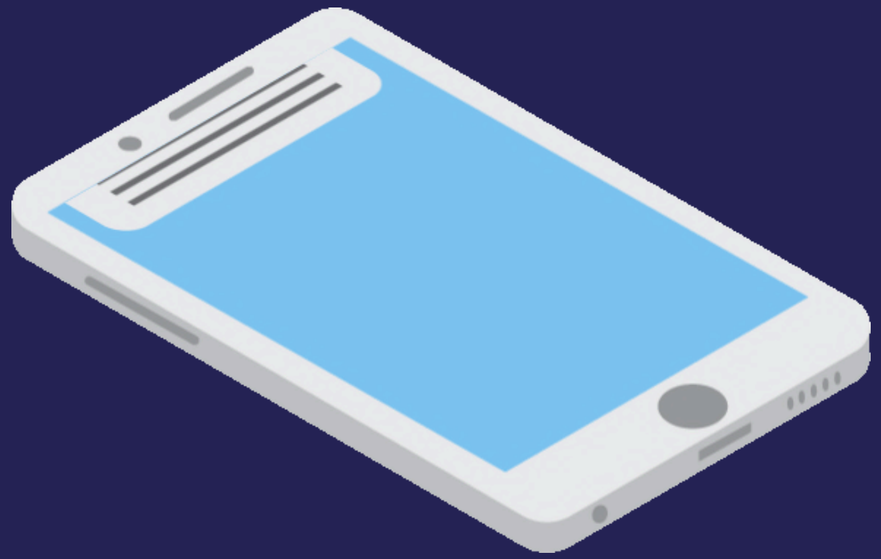
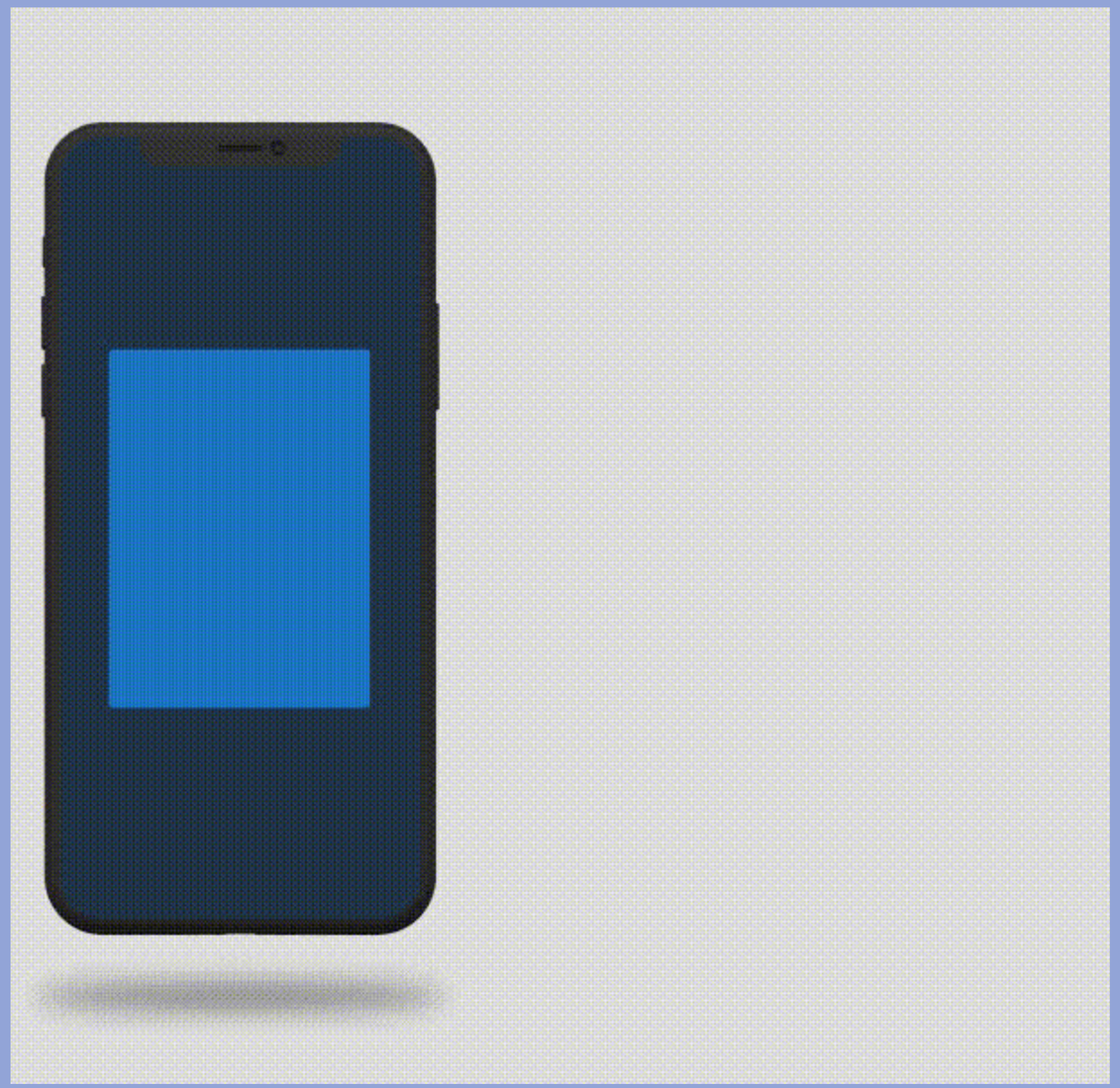


Buttons & Gestures

A study to explore the design space and evolution of gestures on touch interfaces.



What are gestures?

- If you tap on a smartphone display and if there is an icon under the tap area, the phone will do something. If you tap and move your finger (or fingers), you are making a gesture. The phone senses what has happened checks what it needs to do, and does it.

- Two-fingers is usually all it takes, but some devices will allow 3 or even 4 fingers on the screen at once. This allows for a huge range of gestures.

