

6.1040 · software studio · fall 2023

user interaction design & review

Daniel Jackson & Arvind Satyanarayan

today's goals

criteria for usability

give you a deeper & broader understanding
what you're trying to achieve

usability heuristics

rules of thumb you can apply
a shortcut to expertise

criteria

ease of use

easy to use



learnable

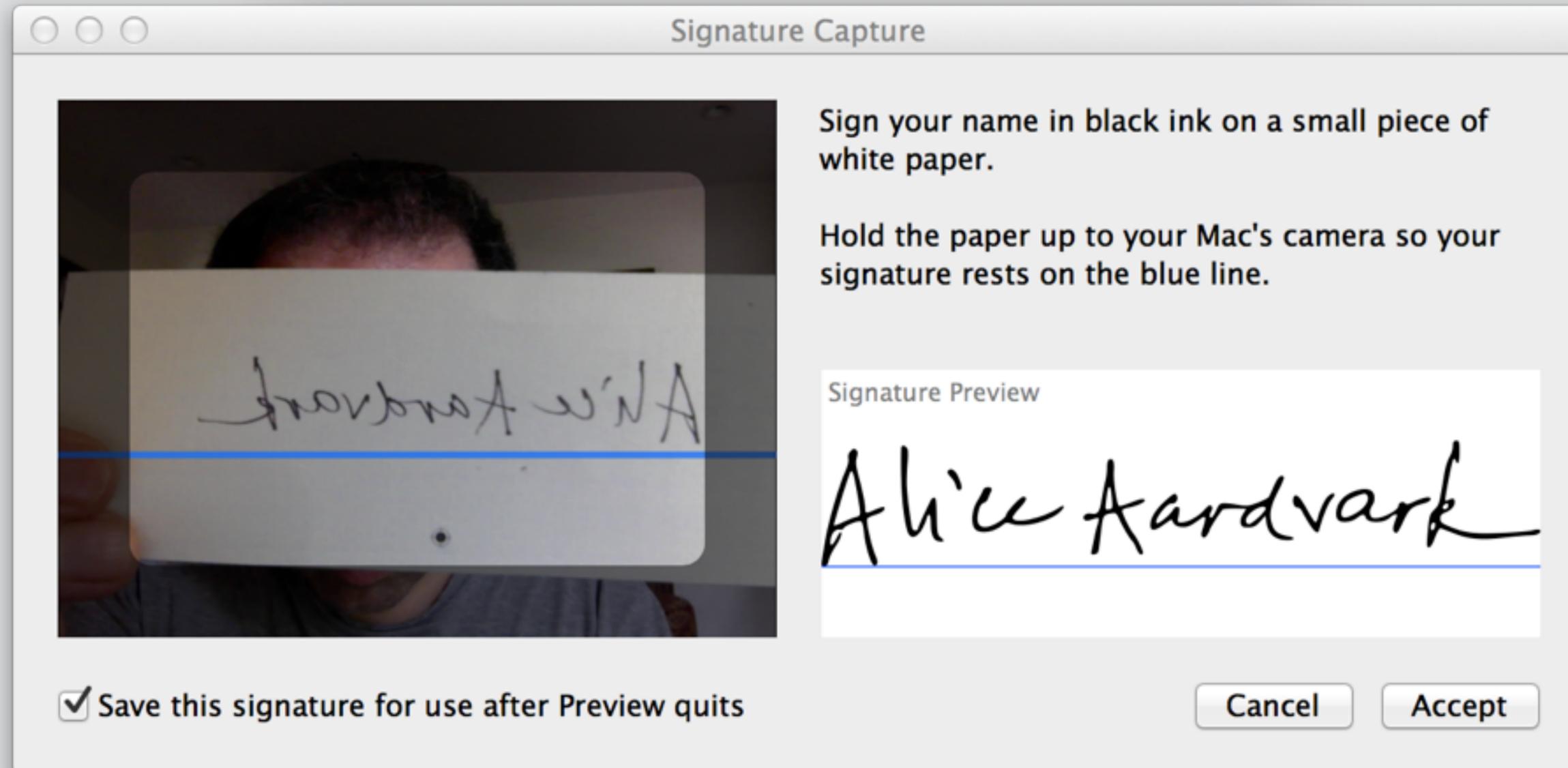


efficient



error-tolerant

example: signatures in Apple Preview



learnable?

yes, as good as it gets

efficient?

yes, but not very flexible

error-tolerant?

yes, feedback as you position it

example: car radio presets



learnable?

not really: who would guess?

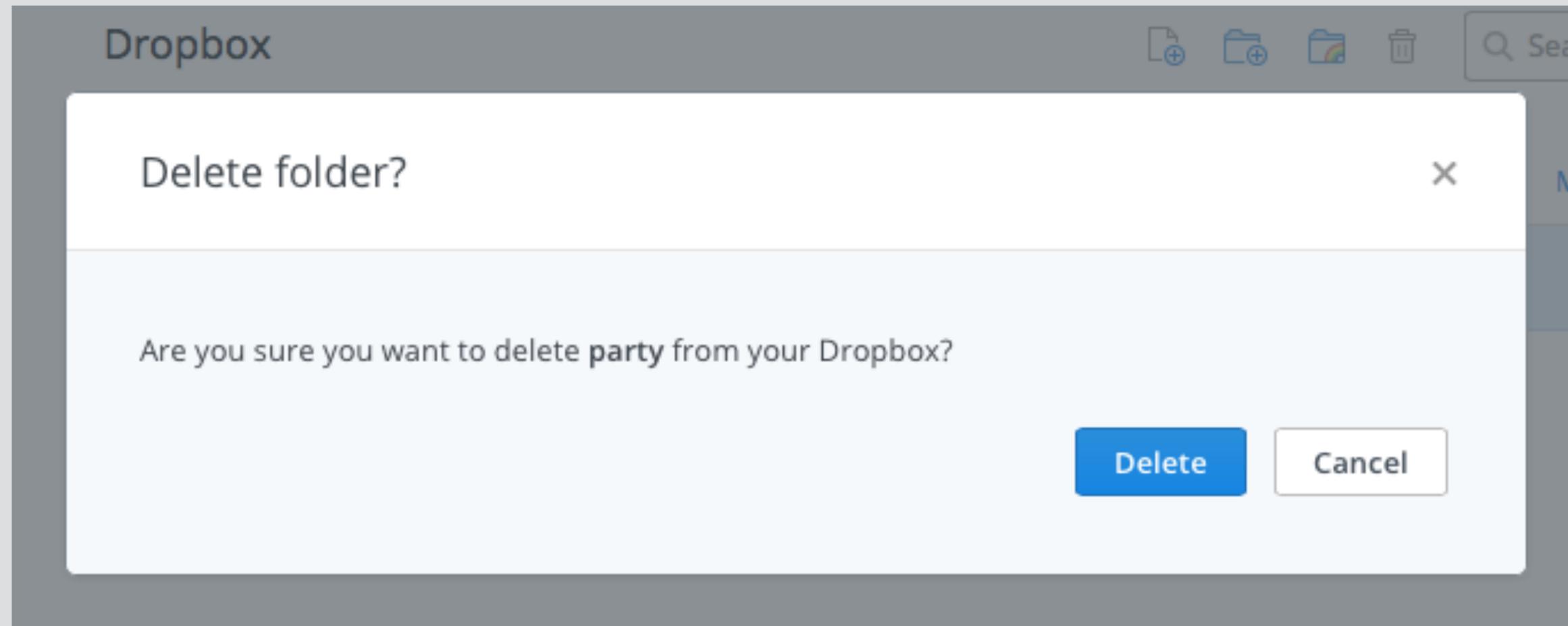
efficient?

