

EMBEDDED SYSTEMS PROGRAMMING 2017-18

UI Guidelines

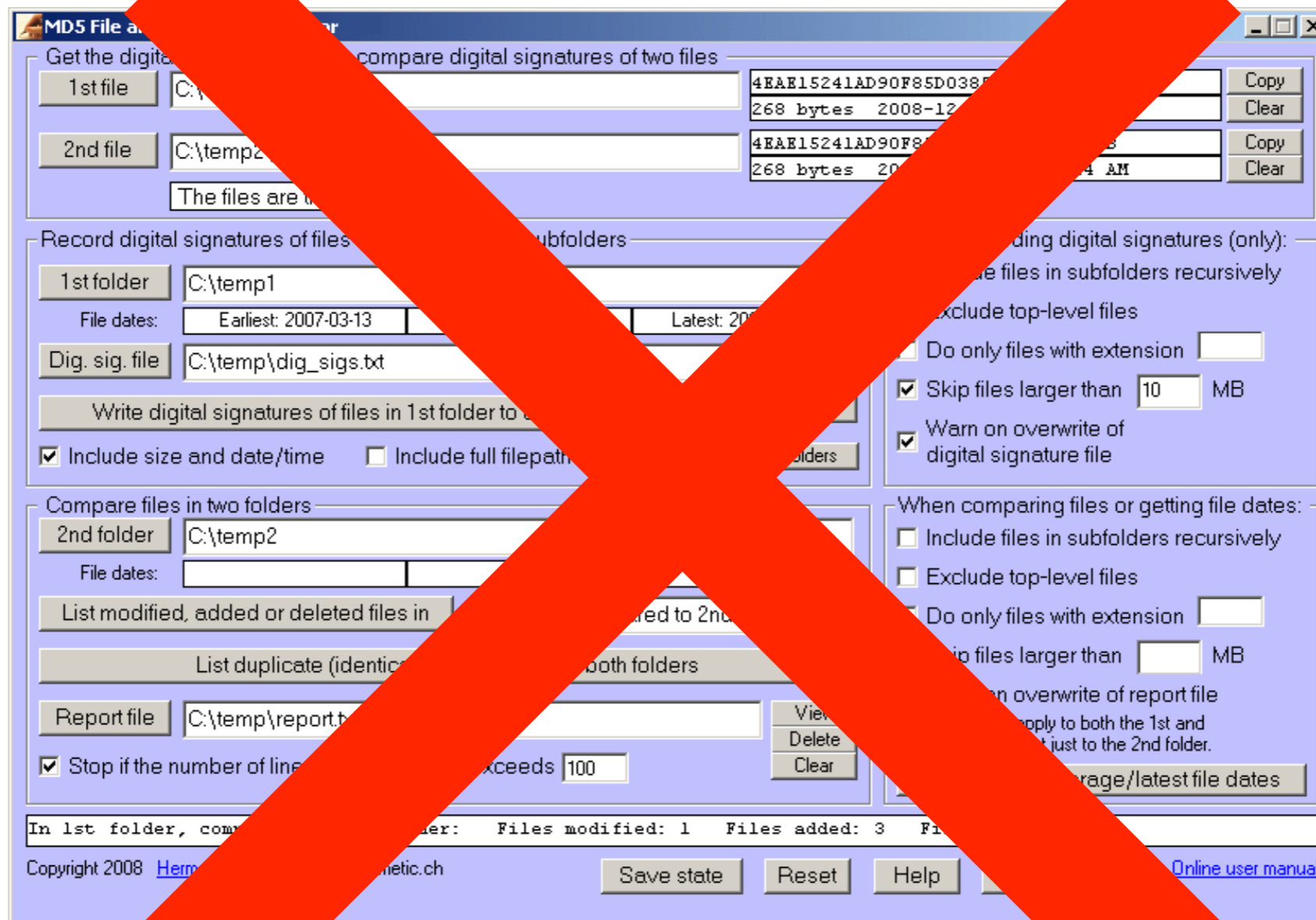
UIS (1/2)

Always true (almost trivial):

- a UI should be simple to use,
- a UI should be tailored to the characteristics of the device, to its screen, to its input facilities



UIS (2/2)



UIS AND EMBEDDED DEVICES

True not only for smartphones, but also for industrial controllers, automotive devices, etc.

- **Screen real estate is valuable.**
Corollary: if some piece of information is not necessary, do not show it altogether
- **The applications should respond to user input instantaneously, much faster than on a PC**

CONSEQUENCES (1/2)

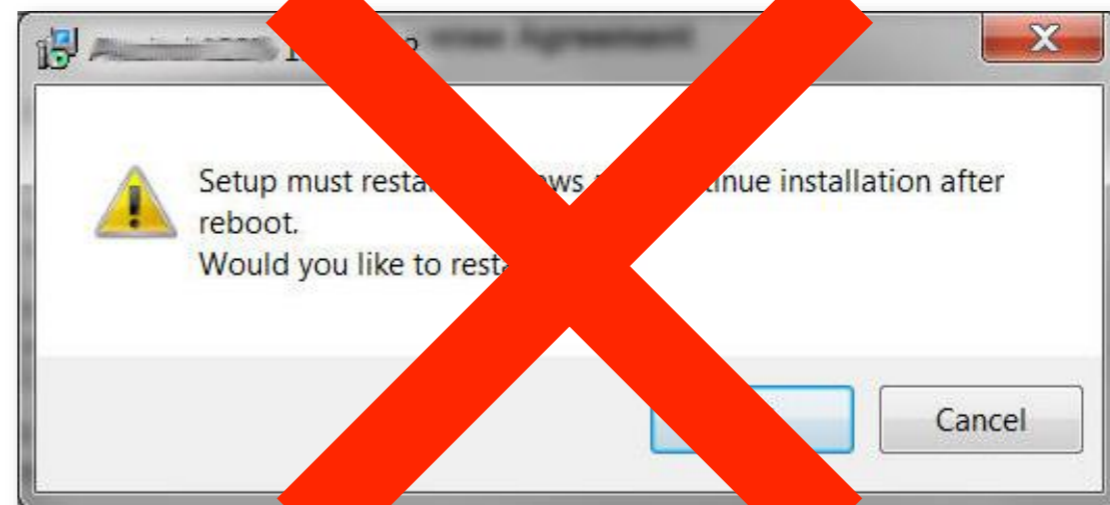
Fast response

- The application should start as quickly as possible: no “loading components”, no configuration questions, ...
- Build indexes of your data to speed up access
- Display placeholder content right away and partial results as they become available

