

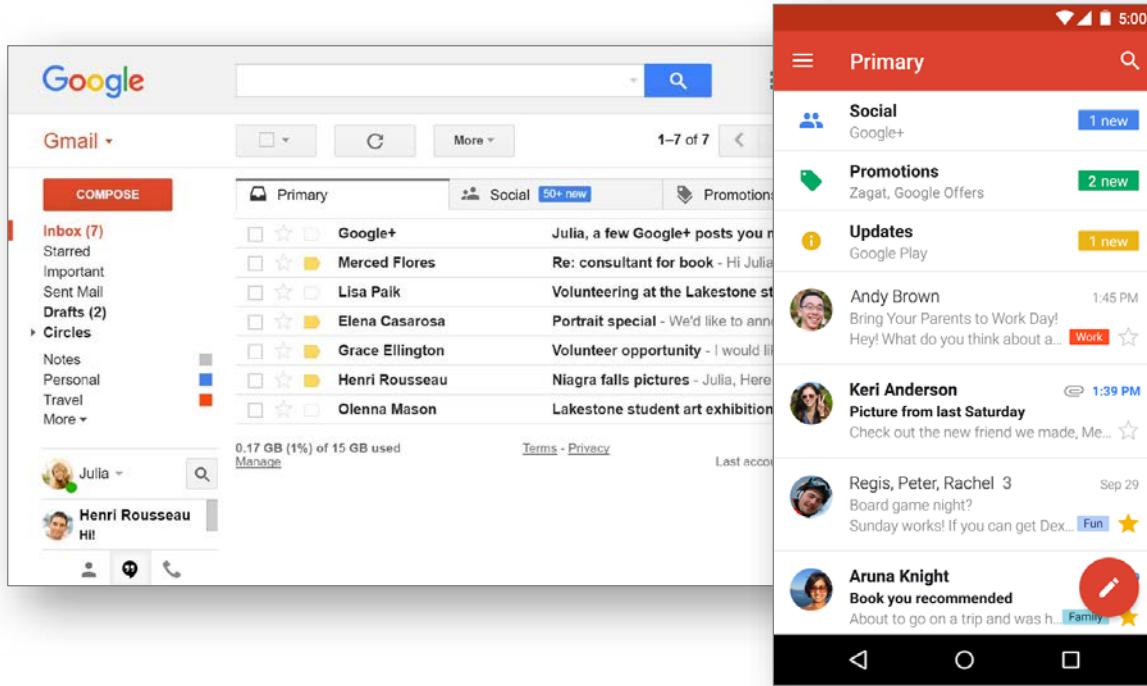
Mobile UI

Device, Input, Interaction Characteristics

Mobile UI 1



Desktop and Mobile



Mobile UI 3

Device Characteristics

- Limited resources
 - Limited memory
 - Limited processing
 - Battery conservation
- Primarily touch interaction
 - Input capabilities and challenges
- Mobile form factor
 - Small display size
 - Different aspect ratios (orientations)
 - Single application focus



Mobile UI 4

Design is about Constraints

"One way to look at design — at any kind of design — is that it's essentially about constraints (things you have to do and things you can't do) and tradeoffs (the less-than-ideal choices you make to live within the constraints)."

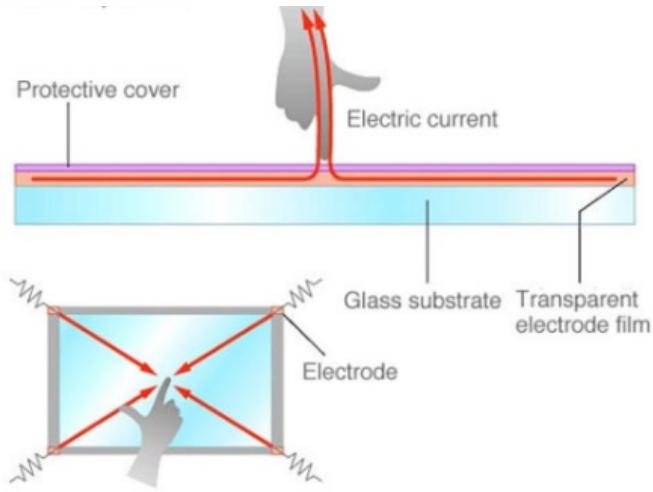
- Steve Krug ("Don't Make Me Think Revisited")

Limited Resources

- Limited processing capabilities
 - Intensive tasks need to be done offline/preprocessed
 - Single application model
 - One app in the foreground, others suspended
 - Few active background processes
 - Primarily full-screen apps, consisting of a sequence of screens
 - Limits interaction but also limits processing requirements
 - Responsiveness
 - connectivity, data rates, reliance on server
- **Big implications for UI programming model**

