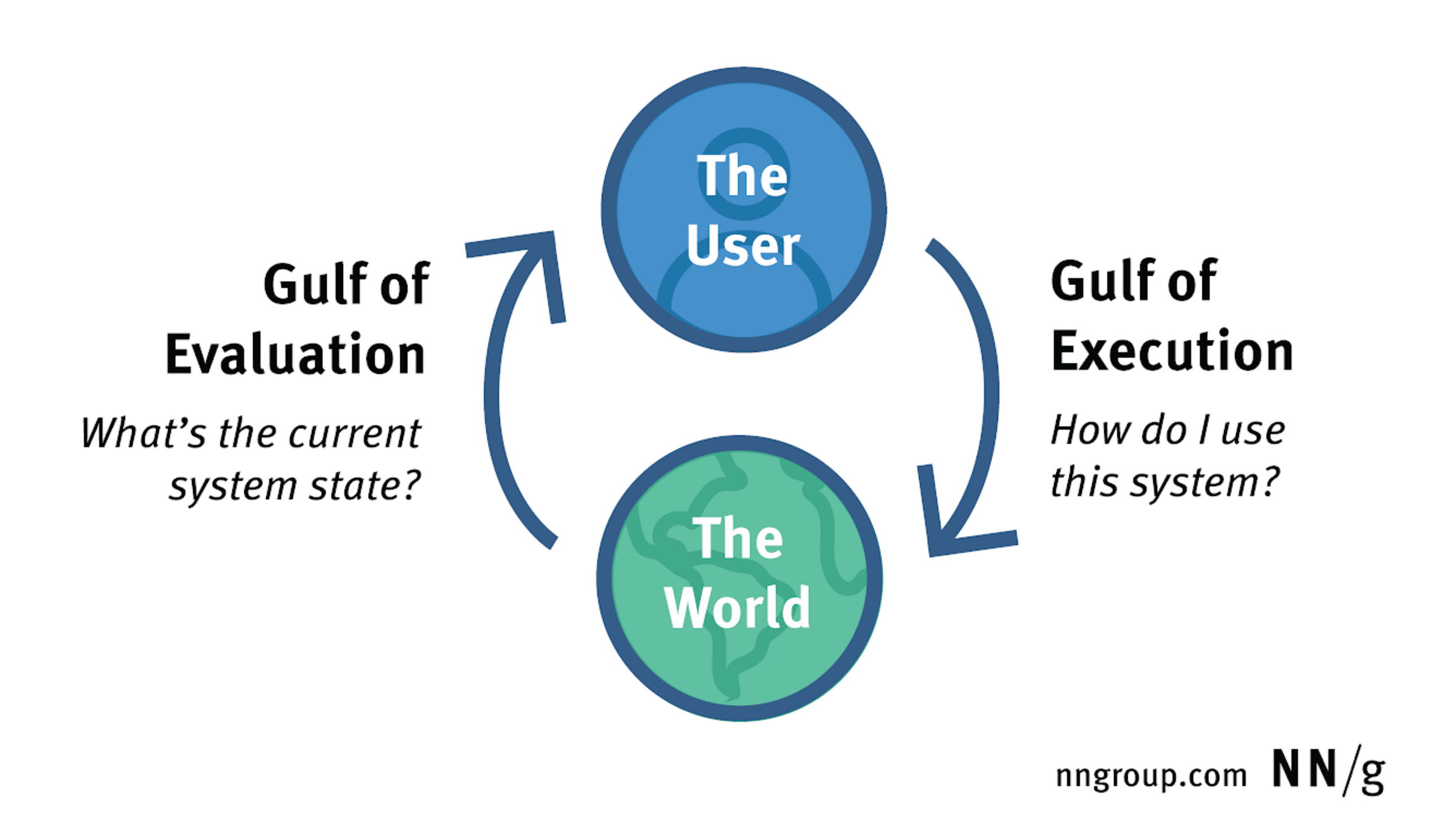
6.1040 · software studio · fall 2026

user interaction design

Mitchell Gordon & Daniel Jackson
Slides from Daniel Jackson


Gulf of Evaluation
What's the current system state?
The User
The World
Gulf of Execution
How do I use this system?

three bridges:

(1) usability criteria

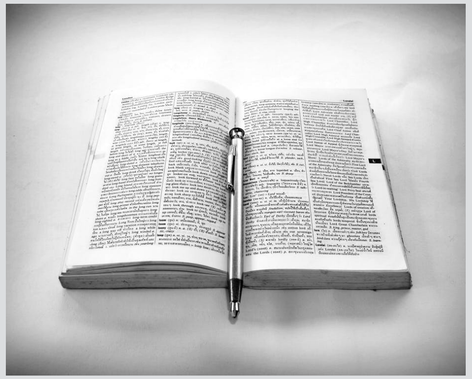
(2) physical heuristics

(3) linguistic heuristics

usability criteria

ease of use

easy to use



discoverable
(first use)



efficient
(repeated use)



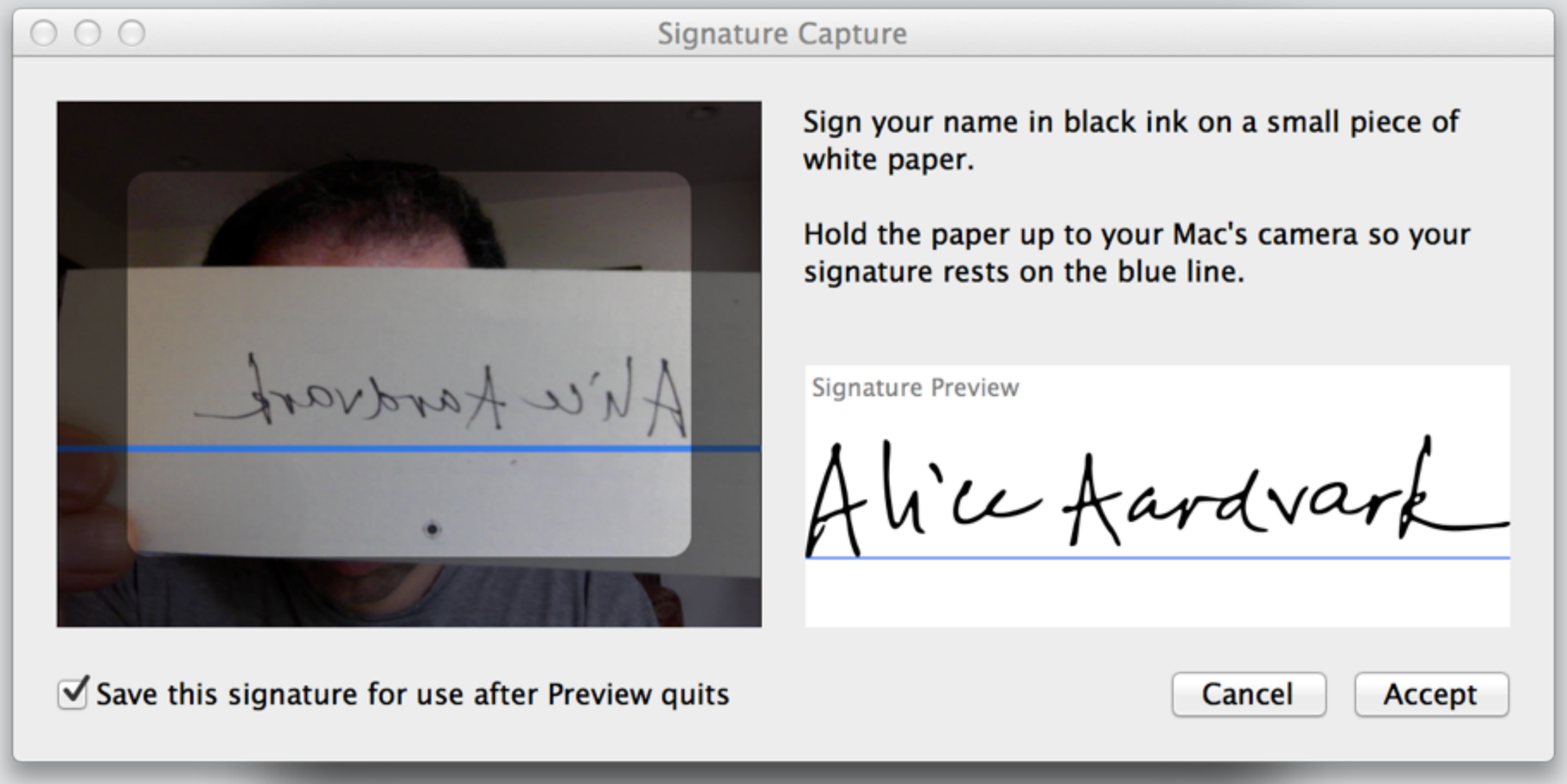
error-tolerant

example: car radio presets



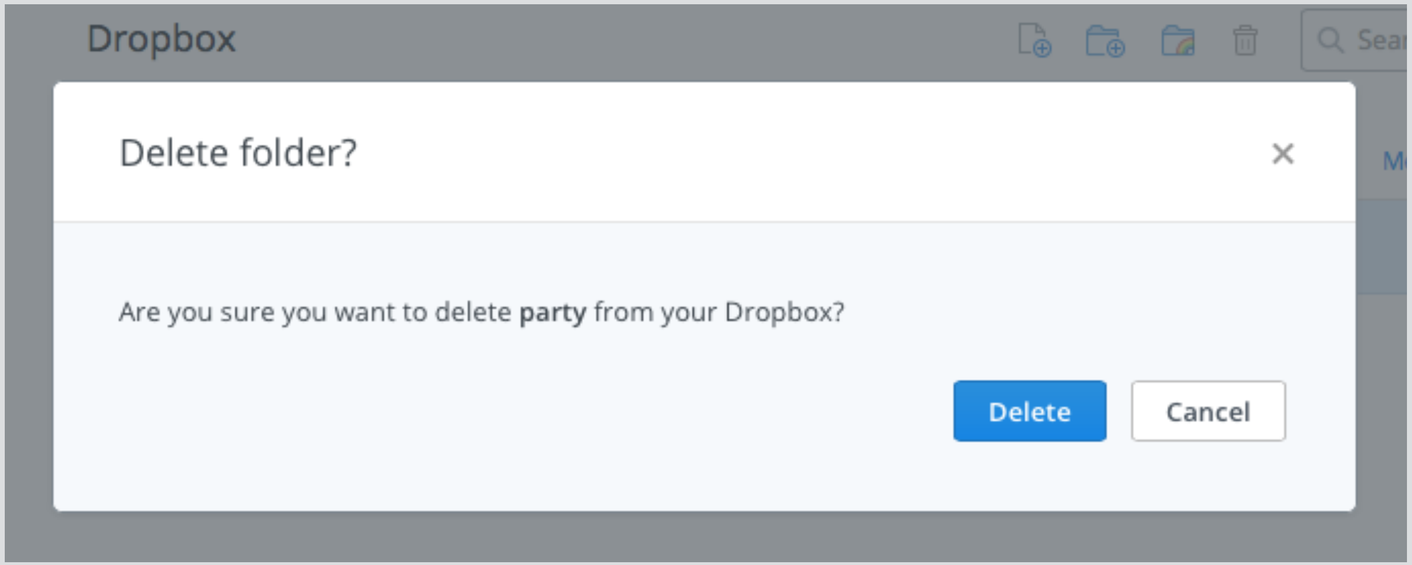
discoverable?	not really: who would guess?
efficient?	yes, perfect
error-tolerant?	partly: a long press can overwrite a saved station

example: signatures in Apple Preview



discoverable?	yes, as good as it gets
efficient?	yes, but not very flexible
error-tolerant?	yes, feedback as you position it

example: dropbox/gdrive deletion

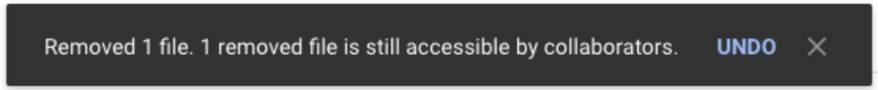


discoverable?	yes, but might not mean what you think
efficient?	yes, just click a button
error-tolerant?	sort of: deletes other users' copies, but can undo.

Dave Salyer
G-Suite (Workspace) & Google Docs/Sheets user/expert · Author has **1.2K** answers and **4.4M** answer views · 4y

Related **When you delete something in Google Drive, does it unshare it from whoever was a collaborator?**

Deleting a file from your My Drive that is shared with others will show you this message:



This is a confusing message because you would think that other people who the file has been shared with would still be able to work on the file like normal.

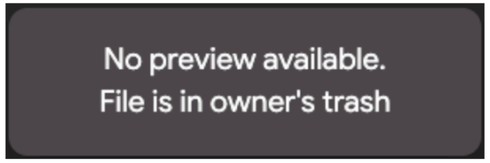
But that is not the case. In the test I did, I was the Owner on one account and an Editor on another. In the Owner account, I removed the file and received the above message. It then appeared in the Trash (Bin).

I went in to the other, Editor account and the file was no longer visible, anywhere in Drive, not even in the Trash (Bin).

I went back to the Owner account and restored the file and it returned as an accessible file in both places as expected.

I tested this also with Link Sharing. I turned on Link Sharing for a file and shared it with my 'other self' via a link in an email. I tested to see that I could open the file and it was fine. I closed the file, went back to the other account and removed it, putting it in the Trash (Bin).

I went back to the email with the link and I got this when I clicked it:



I think the "accessible by collaborators" message is confusing but it's better to be there as a reminder that the file still exists somewhere. Even though it is not readily accessible by collaborators, the Owner can easily restore it to make that so.