CONSEQUENCES (2/2)

Fast response

- Apple says: do not tell the user to reboot/restart after installing your app. If your app has memory-usage or other issues that prevent it from running unless the system has just booted, you need to **rewrite it**



UIS AND SMARTPHONES/TABLETS

- Each app provides a single functionality
- No concept of launching/closing an app
- Fading concept of loading/saving data
- File system: user is seldom aware of it

CONSEQUENCES (1/4)

One app, one functionality

- **“Resist the temptation” to add features that are not essential to the main purpose of your app and to your target audience**
- **Instead, focus your effort on introducing new ways to interact with key app content**
- **Keep modal tasks short and narrowly focused**

CONSEQUENCES (2/4)

No concept of opening/closing an application

- Do not quit programmatically
- Always be prepared to stop
- Android, iOS: restore the state of the app to that in use when the user last ceased using the app

CONSEQUENCES (3/4)

Fading concept of loading/saving data

- Your application has its own “documents” inside itself
- **Auto-save** data behind the curtains every time a change is made
- Implement an “**undo**” function so that the user can revert undesired saves

CONSEQUENCES (4/4)

No filesystem awareness

- Do not show anything that makes the user think about file metadata, file locations or even files altogether

UI PRINCIPLES ACCORDING TO APPLE

- User control
- Aesthetic integrity
- Consistency
- Metaphors
- Direct manipulation
- Feedback



USER CONTROL (1/2)

- “An app can suggest a course of action or warn about dangerous consequences, but it is usually a mistake [...] to take decision-making away from the user”
- “The best apps find the correct balance between giving people the capabilities they need while helping them avoid unwanted outcomes”

USER CONTROL (2/2)

- The user's focus is on the **content**
- As you customize your UI, take care to ensure that it does not overshadow the content
- Do not try to replicate paradigms developed for other kinds of platforms (e.g., the web)

AESTHETIC INTEGRITY

- The quality of app artwork is very apparent, but there is more to aesthetics than this
- “Aesthetic integrity [...] represents how well an app’s appearance [...] integrates with its function”
- An app must send “a clear, unified message about its purpose and its identity that helps people trust it”

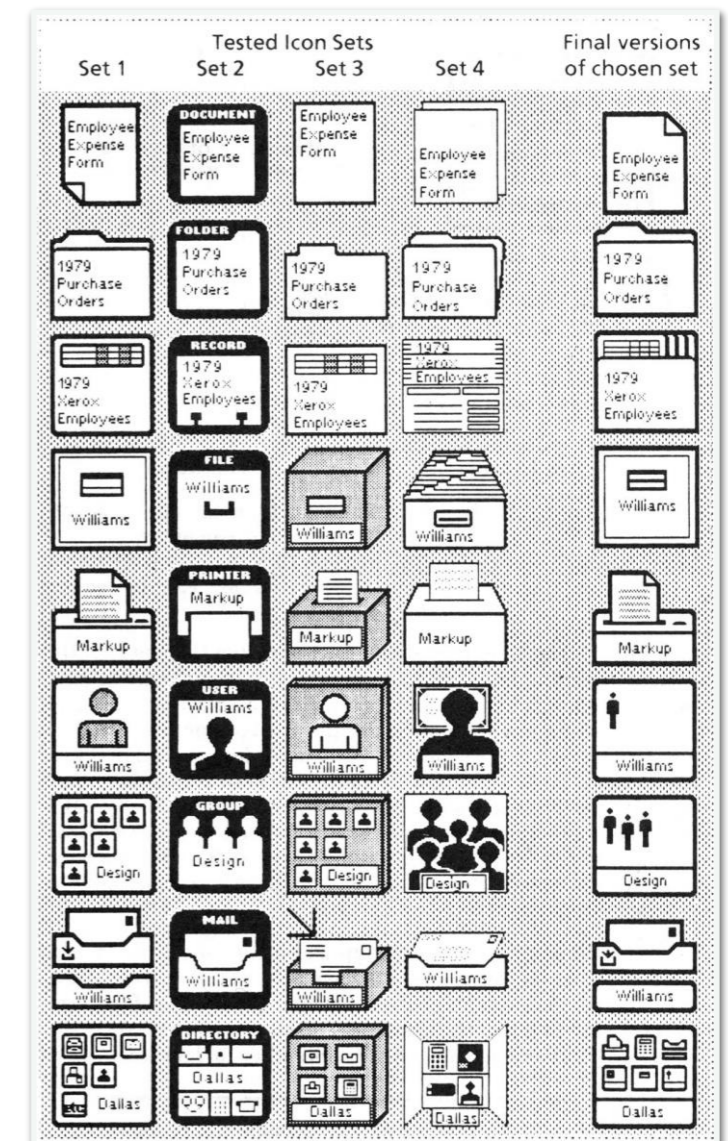


CONSISTENCY

- **Consistency allows people to leverage on previous knowledge and skills, so as to avoid increasing the user's cognitive burden**
- **Consistency within the application itself**
- **Consistency among applications**
- **“A consistent application is not a slavish copy of other apps and it isn't stylistically stagnant”**
- **Use standard widgets and resources (icons, buttons...)**
- **Implement a UI customization only if it “facilitates the task people want to perform and enhances their experience”**