Capacitive Touch Screen Technology

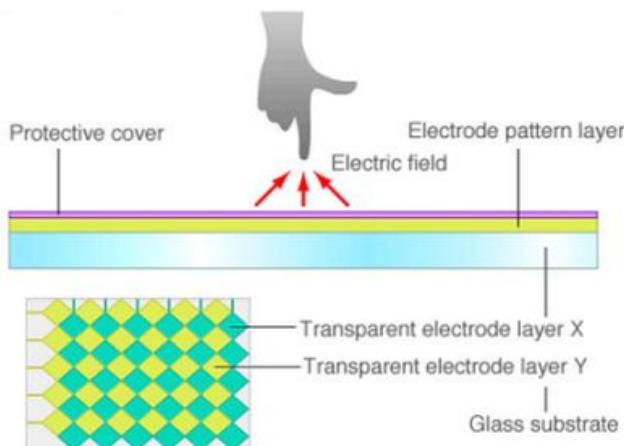
- Finger changes material capacitance
- **Surface Capacitance**
 - voltage applied to conductive material creates *electrostatic field*
 - a finger touch creates a capacitor
 - measure effective capacitance at four corners to localize touch



Mobile UI 7

Capacitive Touch Screens

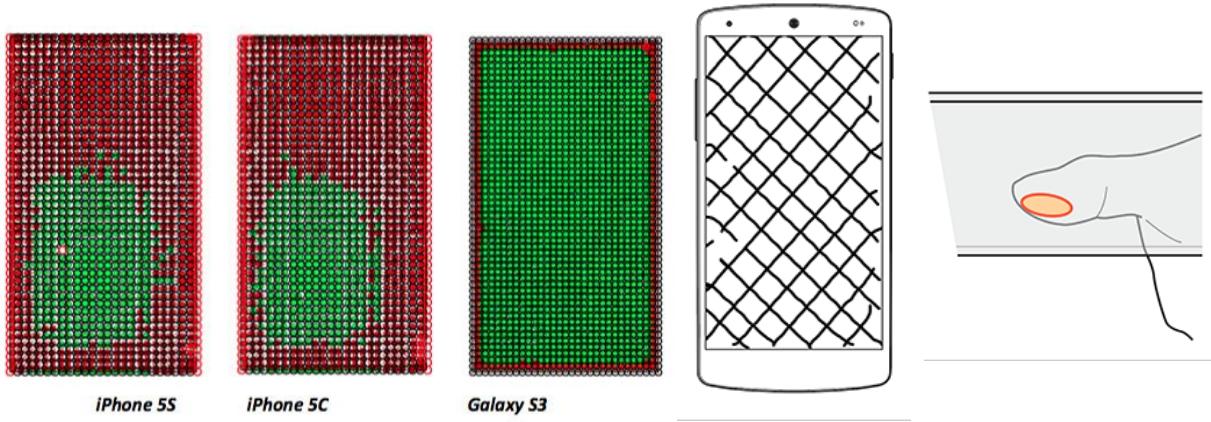
- Finger changes material capacitance
- **Projective Capacitive (PCT, PCAP)**
 - X-Y grid of thin wires or electrodes (driving lines, sensing lines)
 - a capacitor at each wire intersection
 - measure effective capacitance each point



Mobile UI 8

Touch Sensing Accuracy

- Touch screen input is noisy
- Estimates for “pressure” very noisy



Mobile UI

Design for Fingers, Touch and People, Steven Hoover (<https://www.uxmatters.com>)

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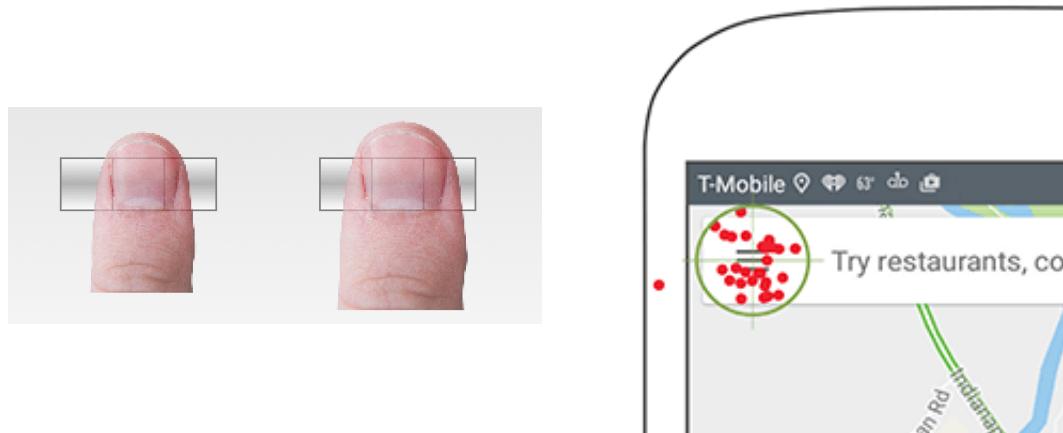


Automated Touch Screen Testing with Robots

- <https://youtu.be/qw3OkC5CaZU?t=49s>

Human Accuracy

- People have “fat fingers”, so touch targets need to be large
 - Apple recommends 15mm
 - Microsoft recommends 9mm (min 7mm; min spacing 2mm)
 - Nokia recommends 10mm (min 7mm, min spacing 1mm)