yes, perfect

error-tolerant?

unless you lean on a button

example: dropbox deletion



learnable?

yes, but might not mean what you think

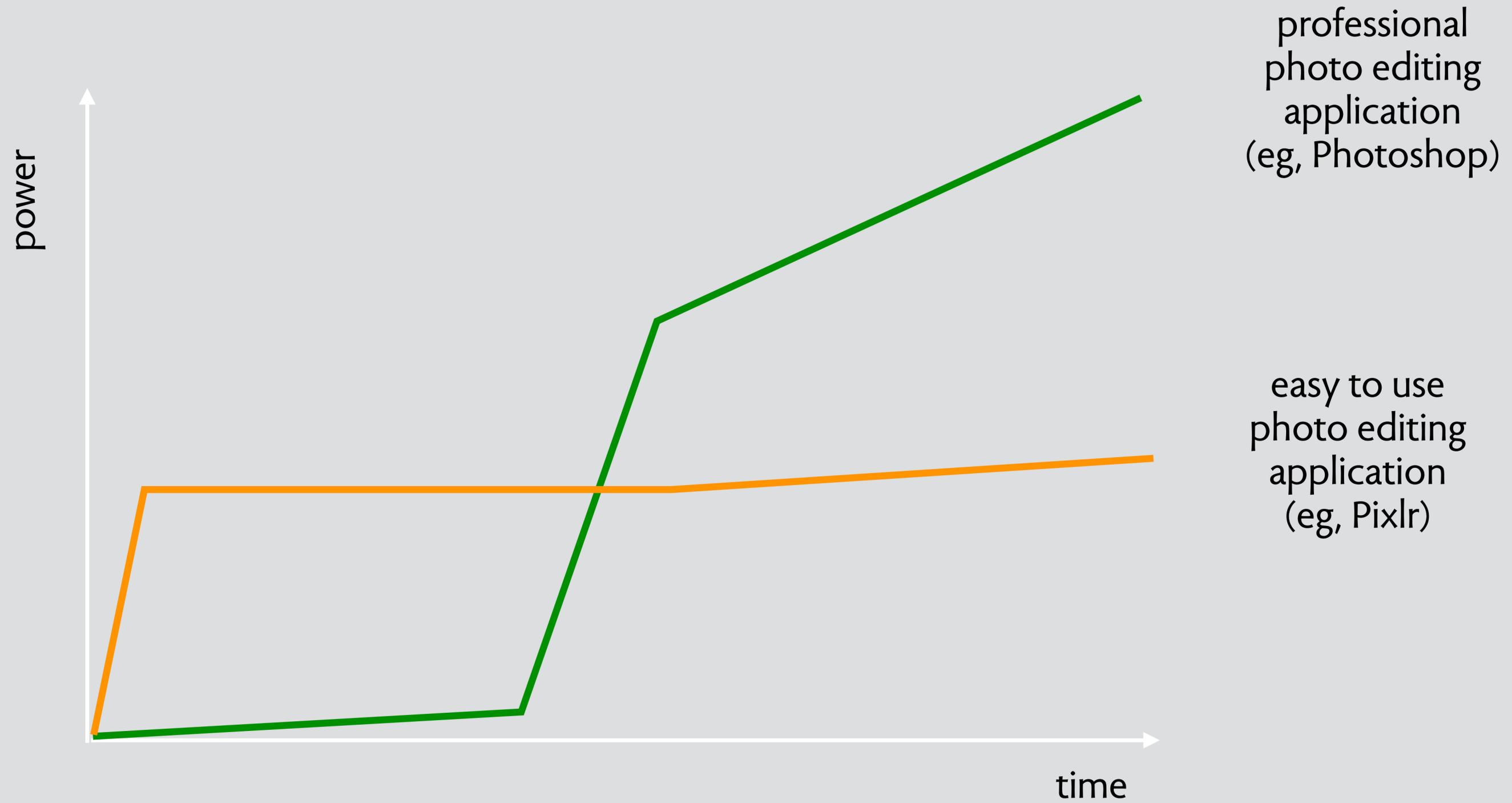
efficient?

yes, just click a button

error-tolerant?

no: deletes other users' copies too!