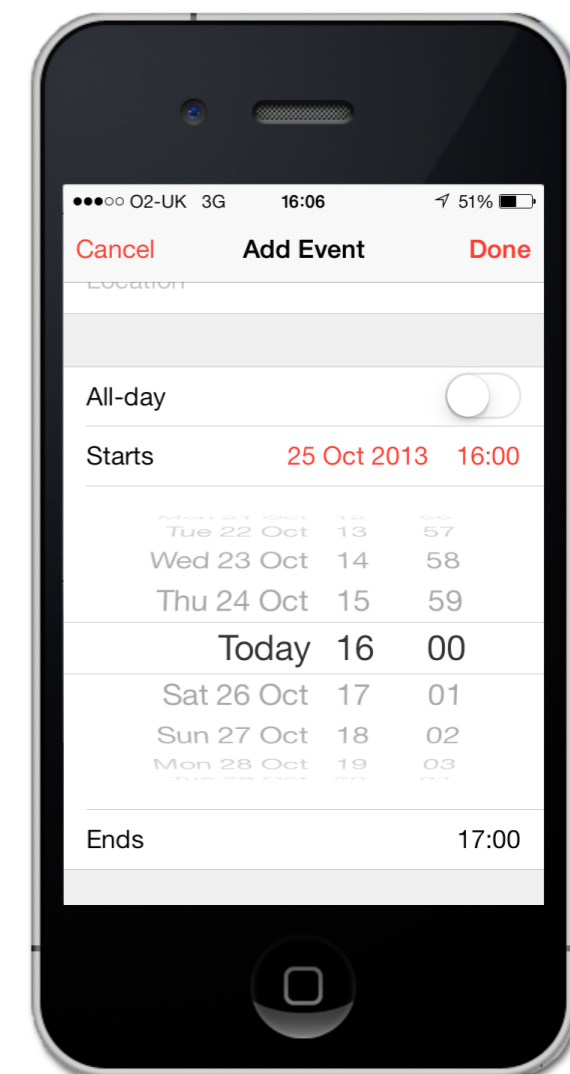
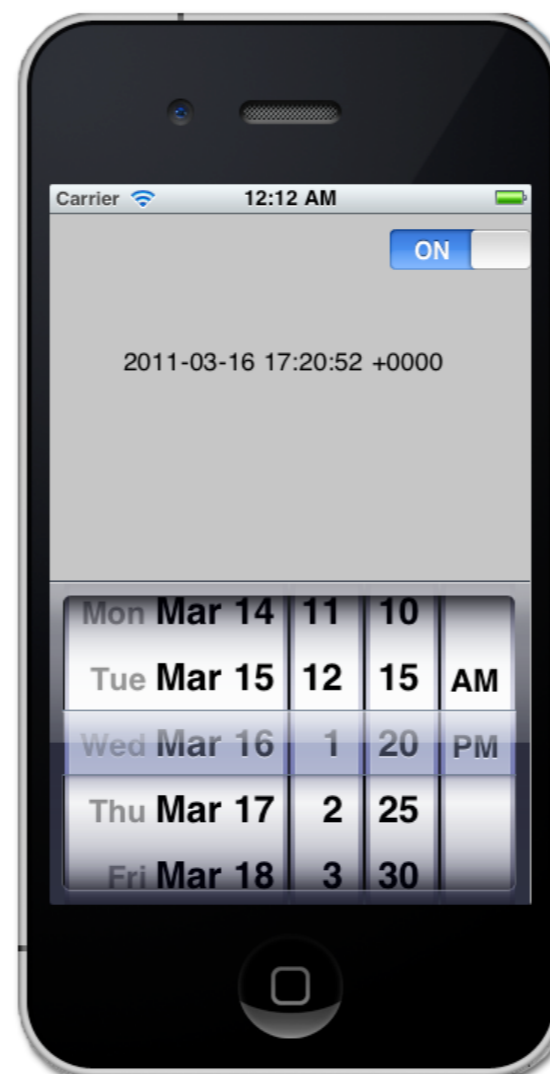
METAPHORS (1/4)

- “When virtual objects and actions in an app are metaphors for familiar experiences [...] users quickly grasp how to use the app”
- “It’s best when an app uses a metaphor to suggest a usage or experience without letting the metaphor enforce the limitations of the object or action on which it’s based”
- Smartphones/tablets provide powerful hardware, which makes it possible to implement rich metaphors