Introduction

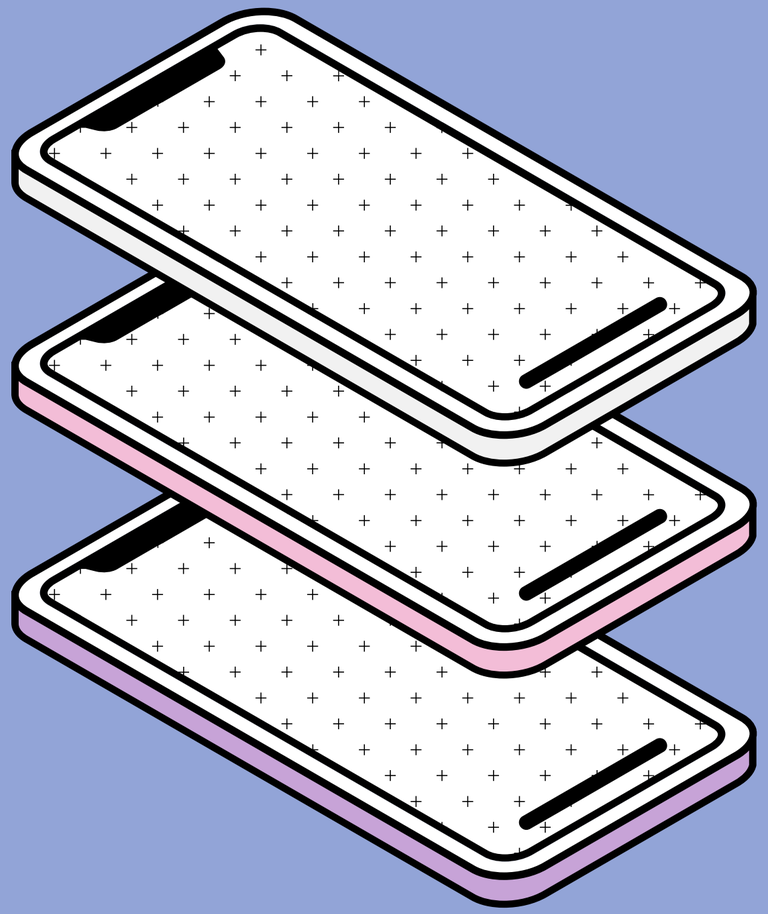
- In different periods of time, designers have developed their own gestures while designing their products.
- Apple has its own gestures, Android has its own, and even laptop touchpads have their own set of 2-finger 3-finger gestures.
- For the scope of this study, buttons here mean soft buttons, i.e. single tap gestures.

Tapping and swiping gestures

- A tap is where you lightly touch a spot on the screen for just an instant. You can use this gesture to open apps, activate the onscreen keyboard and return to the home screen.

- A swipe is when you touch and slide your finger across the screen. A gesture is a more complex/gross function that involves more than single touch.

- The screen of a smartphone or tablet is multi-touch, which means it can detect more than one touch at a time.



Motivation

- One of the most significant changes in this decade is the rise of gesture-based controls and navigations.
- The **release of Android 10** in 2019 included plenty of new features and improvements for Google's mobile operating system. Perhaps the most controversial new additions were the Android 10 gestures.
- How gestures being more complex than simple buttons feel more intuitive and usable?

Problem Statement

- How do people interact with touchscreens, and why do they do it that way?
- Explore the design space and evolution of touch gestures on mobile devices.
- Is the complexity of gesture design justifiable?

Literature Review

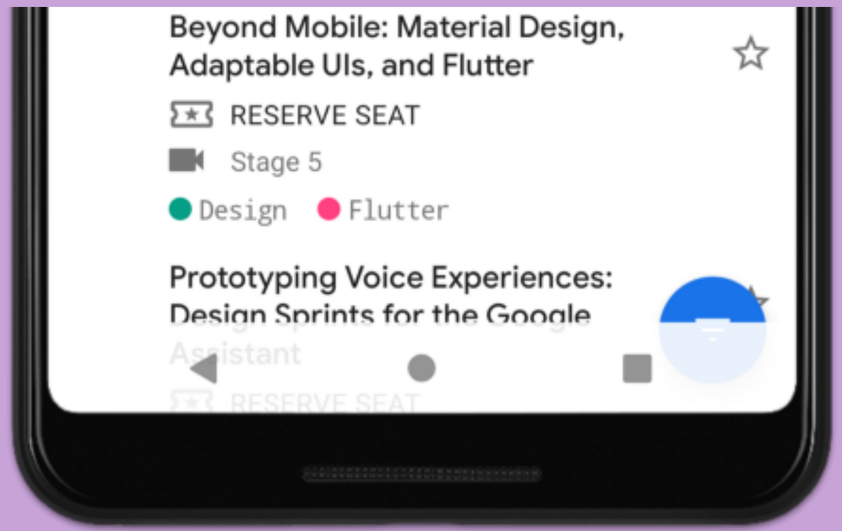
Gestures and attentional load

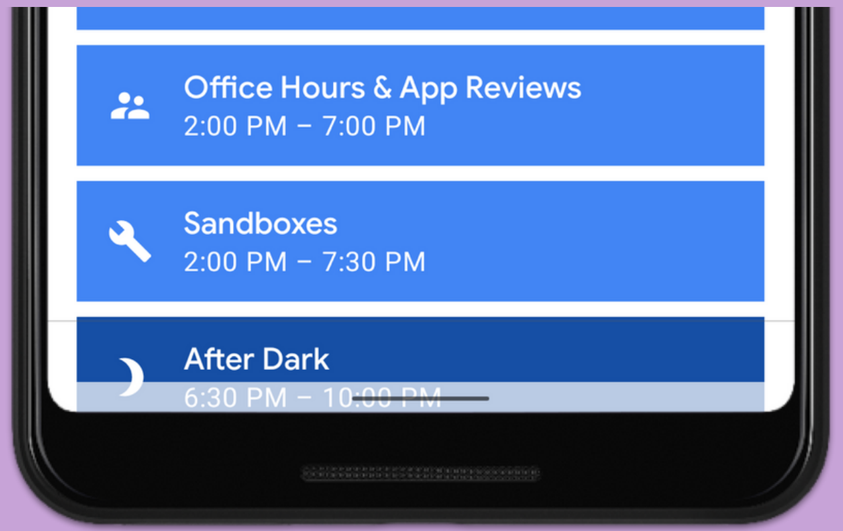
- Users rely on mobile devices while sitting, walking, driving, and in diverse environments with various distraction levels.
- Techniques such as soft buttons, which require the user to look at and press a relatively small target, will suffer performance degradation in non-ideal environments.
- In the presence of such situational impairments, gestures can offer significant performance gains and reduced attentional load.
- Some gestures could be articulated eyes-free, with one hand.
- In addition to that, gestures can be committed to muscle memory, which helps users focus on their tasks.

Three-button vs Gesture-based navigation

Android Q - Google's attempt to standardise gestures on Android phones.
According to Product Managers on the Android UI, gestures are a “faster, more natural and ergonomic way to navigate your phone.”