Perhaps the message is there to tell the Owner that if they truly want to make it impossible for anyone to access the file, they should remove it forever by visiting their Trash (Bin).

pleasantness

example: pleasantness in architecture



Ryōan-ji, Kyoto

amber case: calm tech evangelist



require least attention possible
communicate without noise
respect social norms
minimal technology needed
use the periphery

example: grayscale filter

WIRED SUBSCRIBE

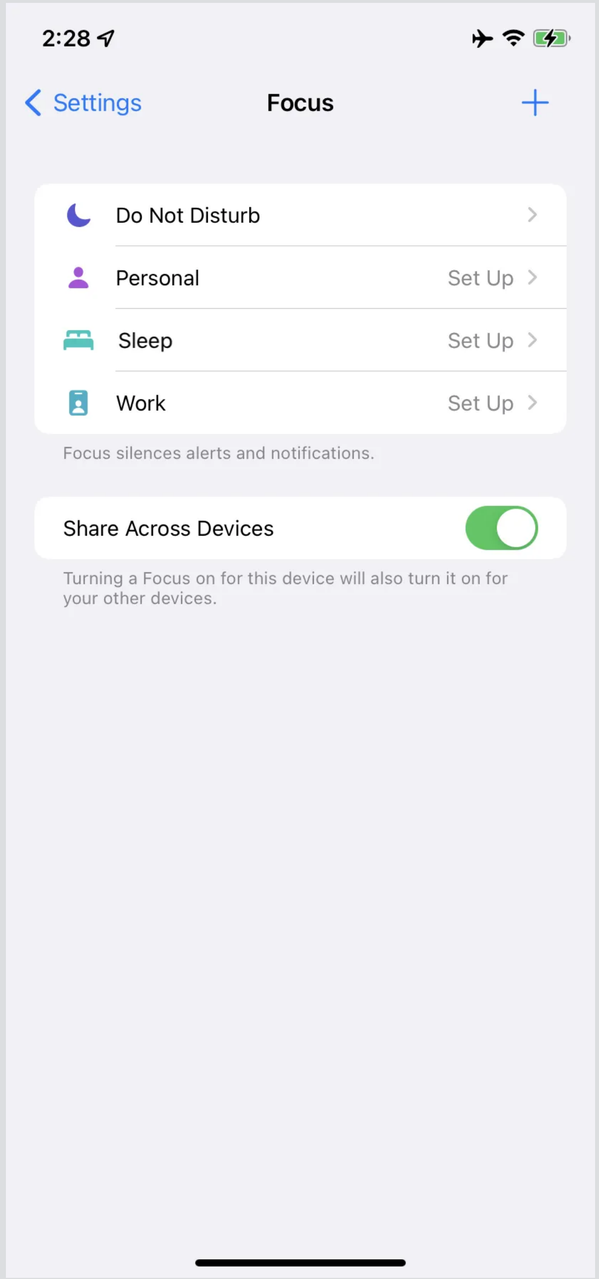
DAVID NIELD GEAR DEC 1, 2019 7:00 AM

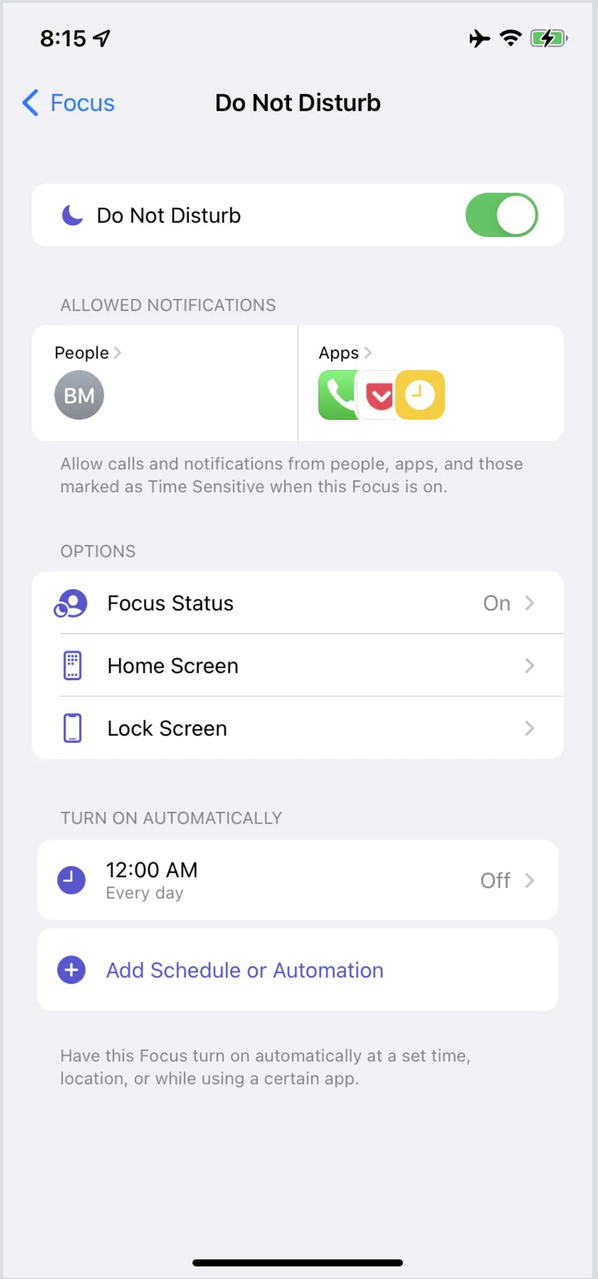
Try Grayscale Mode to Curb Your Phone Addiction

iOS and Android make it easier than ever to sap the color from your phone, and help you save some sanity in the process.



example: focus modes





Screenshots from The Verge

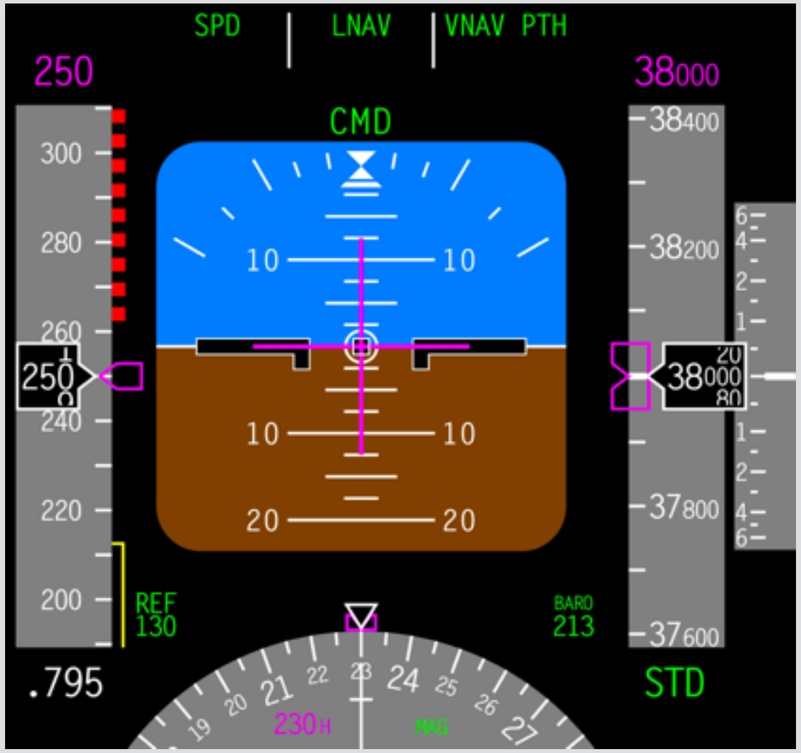
example: the light phone



"A credit card-sized cell phone designed to be used as little as possible. The Light Phone is your phone away from phone."

safety

what's safety for?



safety-critical products



regular products

interlocks, not just messages



Heathrow Airport

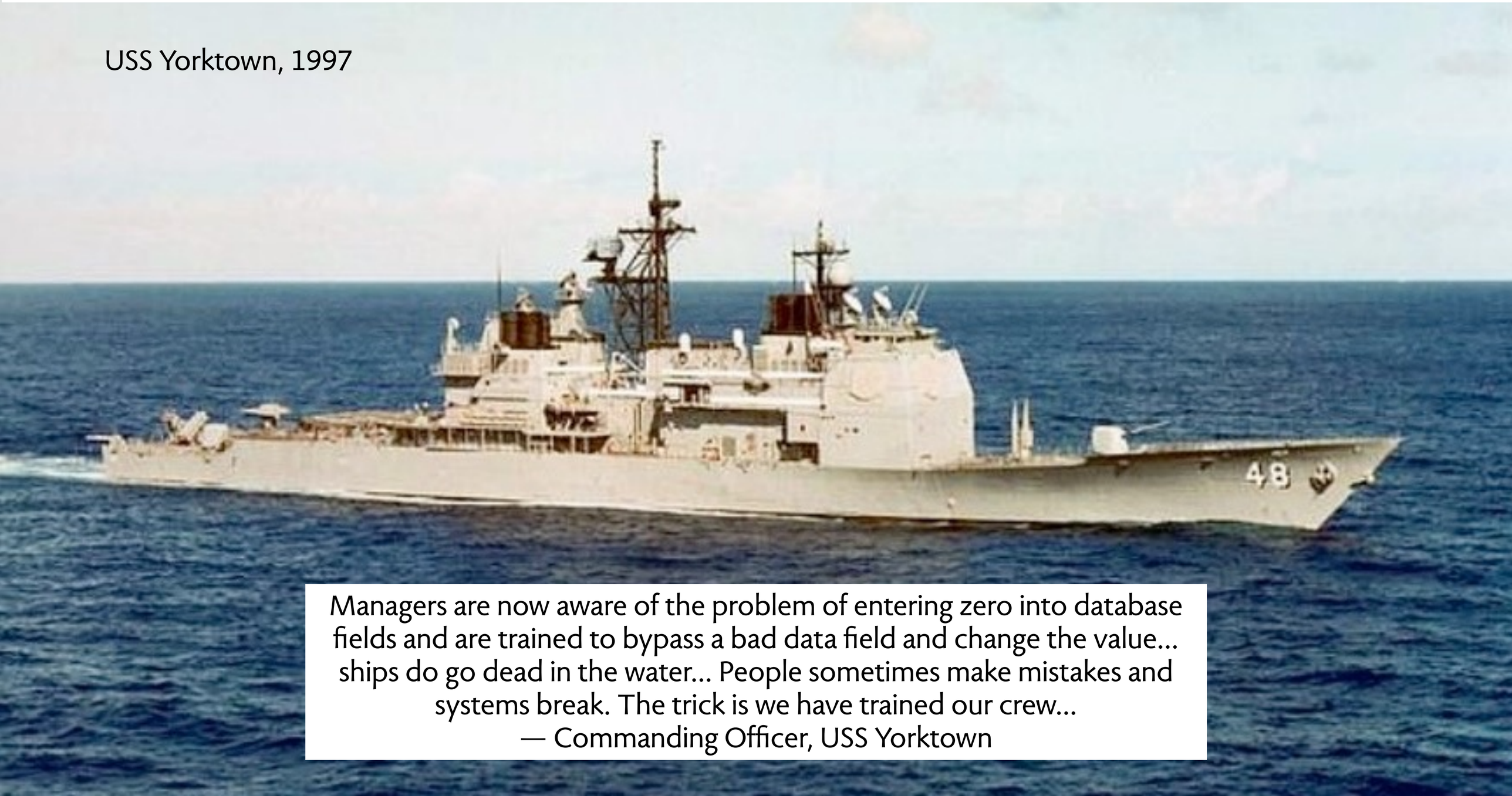
(in)tangible user experiences





not blaming the user

USS Yorktown, 1997



Managers are now aware of the problem of entering zero into database fields and are trained to bypass a bad data field and change the value... ships do go dead in the water... People sometimes make mistakes and systems break. The trick is we have trained our crew...

— Commanding Officer, USS Yorktown

security

anecdote: bad password

From: "TIG" <help@MIT.EDU>
Date: October 13, 2008 11:04:08 AM EDT
To: "'Daniel Jackson'" <dnj@csail.mit.edu>
Subject: your password

We recently ran a password checker to evaluate passwords of all CSAIL users, and your password was readily broken. Please choose a new password ASAP...

my password:

sergeantpepper1967

8 character UNIX limit: truncated after this

a common password policy

ACTION REQUIRED TO RETAIN ACCESS TO APPLICATIONS VIA THE INTERNET SUCH AS EMAIL, WEB SITES AND REMOTE DIAL UP

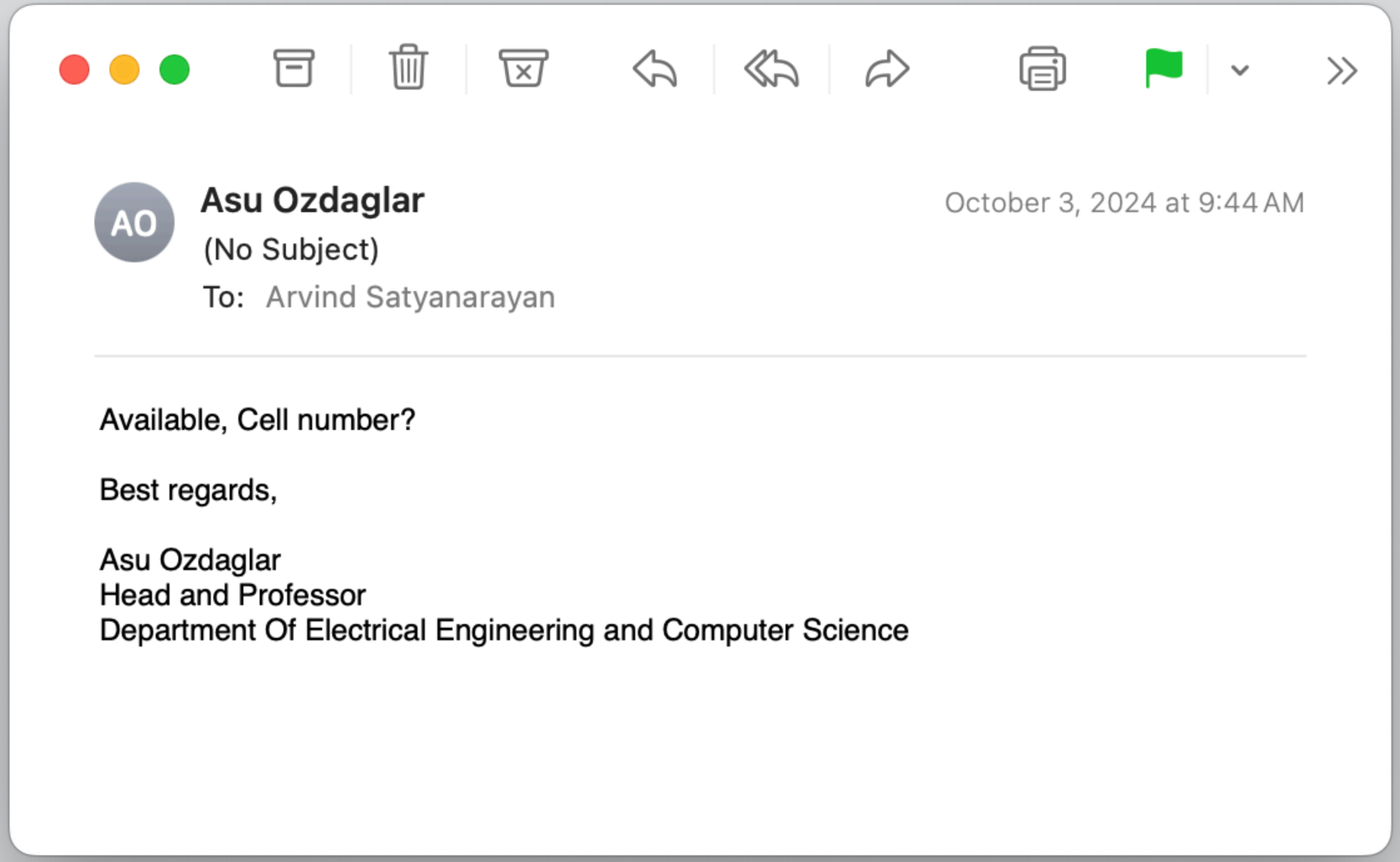
Company provides the ability to access various applications via a Company ID and password. Your password expires every 75 days.

This reminder is being sent as it has been 60 days since your last password change.