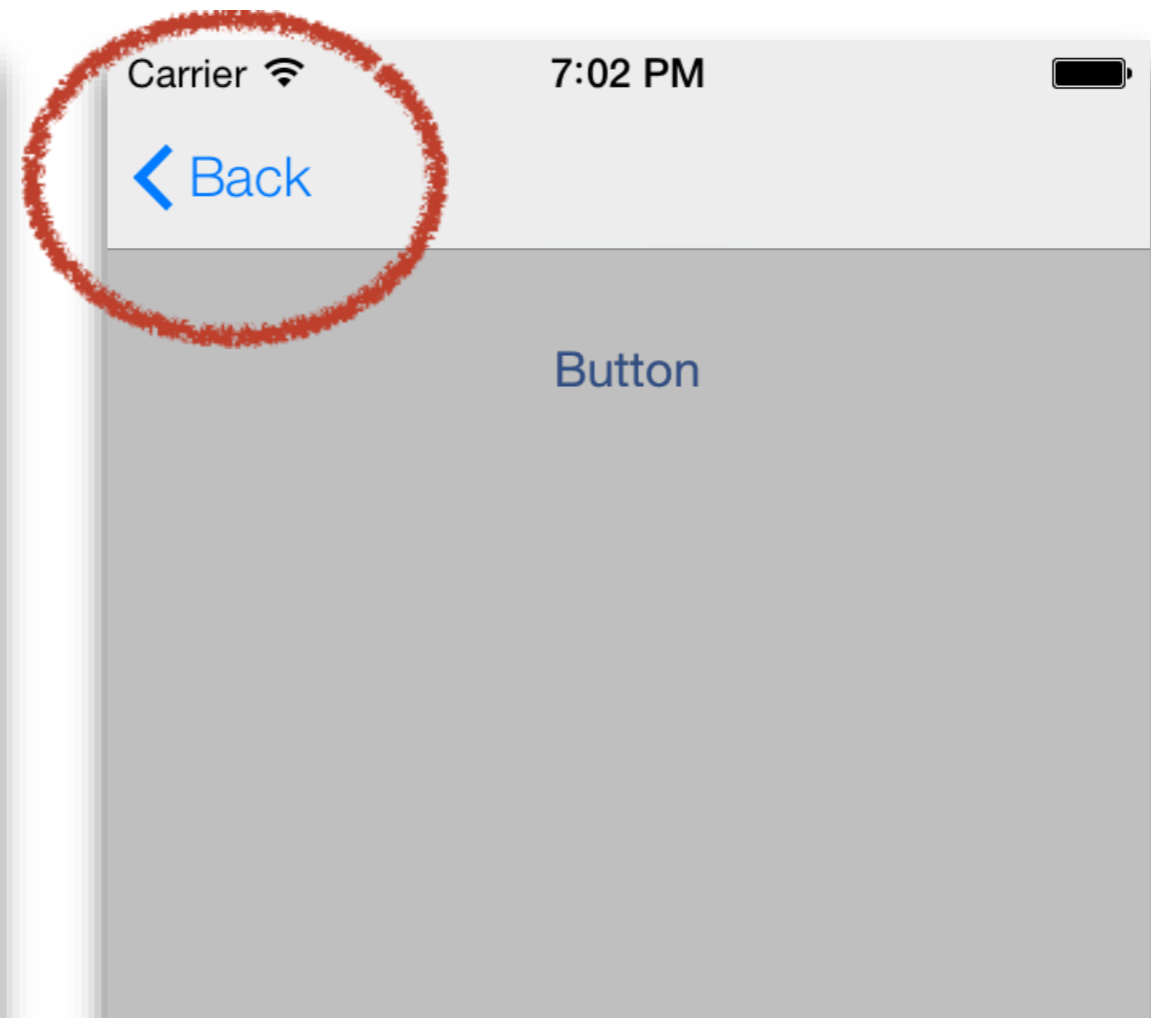
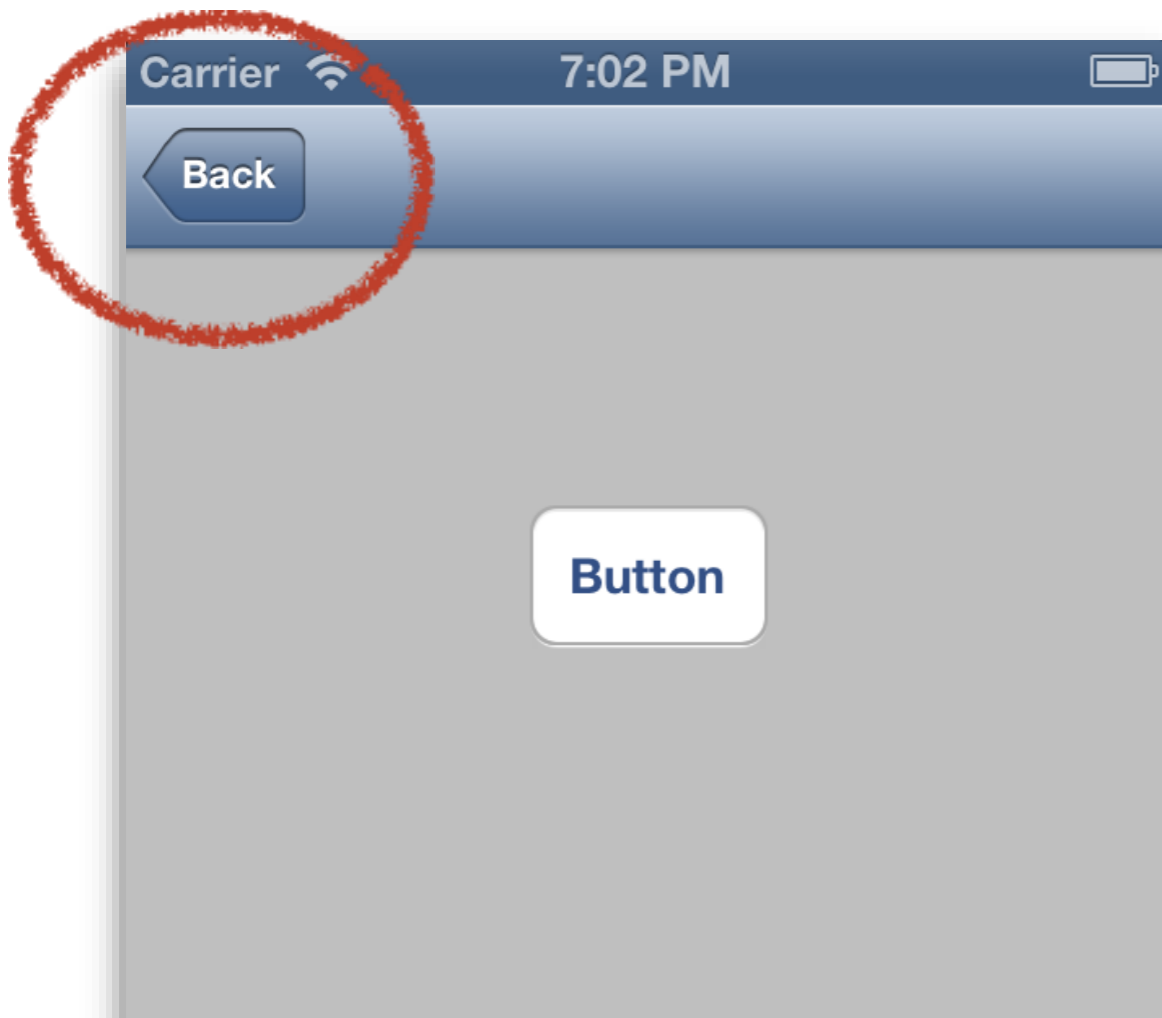
METAPHORS (2/4)

- Metaphors for familiar experiences
“rooted in the real world”