learnability vs efficiency



pleasantness

example: pleasantness in architecture



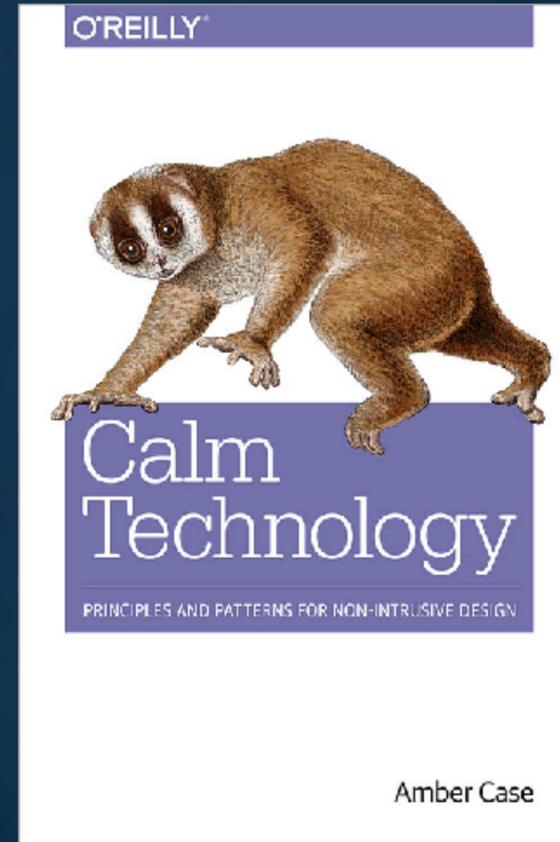
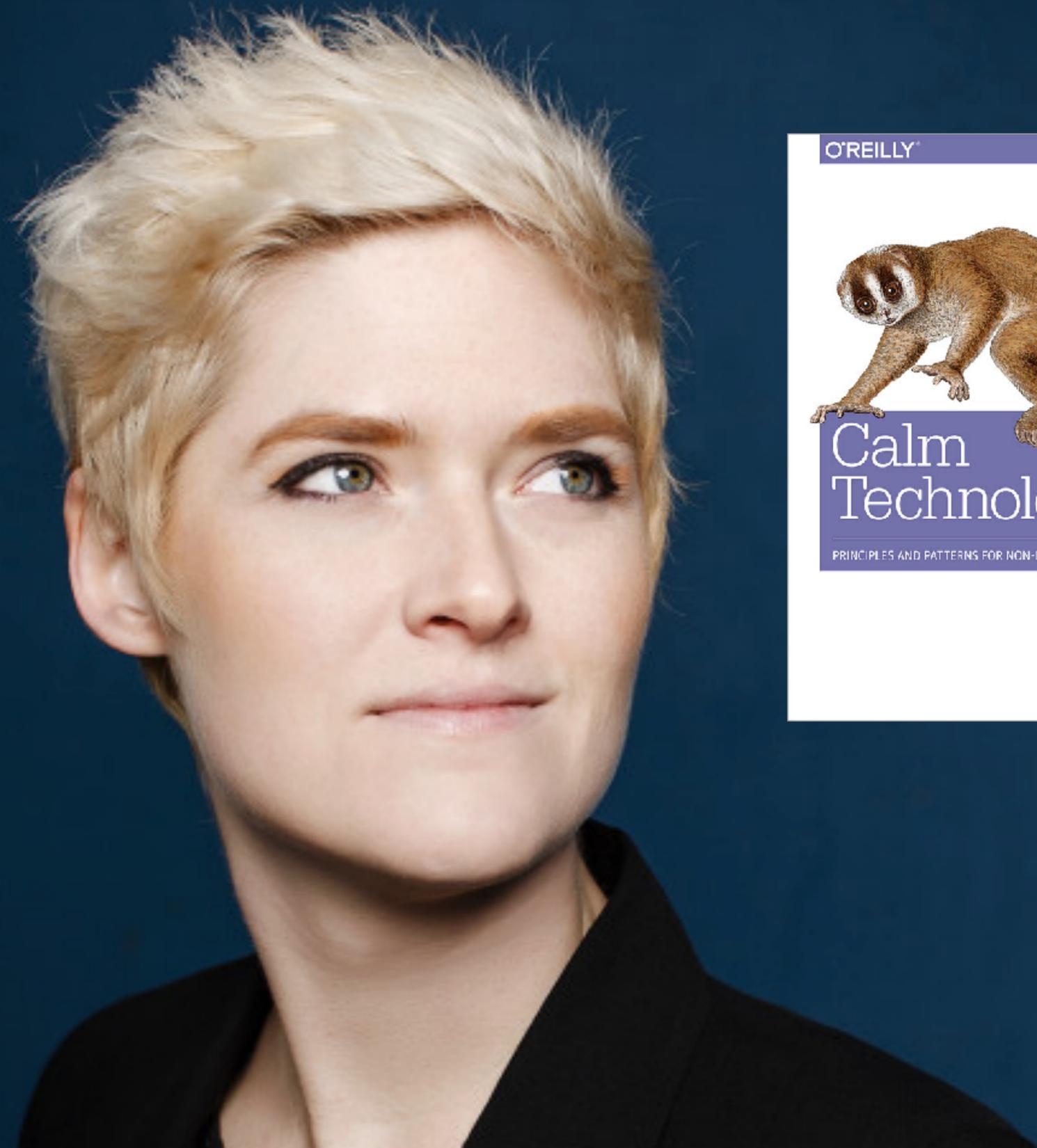
Ryōan-ji, Kyoto

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.”

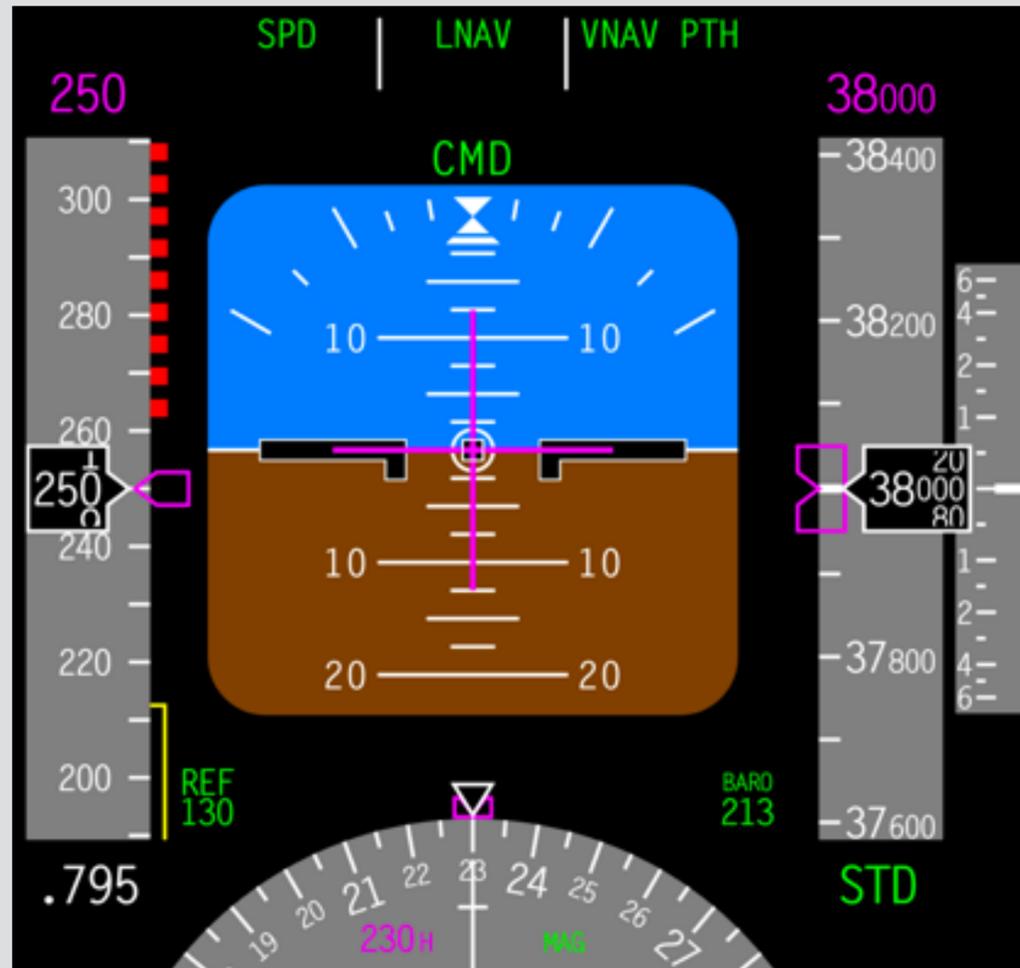
amber case: calm tech evangelist



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

safety

what's safety for?



