for executing Android app code.



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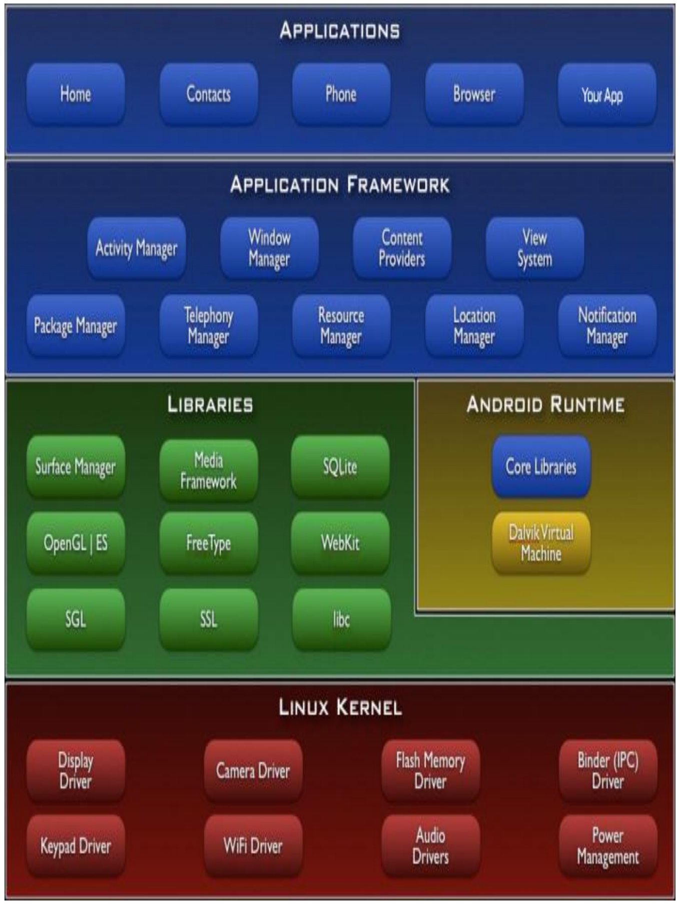
Android Architecture (2)

- **Core Libraries**: they are written in Java and provide the foundation for Android app development including classes for data manipulation, I/O, network comm, and more.
- **Android Framework:** It is a collection of Java classes and APIs that simplify app development such as building UIs, managing app lifecycle, and handling user input.
- **System Apps:** Android comes with a set of pre-installed system apps, such as the Phone, Contacts, and Messaging apps. These apps demonstrate best practices and serve as examples for app development.
- **Application Layer:** This is where Android apps reside. Each Android app runs in its own process and interacts with the Android framework and system services through well-defined APIs.



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What is a smartphone?

- ❑ Any phone is just that. A phone.
- ❑ Could say apps work respecting the devices first purpose of being a phone.
- ❑ As an app designer you need to always be aware of this when designing your applications.

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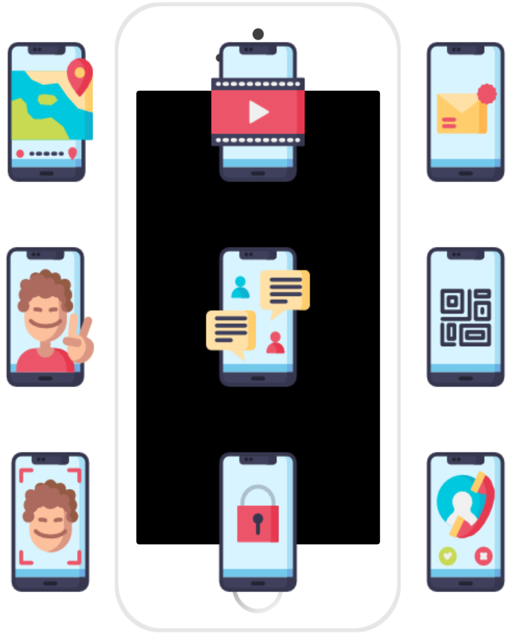
Event driven nature (1)

- App developers are writing code in anticipation of "**events**".
- How is this different from:
  - Websites ?
  - Standalone programs on a PC?
  - Games (not app games)?



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Event driven nature (2)

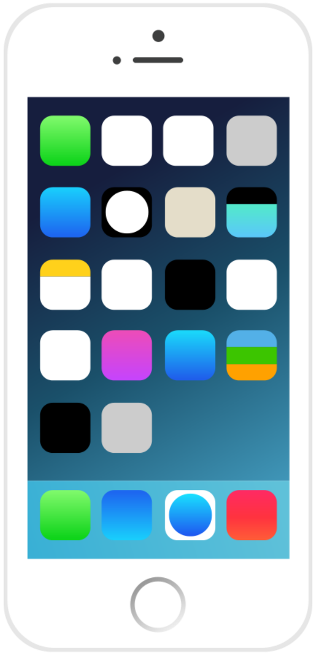
- Mobile applications have highly interactive (or rich) user interfaces implement a programming model known as event-driven programming.
- Event-driven programs are different to traditional computer systems. Their purpose isn't to accomplish a computational goal but to make capabilities available to the user or external systems, and then react to these events.
- Sensors continually post events that your app may need to handle.

Event driven nature in Android

- This event-driven architecture is fundamental to creating responsive and interactive mobile applications.
- Scenario: Imagine you're building a simple Android app—a to-do list application. Users can add tasks to their list, mark tasks as completed, and delete tasks. Each of these actions triggers events that the app needs to respond to in real-time.
  - **Adding a task**
  - **Marking a Task as Completed**:
  - **Deleting a Task**
  - **Orientation Change**
  - **Back Button Press**
- In each of these scenarios, Android relies on an event-driven architecture to capture and respond to user actions or system events.