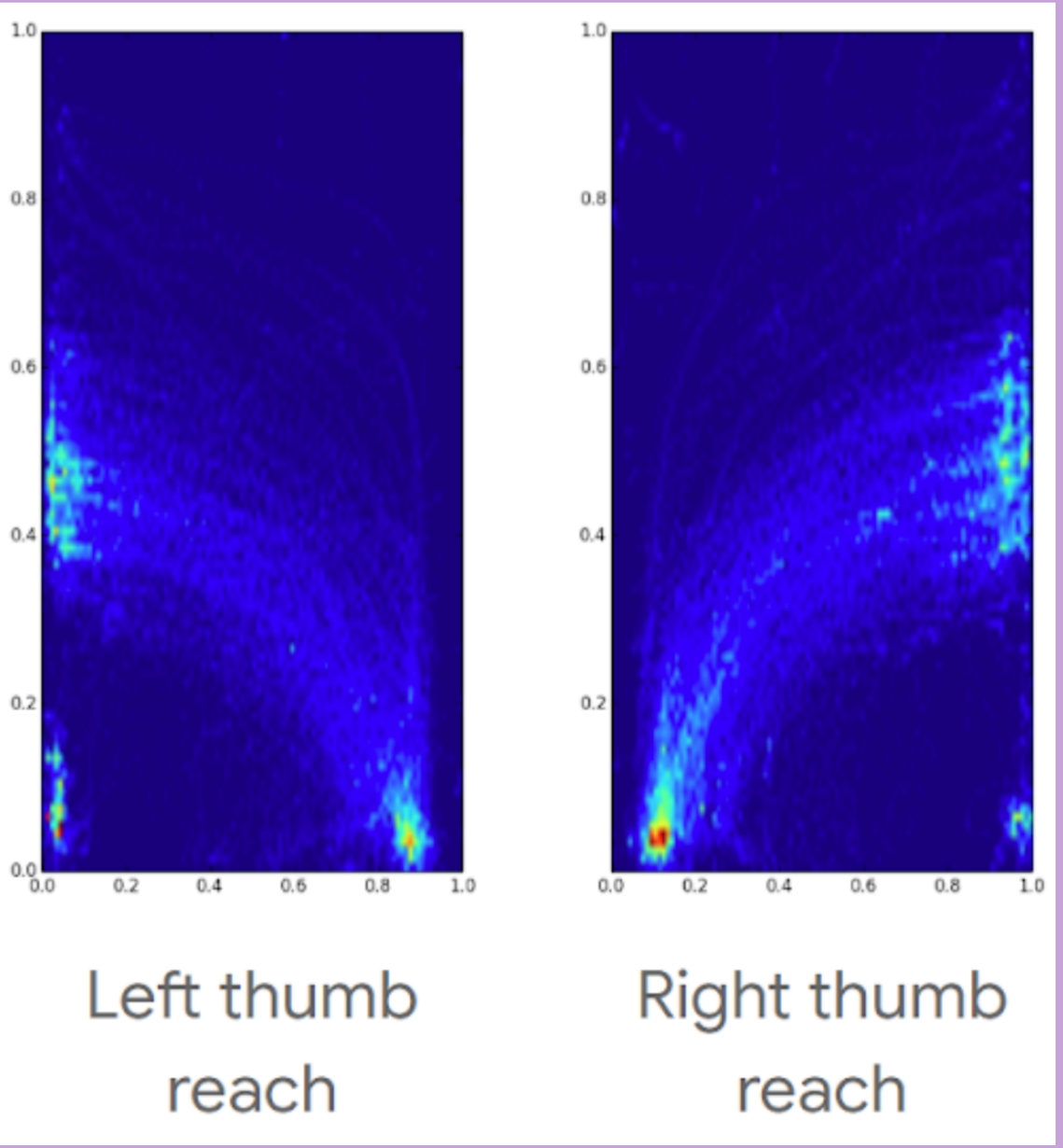
Not every user is comfortable with gestures especially those with more limited dexterity and mobility. Thus gestures are harder to learn and can take some adjustment. So we trade off the simplicity of use for better performance.
Additionally, Gestures can interfere with an app’s navigation pattern.