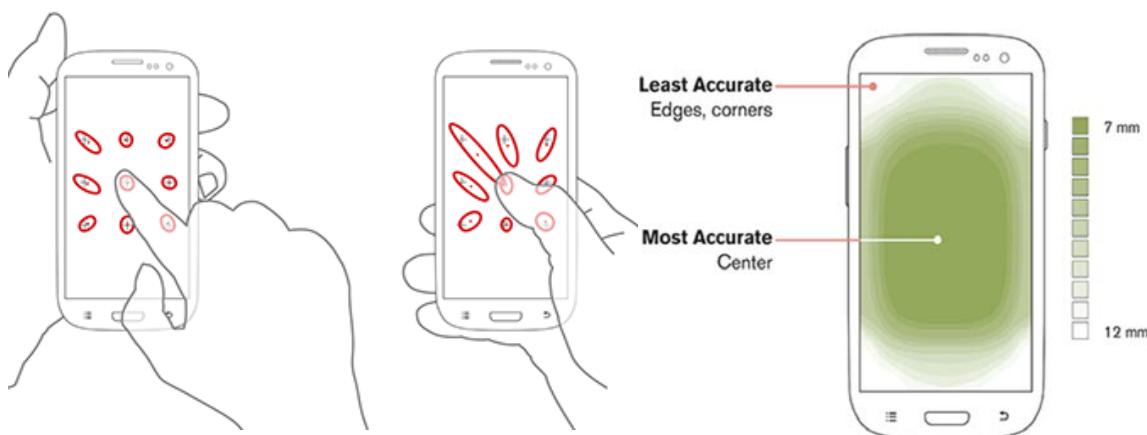


Design for Fingers, Touch and People, Steven Hoober (<https://www.uxmatters.com>)

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Human Accuracy Varies By Position and Grip

- (and when walking, etc.)



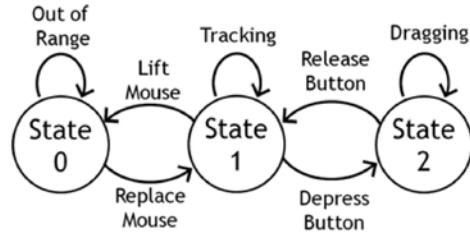
Design for Fingers, Touch and People, Steven Hoober (<https://www.uxmatters.com>)

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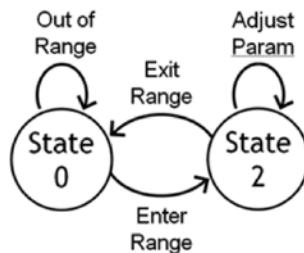
No Hover State in Touch

- Having a middle “tracking” input state allows for hover
 - users can preview action before committing
- Mouse input typically supports 3-states (not touching, dragging, mouse-down)
- Touch-input only supports 2-states (i.e. touching or not-touching the screen).

mouse input states



touch input states



“Imprecision, Inaccuracy, and Frustration: The Tale of Touch Input” by Benko and Wigdor

Multi-touch Dispatch

- In multi-touch, multiple fingers may hit a control simultaneously
 - ... leading to ambiguity
- when is click event generated?
 - “click” events generated for buttons only when the last contact is lifted from the control.
 - “click” events generated every time a user taps a button, even if another finger is holding it down
 - over-capture: multi-touch controls captured by more than 1 contact simultaneously (e.g., selecting the thumb of a slider with two fingers can mean that it will not track directly under a single finger when moved.)