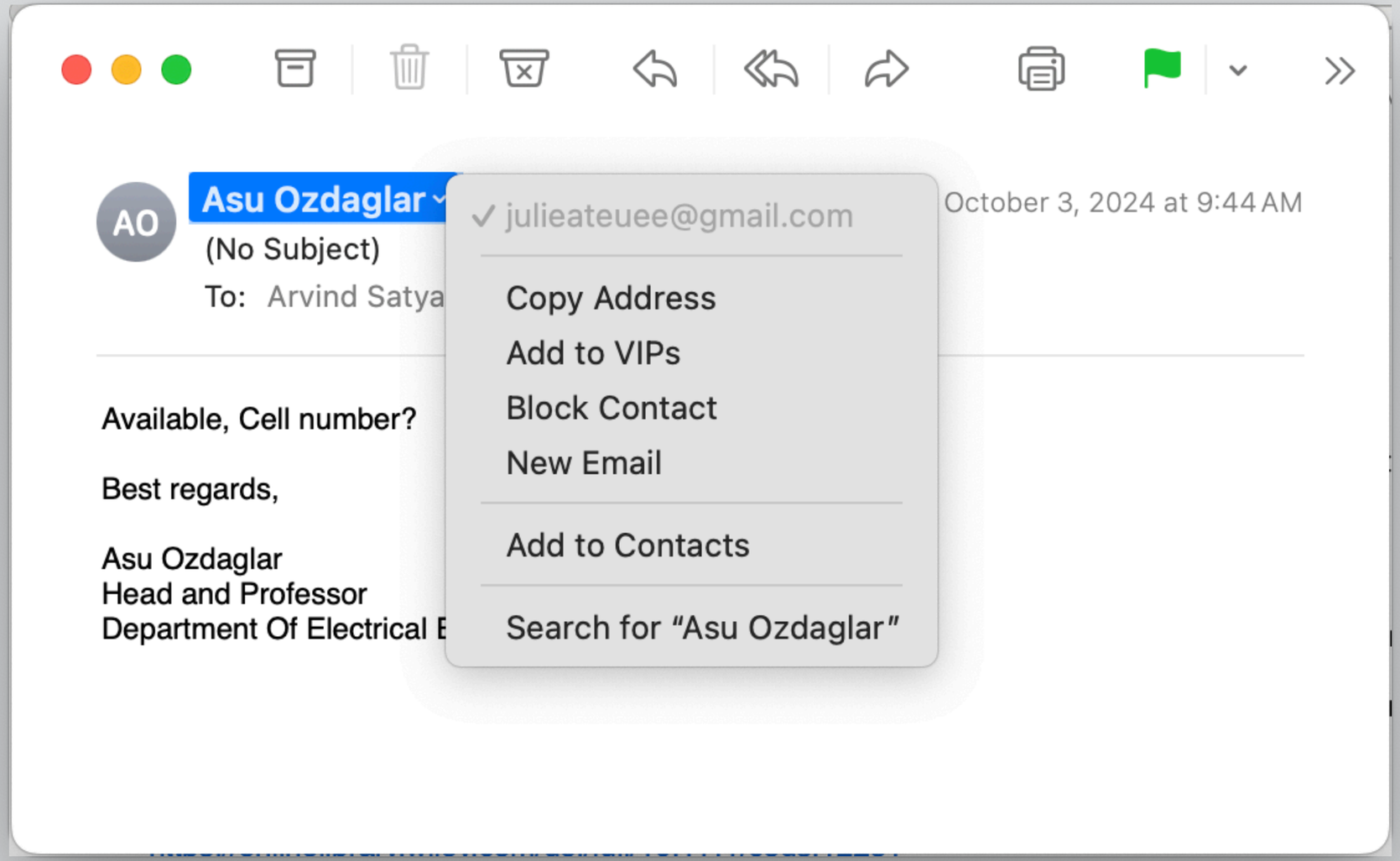
If you do not change your password within the next 15 days, your password will expire and you will lose access to company applications.

is this a good policy?

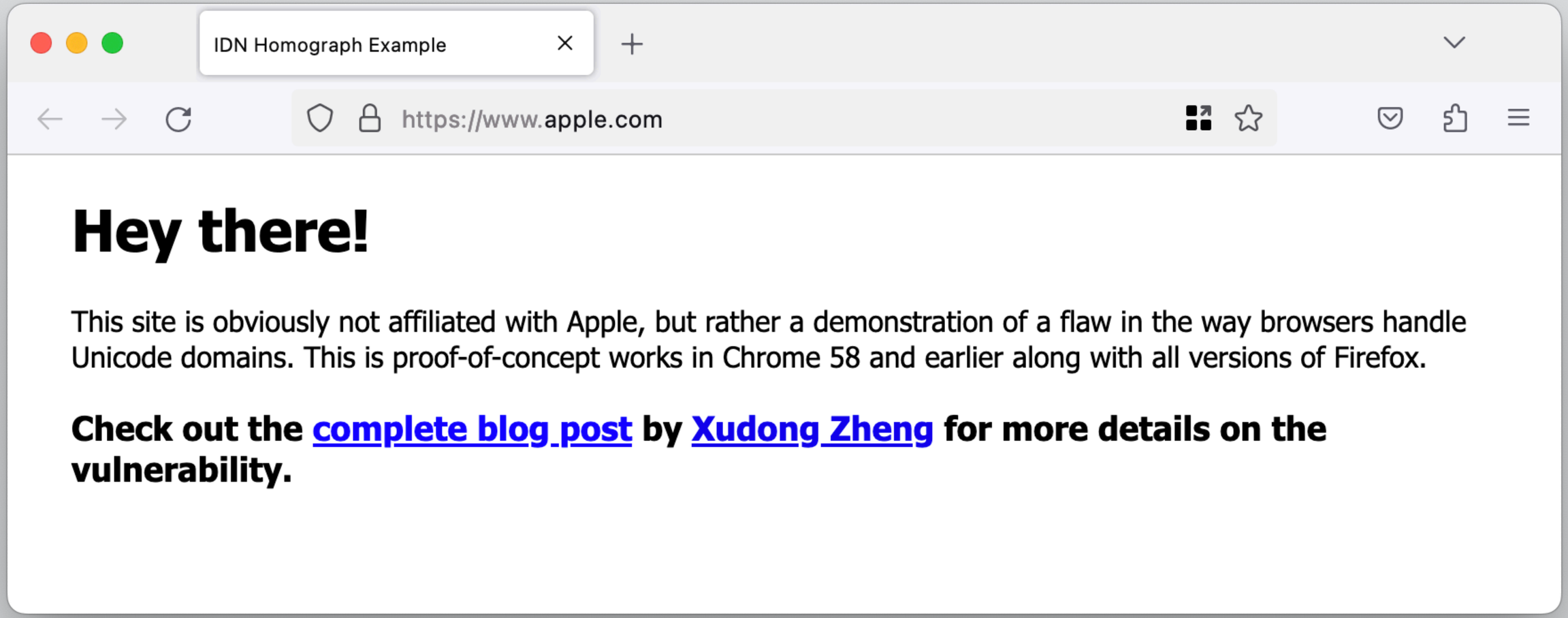
social engineering: who is this message from?



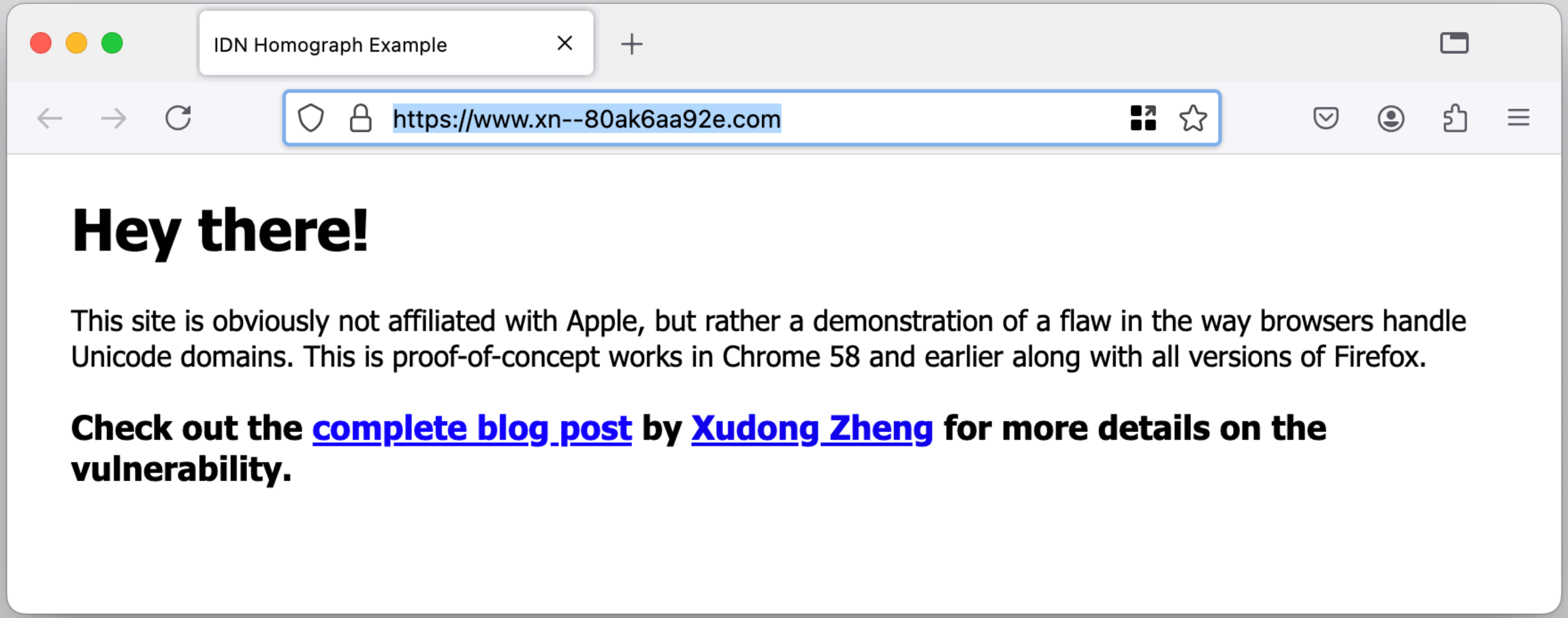
social engineering: who is this message from?



homograph attacks

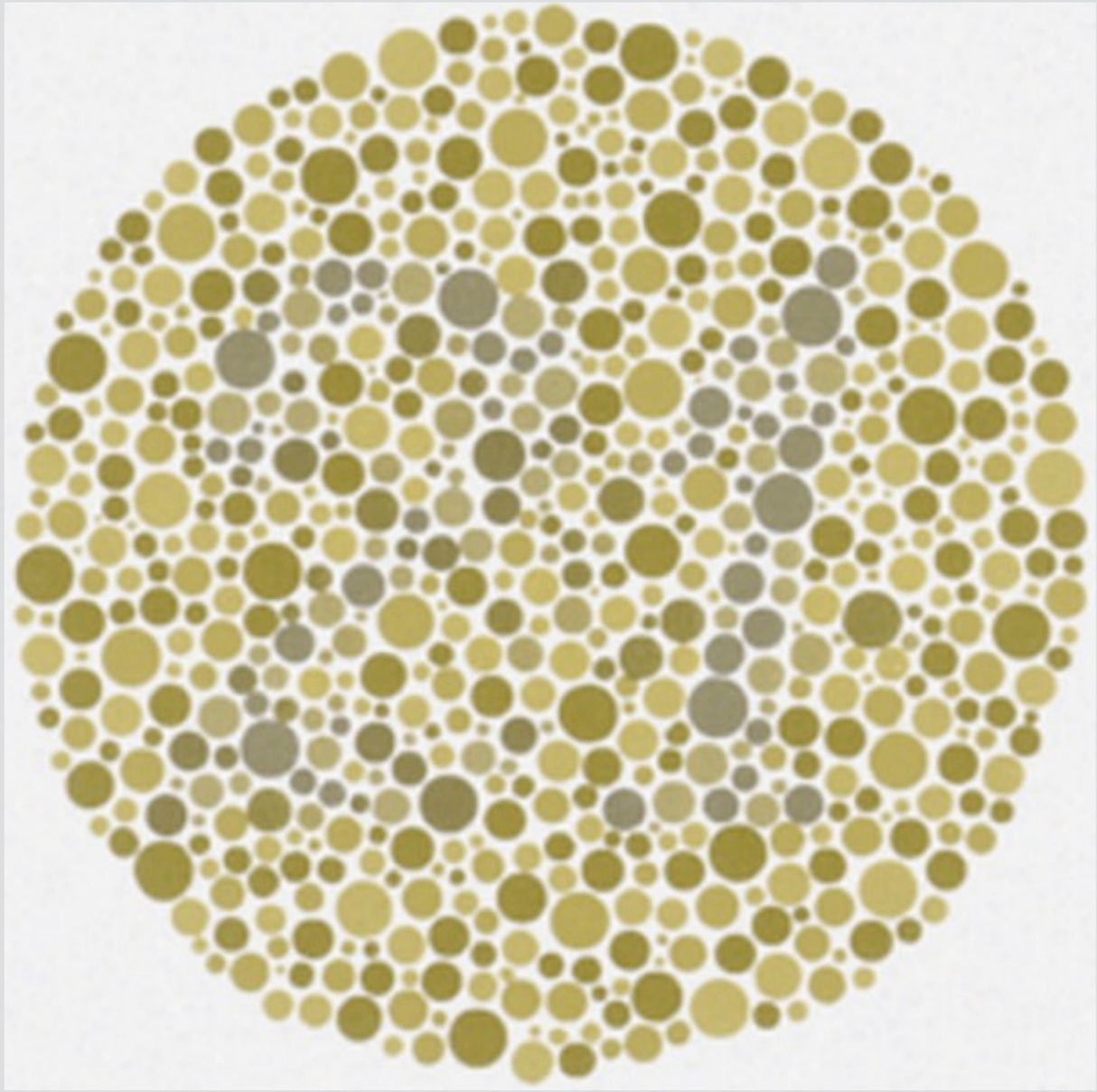


homograph attacks



accessibility

red-green colorblindness



affects 8% of men

example: colorblindness

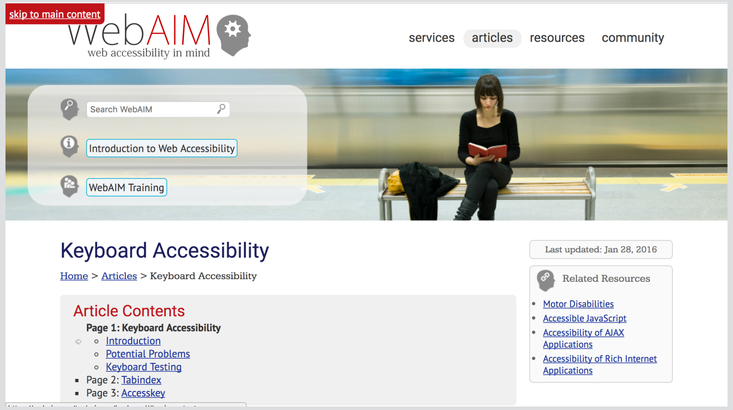


simulated with SEE Chrome plugin

web accessibility guidelines



provide text alternatives to images



keyboard accessible



offer captioning of video content

See: Web Accessibility Initiative, http://www.w3.org/WAI

lessons

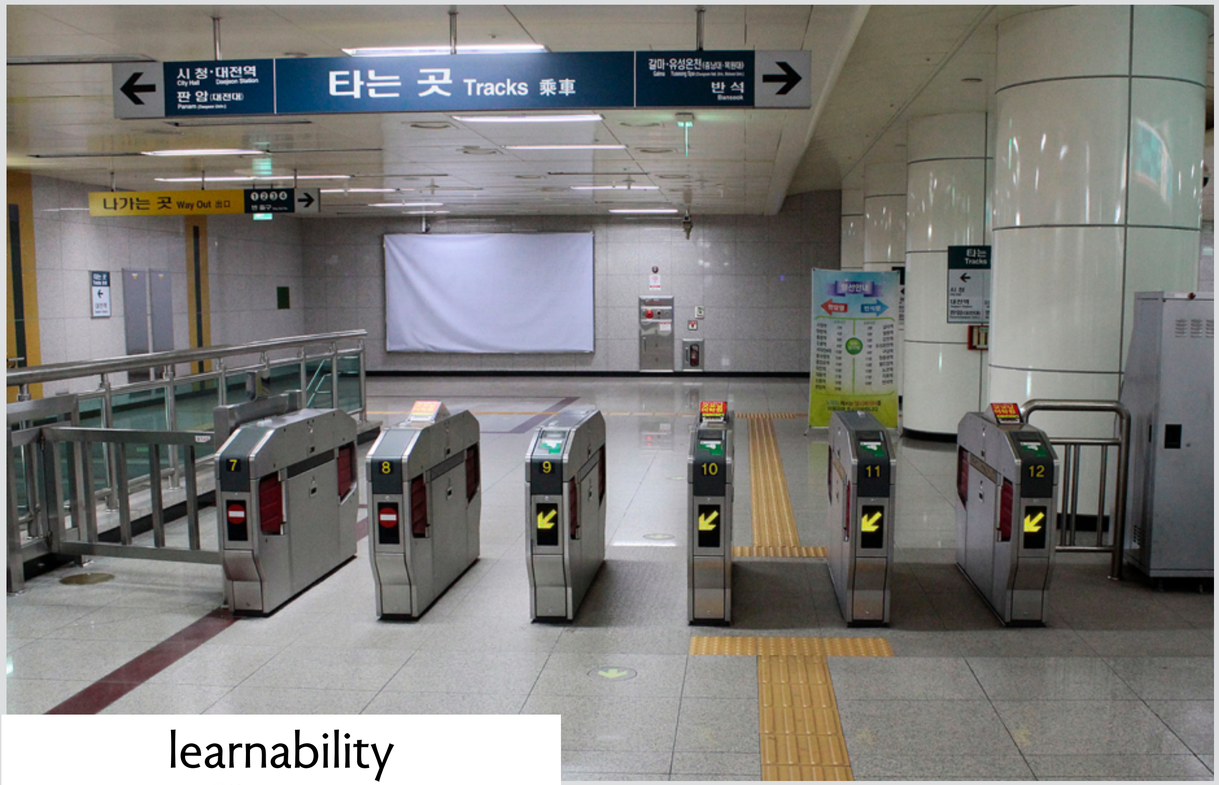
ease of use: conflicting goals
pleasantness: we're not machines
safety: usability means constraints
security from usability & usable security
accessibility: important & beneficial to all

exercise: subway turnstiles



learnability
efficiency
error tolerance
pleasantness
safety
security
accessibility

Commons: redesign a subway gate



learnability
efficiency
error tolerance
pleasantness
safety
security
accessibility

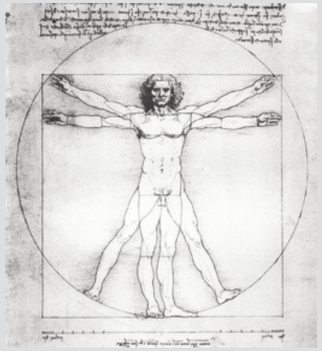
Think of someone using this subway gate. Describe a situation where they might have difficulty.