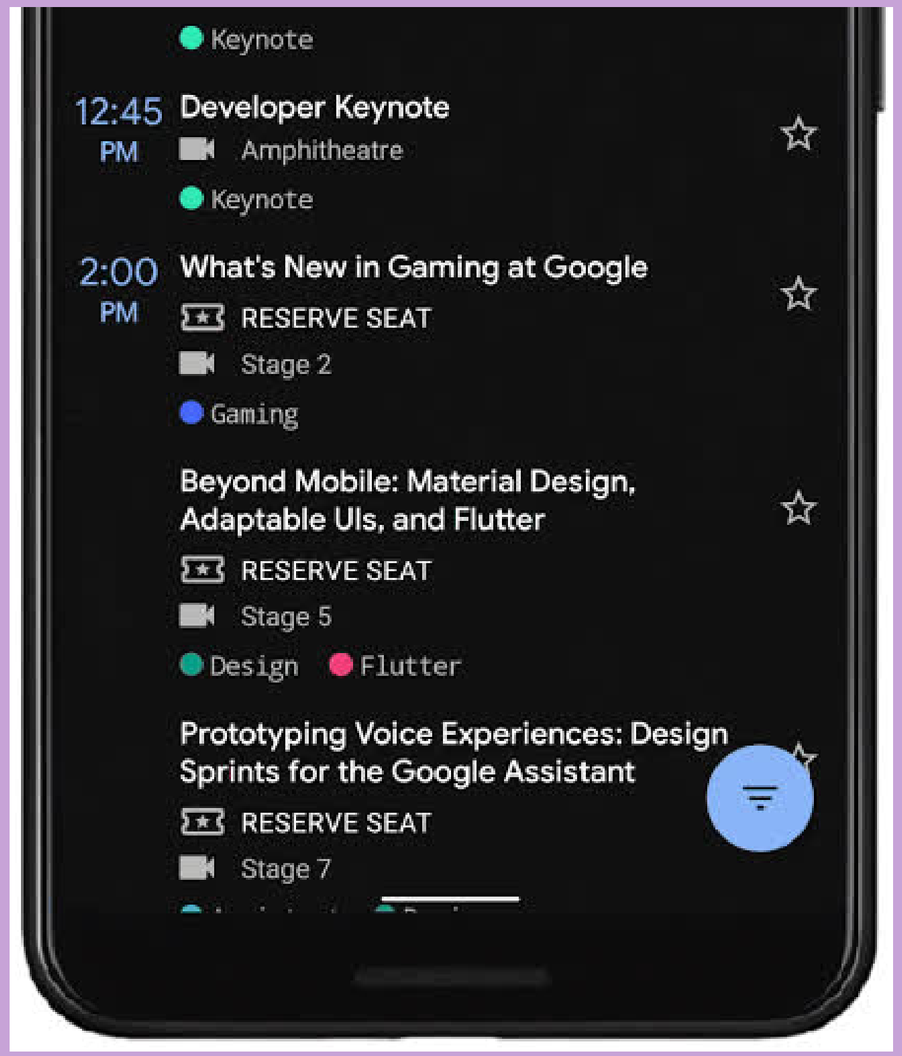




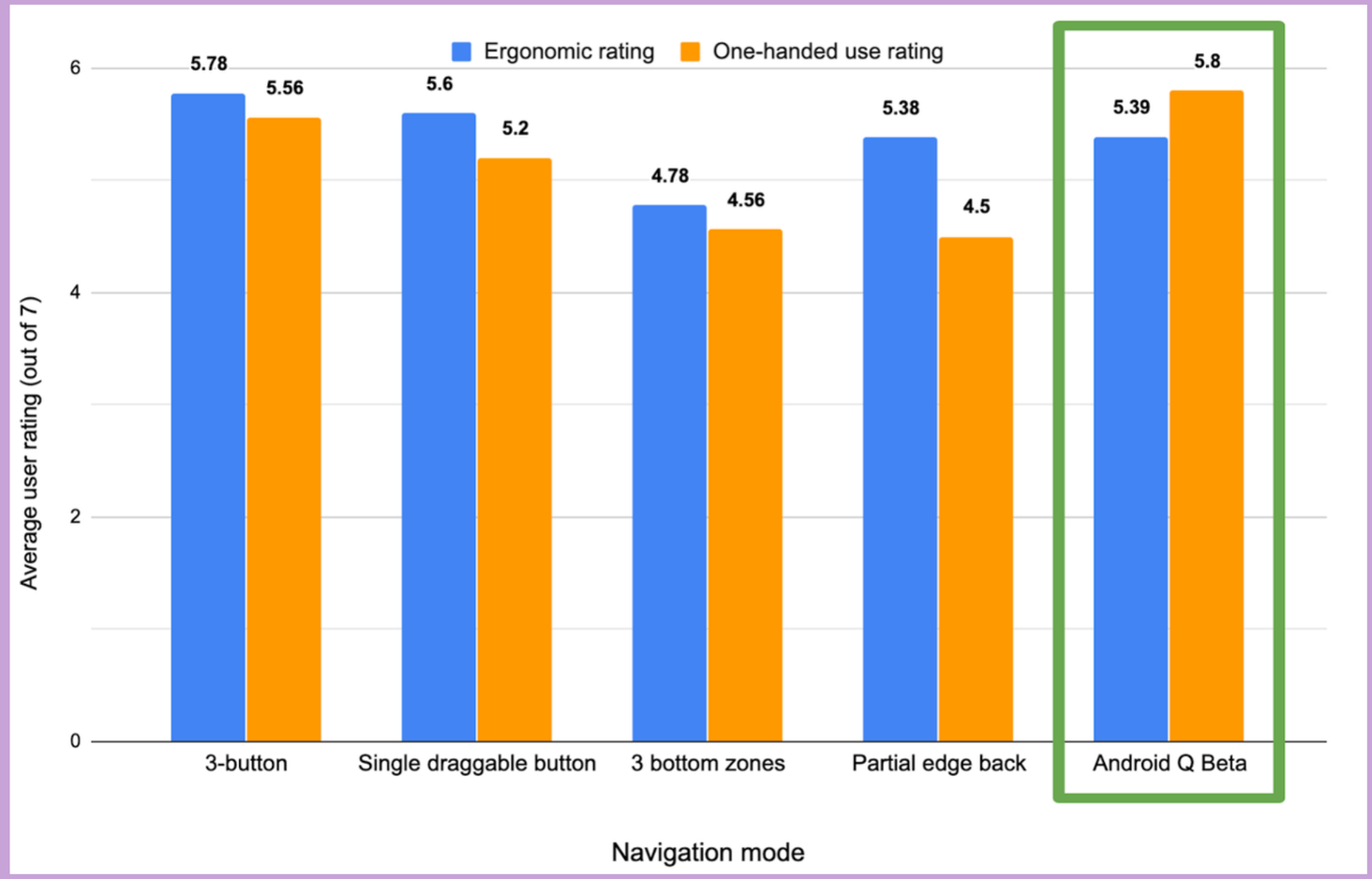
Gestures are great for one-handed navigation because, in theory, you don't have to move your hands from the resting position.

Reachability charts
Two core gestures (Back and Home) were designed to coincide with the most reachable areas and comfortable movement for thumbs.





Additionally, gestures do not require any dedicated screen space, a limited resource on mobile phones offering an edge to edge display



Average users performed Home and Back gestures more quickly with navigation gestures than most other models.

Using gestures

I love the gestures. Especially the swipe left or right to go back, and the quick swipe on the bar to cycle between apps. Not sure how those could be viewed as impractical. Maybe I'm a thumb genie but it's way faster for me than the 3-button nav. I could never go back. Honestly 2 of my fav features altogether.

I tried it but i ended up getting used to the gestures that when I had it enabled muscle memory would kick in and still force me to use gestures to only find out "oh yeah i disabled it". I know it's just getting used to it again, but i enjoy gestures more because of how clean it looks and not having the 3 buttons visible at the bottom and ended up switching back to gestures again.

Yeah its all personal preference, but without buttons it gives the full immersive experience .

Agree with more fluid with buttons and I've tested a few phones especially with 3rd party launchers... Unfortunately I can't go without gestures as well due to screen real estate and convenience of gestures

I like the gestures too but I always expect swiping on the right to go forward instead of back! Not sure if there is some setting or launcher that can change that.

or kicking it old school with buttons

I've always used button navigation, and mostly use a stylus for typing, so the gestures never seemed to offer much benefit for me. I also like to tap buttons vs sliding my fingers all over the screen, the buttons seem more direct and responsive, and the screen stays cleaner lol. Yes I'm a little ocd 🤢🤢

I have tried many times to get used to gestures on Android, but I just can't. I have used webOS for so many years that any gestures that don't work the same way just don't work for me. I just hope they never take button navigation away as an option!

Yeah I hear you! Like I said, gesture navigations nice overall. But they can get a bit janky and not very responsive at other times. Three button navigation feel more direct, more responsive and faster on the phone. That's just my take on it. But you're right, having choices and options and android as well the operating system and what Google is all about.

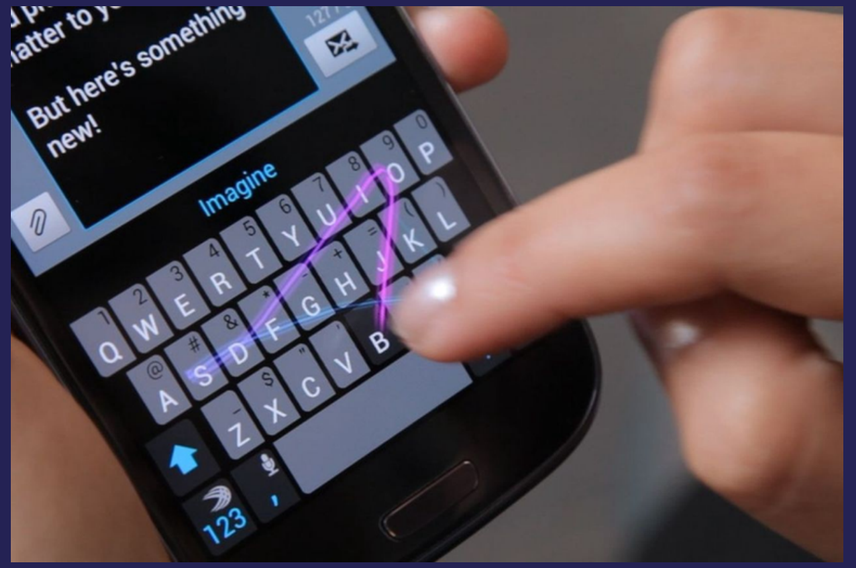
At least for me, overall navigational performance is much better with these buttons, but I do find myself still trying to swipe back on the side of the screen every now and then. For example, lurking through Instagram is better with gestures and the same goes for Twitter. For my mental health, though, I have to go with 3 buttons while I'm using Nova Launcher.

How do people type on mobile devices?