The App Life Cycle (1)

- Phones have limited:
  - Memory
  - Battery
- Therefore, they only put their resources into what is currently being used.
  - The OS at any given time is monitoring the memory of your device and the apps in use.
  - If the user navigates to a more memory intensive app, or the OS needs resources…
  - ……your app may get "assassinated".



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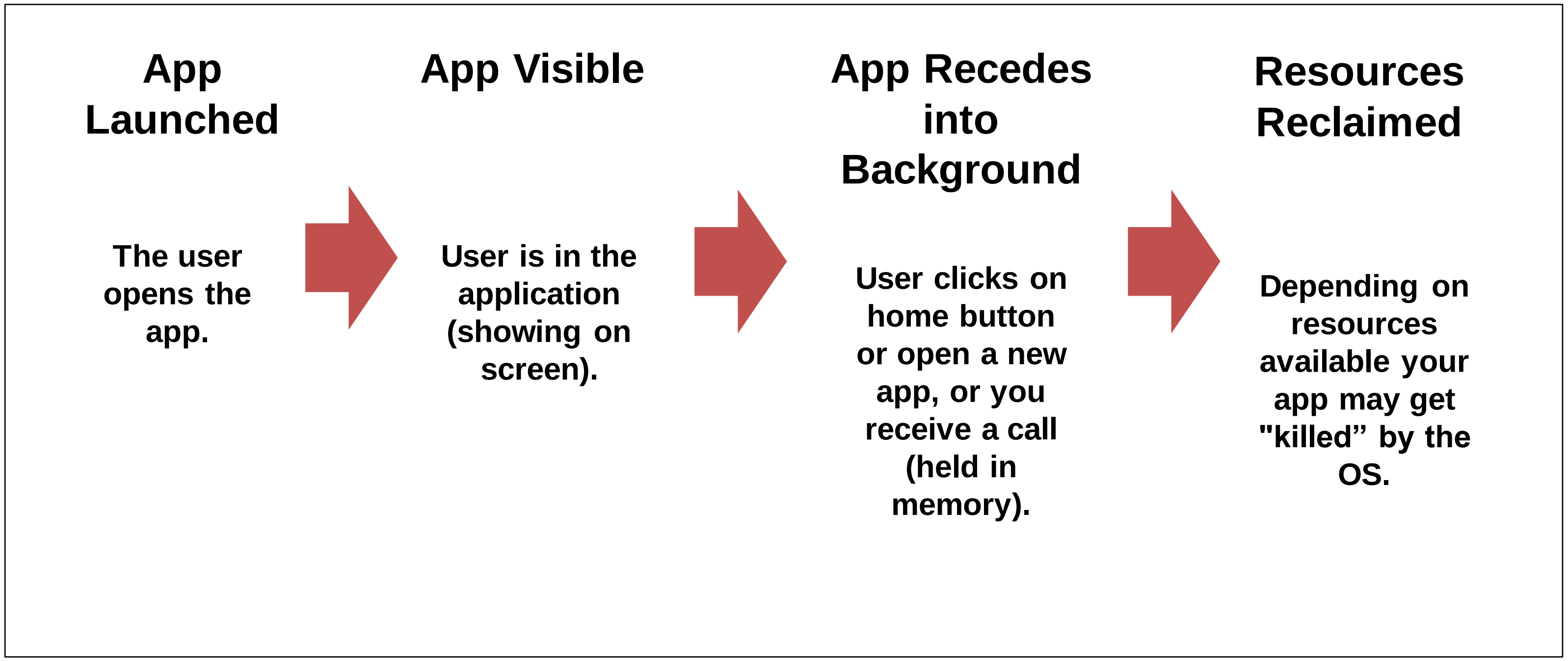
The App Life Cycle (2)

- In this sense we say your app has a “life” or “lives and dies”.



App Launched → **App Visible** → **App Recedes into Background** → **Resources Reclaimed**

App Launched: The user opens the app.

App Visible: User is in the application (showing on screen).

App Recedes into Background: User clicks on home button or open a new app, or you receive a call (held in memory).

Resources Reclaimed: Depending on resources available your app may get "killed” by the OS.

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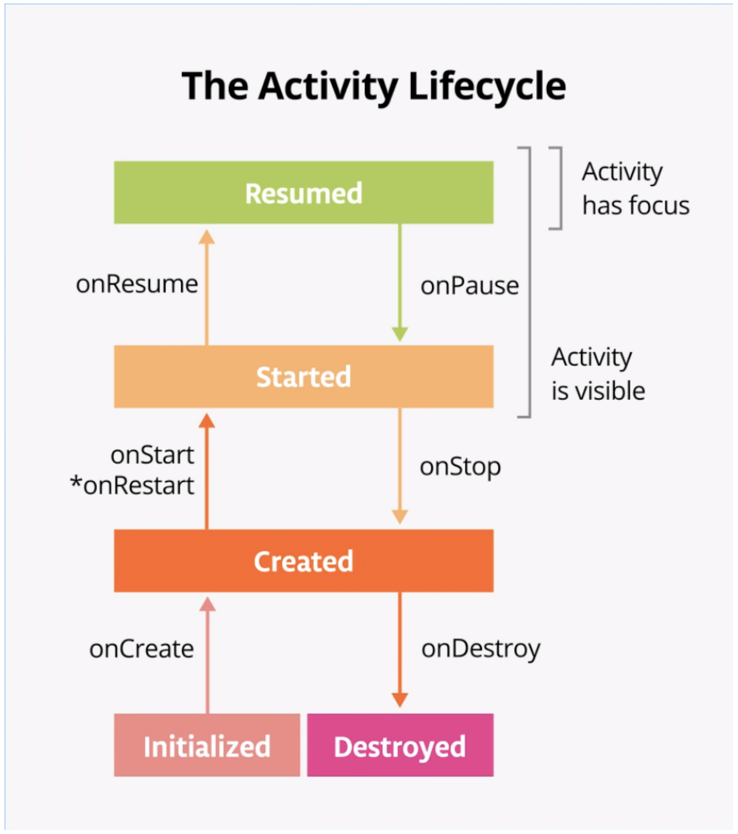
The App Life Cycle (3)

- NOT RUNNING: Not started yet or was running and has been terminated.