Propose a change to help. Explain which usability criterion it improves and why.

Could your change create a different problem? Explain.

Discuss with a neighbor, then each submit a short answer in Commons.

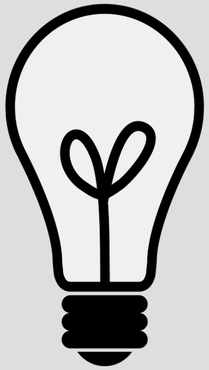
levels of UX design



physical



linguistic



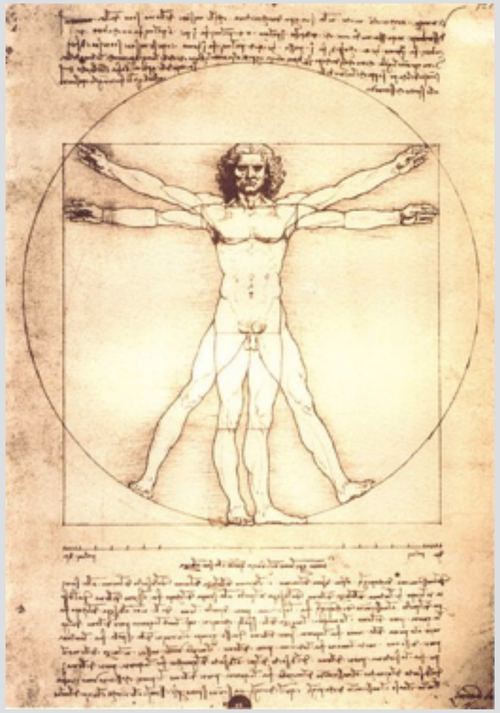
conceptual

concrete

abstract

physical level

concerns of the physical level



human characteristics

time to move mouse?
perception of delay?
sensitivity of the eye?
memory capacity?

touch, sight, sound



design of interface

where to put buttons
when to show progress bar
what colors to use
when to rely on recall

fitts's law

fitts's law

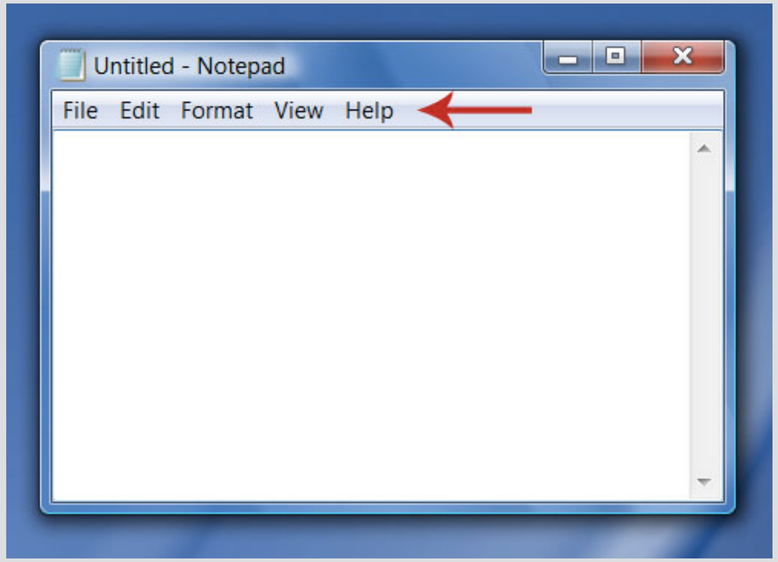
heuristic
make features
close & large

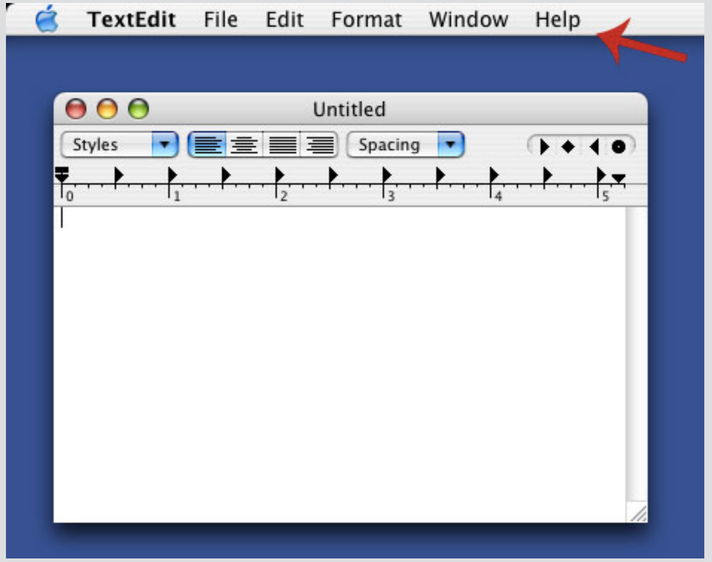


time to move to target T = a + b.log(D/W + 1)
reaction time a is fixed
moving time depends on 'index of difficulty' D/W

for demos, see http://fww.few.vu.nl/hci/interactive/fitts/
and http://simonwallner.at/ext/fitts/

discussion: windows vs mac

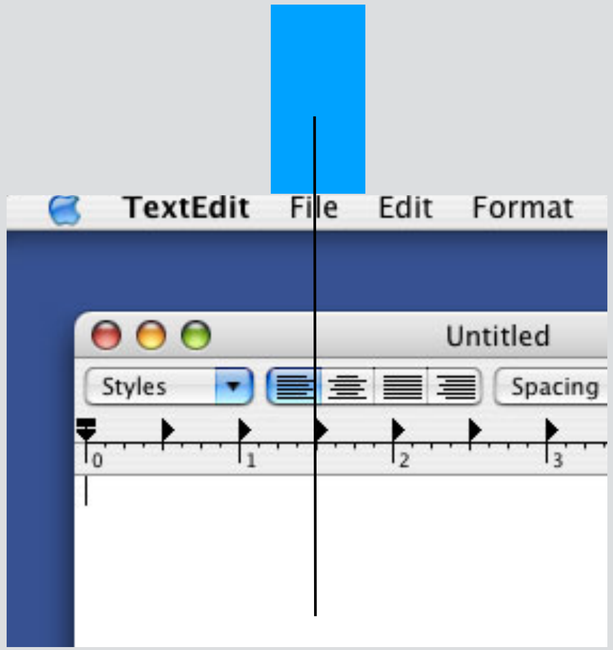




"On Windows the menu bar is right there, no need to move your eye to another part of the screen."

An online argument. Is he right? What does Fitts's Law say?

applying fitt: windows vs mac

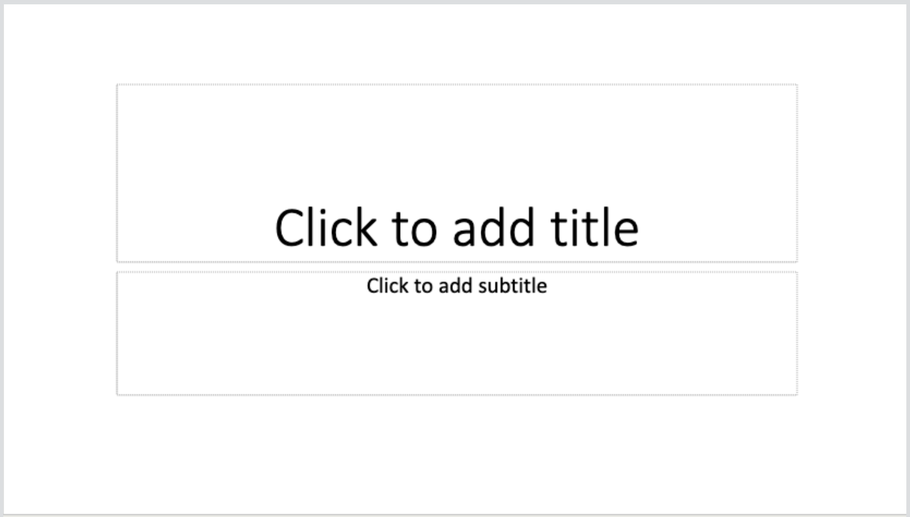


the Mac menu is a bit further away, but it effectively has **infinite size**, so it's much quicker to locate