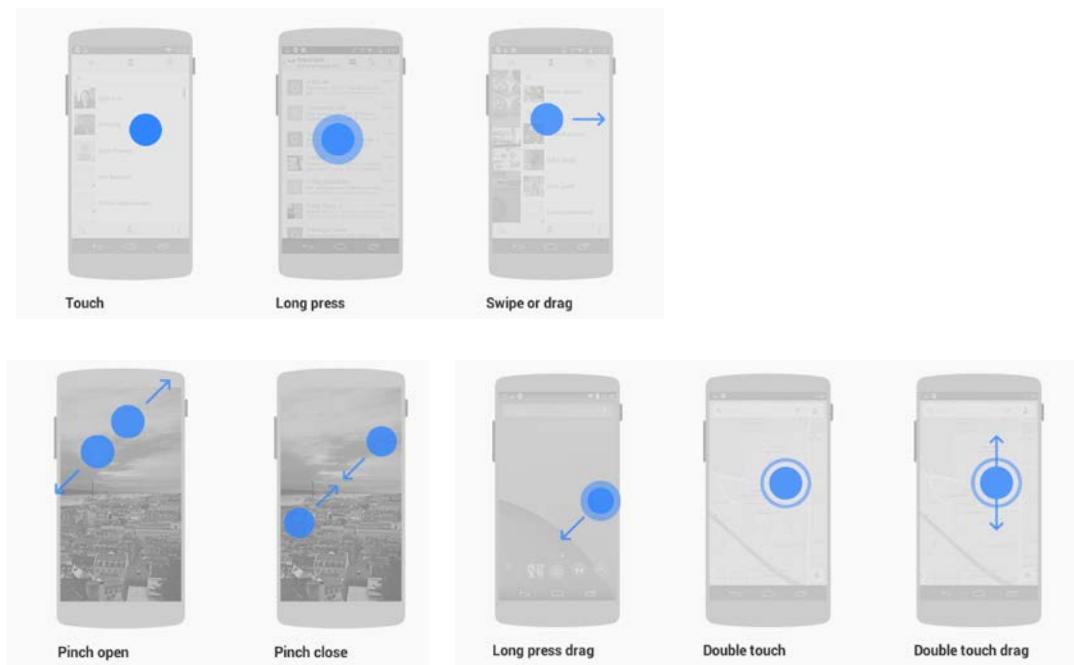
Physical Constraints

- Touch input relies on the principle of direct manipulation, i.e., user places their fingers onto an object, moves their fingers, and the object changes its position, orientation and size to maintain the contact points.
- Direct touch breaks when movement constraints are reached (e.g., moving beyond bounds, scrolling past limits).
- Solution:
 - elastic effects (e.g., apple iPhone scrolling past a list)

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Gestures

- Increase expressivity with time-based or contact-based gestures



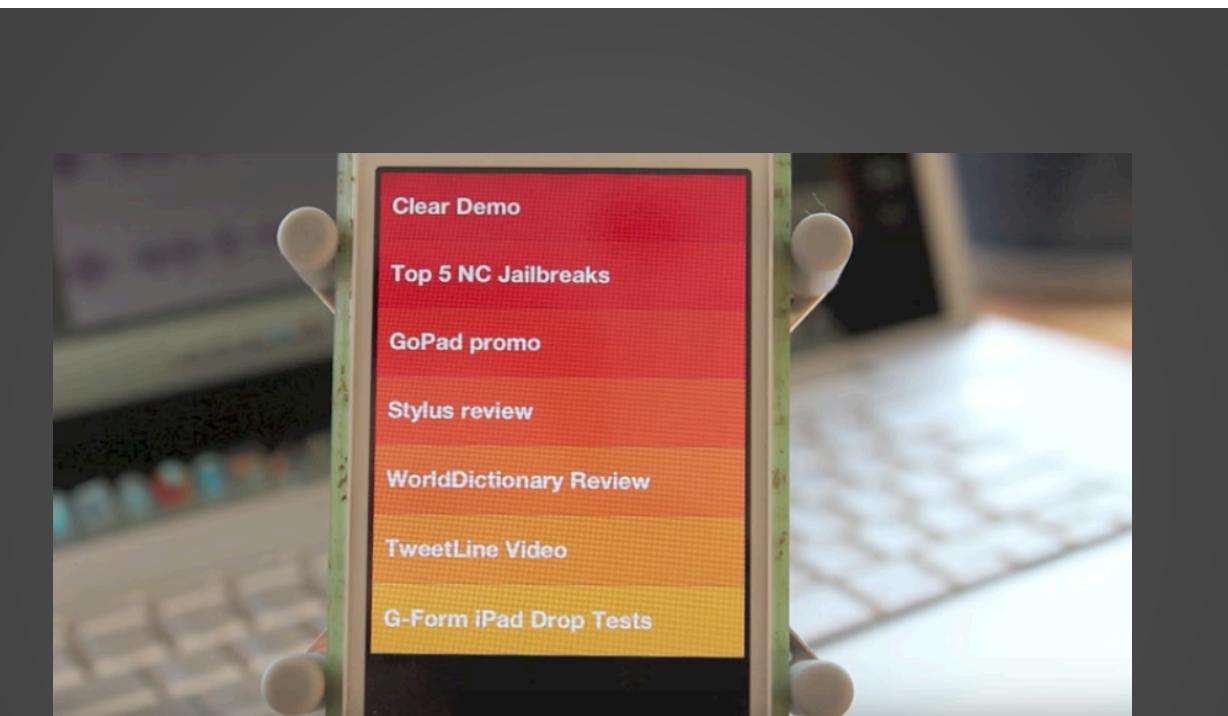
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Direct Manipulation via Gestures