- INACTIVE: App running in the foreground but is not receiving any events. If a Call or Message is received. In this State, we cannot interact with app’s UI.
- ACTIVE: App is running in the foreground and receiving the events. The only way to go to or from the Active state is through the Inactive state. User normally interacts with UI and can see the response / result for user actions.
- BACKGROUND: App is running in the background and <u>executing the code</u>. Freshly launching apps directly enter Inactive state and then to Active state.
- SUSPENDED: App is in the background but is <u>not executing the code</u>. In case of low memory, the system may purge suspended apps without notice to make free space for the foreground application.

Android's activity lifecycle



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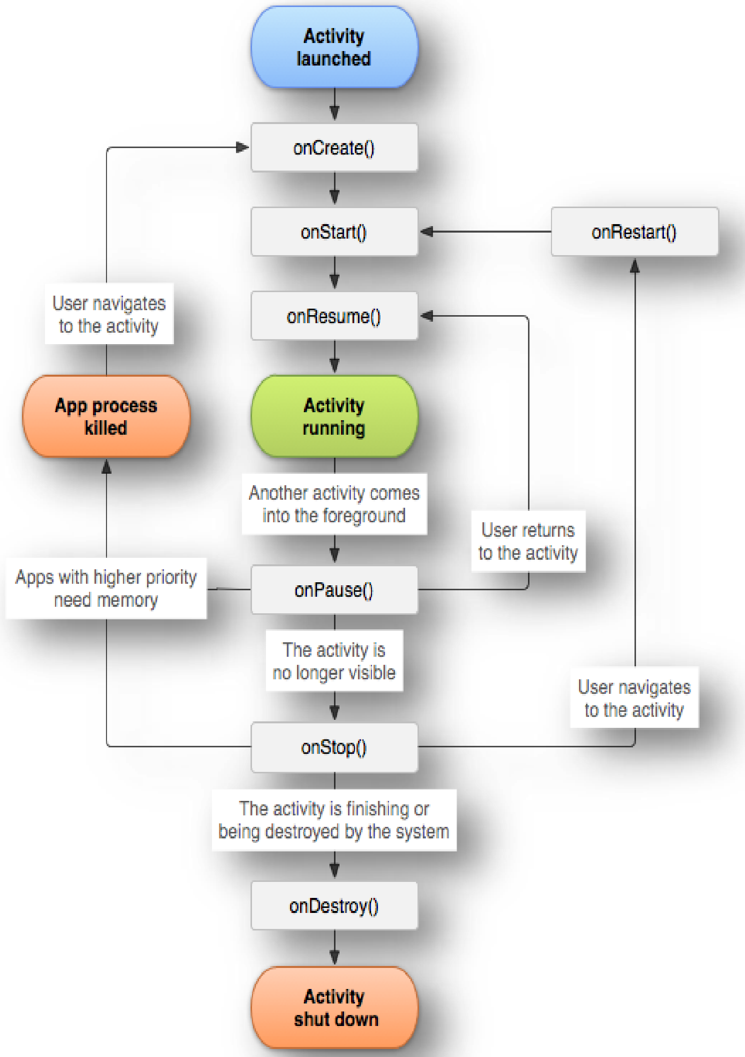
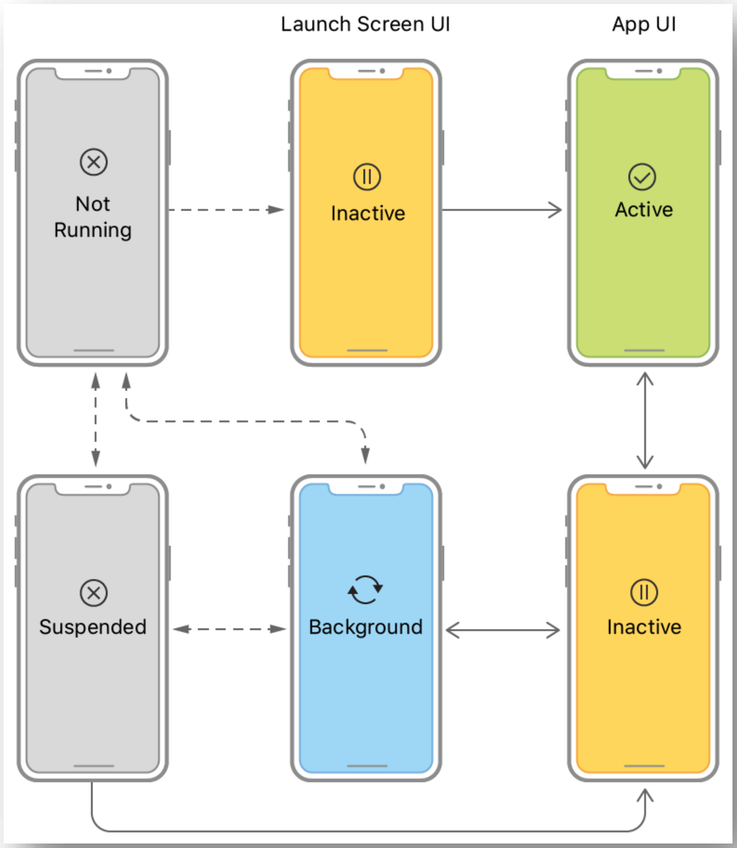

Activity launched
onCreate()
onStart()
onRestart()
User navigates to the activity
onResume()
App process killed
Activity running
Another activity comes into the foreground
User returns to the activity
Apps with higher priority need memory
onPause()
The activity is no longer visible
User navigates to the activity
onStop()
The activity is finishing or being destroyed by the system
onDestroy()
Activity shut down

iOS’s activity lifecycle

- Link available on Blackboard
- They provide guidance how to develop a modern iOS application.
- You must consider this in your assessment to achieve higher marks.