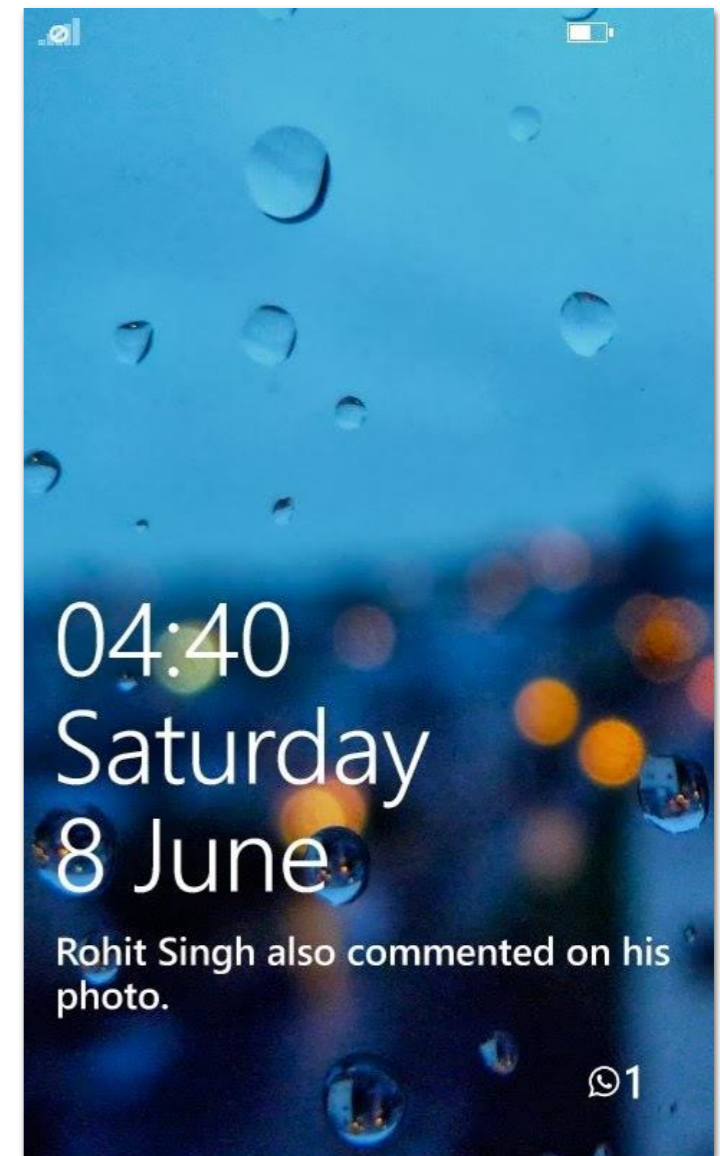
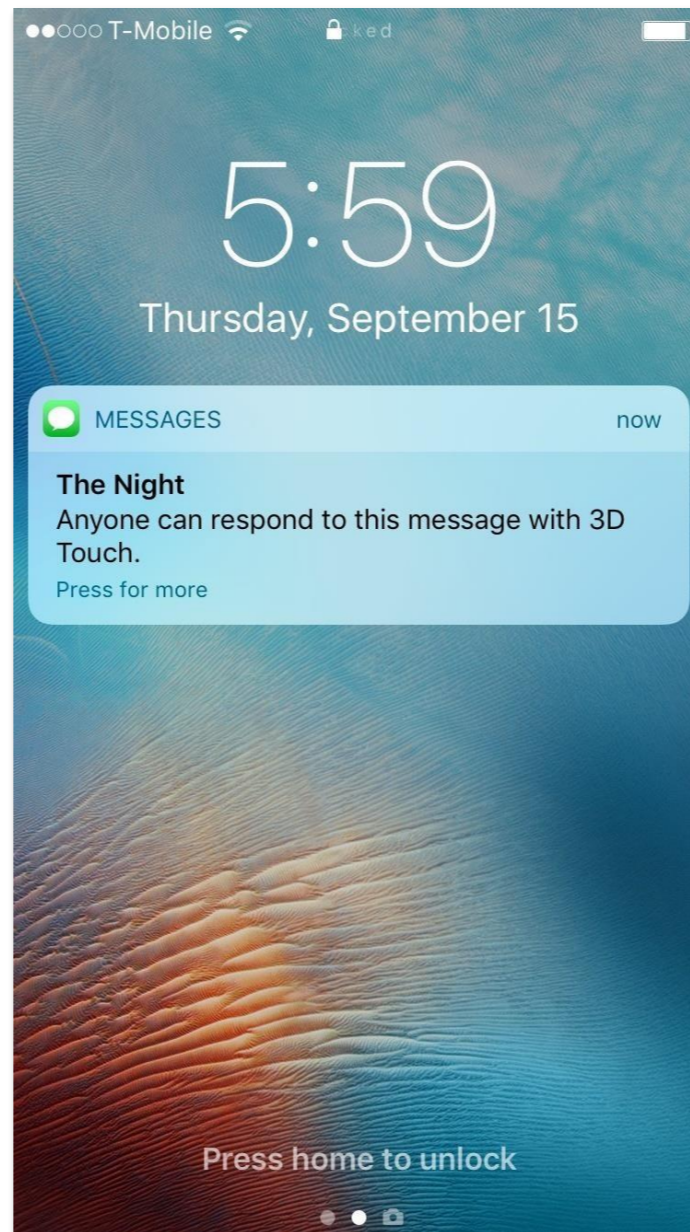
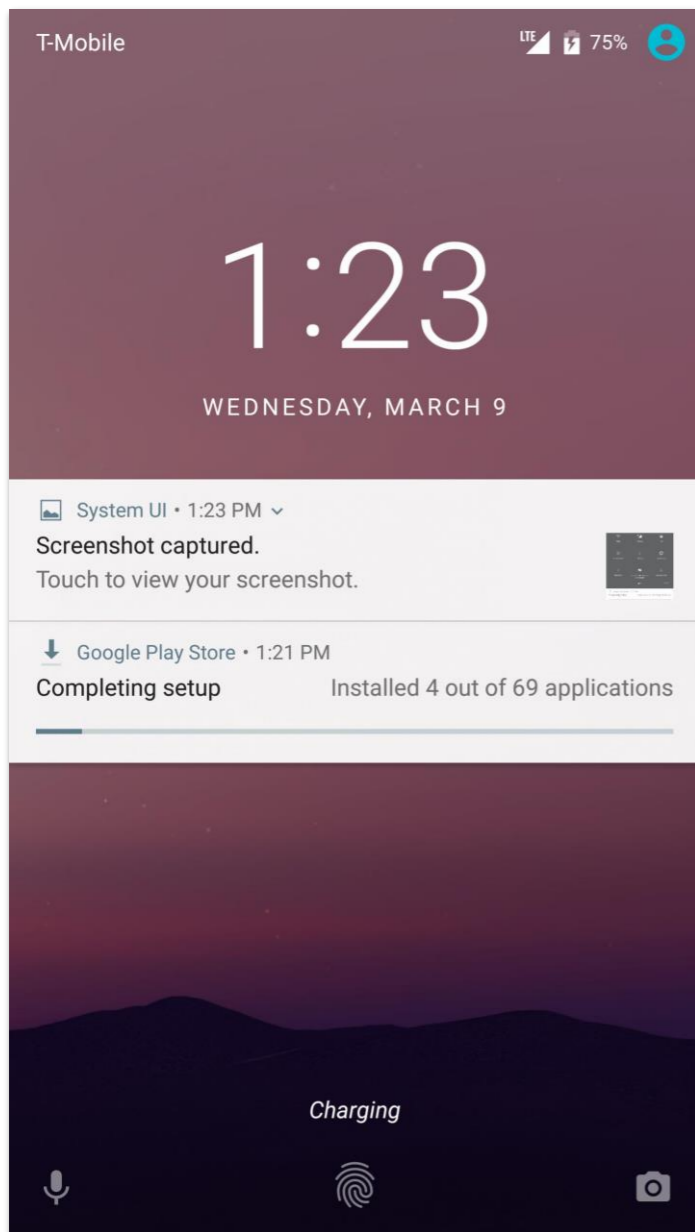