safety-critical products



regular products

interlocks, not just messages



Heathrow Airport

an infusion pump



Thimbleby et al: <http://cs.swan.ac.uk/gcsharold/health/>

an FDA recall

“

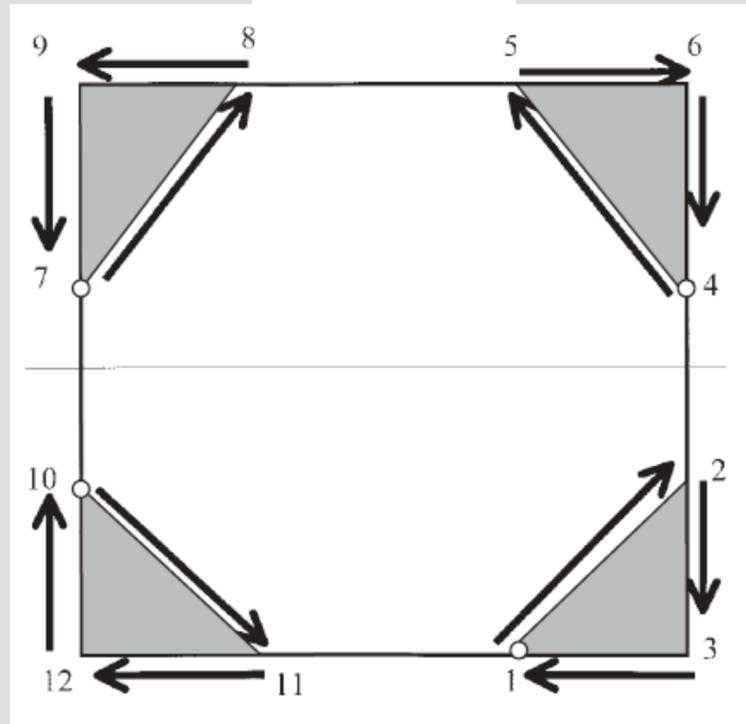
Infusion pumps, including the Baxter Colleague models, have been the source of persistent safety problems. In the past five years, the FDA has received more than 56,000 reports of adverse events associated with the use of infusion pumps. Those events have included serious injuries and more than 500 deaths.

”

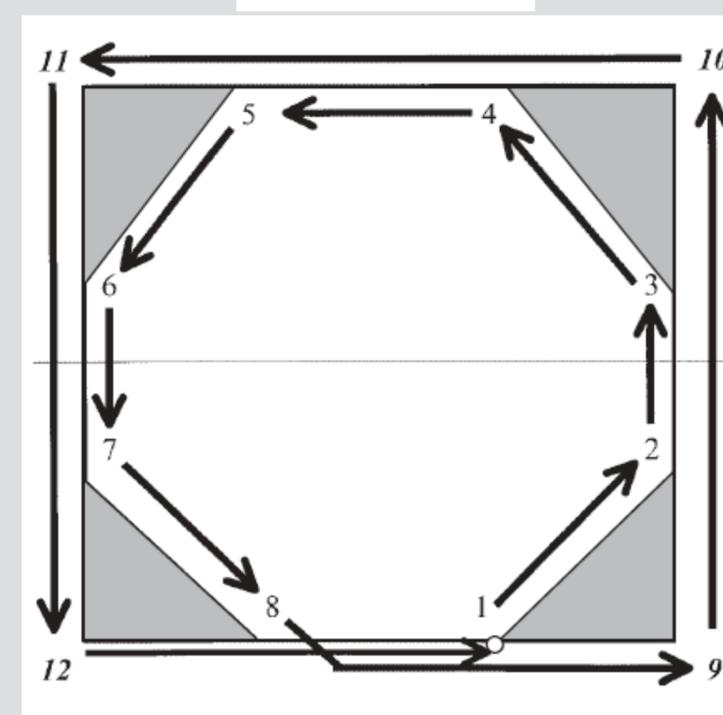
FDA Recall notice (2010)
[http://www.fda.gov/NewsEvents/
Newsroom/PressAnnouncements/
ucm210664.htm](http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm210664.htm)

more designs that killed people

dose = D



dose = 2D



Panama City Hospital, 2001
Multidata therapy planning system kills 18
patients



PLUGR, Afghanistan 2001

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: my 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?