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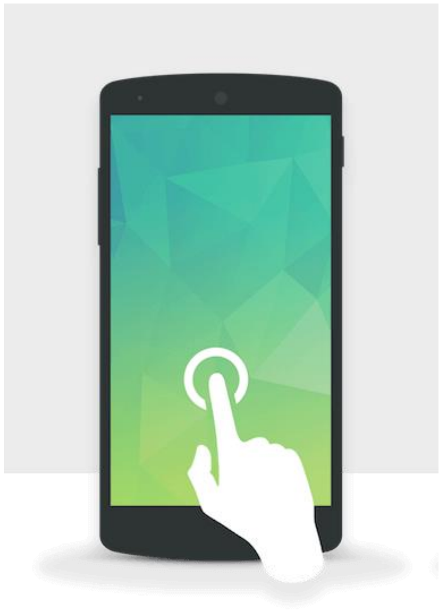
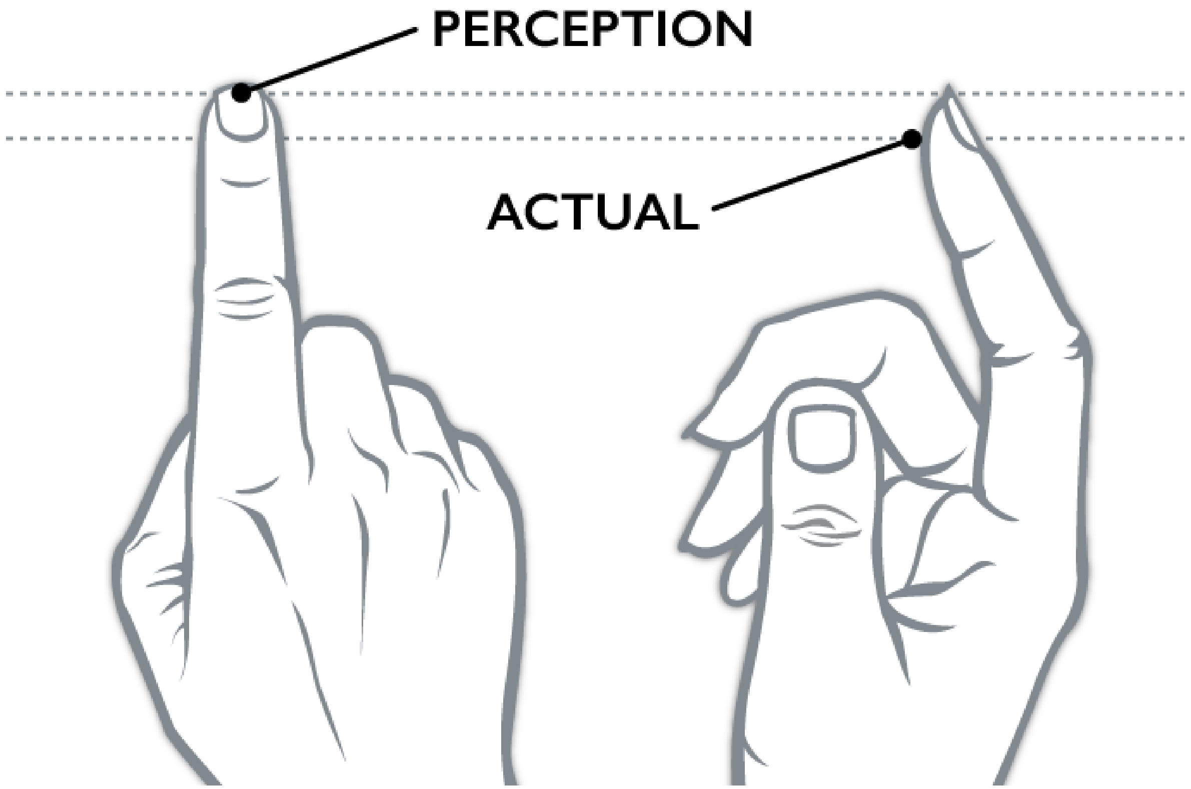
Touch interface

- What touch gestures are there on mobile devices?

➢ Single tap	Long touch
➢ Double-tap	Fling / flick
➢ Drag	Scroll
➢ Spread	Press and drag
➢ Rotate	Press and tap
➢ Pinch	Multi-touch



Where do we press?



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UI vs UX Design

- In the early 90's and 2000's we didn't really have these two fields.
- User Interface: Focuses on how a products surfaces look and function.
- User Experience: Focuses on the users' journey to solve a problem.

"UI is the bridge that gets us where we want to go, UX is the feeling we get when we arrive."

Jason Ogle

What happens when we have bad design?