example: closing app on iPhone



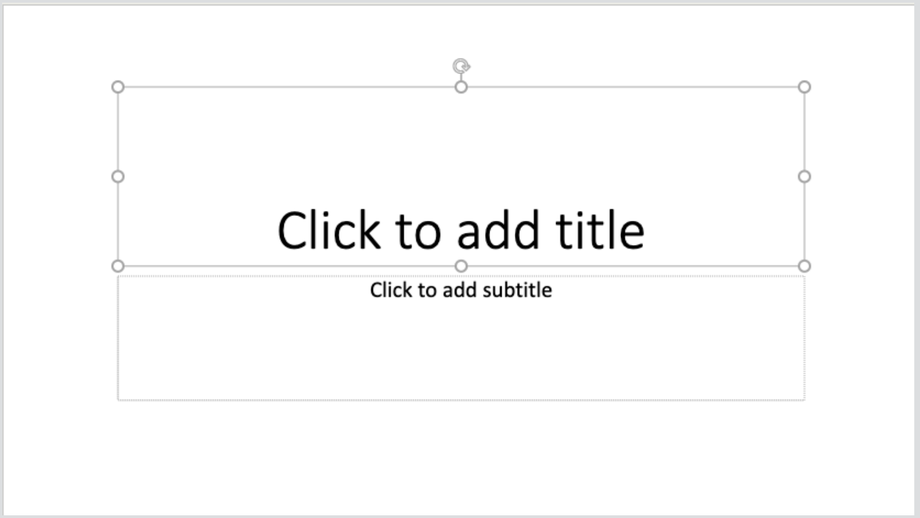
selecting objects in powerpoint



slide when first viewing

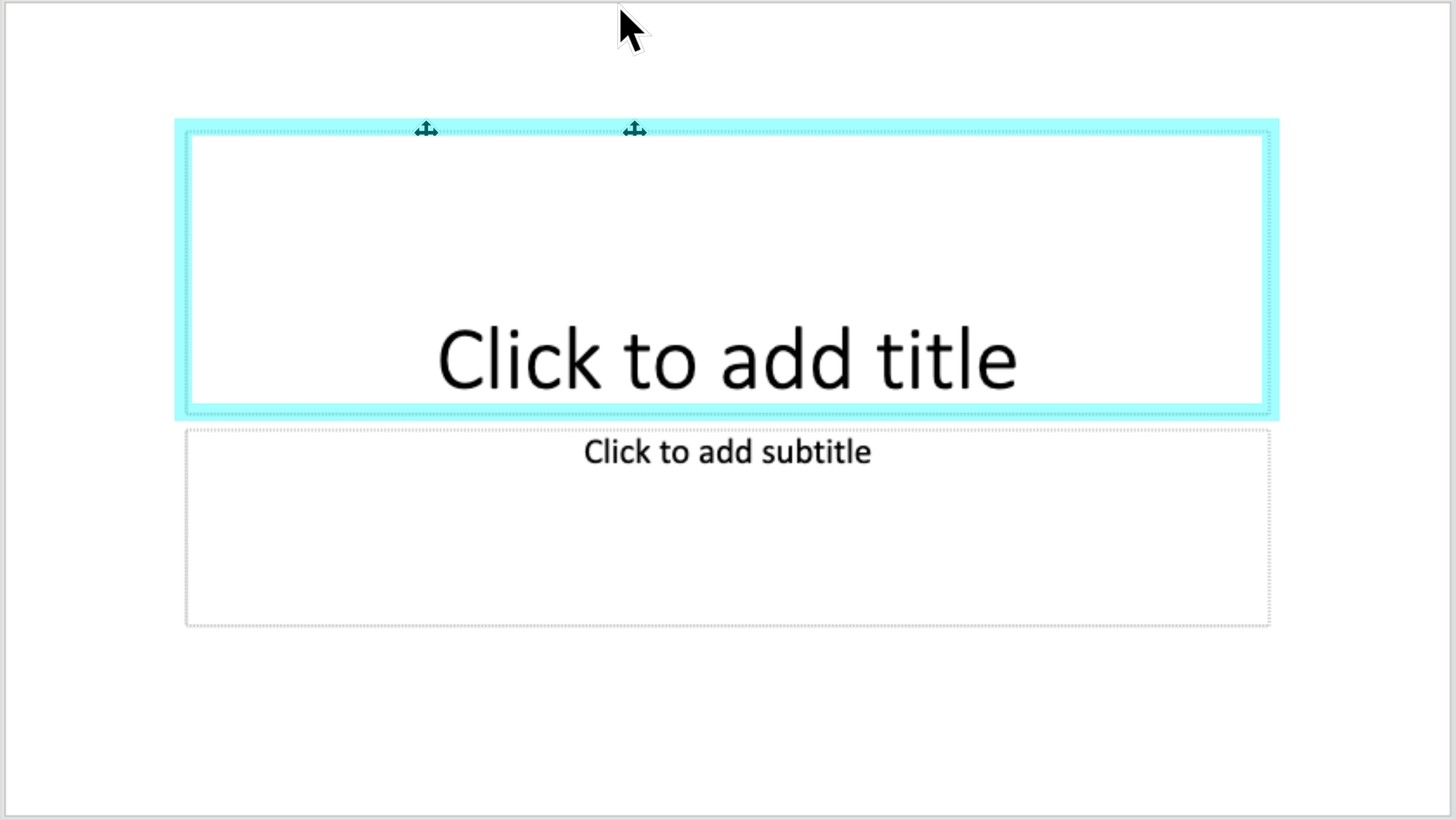


slide after clicking on object



slide after selecting object

how to select an object in *powerpoint*

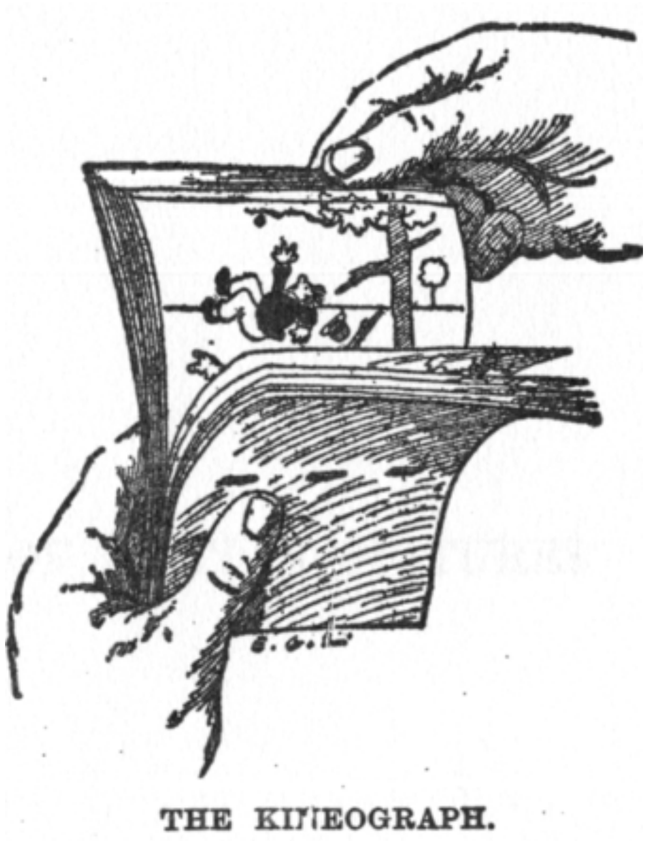


how to select an object in *keynote*



response time & feedback

heuristics
acknowledge actions promptly
show when work is still in progress

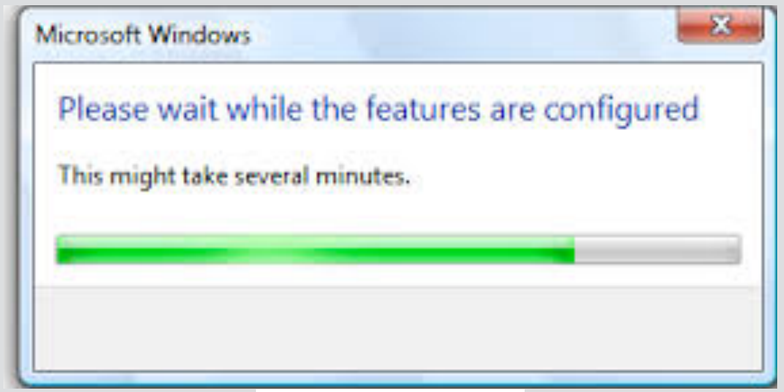


an early flipbook

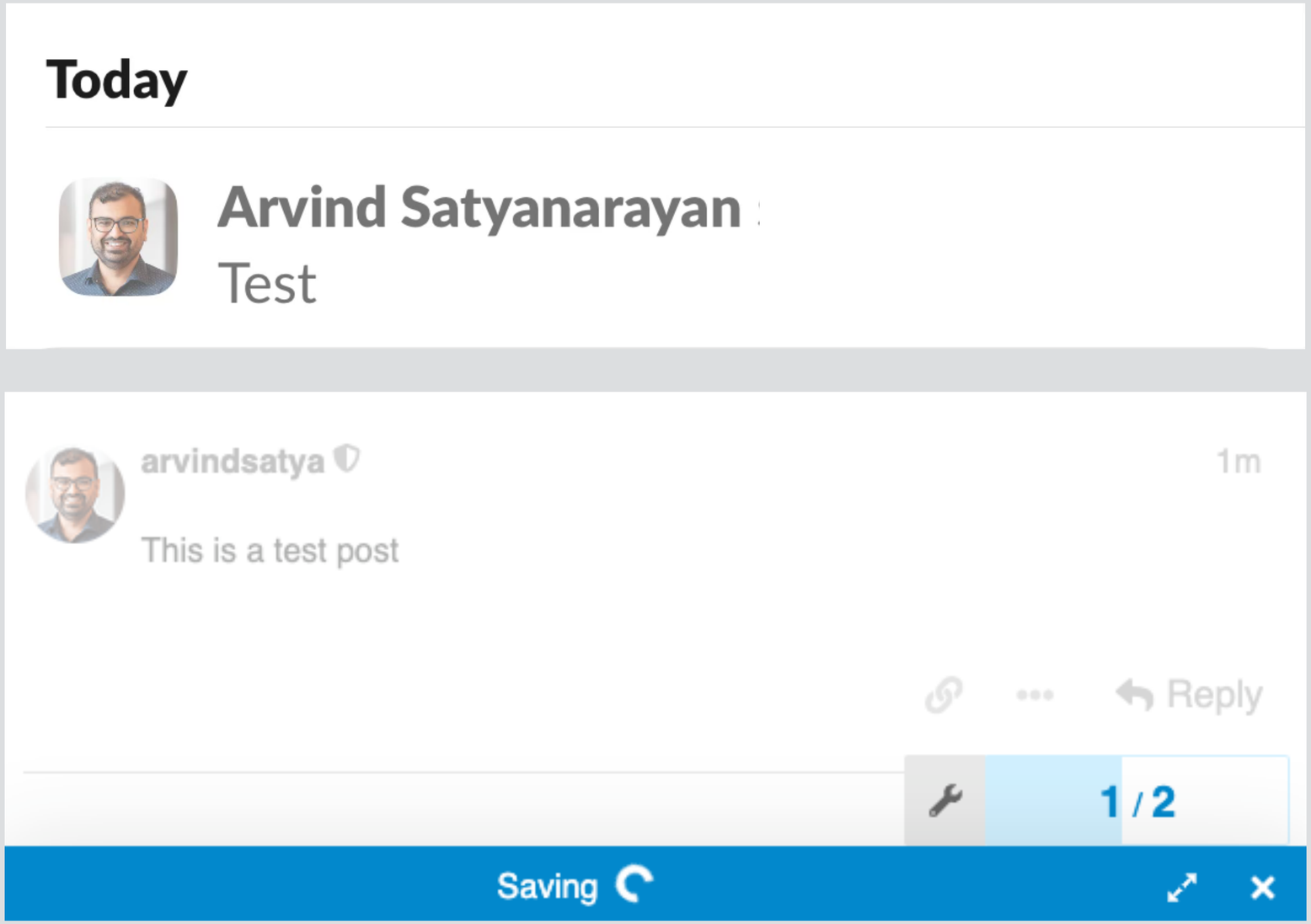
responses within about 100ms
can feel instantaneous

response time and feedback

heuristics
acknowledge actions promptly
show when work is still in progress

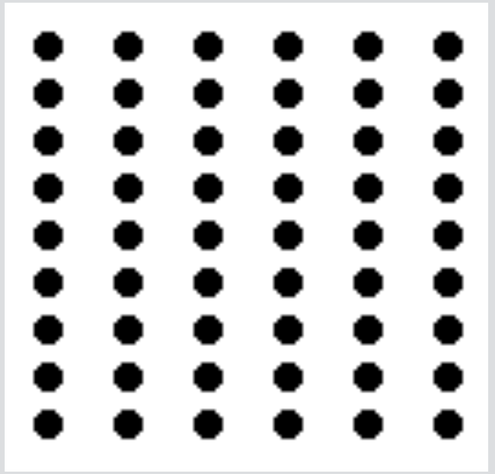


progress bar

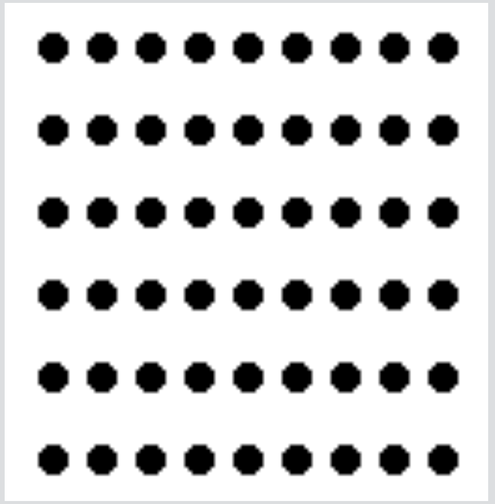


gestalt principles of grouping

heuristic
use visual layout
to convey structure







http://visual-memory.co.uk/daniel/Modules/FM21820/vispero7.html

gestalt principles of grouping

USER

password

username

password

username

password

heuristic
use visual layout
to convey structure

https://mtc.dor.state.ma.us

Taxpayer Identification

Individual Name

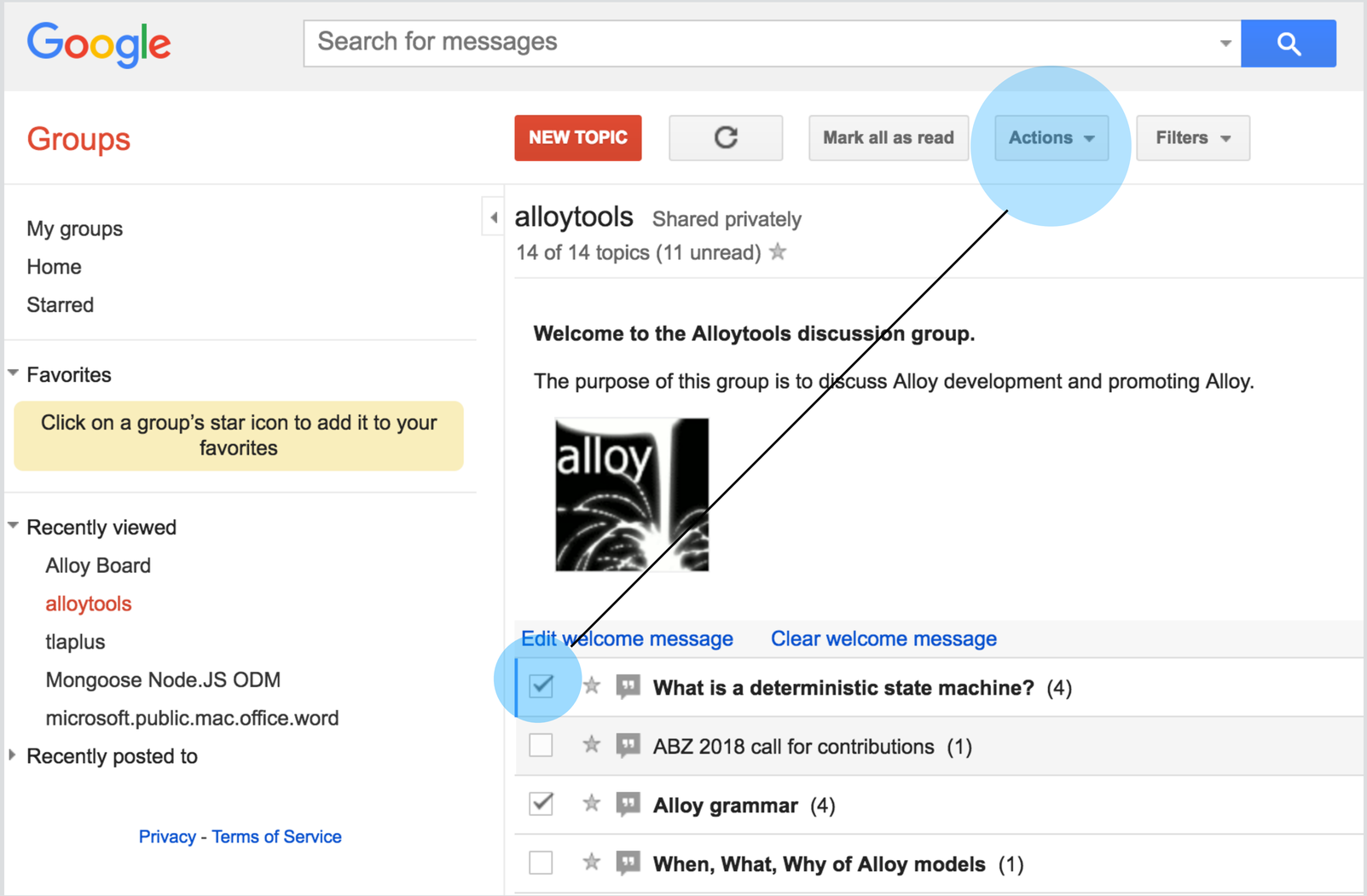
ID Type — SSN

ID * — Required

Confirm ID * — Required

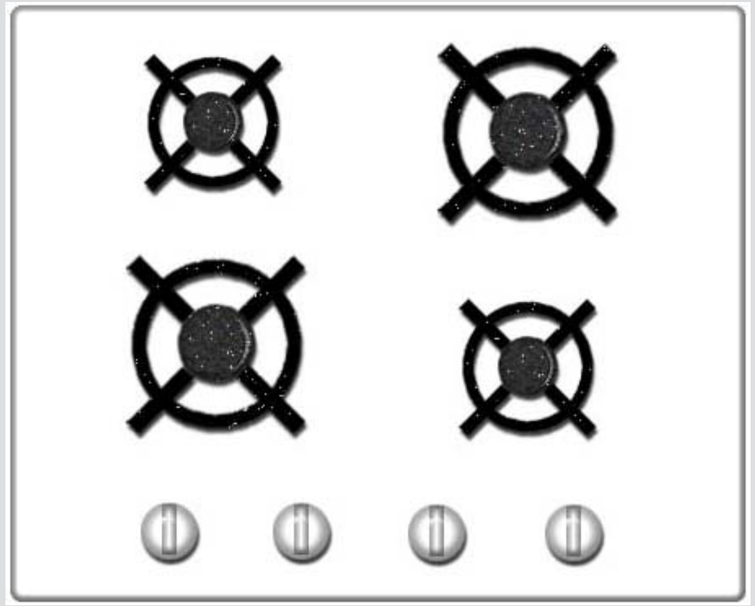
Phone Number * — Required

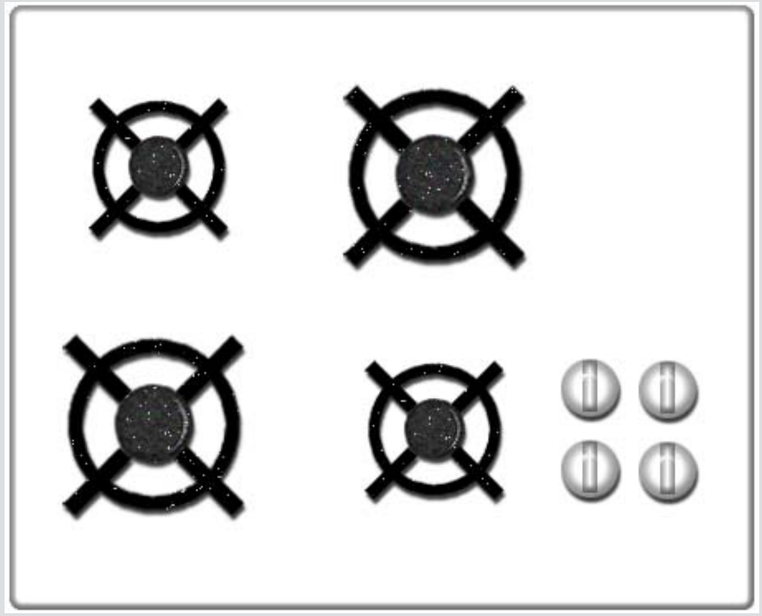
example: aggregate actions in Google groups