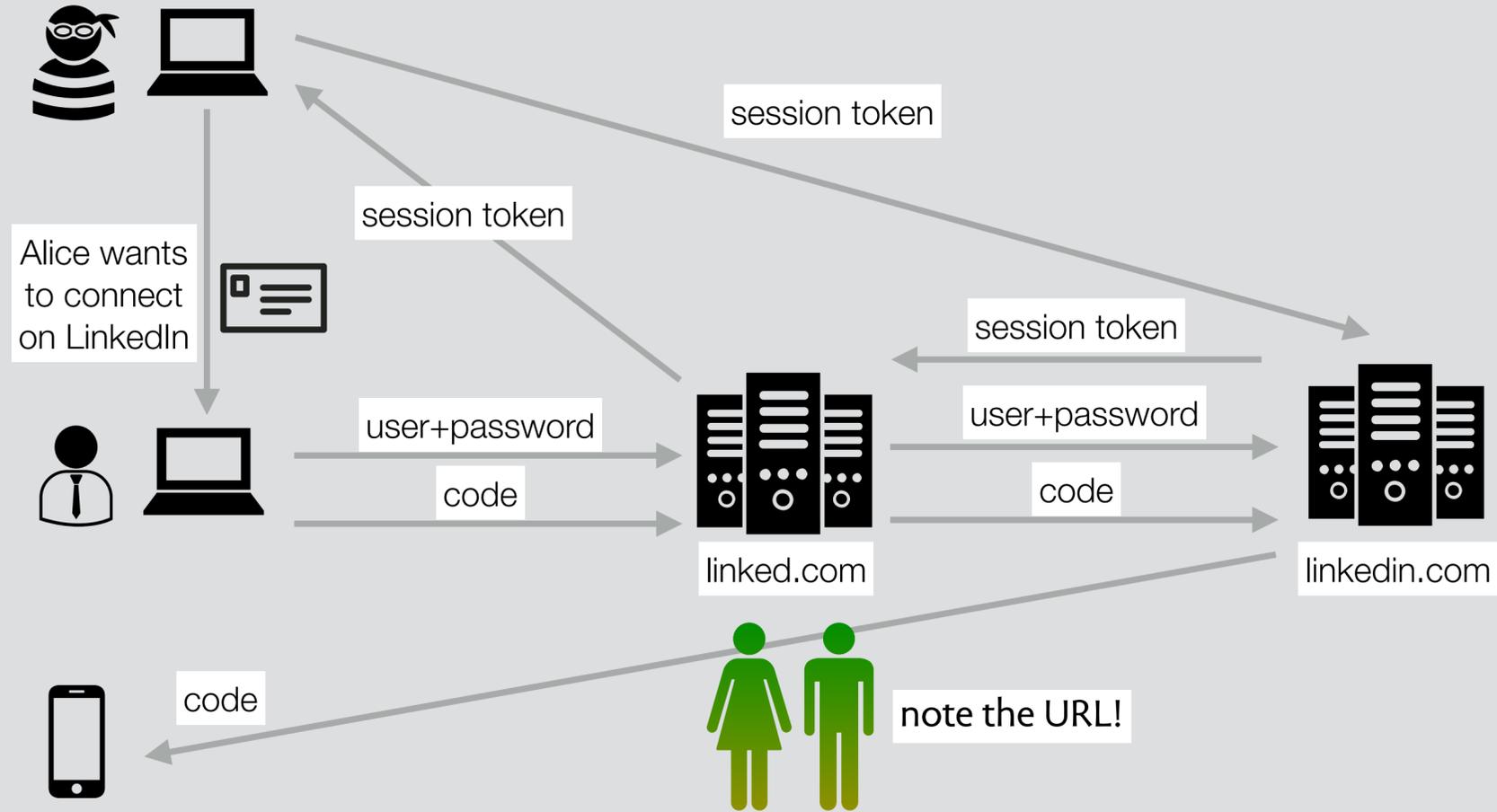
**From: admin@company.com
Sent: Friday, January 09, 2011
4:43 PM
To: [consultants](#)
Subject: your passwords**

I have updated all the passwords for you.

**New Password: Company1
IDs affected: jackson, smith, doe**

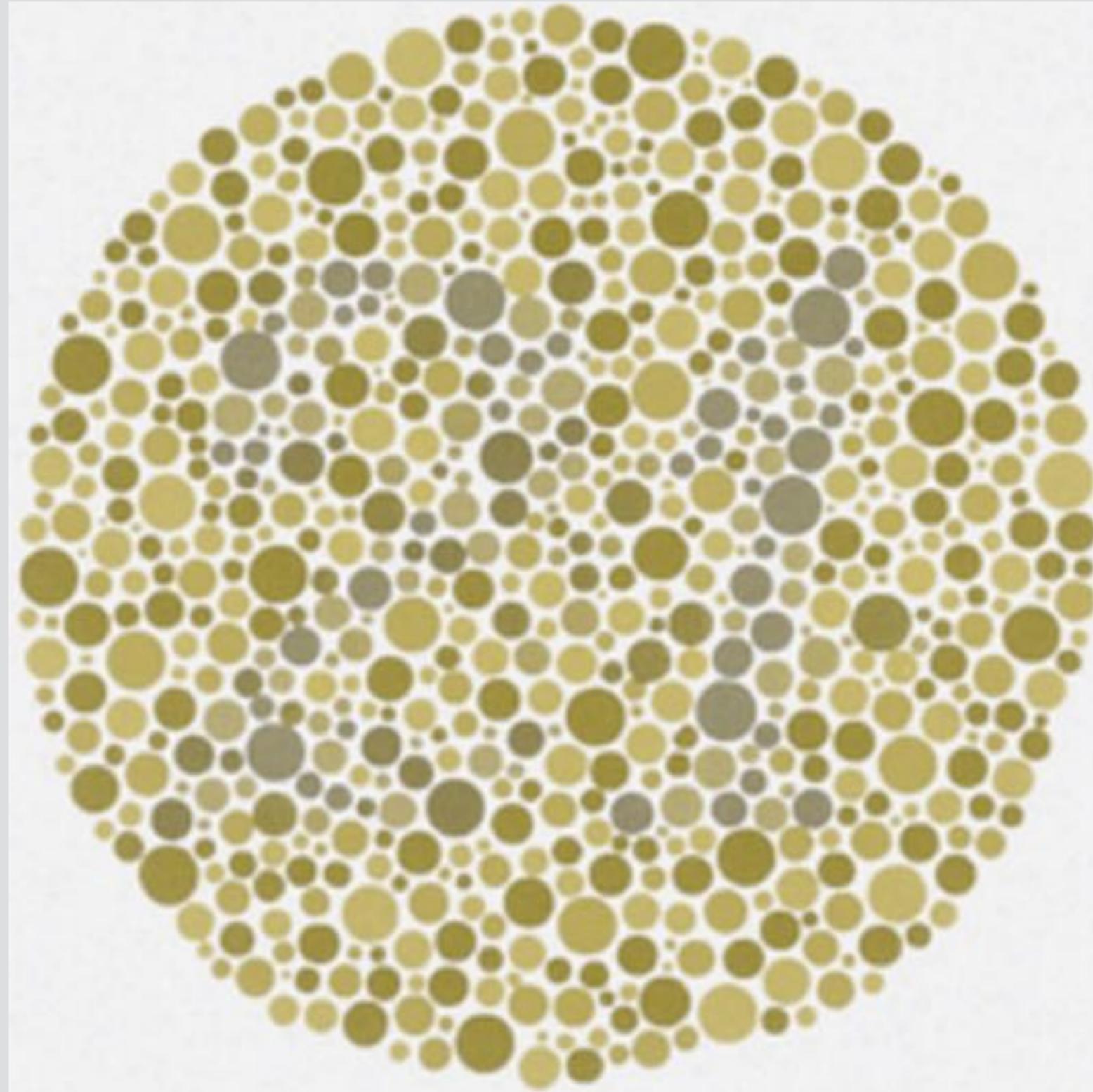
how the company worked around it

almost all security attacks begin with social engineering



accessibility

red-green colorblindness



affects 8% of men

example: colorblindness

The image shows a news article on a website. The main headline is "Transport select committee warns drivers of fake websites". Below the headline is a large image of two computer keyboard keys: a yellow key labeled "Fake" and a white key labeled "Genuine". The text "Fake" and "Genuine" is rendered in a light yellow color, which is difficult to distinguish from the yellow key background due to the colorblindness simulation. Below the image is a "SHARE" section with buttons for Twitter, LinkedIn, Facebook, Google+, and a generic share icon. To the right of the main article is a "Promoted Content" section with a card titled "Innovation at work" and a "Latest in Strategy" section with a card titled "Apple Music faces antitrust investigation".