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Design Fundamentals

- 6 things that you should know before you start UI design. These apply to all types of design.
  - Colour and Contrast
  - White Space
  - Visual Hierarchy
  - Complexity vs. Simplicity
  - Consistency
  - Scale

Gary Simon (2019)

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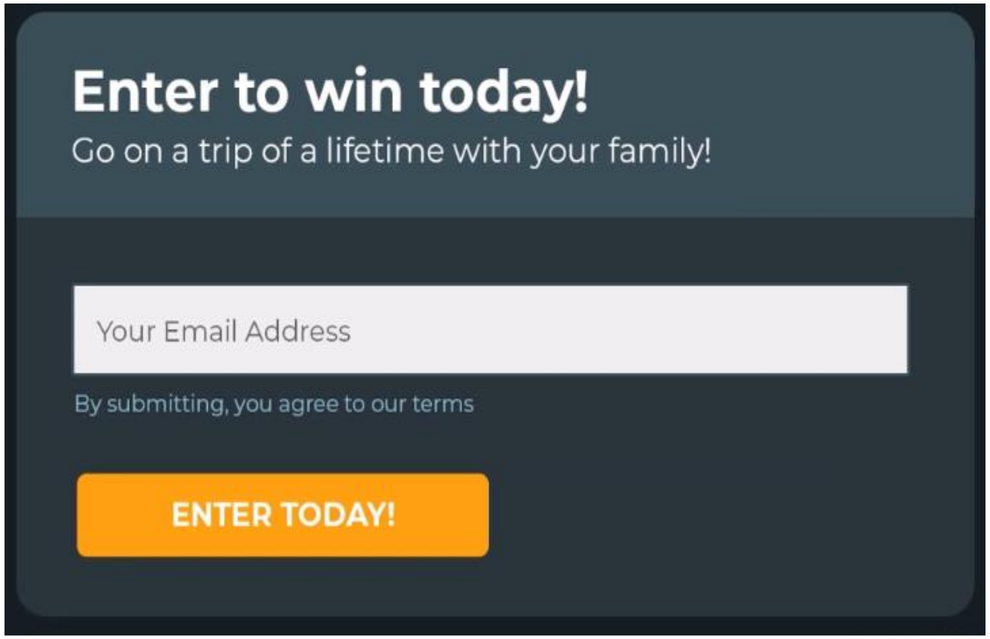
Colour and Contrast (1)

- Possibly the most basic
- Hard to read some of the text
- Colours do not work well together
- Dark mode for developer now also needs to be considered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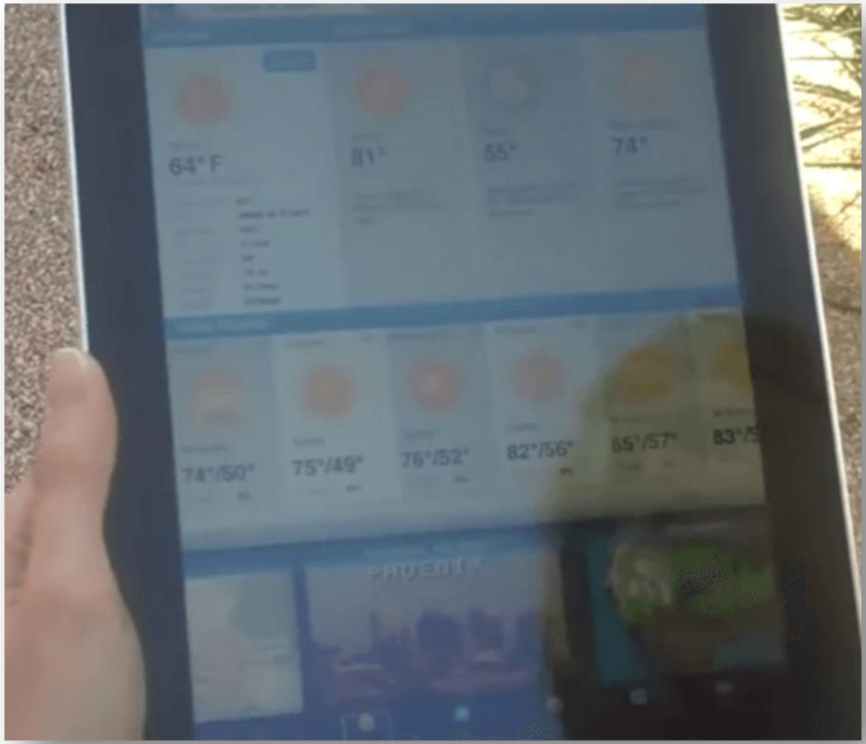
Colour and Contrast (2)

- Light-coloured text (such as light grey) might look aesthetically appealing, but users will have a hard time reading it, especially against a light background.
- Make sure there is plenty of contrast between the font and the background for easy readability.



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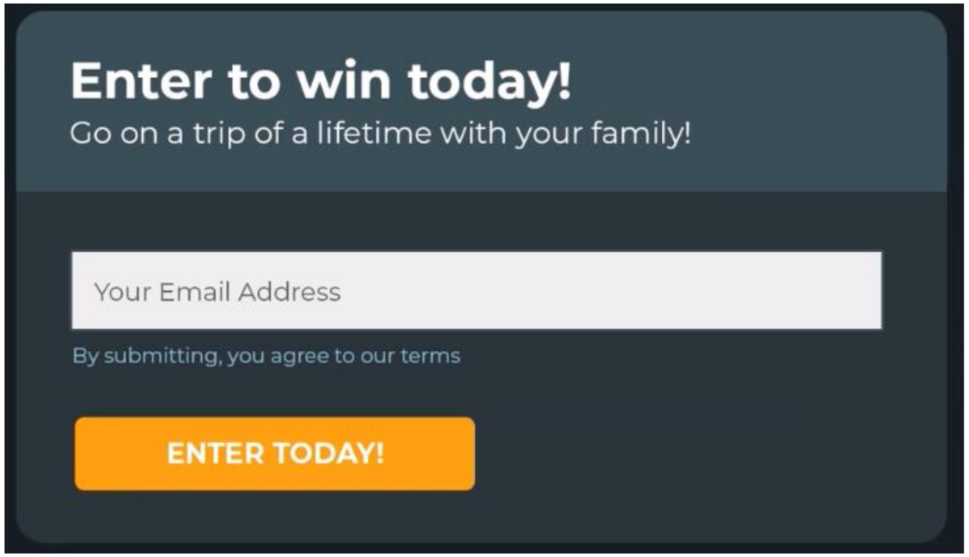
White Space