mapping

heuristic
make layout consistent with function

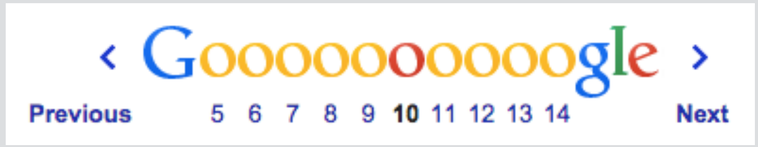




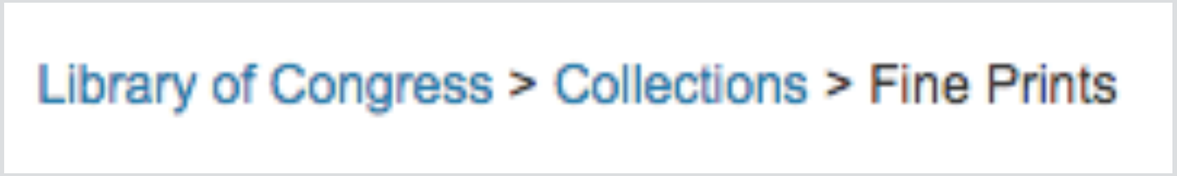
from: Donald Norman, The Design of Everyday Things

situational context

heuristic
make user's location (and state) visible



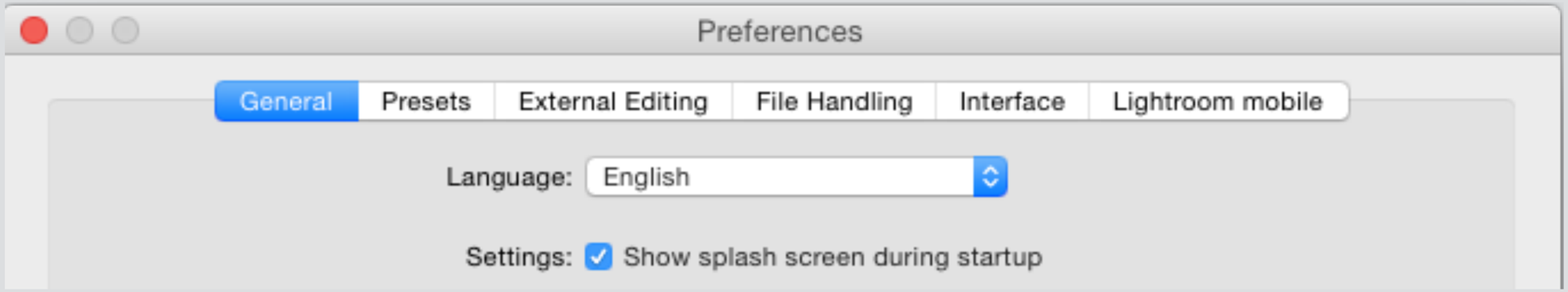
pagination



a breadcrumb from http://www.loc.gov



filters from http://www.loc.gov



tabs from Adobe Lightroom

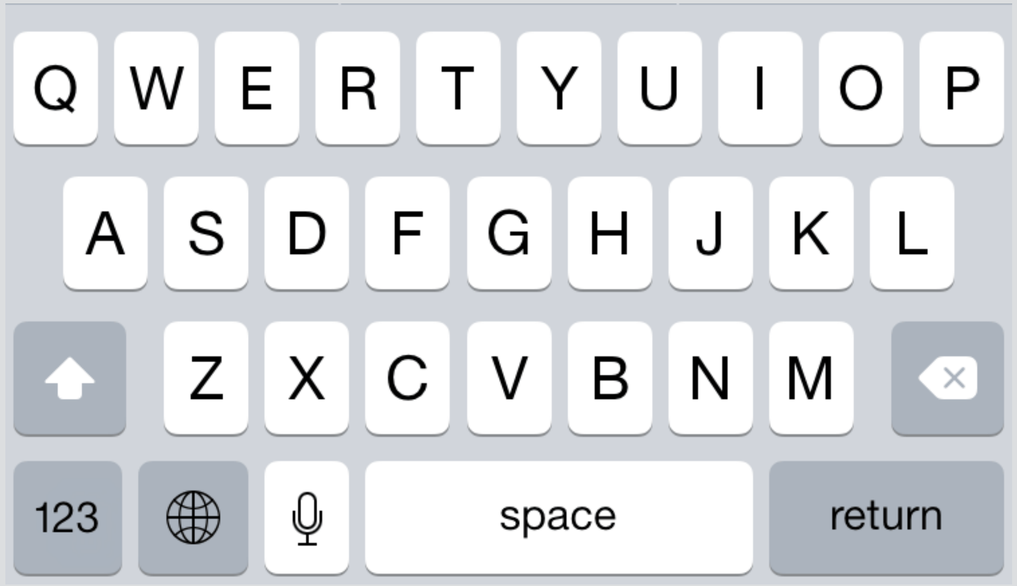
situational context

heuristic
make user's location (and state) visible



iOS Keyboards from Allen Pike

situational context





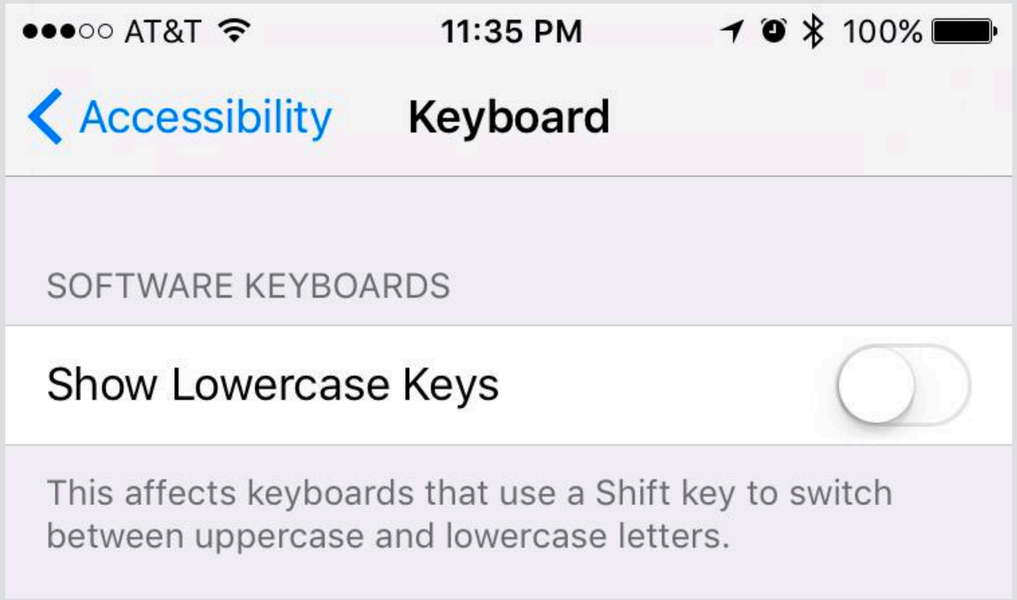
heuristic
make user's location (and state) visible

iOS Keyboards from Allen Pike

situational context

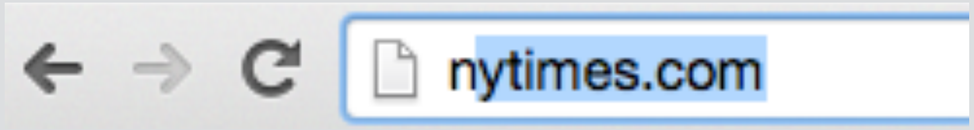
heuristic
make user's location (and state) visible



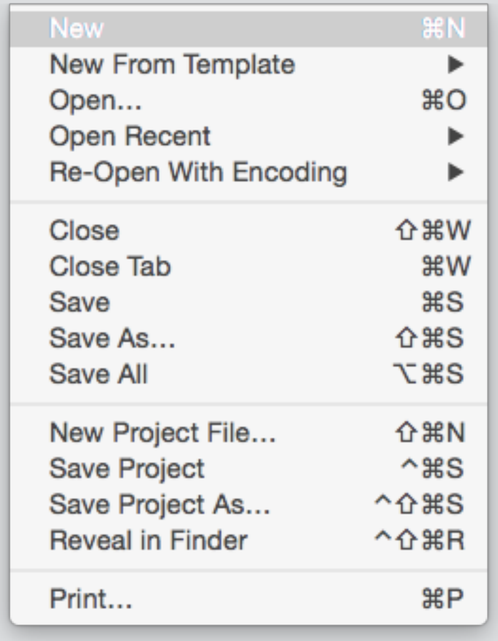


accelerators

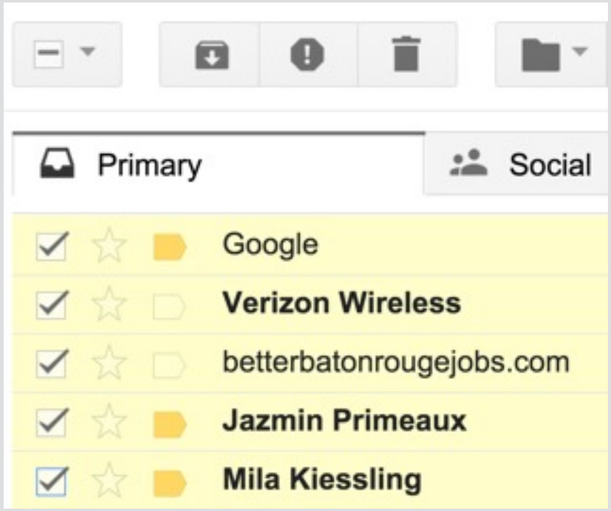
heuristic
provide accelerators for expert users



Google search bar autocompletion



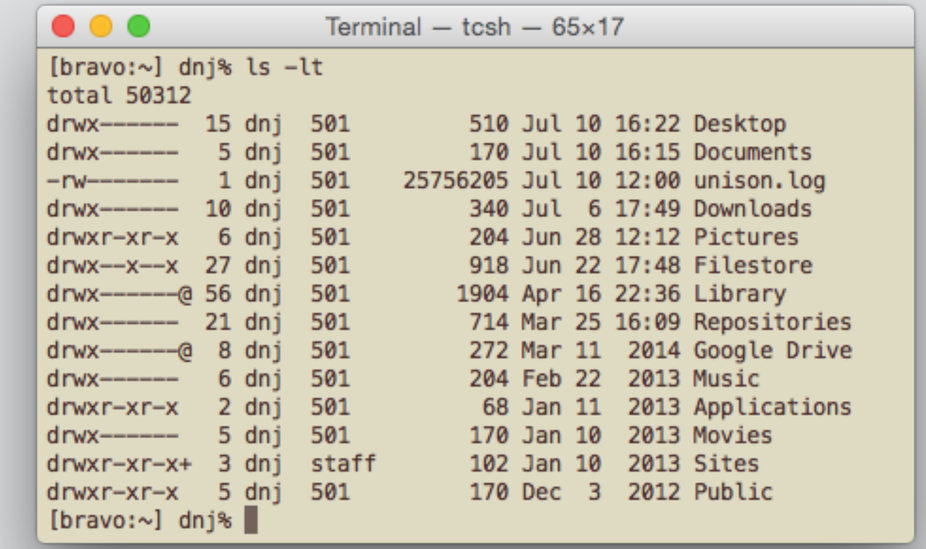
Textmate shortcuts



Gmail aggregation

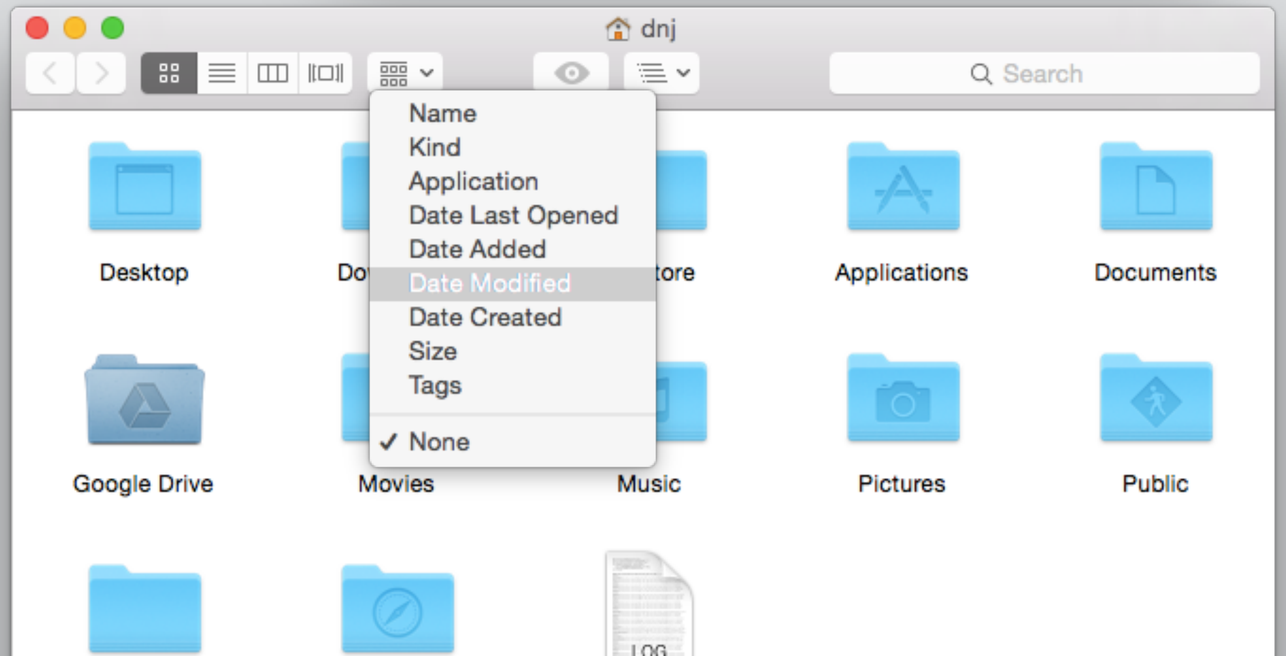


recognition vs. recall



heuristic
let the user recognize
not have to remember!