patentlyapple.com

Mobile UI 17



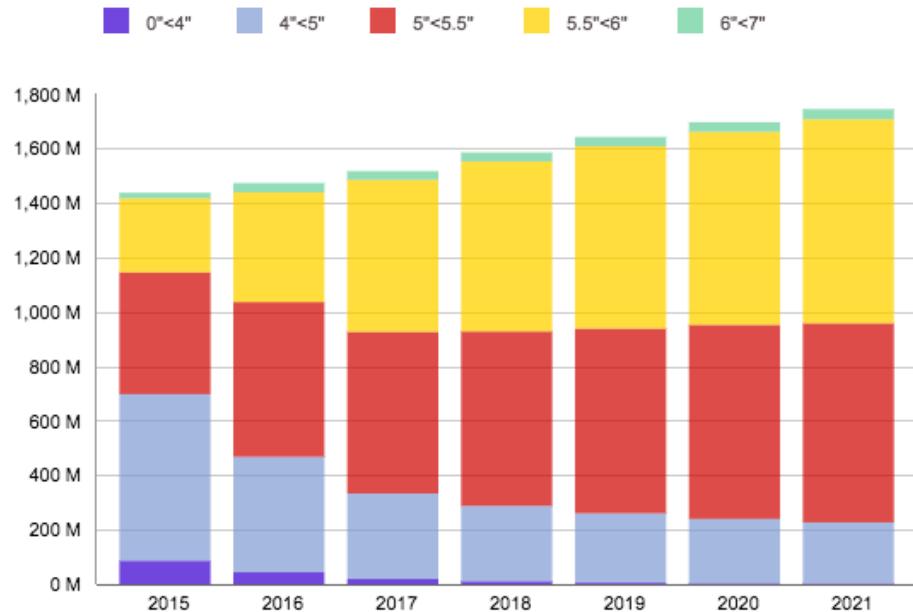
Gesture Example: Clear

- <https://youtu.be/DFzjyf2E7KI?t=4s>

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Display Size

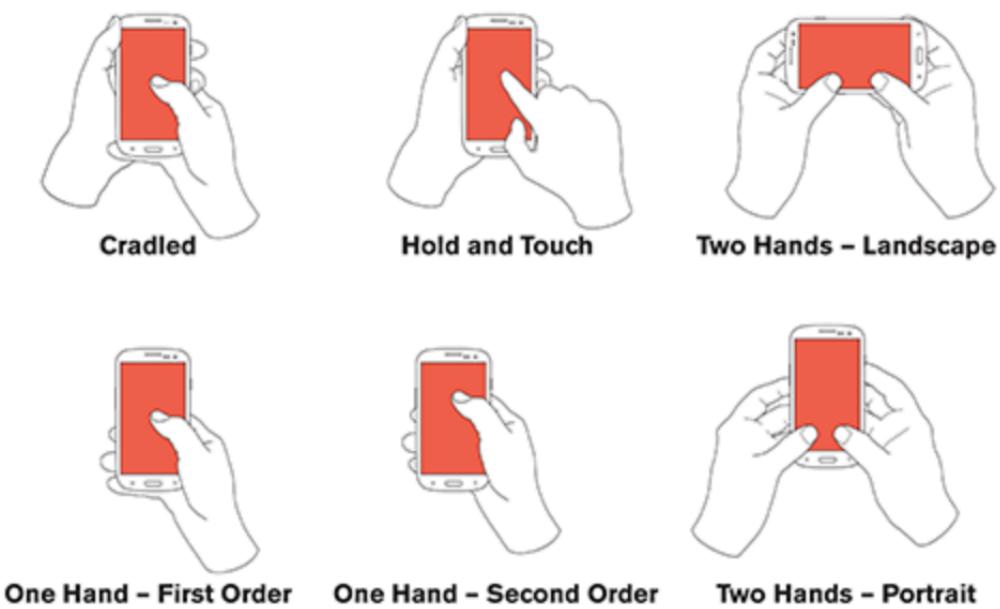
Worldwide Smartphone Shipment Forecast by Screen Size, 2015-2021



<https://techcrunch.com/2017/05/31/phabiles-are-the-phuture/screen-shot-2017-05-31-at-11-15-41-am/>

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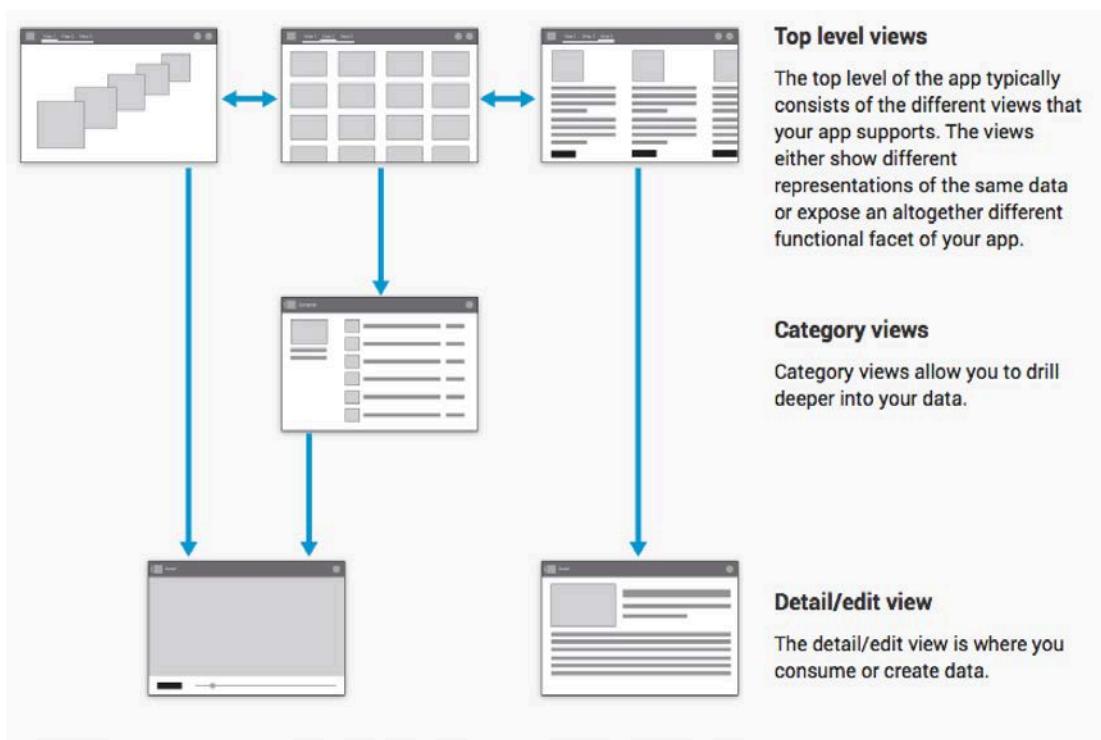
Different Ways to Hold