Transport select committee warns drivers of fake websites

Promoted Content

Innovation at work
Want to find out how to unleash innovation in your organisation? Whether you're keen to learn more about hotdesking, laser printing, connectivity, mobility, security or more, check out our...

Latest in Strategy

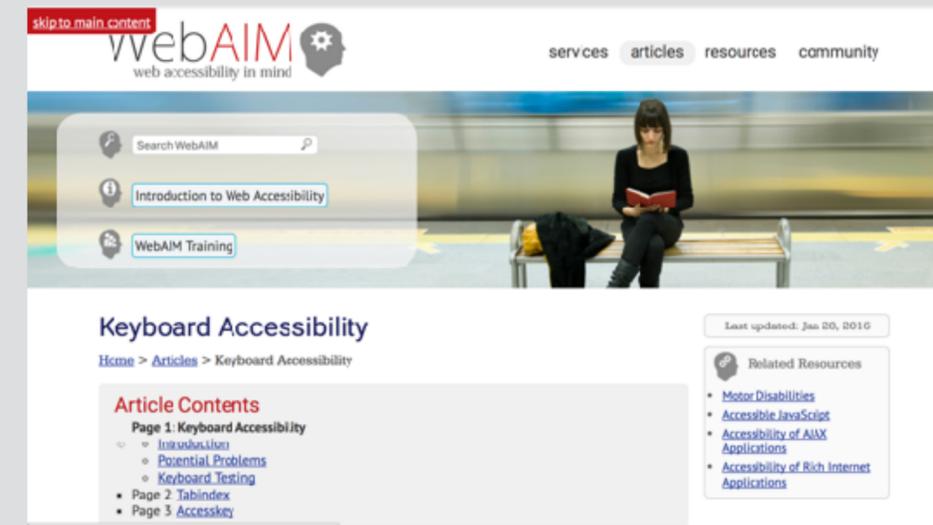
Apple Music faces antitrust investigation