- Scientists wanted to develop a faster typing method. Various keyboard layouts were built, but consumer stubbornness left scientists with a difficult challenge to come up with a system that worked in a similar way and could be learnt in minutes. The only system to tick these boxes is gesture typing.
- Gesture is the event where the user continuously draws from one letter to another to input a full word.
- World speed record for texting was set by Abdul Basit from Pakistan who used gesture typing. Instead of prodding at letters on the screen, he swiped between letters with a finger, lifting only between each word.

AI in typing

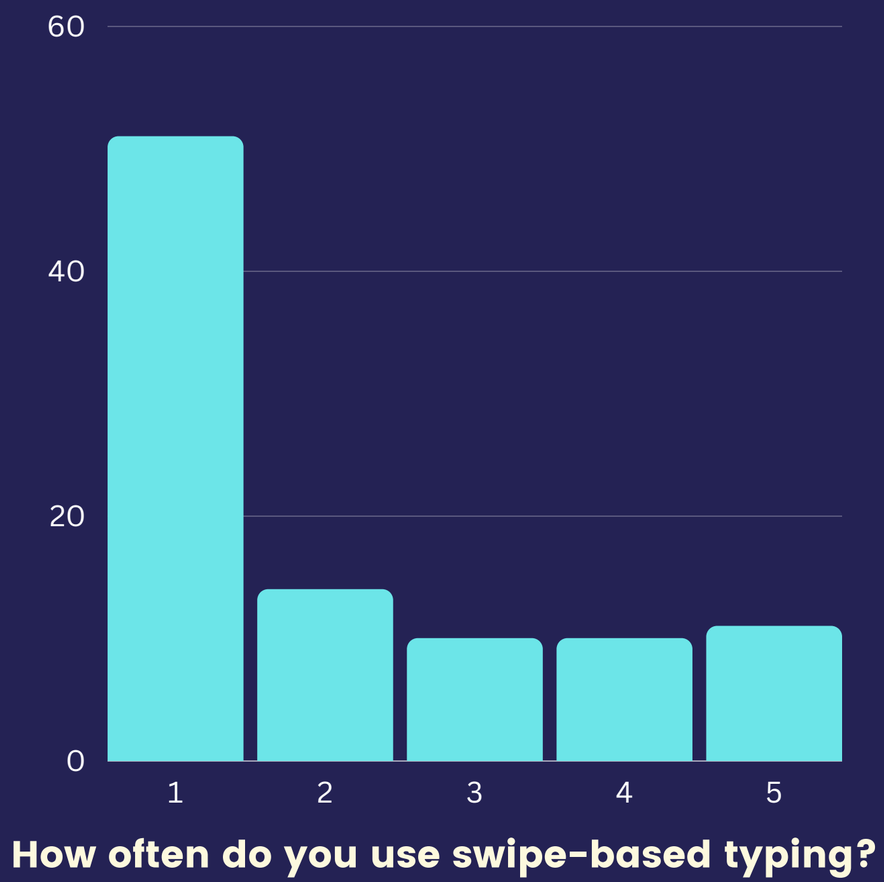
- Learning and memory
- By continuous use, this squiggle unique to each word becomes automatic and involuntary.
- Humans are incredibly predictable when it comes to typing, and AI uses just that.
- Fifty per cent of the words we type consist of the 200 most frequently used words in English.
- In other words, gesture typing gives each word its own unique squiggle that we learn almost by accident.
- Intelligent text entry techniques (ITE) such as Autocompletion + Suggestions + Gestures make typing a seamless intelligent experience for the user.



Design features

- One continuous movement - In comparison to tapping-based touchscreen keyboards, gesture keyboards do not require up and down movements for each letter. Instead an entire word involves only one continuous movement.
- Auto word ending and spacing: Because a word-gesture keyboard works at the word level, there is a natural separation between words: each time a user lifts the finger from the touch surface, a word and a space are entered.
- Error-tolerance: Since a word-gesture keyboard can perform error-tolerant gesture recognition, users do not have to precisely slide though every letter in the intended word.
- Progression from ease to efficiency

- Some research indicates gesture keyboard does not experience frequent use in practice.
- In our survey around 20-30 per cent of the people use gesture keyboards frequently.



How often do you use swipe-based typing?

User acceptance

Some of the comments were highly enthusiastic. For instance, *"Game changing app"* by jhudge05: *"Typing on the iPhone used to [sic] tedious and frustrating for me, but now that I use WritingPad I am actually writing faster on the iPhone than I was on my Blackberry"*, and *"Holy $41t"* by Corso123: *"'revolutionized typing' is the understatement of the year. This technology should be part of every keyboard on all touchscreens. Someone nominate these software developers for a Nobel. No Joke. Thank you so much for this software... –brian."*

There were individual differences in the reviews. Some users stated that they quickly become proficient with the technique (*"It's super accurate and super easy to use and I'm still in awe of how genius it is."*), while others had trouble getting used to it (*"It took me a few days of use to get used to it"*).

Swipe-based keyboards add extra cognitive burden to the typing experience as they initiate you in a physical finger dance which forces you to plan your finger trajectory in advance as you spell out the word in your head. And if you take too long to connect the next letter in your word sequence, swiping keyboards will often error (although Microsoft's

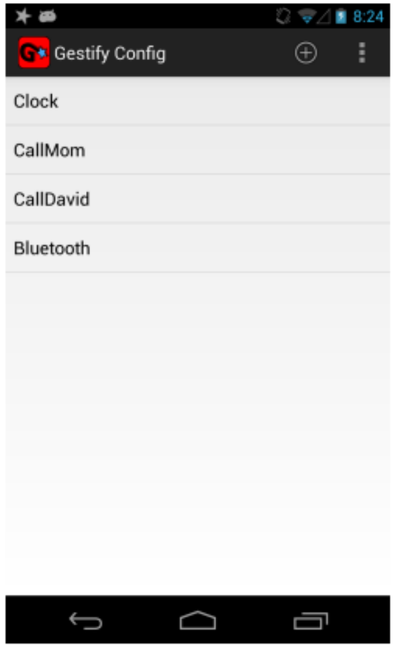
Gesture Shortucts

- Gesture shortcuts include a vast range of **simple as well as complex shortcuts**. It can be as simple as two taps to sleep/wake your phone to as complex as making a star on the screen.

- **To open an app from the app menu**, one had to unlock the phone, go to home and then scroll through the options to find the required app finally. With the help of shortcuts, one can quickly draw on a blank screen to directly load the app.

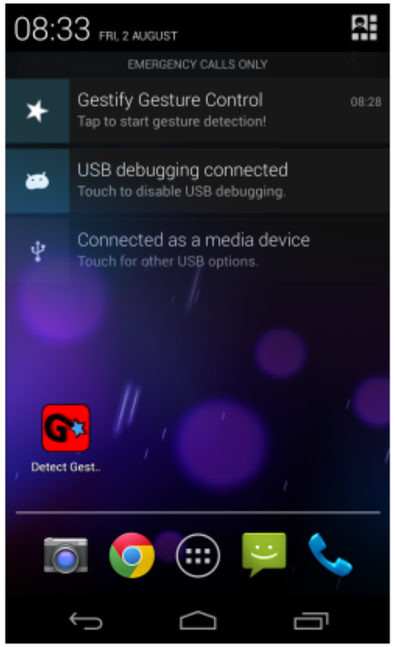
- **Gestures are also incorporated to remove accidental clicks**. Since gestures are prolonged touches, there is a lesser chance of accidents, such as picking up a call or accidentally clicking on the delete button that does not have a confirmation page.