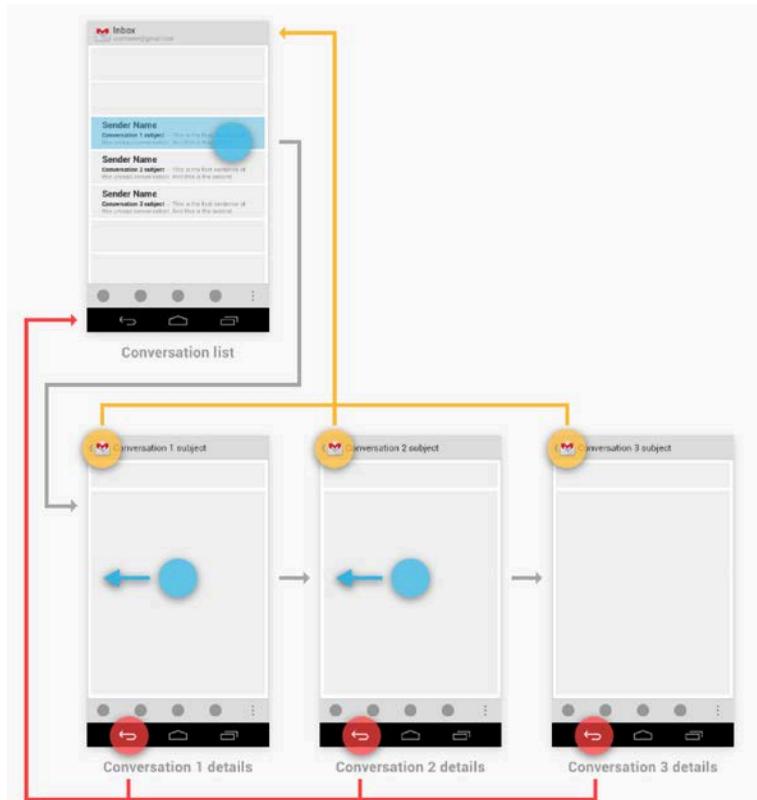
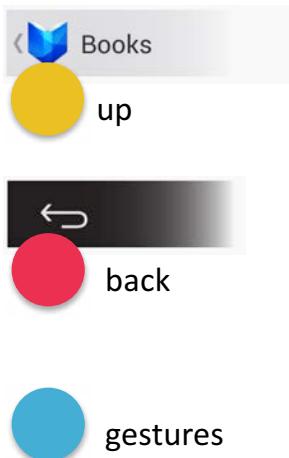
Device Characteristics: Interaction

- One app at a time
 - one app in the foreground
 - most apps are suspended when not in the foreground
- Each app has window that fills the entire screen
 - interaction is a sequence of different screens
 - consistent navigation model is key

Mobile Interaction Flow



Navigation



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Android Design: Creative Vision

- (circa 2013, but still relevant today)

Enchant me

Beauty is more than skin deep. Android apps are sleek and aesthetically pleasing on multiple levels. Transitions are fast and clear; layout and typography are crisp and meaningful. App icons are works of art in their own right. Just like a well-made tool, your app should strive to combine beauty, simplicity and purpose to create a magical experience that is effortless and powerful.

Simplify my life

Android apps make life easier and are easy to understand. When people use your app for the first time, they should intuitively grasp the most important features. The design work doesn't stop at the first use, though. Android apps remove ongoing chores like file management and syncing. Simple tasks never require complex procedures, and complex tasks are tailored to the human hand and mind. People of all ages and cultures feel firmly in control, and are never overwhelmed by too many choices or irrelevant flash.

Make me amazing

It's not enough to make an app that is easy to use. Android apps empower people to try new things and to use apps in inventive new ways. Android lets people combine applications into new workflows through multitasking, notifications, and sharing across apps. At the same time, your app should feel personal, giving people access to superb technology with clarity and grace.