- Refers to the negative space around UI elements
- Think mathematically about spacing
- Balancing UI elements is key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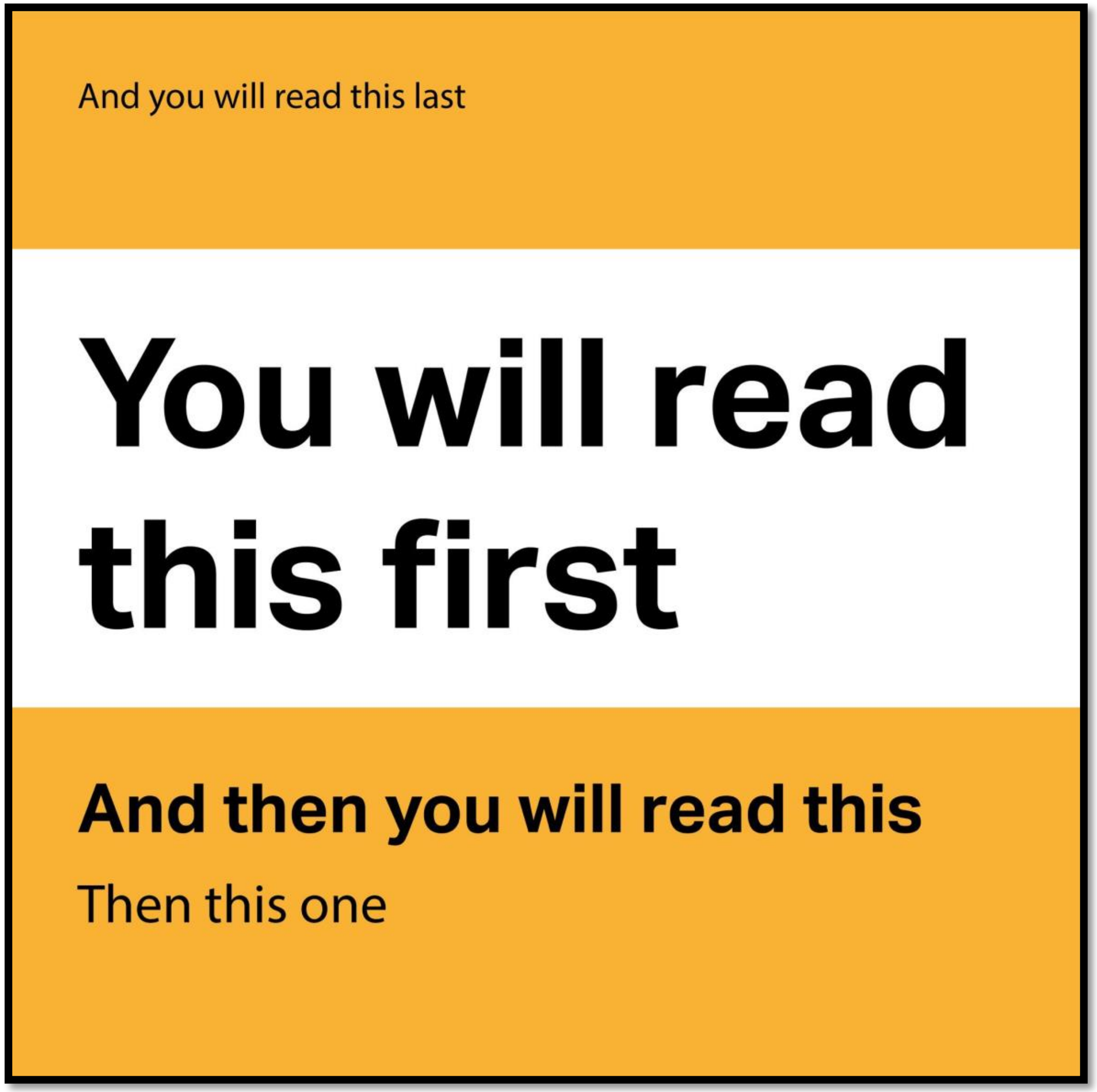