Oddly enough, with all of the futuristic appeal and hype paid to gestural controls, the trend isn't universally beloved. In fact, a sizeable camp in the design world considers **gestural controls to be a step back in usability.**



(a) List of existing gestures.

(b) Add a new gesture.



(c) Trigger detection through one of the provided activators, e.g., notification bar.

(d) Draw gesture in recognition activity.

(e) A pop-up indicates that the gesture is detected.

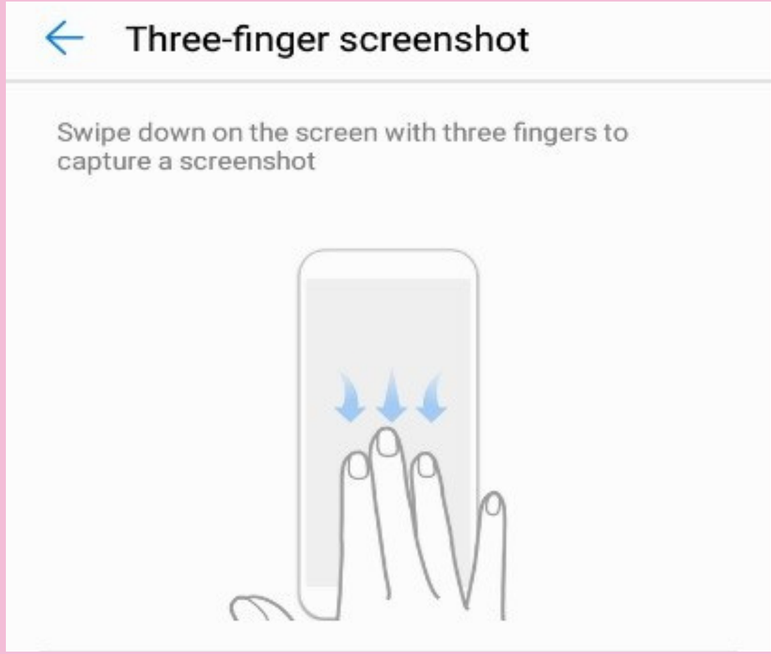
- According to the Material design guidelines, the tap is a ‘fine gesture’ that requires just a small movement from the user. **A tap on the screen generates a single data point and is, therefore, ideal for one-off, precise actions such as opening an app or sending an email.**

- If the tap doesn’t land in the correct location on-screen, the system will misinterpret the user’s tap. This may not seem too grave, but an erroneous gesture can cause frustration and affect the user experience.

- As the Material design guidelines explain, the swipe mobile gesture is a ‘gross gesture’, involving a sweeping movement either vertically or horizontally across the screen. **It is built for intuitive decisions and can be performed with either a fast and short or a slow and prolonged action.**

- **A fast, short action** might be dismissing a notification (swipe to the side in Android or drag down in iOS), whereas a slow, **long action could be swiping to unlock** an Android device or refreshing the iPhone Safari browser.

- The majority of gestures are used to open up applications, such as Facebook, WhatsApp, or the Camera application. One action each is dedicated to accessing contact information or toggling system settings. **We identify that about half of all gestures are letter-shaped, and the second most prominent gestures are of abstract shape.** Overall, only a few gestures are of icon, word, or geometric shape. Letter shapes typically represent the first character of a related action, whereby icon gestures typically mimic the application icon.



Adaption of different age groups to gesture-based systems

- As people age, their cognitive and/or physical abilities start to get limited, which could prevent them from properly using a tablet. For this reason, it is essential to study what kind of **skills elderly people have when using multi-touch superficies such as smartphones, tablets and netbooks.**

- People above the age of 60 are capable of performing all gestures. They showed that not all tasks are equally feasible, but elderly people can execute with different levels of complexity. The special elderly people skills that we found in this test was that elderly people can **perform easily scale-down (99 % success) and scale-up (98 % success) gestures**. The quantitative results also show that there are still challenging gestures for elderly people **(double tap, tap, long pressed) with relatively low success rates ranging**.

- These gestures have to be discussed in the context of the interaction aids or design guidelines that application designers should take into account if these touch interactions are included in future applications.

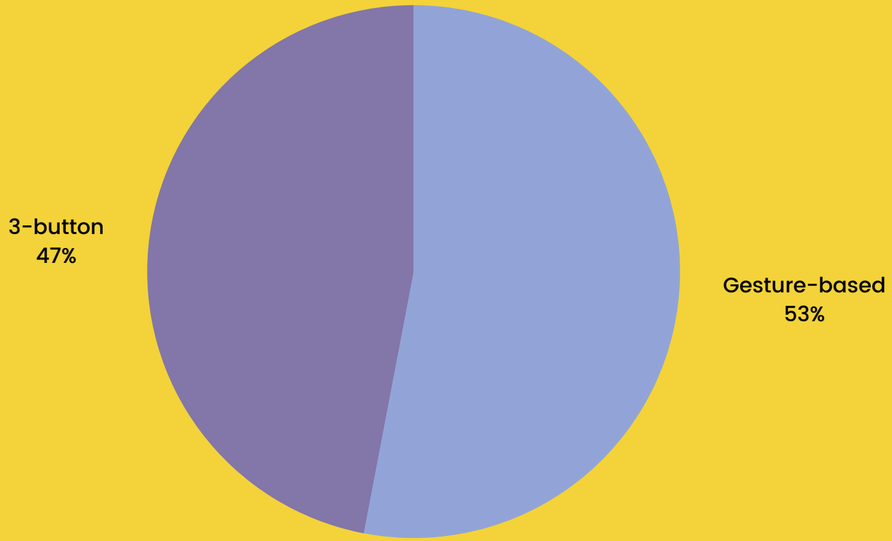
- It was observed that there is a general trend in **how people of different age groups hold their smartphones**. While the younger generation usually holds the device in one of two ways **a) phone held in both hands using both thumbs and b) phone held in one hand using the same thumb**, the older generation is reasonably equipped with using the phone by holding it in **one palm and using the index of the other hand.**

- Corresponding to the complexity of gestures and more and more gestures being developed each day, the younger generation's extensive use makes it easier to get used to any new gesture method instantly. Whereas labels or **general instructions were needed to remove the confusion on how to perform and what the end result is** on performing the particular gesture.