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"Enchant Me"

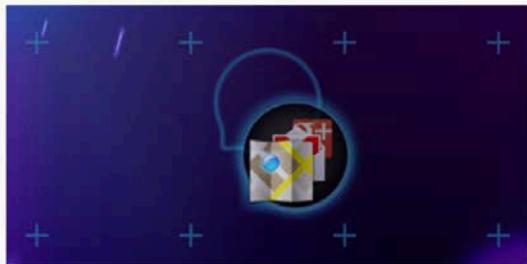
Delight me in surprising ways

A beautiful surface, a carefully-placed animation, or a well-timed sound effect is a joy to experience. Subtle effects contribute to a feeling of effortlessness and a sense that a powerful force is at hand.



Real objects are more fun than buttons and menus

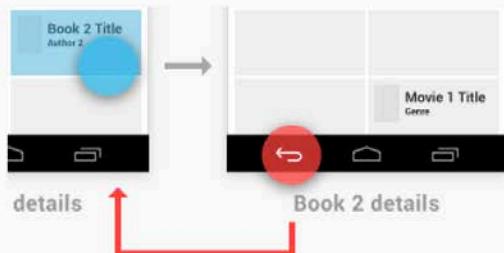
Allow people to directly touch and manipulate objects in your app. It reduces the cognitive effort needed to perform a task while making it more emotionally satisfying.



"Simplify My Life"

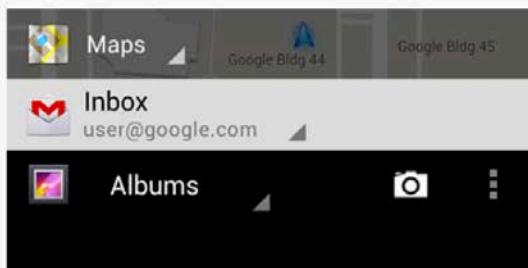
I should always know where I am

Give people confidence that they know their way around. Make places in your app look distinct and use transitions to show relationships among screens. Provide feedback on tasks in progress.



If it looks the same, it should act the same

Help people discern functional differences by making them visually distinct rather than subtle. Avoid modes, which are places that look similar but act differently on the same input.



"Make Me Amazing"

It's not my fault

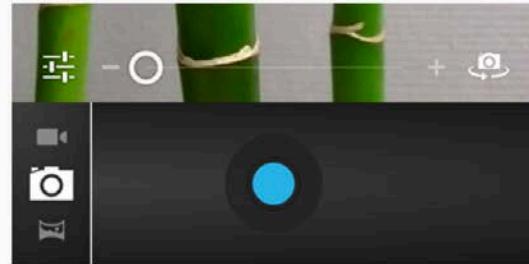
Be gentle in how you prompt people to make corrections. They want to feel smart when they use your app. If something goes wrong, give clear recovery instructions but spare them the technical details. If you can fix it behind the scenes, even better.

Insert SIM card

Turn off your phone, remove the battery, and carefully insert your SIM card with the gold contact side down. The cut-off corner should end up furthest away from the battery.

Make important things fast

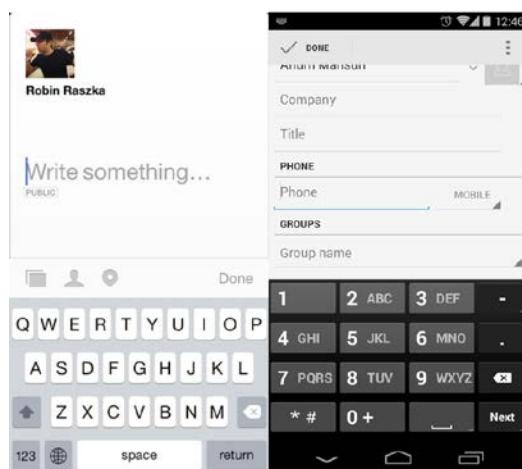
Not all actions are equal. Decide what's most important in your app and make it easy to find and fast to use, like the shutter button in a camera, or the pause button in a music player.



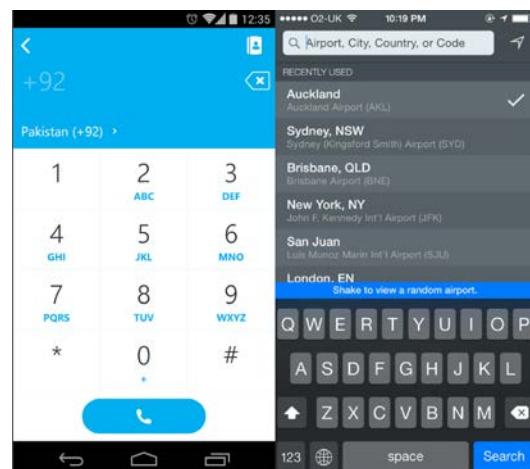
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Help Users to Enter Information