METAPHORS (3/4)

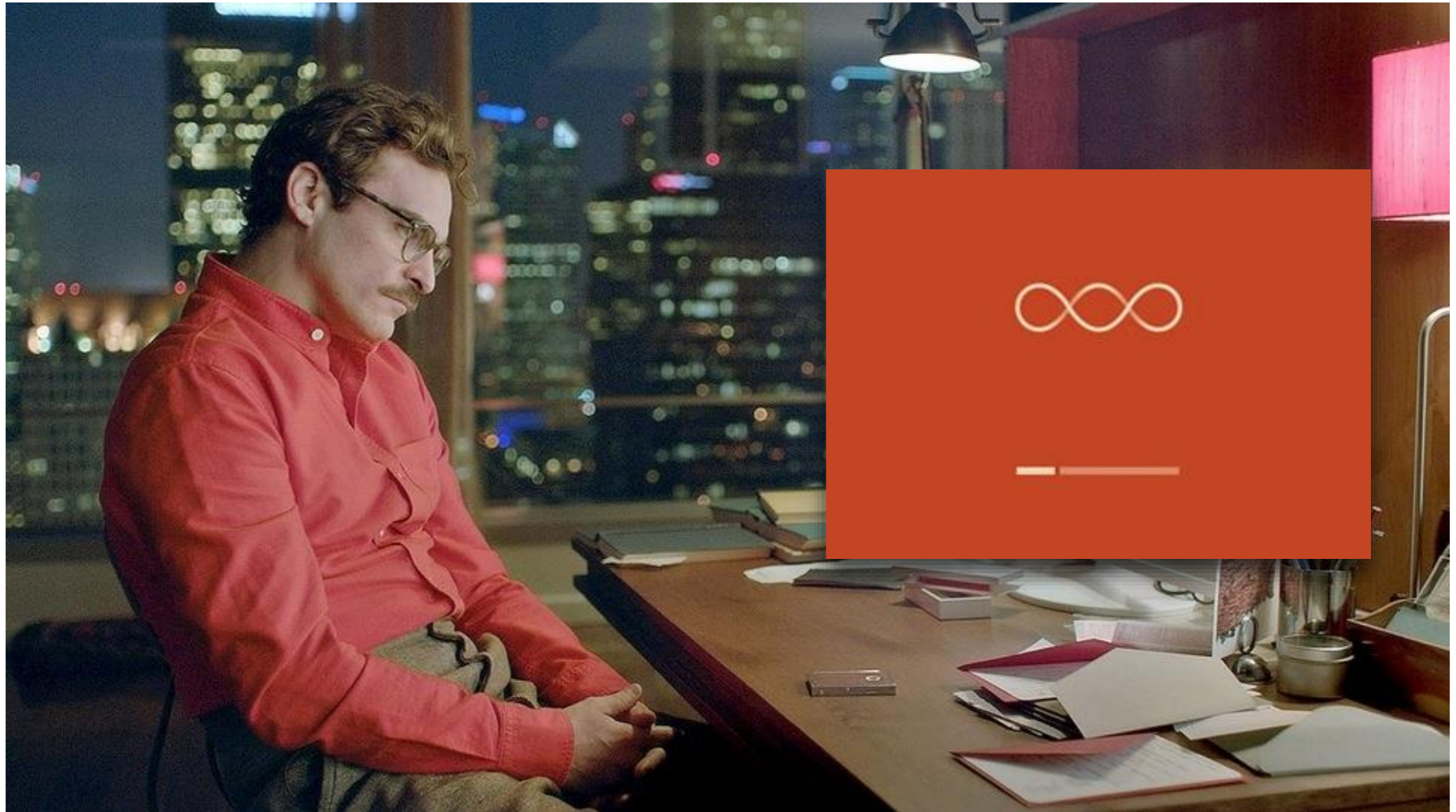
- Trend towards less skeuomorphic UIs:
the connection with the real world is getting subtler



ZEITGEIST & CONVERGENCE



ZEITGEIST & THE FUTURE



METAPHORS (4/4)

- Metaphors for familiar experiences
“rooted in the digital world”



DIRECT MANIPULATION

- “When people **directly manipulate onscreen objects** [...] they’re more engaged with their task and it’s easier for them to understand the results of their actions”
- The sense of direct manipulation is further enhanced by
 - **animations** (e.g., kinetic scrolling)
 - **multi-touch support and gestures**
- Caveat: “the screen size [...] might vary, but the average size of a fingertip does not”



GESTURES (1/2)