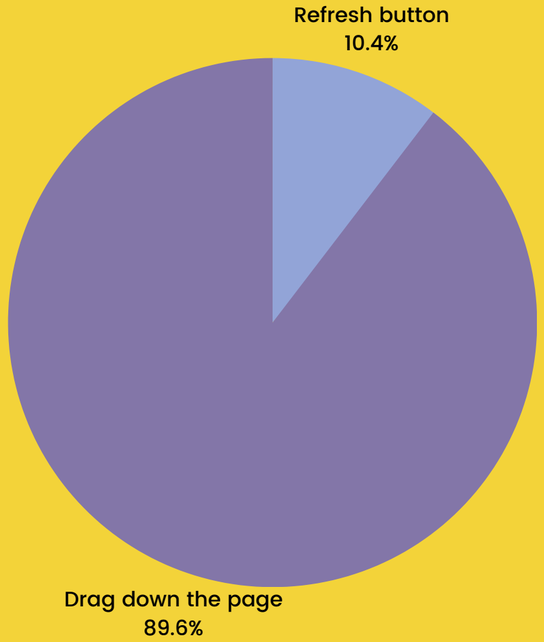
Survey

https://forms.gle/WZDQ18Z4sLoR9eSE7

What type of navigation system do you use on your smart phones/devices?



How do you refresh a chrome tab generally? (Refresh button or drag the page down)



How often do you use a single hand to operate your smartphone?

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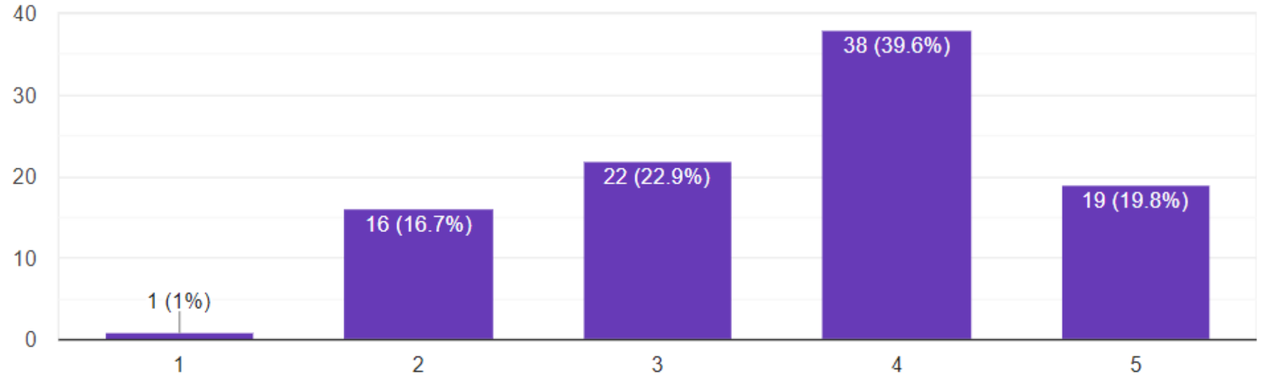
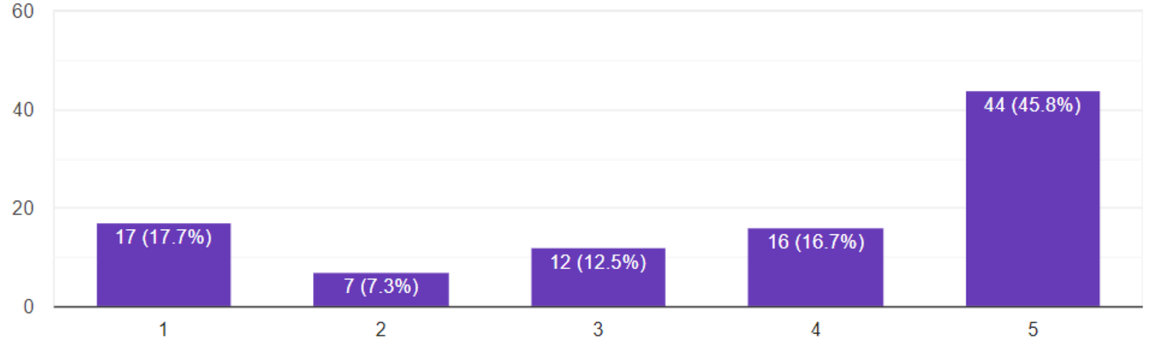
96 responses



What do you think is better? (1 - Always use tap to answer a call and 5 - Always use swipe/drag to answer a call)

Copy

96 responses



What do you use more often to wake/sleep screen? (1 - Always use power button and 5 - Always use double tap)

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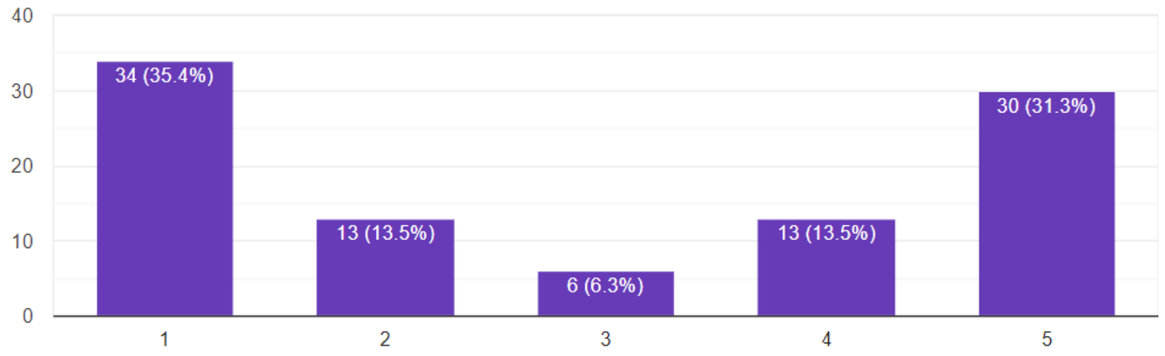

How often (or how comfortably) do you use the trackpad on your laptops? Do you use an external mouse?

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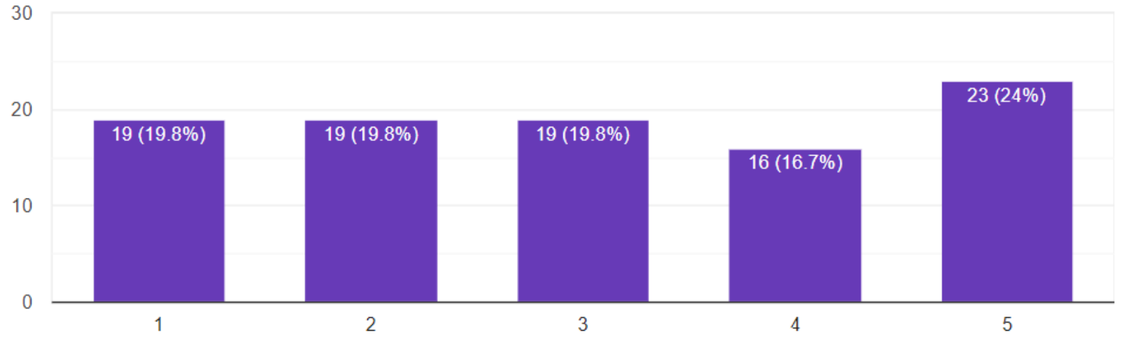
96 responses



How often do you use gesture/swipe-based typing?