Unix shell: have to recall command and options to list directory by modification date



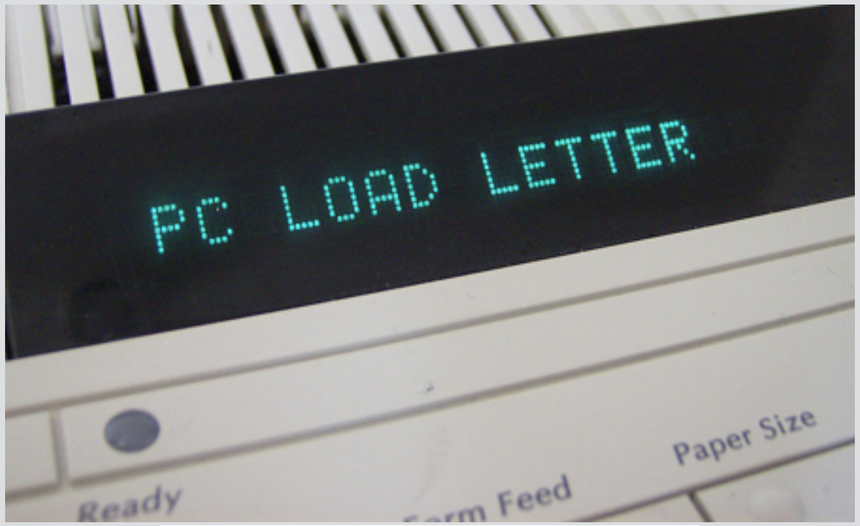
Mac finder: just have to recognize symbol for organize, and then recognize selector for modification date

linguistic
level

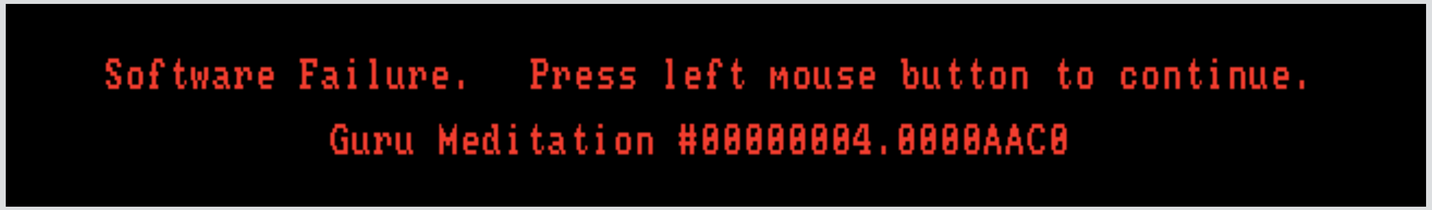
heuristics
use simple terms
word very carefully
never blame the user