simulated with SEE Chrome plugin

web accessibility guidelines



provide text alternatives to images



keyboard accessible



offer captioning of video content

lessons

ease of use: conflicting goals

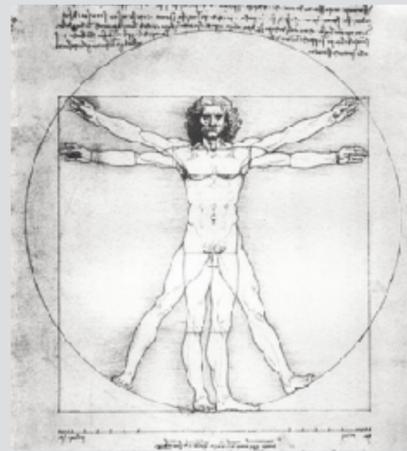
pleasantness: we're not machines

safety: usability means constraints

security from usability & usable security

accessibility: important & beneficial to all

levels of UX design



physical



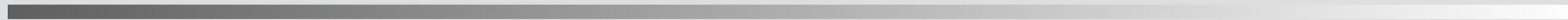
linguistic



conceptual

concrete

abstract



physical
level

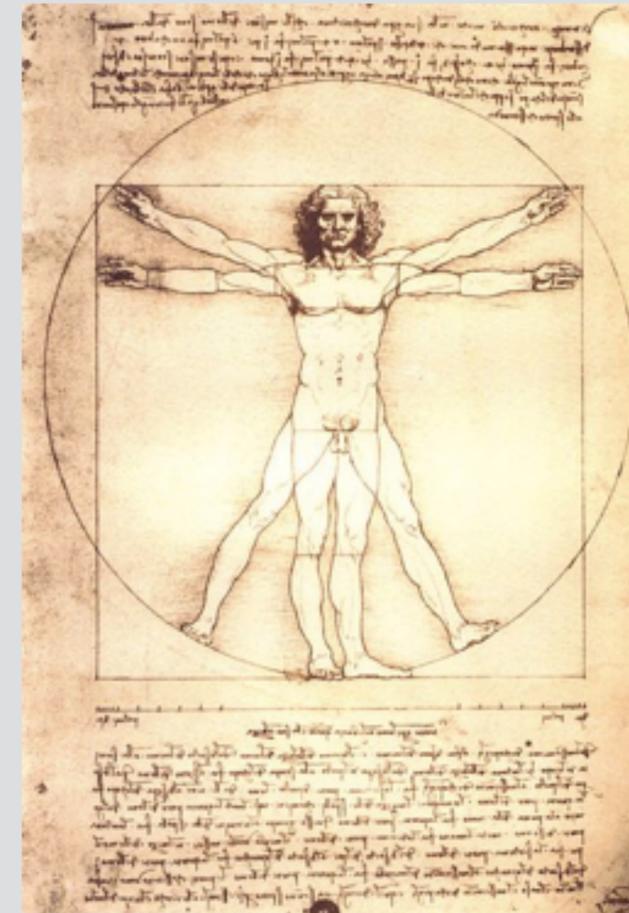
concerns of the physical level



design of interface

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

touch, sight, sound

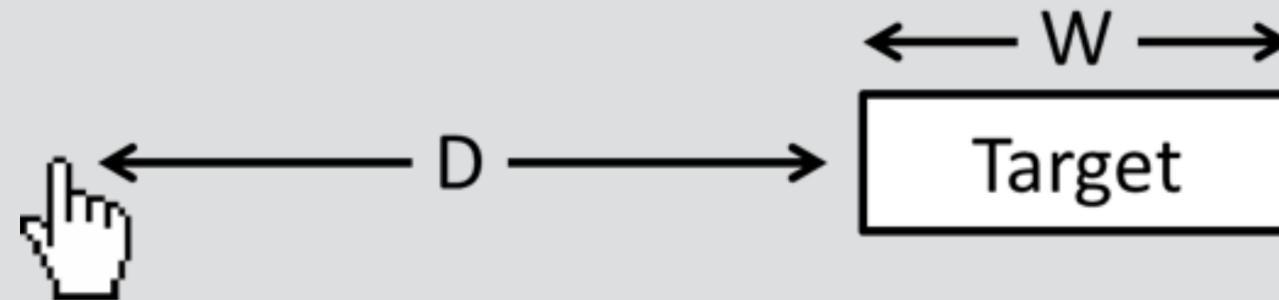


human characteristics

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

fitts's law

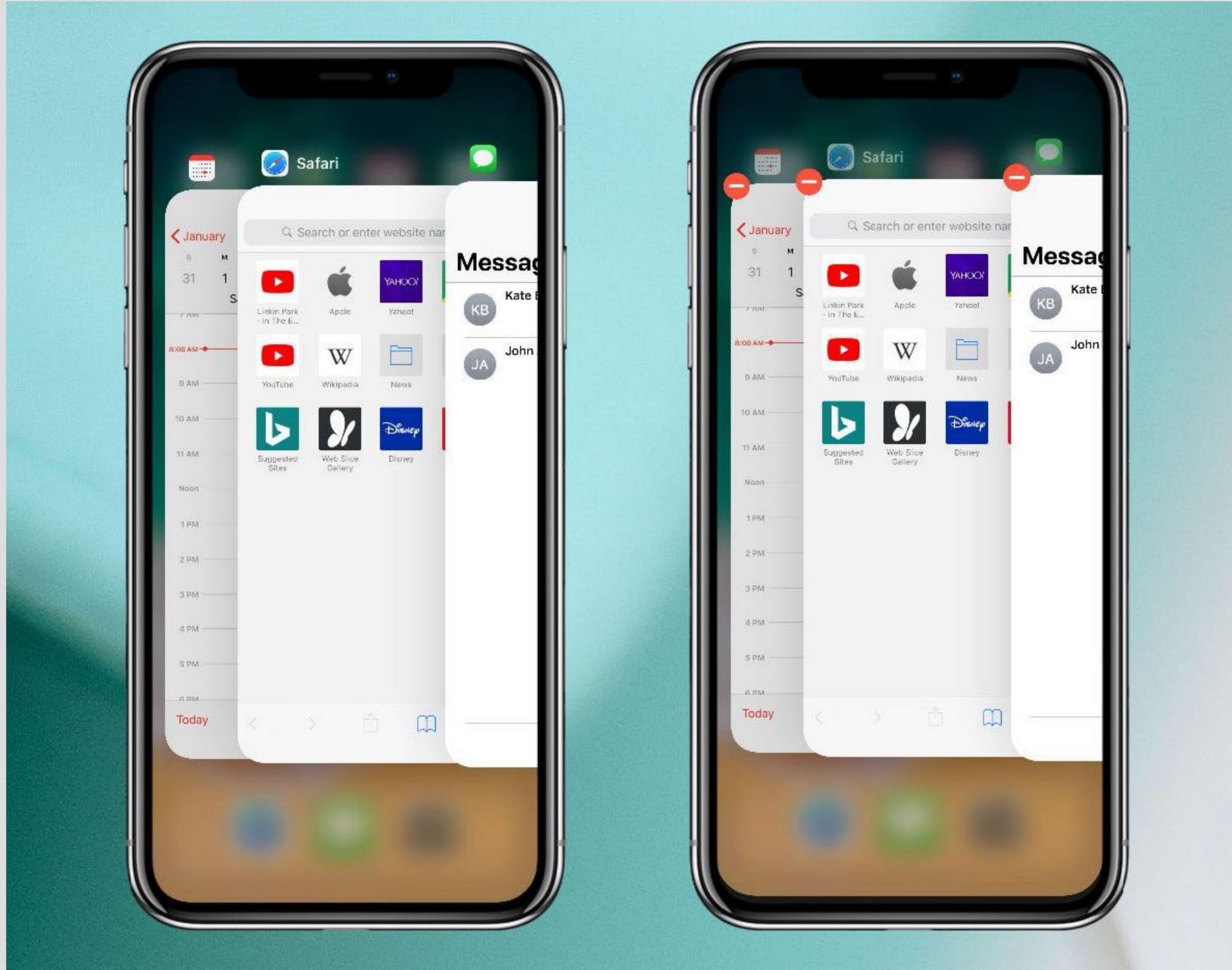
heuristic
make features
close & large



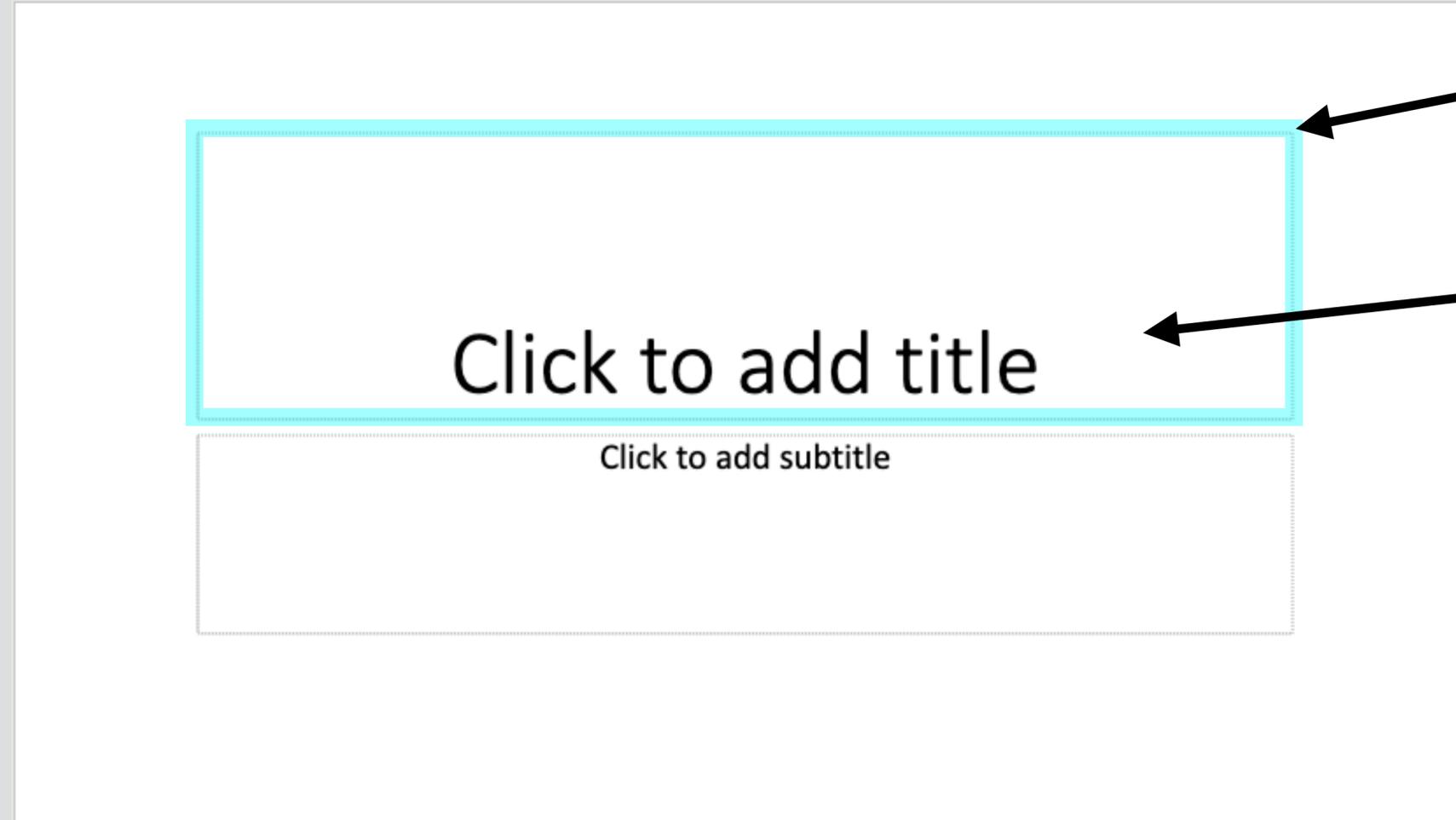
time to move to target $T = a + b \cdot \log(D/W + 1)$
reaction time a is fixed
moving time depends on 'index of difficulty' D/W