Tap



Briefly touch surface with fingertip

Double tap



Rapidly touch surface twice with fingertip

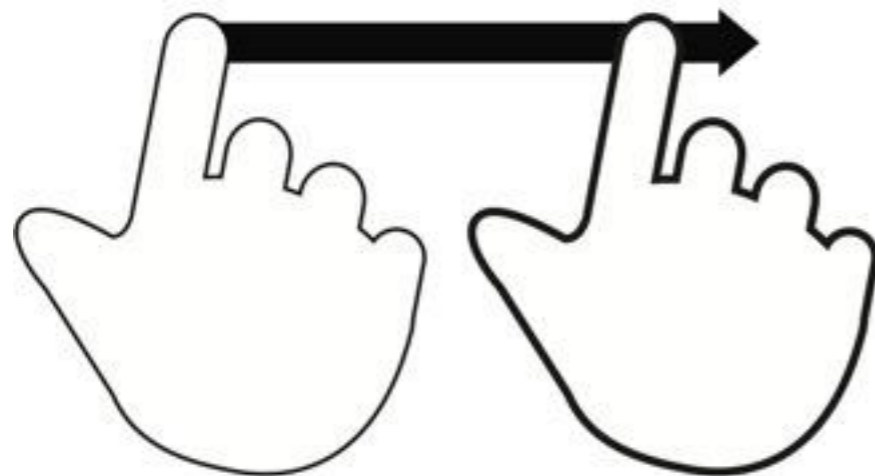
Press



Touch surface for extended period of time

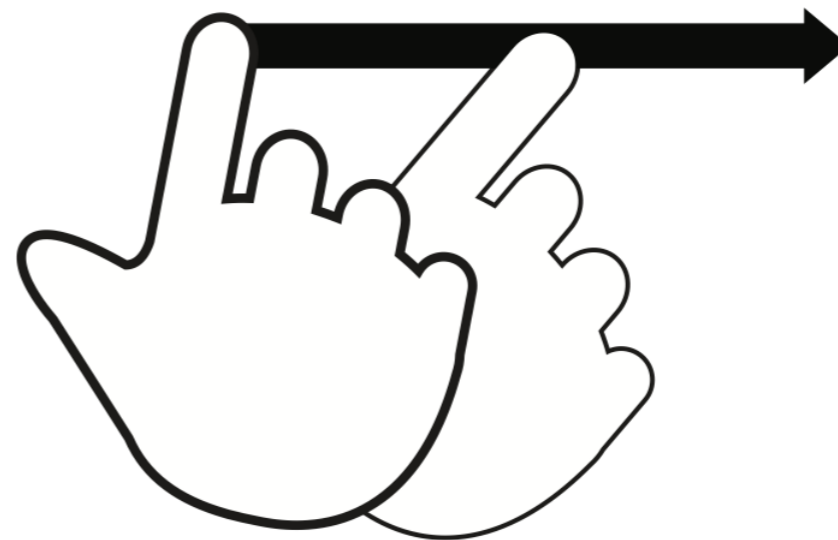
GESTURES (2/2)

Drag



Move fingertip over surface without losing contact

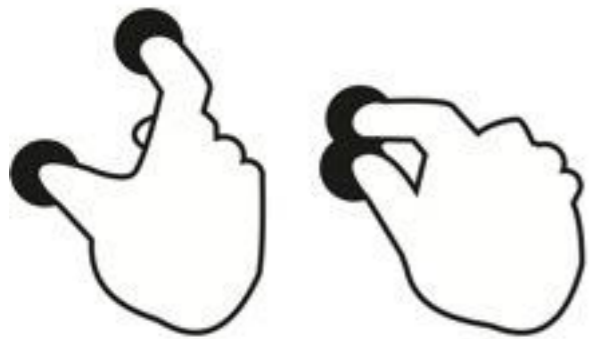
Flick



Quickly brush surface with fingertip
Called “swipe” when the brush is longer

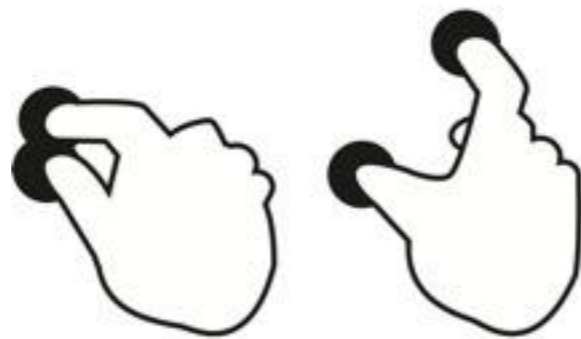
MULTI-TOUCH GESTURES

Pinch



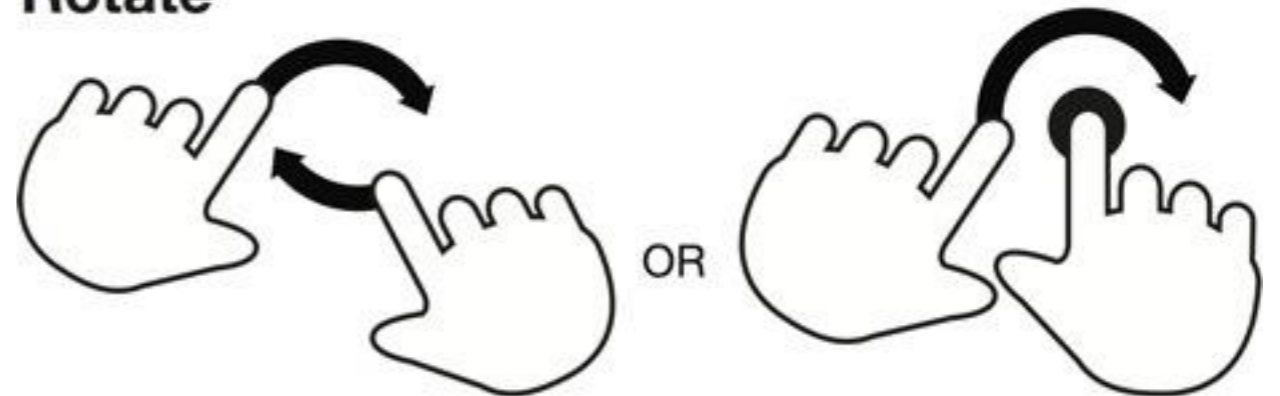
Touch surface with two fingers and bring them closer together