speak the user's language

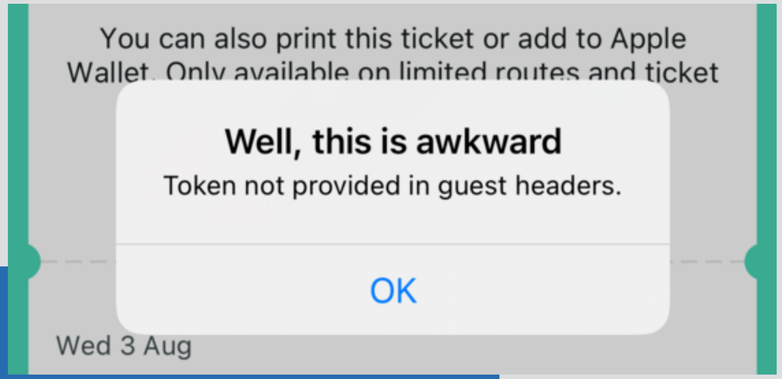
speak the user's language



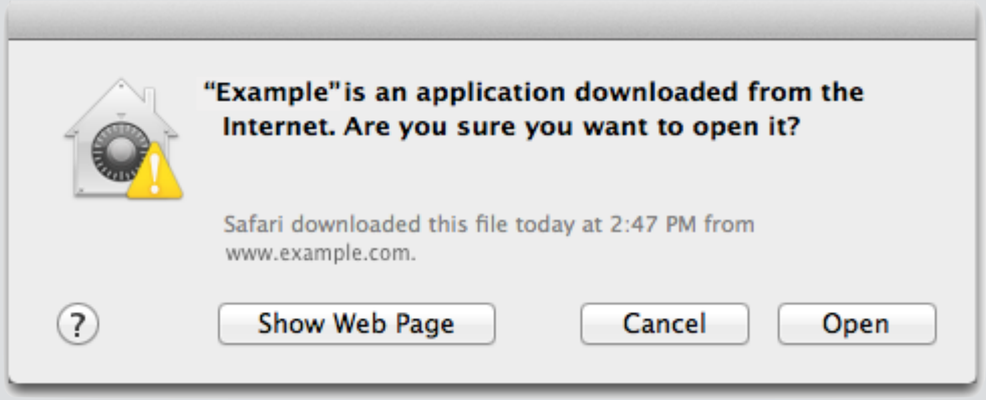
infamous HP printer error



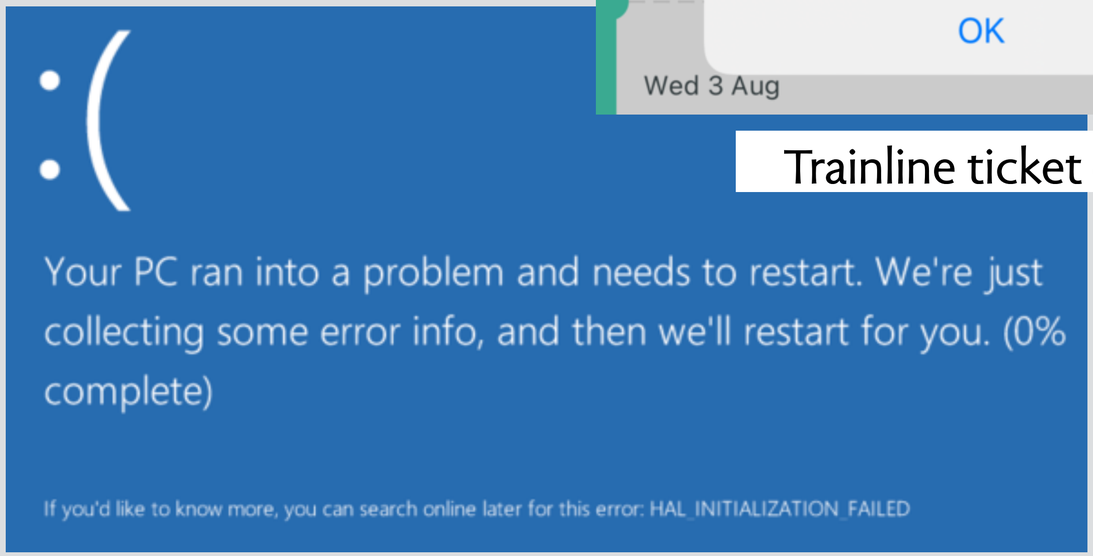
Commodore Amiga crash



Trainline ticket error

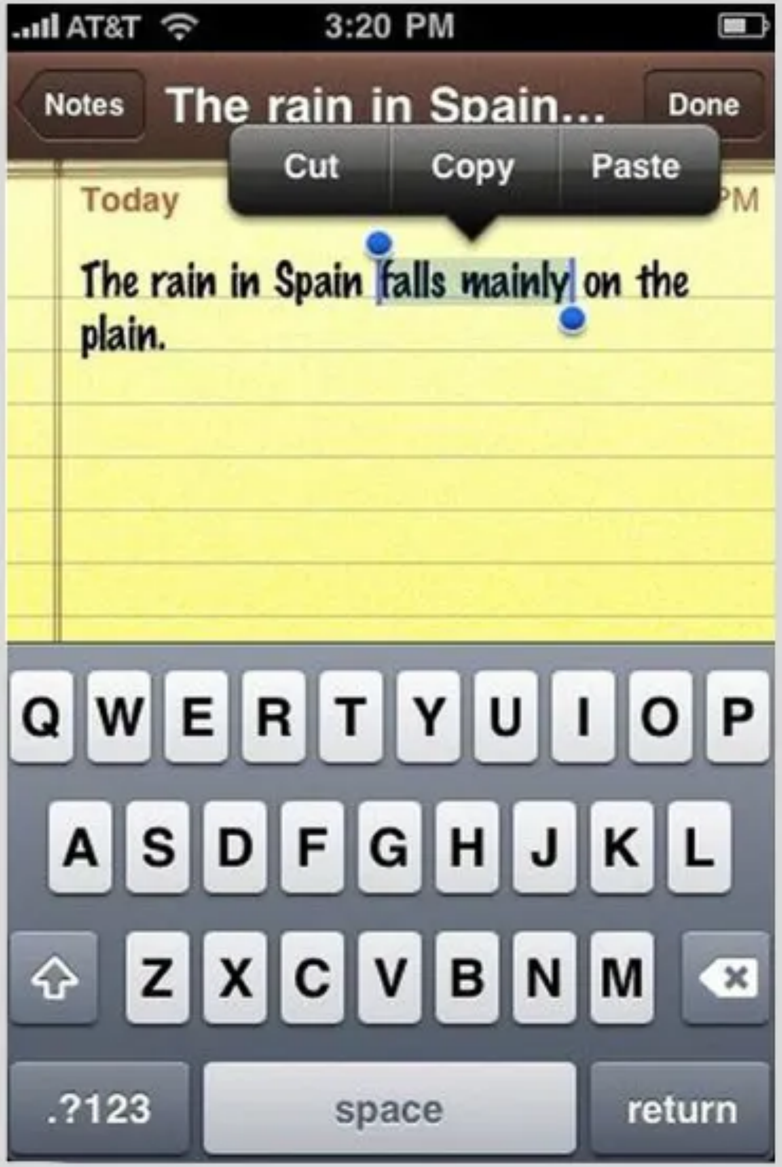


a helpful and informative message

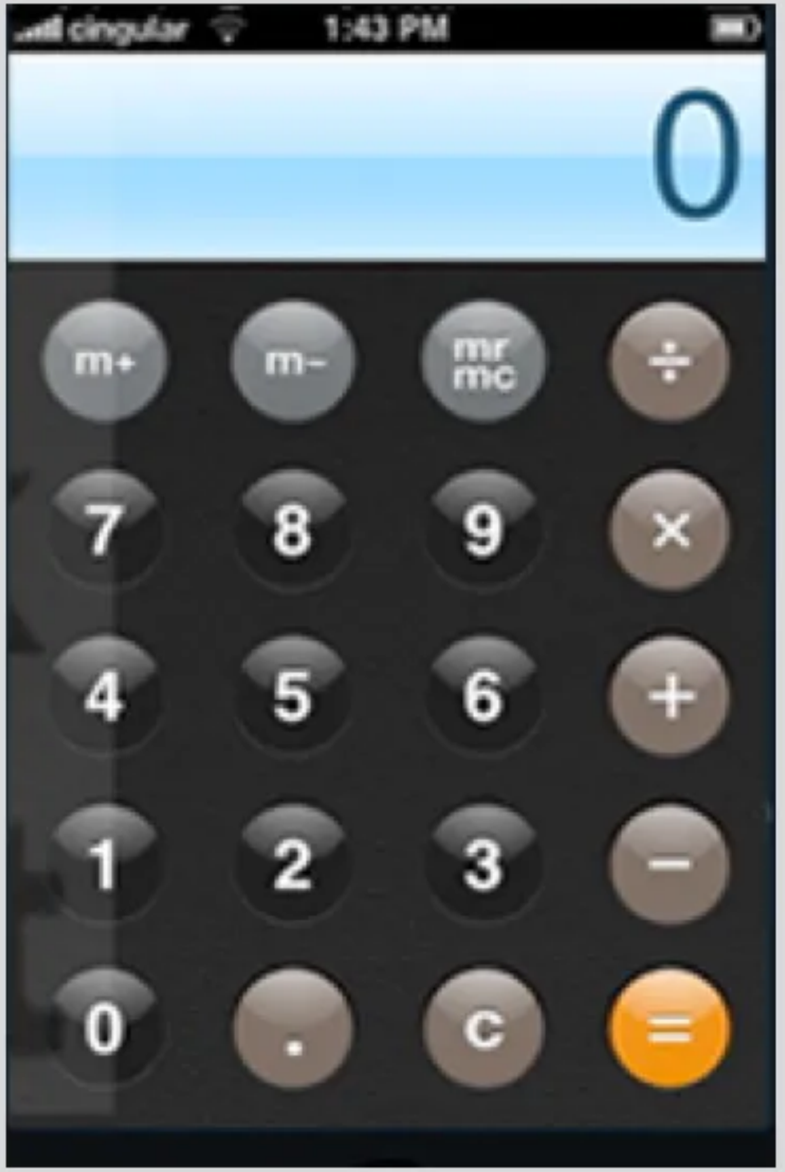


Windows blue screen of death

speak the user's language: using metaphors







speak the user's language: using metaphors

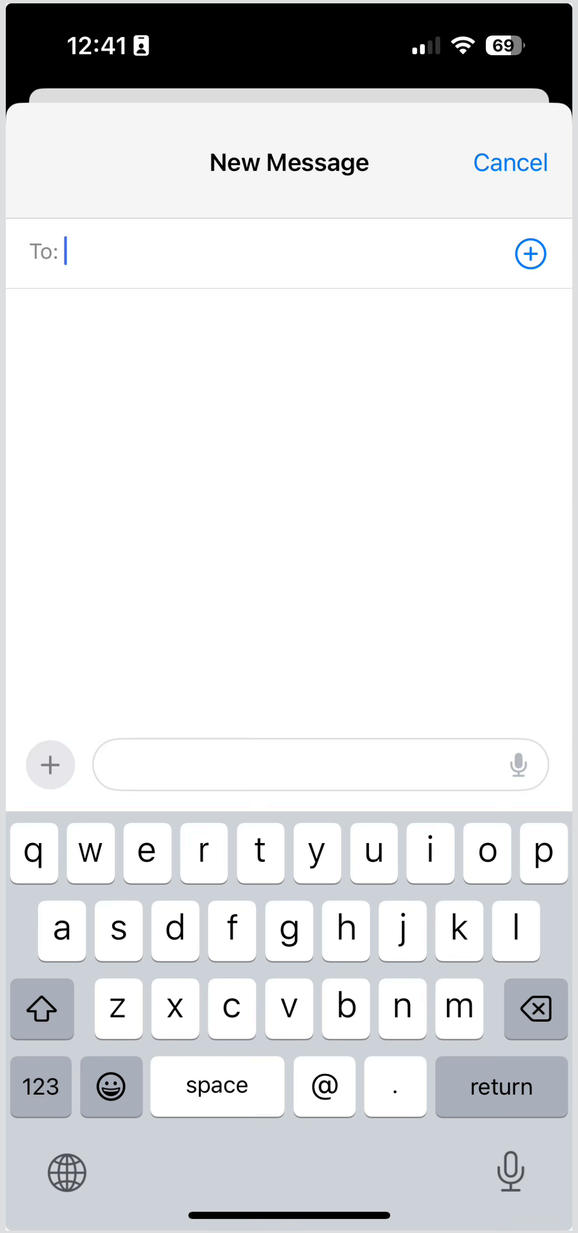




speak the user's language: using metaphors

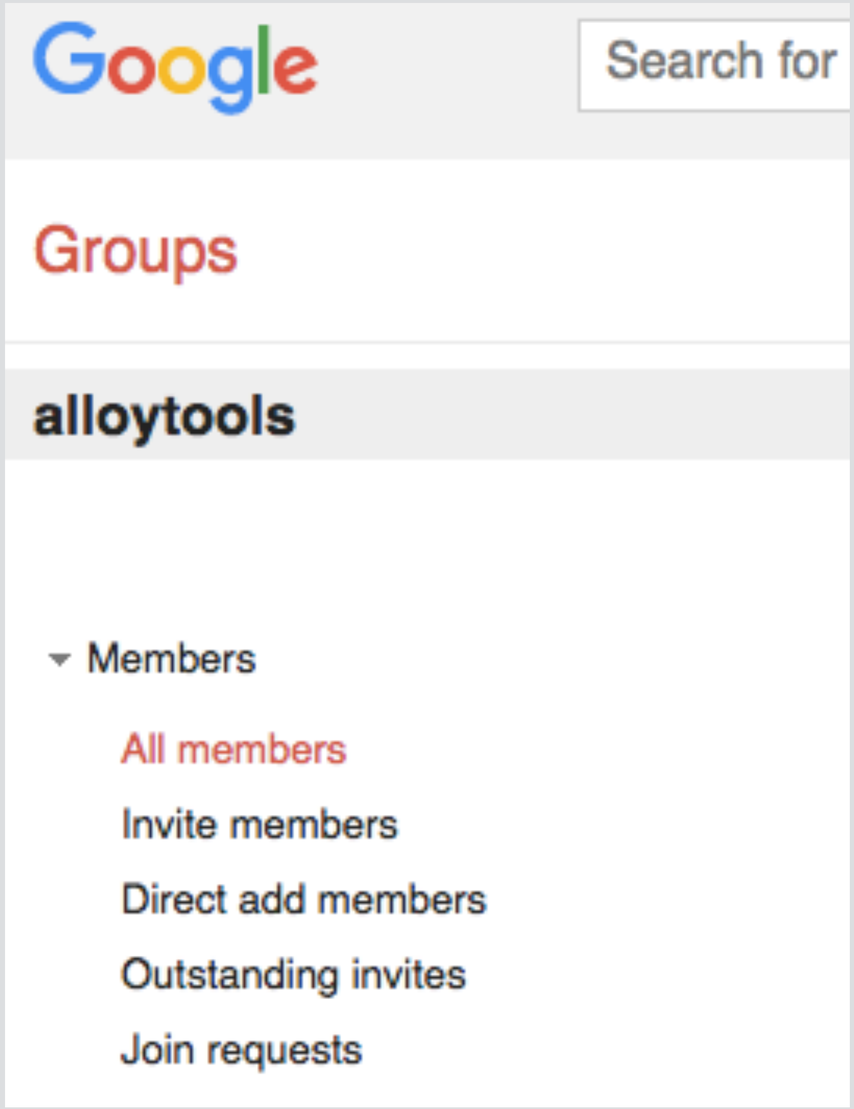


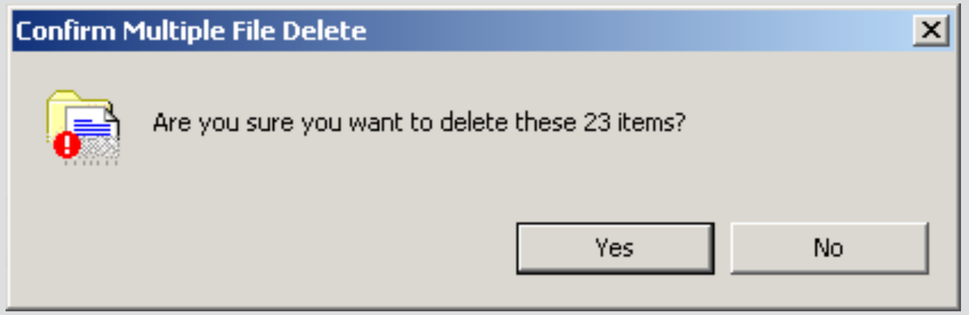




speak the user's language: parts of speech

heuristic
use verbs/nouns for actions/queries, and be consistent



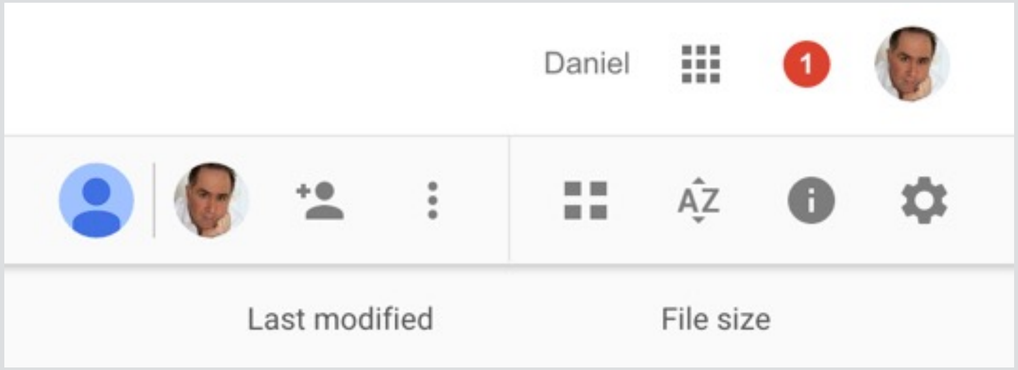




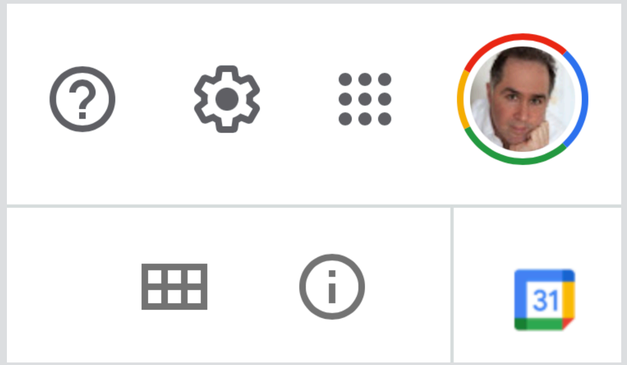
consistency

consistent naming & icons

heuristic
be consistent;
same name or symbol for a concept or action

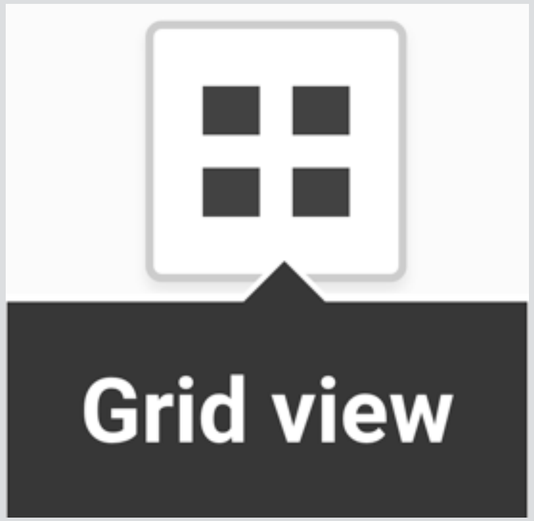


icons shown in Google Drive, c. 2020



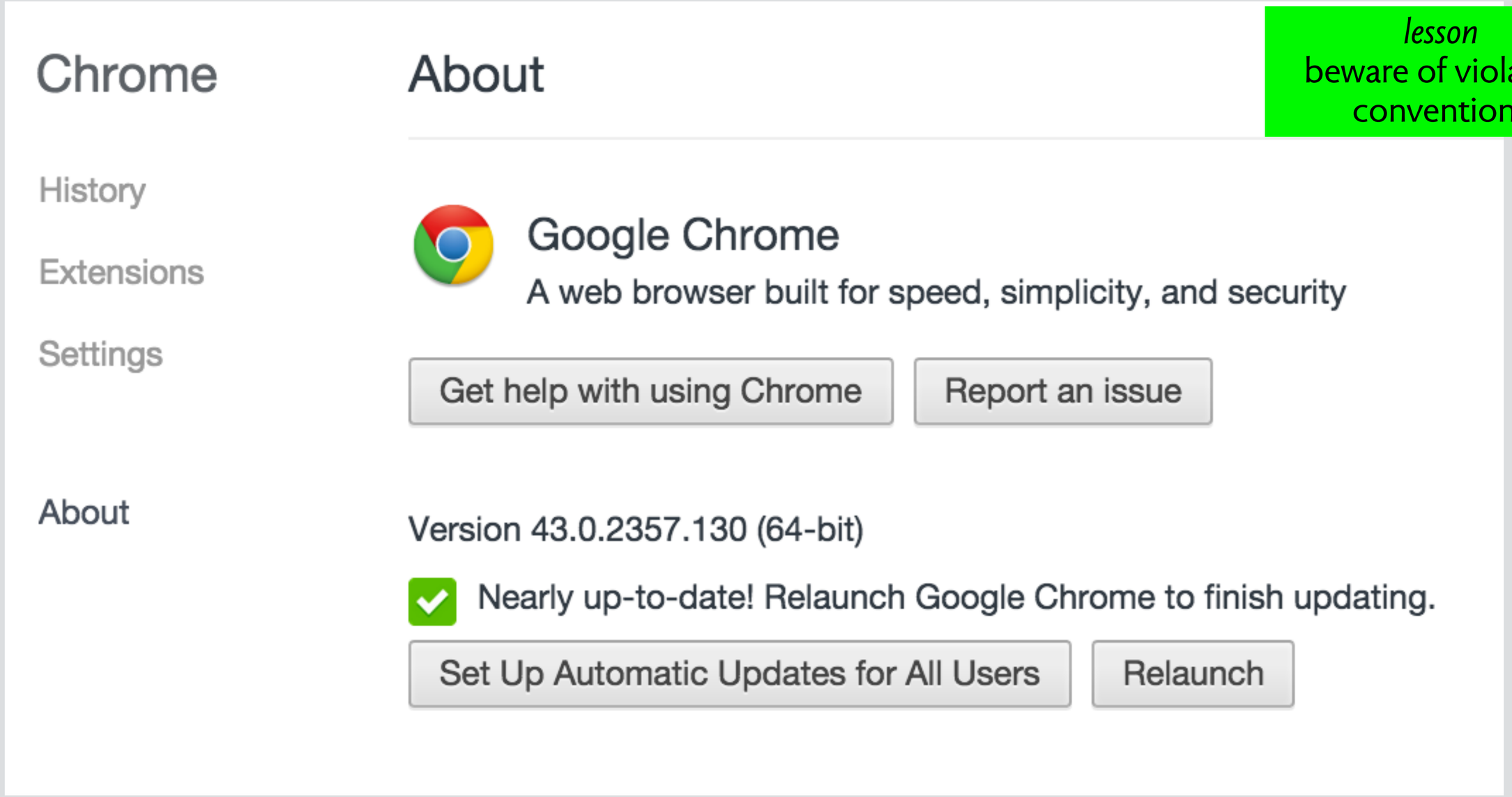
2022





consistency
across
application,
platform,
domain

consistent conventions



lesson
beware of violating conventions

why is 'History' greyed out?



Settings

Search settings

- You and Google
- Autofill
- Privacy and security
- Appearance
- Search engine
- Default browser
- On startup
- Languages
- Downloads
- Accessibility
- System
- Reset settings
- Extensions
- About Chrome

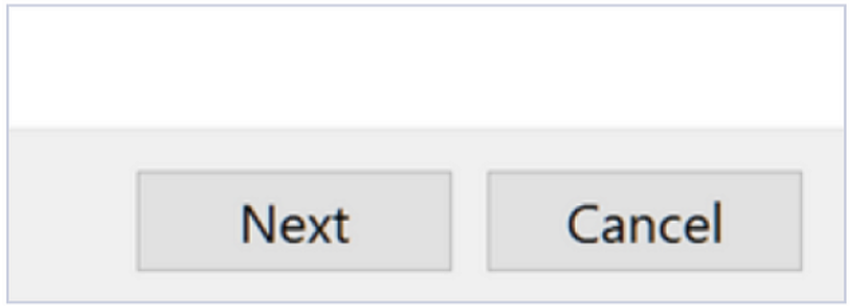
Appearance

Theme Open Chrome Web Store	
Show home button Disabled	
Show bookmarks bar	
Font size	Medium (Recommended)
Customize fonts	
Page zoom	100%
Pressing Tab on a webpage highlights links, as well as form fields	
Show warning before quitting with ⌘Q	

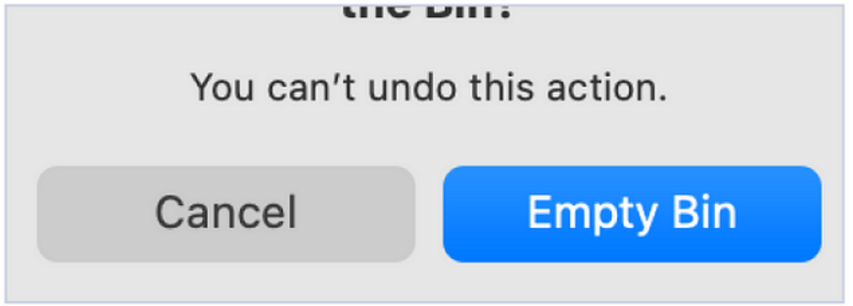
consistent conventions

lesson
beware of violating conventions

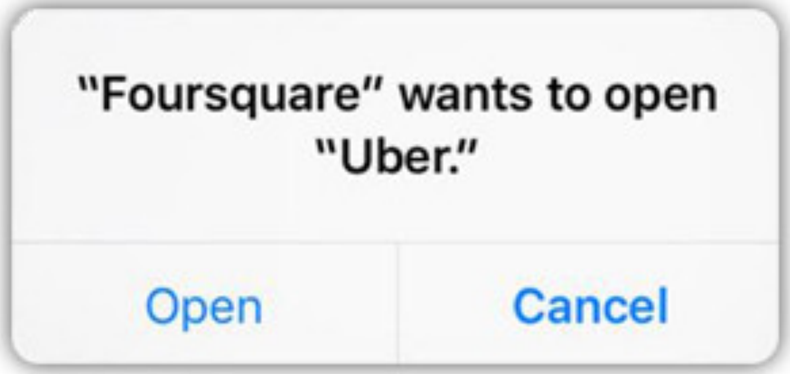
Windows puts **OK first**



Apple puts **OK last**







information scent

heuristic
use 'scent' to aid information 'foraging'

Award Winners
Caldecott Medal (107)
Man Booker Prize (54)
National Book Award (49)
Newbery Medal (84)
The Pulitzer Prize (46)
Hugo & Nebula Awards (25)
Eisner Award (39)

Packaging Option
☐ Frustration-Free Packaging (9)

Promotion
☐ Bargain Books (142,908)

Avg. Customer Review
★★★★☆ & Up (2,903,157)
★★★☆☆ & Up (3,274,714)
★★☆☆☆ & Up (3,378,179)
★☆☆☆☆ & Up (3,481,555)

amazon.com

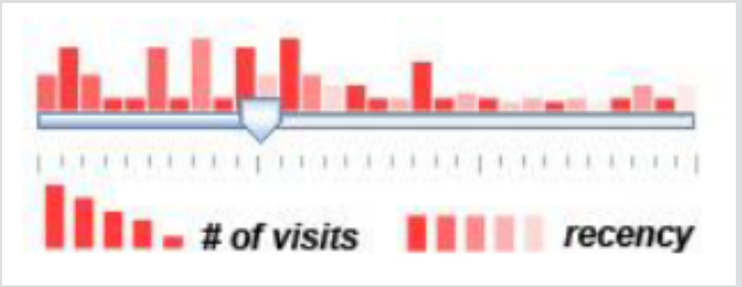
books

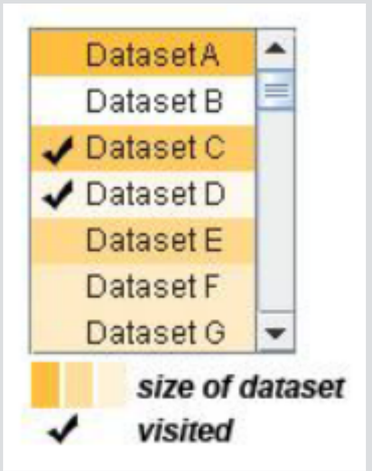
what's new
new releases
pre-orders
NY Times bestsellers
Target Club Picks
Only at Target

featured categories
book deals
Rosetta Stone
John Green
Dr. Seuss
signed books

kids' books
baby-3 years
4-8 years
9-12 years
teen
Common Core State Standards
all kids' books

target.com







not
just
GUIs!

which criteria and principles are violated here?

```
$ ls
a b d
$ mv d c
$ ls
a b c
```

mv = rename

```
$ mv a b
$ ls
b c
```

mv = overwrite

```
$ mv b c
$ ls
c
$ ls c
b
```

mv = move

```
$ ls
f1.c f2.c ... f1.o f2.o ...
$ rm  *>o
$ ls
o
$ ls
a b c d
$ mv a '*'
$ ls
* b c d
$ rm *
$ ls
```

look at where > is on keyboard

*file called **

See: The Unix Hater's Handbook

takeaways

heuristics offer
codification of knowledge
basis for critique
a systematic approach

but remember
no rules are perfect
must be applied thoughtfully
surprises always possible!

cheatsheet for heuristic evaluation of user interfaces / 61040, software studio

criteria	physical	linguistic
learnability can users learn quickly and easily?	**fitt's law** how quick to point?	**speak user's language** not developer's language
efficiency can experts work fast and efficiently?	**perceptual fusion** respect human perception of time	**consistency** are names, icons etc consistent?
error tolerance are user errors mitigated?	**gestalt principles** convey structure by visual layout	**recognition vs. recall** reduce recall burden on user
pleasantness is the app pleasant to use?	**mapping** layout interface to match function	**information scent** provide hints for navigation
safety is it safe?	**situational context** provide features appropriate to context	
security are privacy and integrity ensured?	**accelerators** allow quick access to common features	
accessibility usable by everyone?	**typography** readable text, accessible & effective color	