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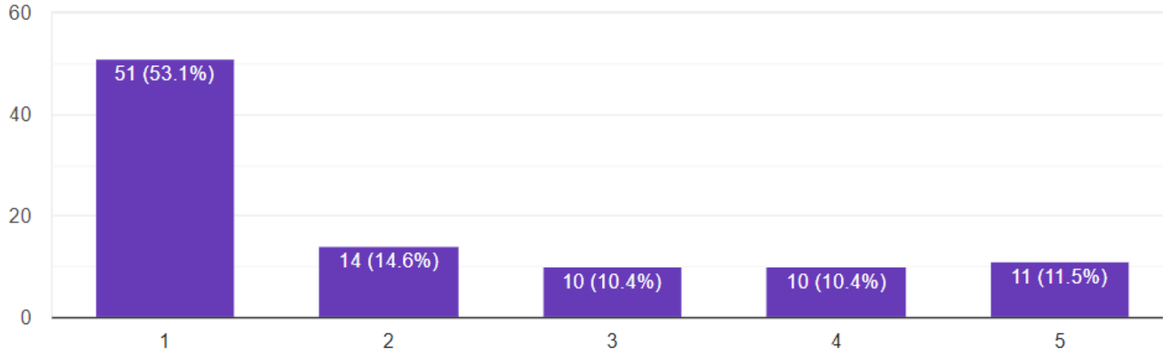
96 responses



How often do you use two-fingers/three-fingers/four-fingers gestures to change application or show desktop on your trackpad?

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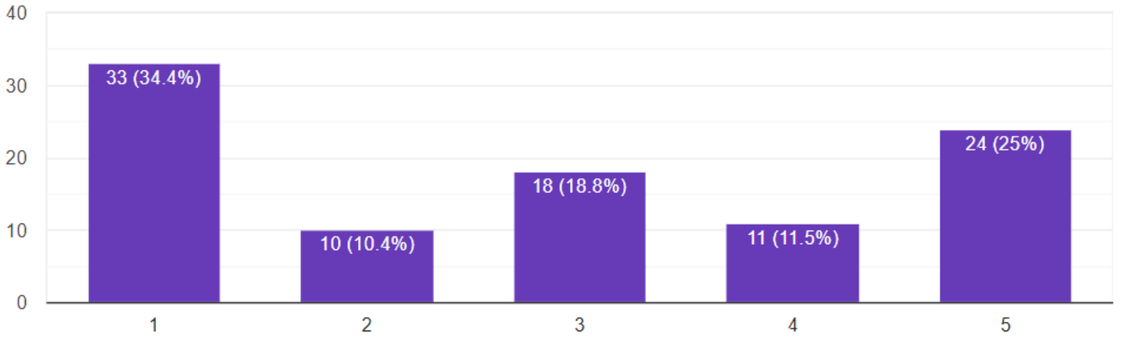
96 responses



Do you use personalised gesture shortcuts? Ex. Opening the camera by making a C on the screen.

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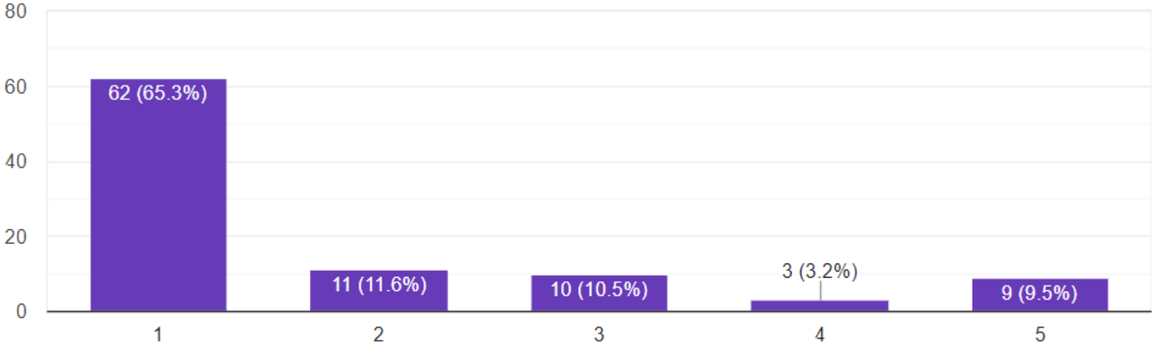
95 responses



Observations

People didn't realise how much of their daily interaction with mobile devices is based on gestures. From unlocking the phone to drawing a pattern rather than a passcode, from dragging an item to the recycle bin to swiping down to refresh the page.

From the survey performed, we have quite some inferences:

- People in the age group <30 years quite **prefer using gesture-based typing to write text/ send messages.**
- The same age group also **prefers to use the phone single-handedly** more often than people in the age group >30 years.
- Irrespective of age, we see a **general inclination to use simple swipe gestures to complete simple tasks on mobile devices**, such as answering a phone using a swipe rather than a tap that might be clicked accidentally or double tapping to wake up the screen rather than using the power button.
- Since people are so used to pressing individual keys to type, there was resistance to using gesture-based typing. Another reason was that people didn't quite need the auto-suggestion provided by the AI keyboard as people generally used shorterned words.

Through the lens of HCI

- **Designing for Complexity**: Gestures are more complex than their tap counterparts. But gestures offer a sweet spot with justifiable complexity and better performance.
- **Interface Design and Usability**: Before designing the gesture-based navigation, Google researched how users held their phones, what typical reach looked like, and what parts of the phone users used the most. They designed the human-technology interface, which aligns with the existing resources, concepts and user behaviour.
- **Personalization**: Gestures allow the customisation of interfaces in a million different ways. From choosing the type of system navigation to personalised gesture shortcuts.
- **AI and data HCI**: Gesture-based typing makes use of the more frequent words while suggesting/completing words. User data is saved to understand their texting patterns and suggest similar words in future.
- **HCI design for age groups**: The setup/position in which people from different age groups hold their phone make a difference in their use of gestures. Gesture-based typing was more common in the younger generation as it is easier to complete that task with a thumb rather than an index finger, that would make the entire arm move.

Conclusion

- The gestures **don't require the user to interact with any particular element** on-screen.
- The downside of soft buttons is that they can easily be worthless **if user movements aren't precise enough**. This is one of the more time-consuming gestures to perform. In order for taps to be executed successfully, **the user needs to be focused.**
- Touch gestures have become steadily more critical with the ongoing success of touchscreen devices. **Compared to traditional user interfaces, gestures have the potential to lower cognitive load and the need for visual attention.**

Conclusion

- Gestures make it possible to **compress a process with various taps** and replace it with a single gesture shortcut to get to the same end result.
- For navigation, **around 50% of the population has shifted to gestures from buttons** in the last three years since Android Q's release.
- Though gestures seem complex on the top, they are **more intuitive, offer better performance, and reduce accidental errors by the end user**.

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Thank you for your time.

Harshita Gupta / Soveet Kumar Nayak