Spread



Touch surface with two fingers and move them apart

Rotate

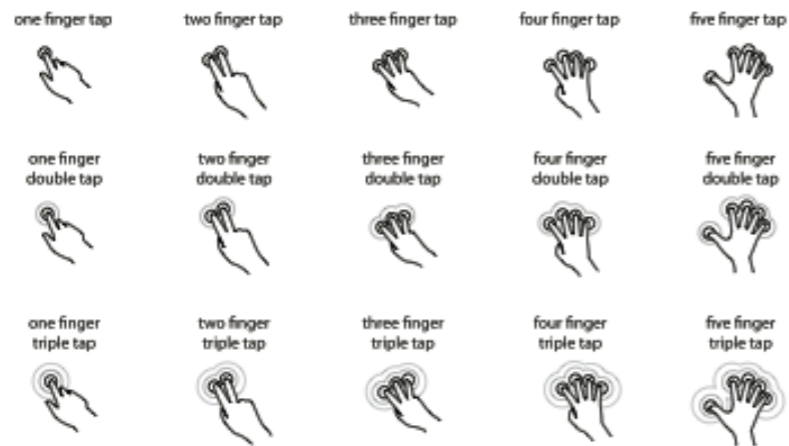


Touch surface with two fingers and move them in a clockwise or counterclockwise direction

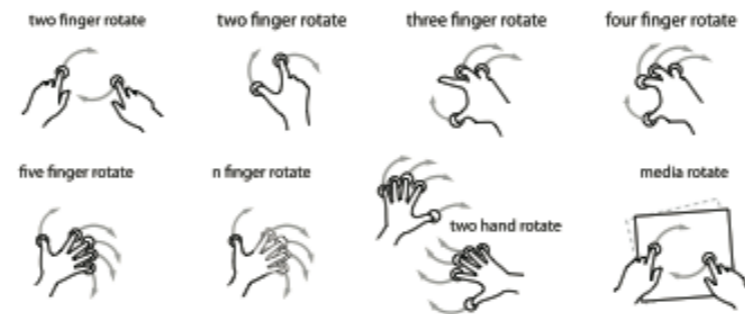
MORE GESTURES

MULTITOUCH GESTURES

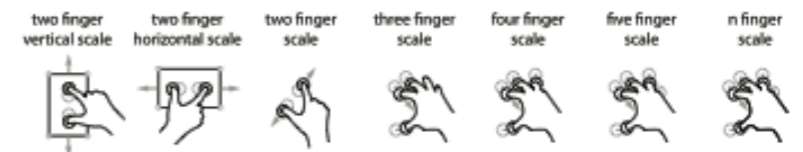
Tap Gestures



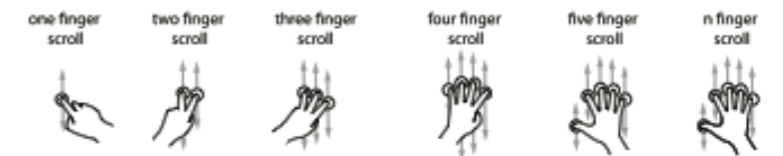
Rotate Gestures



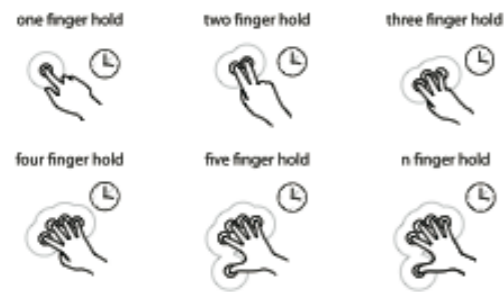
Scale Gestures



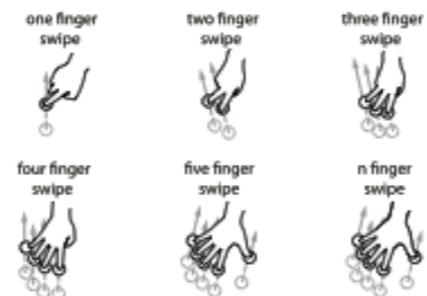
Scroll Gestures



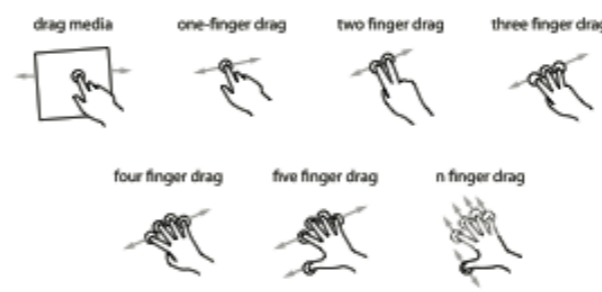
Hold Gestures



Swipe Gestures



Drag Gestures



Split Gestures



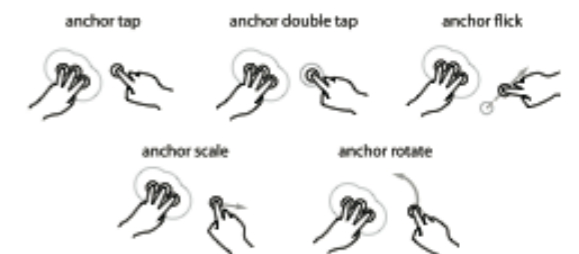
Flick Gestures



3D Gestures



Anchor Gestures



CAVEATS

- Use **complex gestures** as shortcuts to expedite a task, **not as the only way to perform a task**, since users may not know them
- If possible, **avoid introducing new gestures**, since users must make an effort to discover and remember them

FEEDBACK

- People expect **immediate feedback** when they operate a control, and they appreciate status updates during lengthy operations
- “The built-in iOS apps provide **perceptible feedback in response to every user action.**” Your app should do the same
- “Subtle animation can give people meaningful feedback that helps clarify the results of their actions”

REFERENCES

- [Android Design](#)
- [iOS Human Interface Guidelines](#)
- [Windows Design](#)

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