And you will read this last

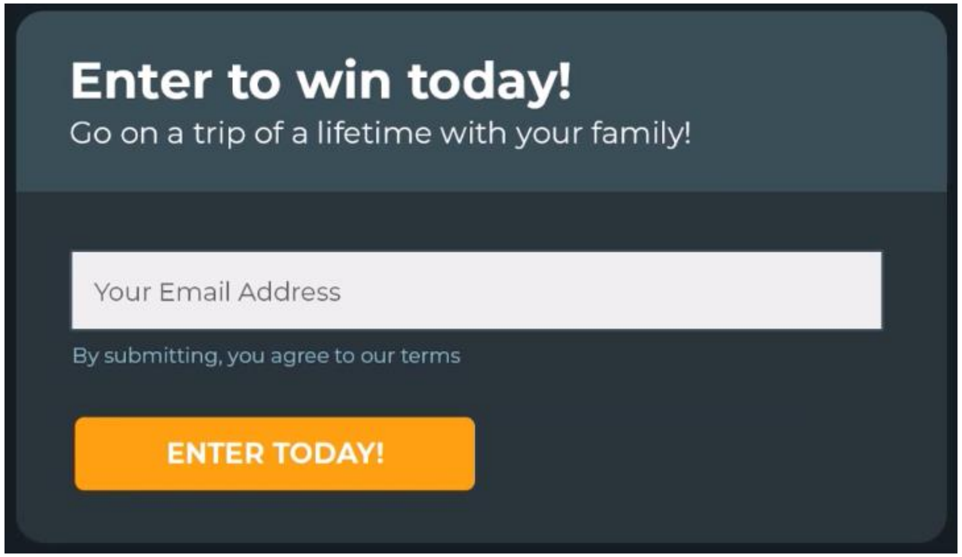
You will read this first

And then you will read this

Then this one

Visual Hierarchy

- Font weight
- Scale and colour highlight important text
- Not everything is equally important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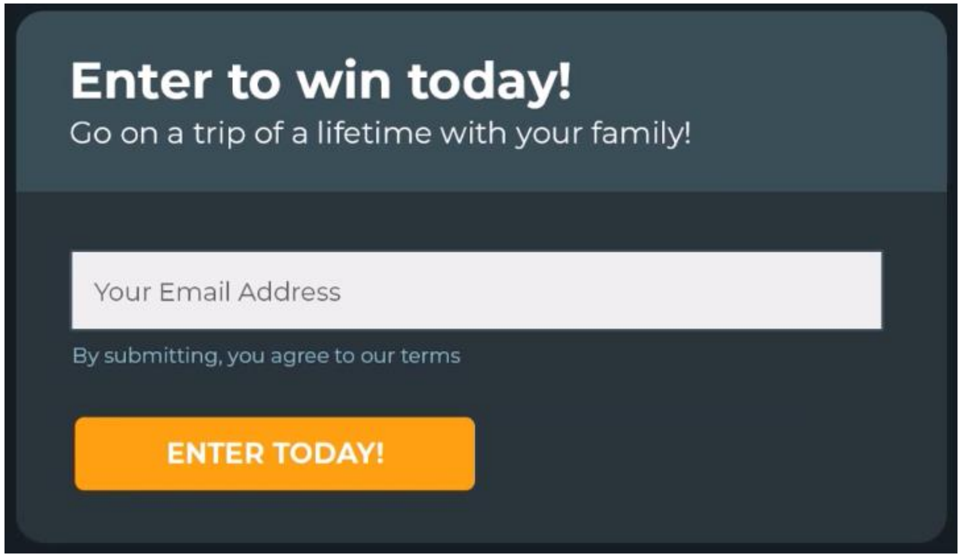
Complexity vs. Simplicity

- There are hundreds of tools available
- Don’t try to show off by cramming in features
- Often seen in newbie’s UI developers work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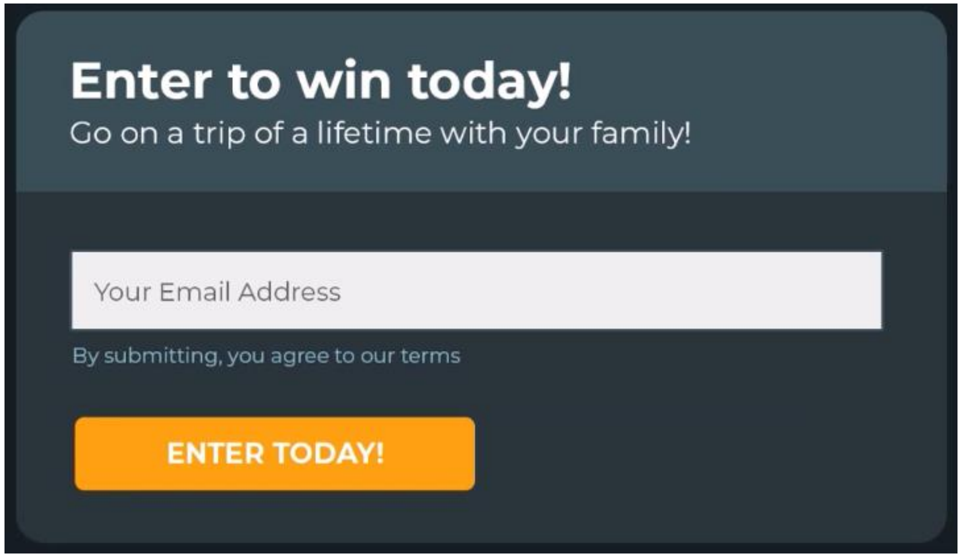
Consistency

- Different fonts – some do work well together (like colours)
- Changes he spacing between words
- *Comic Sans* is … frowned upon



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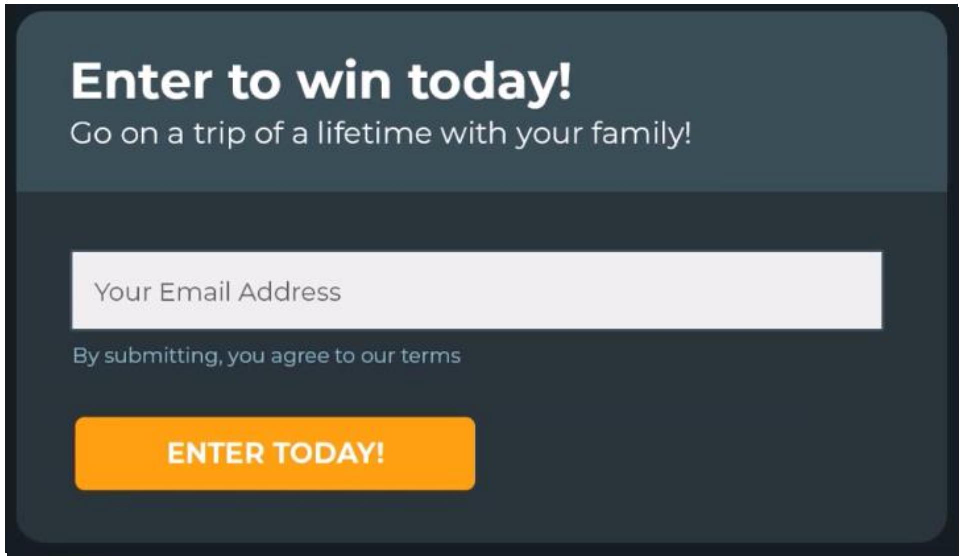
Scale