Provide the Right Data Entry Tool



Anticipate and Predict Input

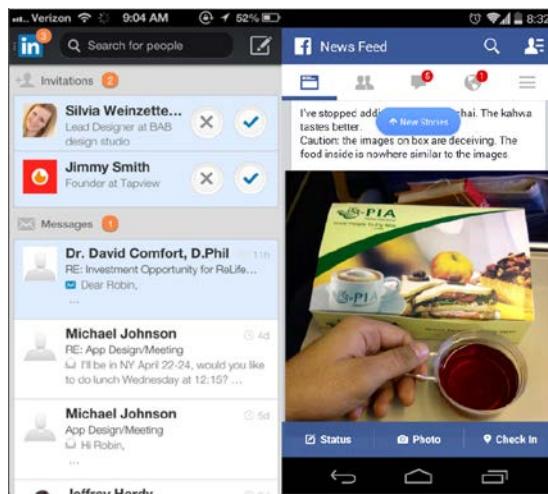


"Mobile UI Design Pattern" (Bank and Zuberi)

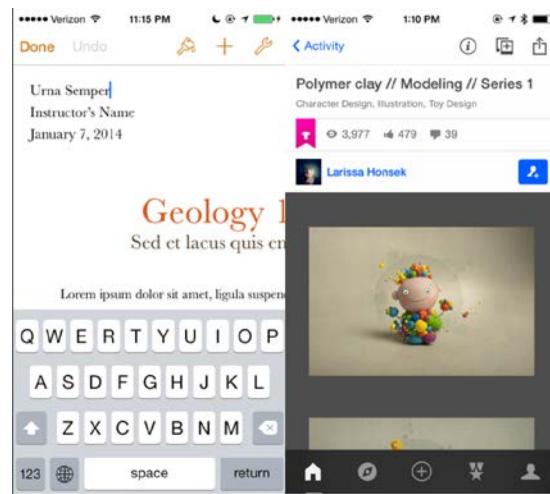
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Help Users Find Correct Actions

Highlight New Content



Quick Access to Frequent Actions



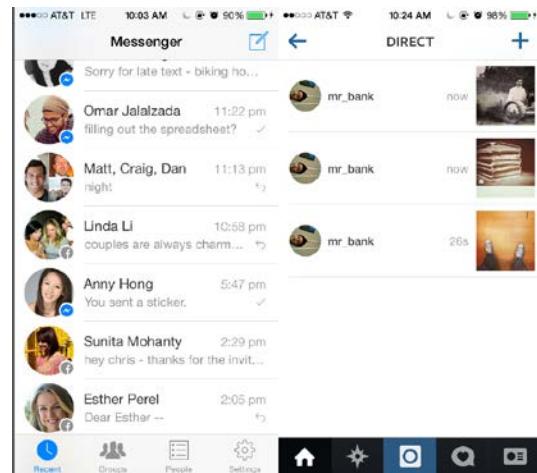
Mobile UI 29

Tip: Help Users Find Correct Actions

Make Actions Obvious



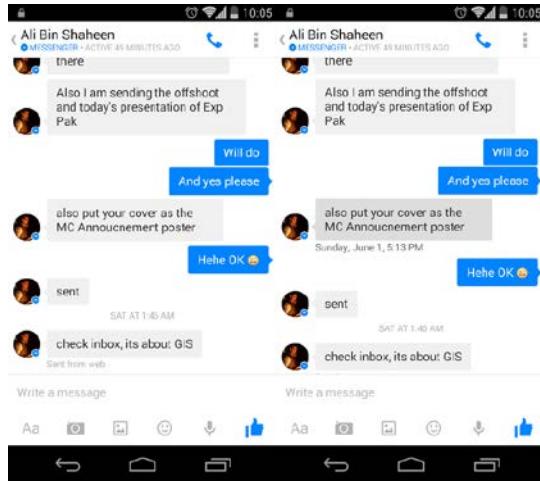
Distinguish Between Controls and Content



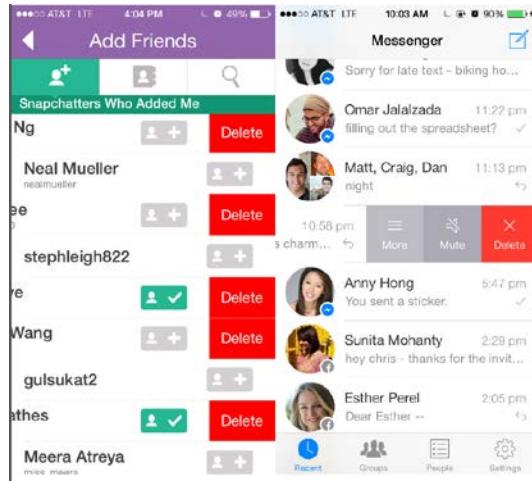
Mobile UI 30

Avoid Clutter

Hide Meta Data



Hide Secondary Menus



Mobile UI 31

Standards: Interface Guidelines

- Platform-specific design guidelines can provide specific usage examples and hints, beyond these basic guidelines

iOS Design Themes
As an iOS designer, you have the opportunity to deliver an extraordinary product that rises to the top of the App Store charts.

iOS Design Guidelines

Up and running with material design
Android uses a new design metaphor inspired by paper and ink that provides a reassuring sense of tactility. Visit the [material design](#) site for more resources.

> Introducing material design
> Downloads for designers
> Articles

Android Design Guidelines

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