- Readability is important
- Scale is even more important on mobile devices
- Should be used but remember consistency and hierarchy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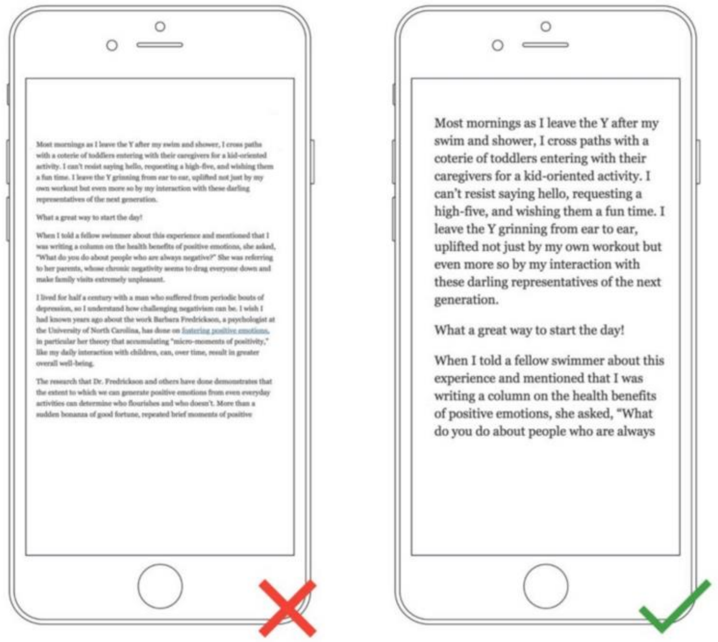
Scale

- Text may look fine on your workstation but always consider it on a device screen.
- Not everyone has the same eyesight
- Some users override text scale. Think what this may do to your UI design.



Most mornings as I leave the Y after my swim and shower, I cross paths with a coterie of toddlers entering with their caregivers for a kid-oriented activity. I can't resist saying hello, requesting a high-five, and wishing them a fun time. I leave the Y grinning from ear to ear, uplifted not just by my own workout but even more so by my interaction with these darling representatives of the next generation.

What a great way to start the day!

When I told a fellow swimmer about this experience and mentioned that I was writing a column on the health benefits of positive emotions, she asked, "What do you do about people who are always negative?" She was referring to her parents, whose chronic negativity seems to drag everyone down and make family visits extremely unpleasant.

I lived for half a century with a man who suffered from periodic bouts of depression, so I understand how challenging negativism can be. I wish I had known years ago about the work Barbara Fredrickson, a psychologist at the University of North Carolina, has done on fostering positive emotions, in particular her theory that accumulating "micro-moments of positivity," like my daily interaction with children, can, over time, result in greater overall well-being.

The research that Dr. Fredrickson and others have done demonstrates that the extent to which we can generate positive emotions from even everyday activities can determine who flourishes and who doesn't. More than a sudden bonanza of good fortune, repeated brief moments of positive

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Design for fingers, not cursors

- When you're designing actionable elements in a mobile interface, it's vital to make targets big enough so that they're easy for users to tap.
- Mistaken taps often happen due to small touch controls.

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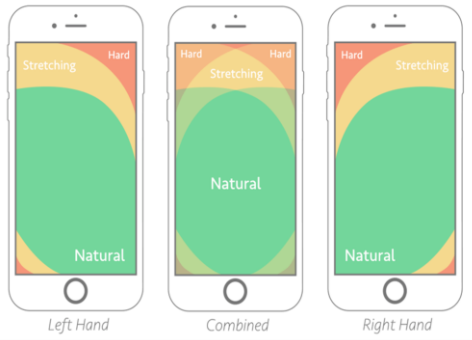
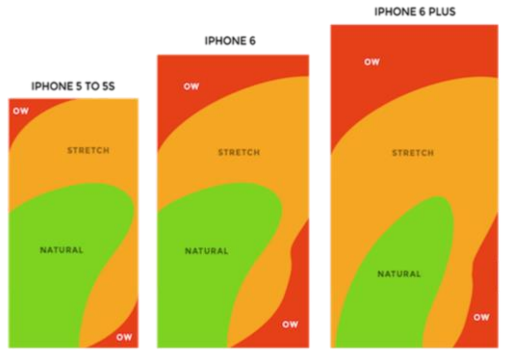
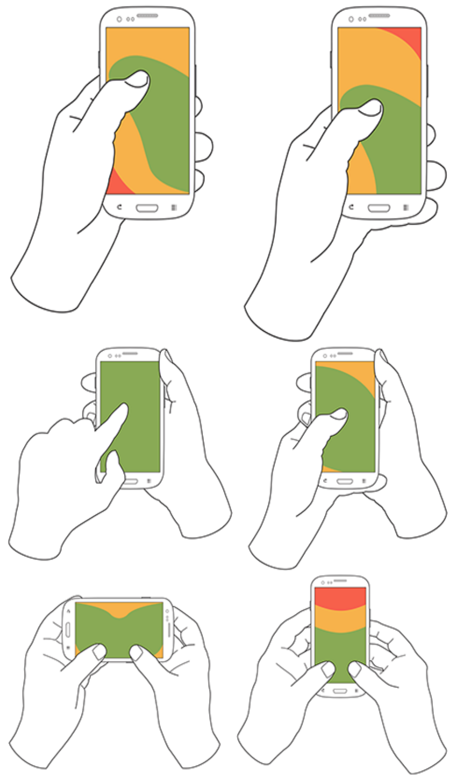
UI Placement

- As an app developer we should always consider the way users hold their device.
- Most users hold their phone with one hand.
- This creates territory called the ‘natural thumb zone’.
- Other zones require finger stretching or even changing the grip to reach them.
- The bigger the display, the more of the screen is less easily accessible.







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