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

example: closing app on iPhone



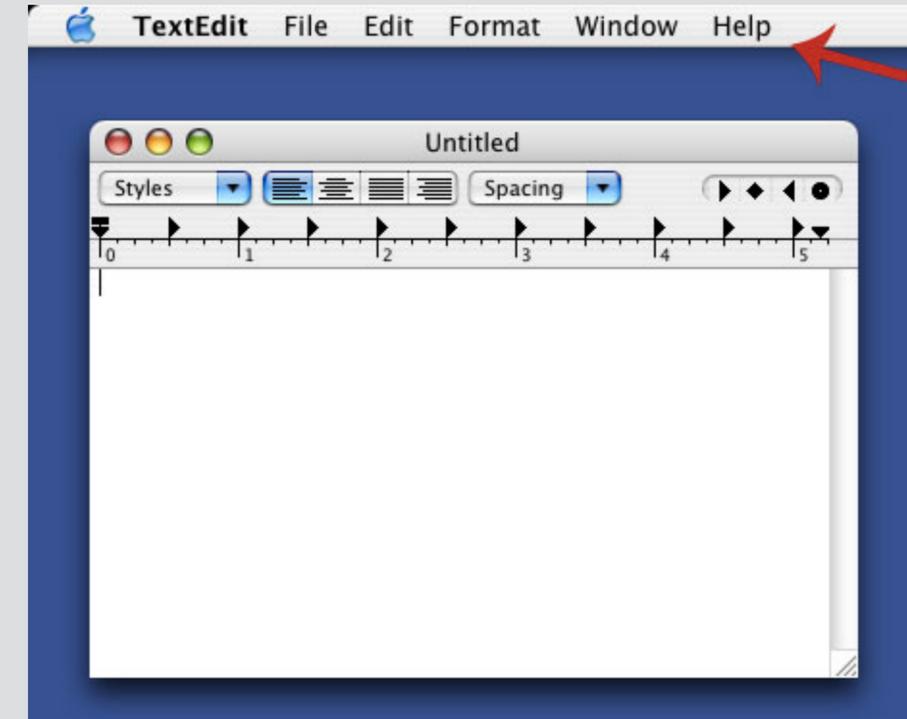
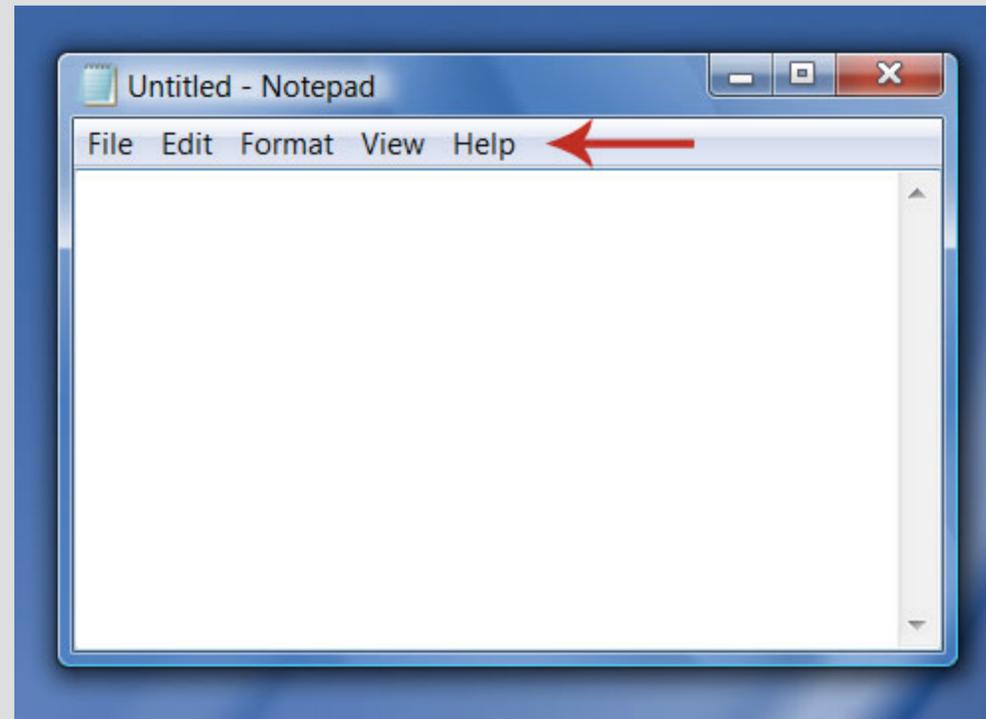
example: powerpoint selection



click here to
select box

click anywhere in
here to edit text

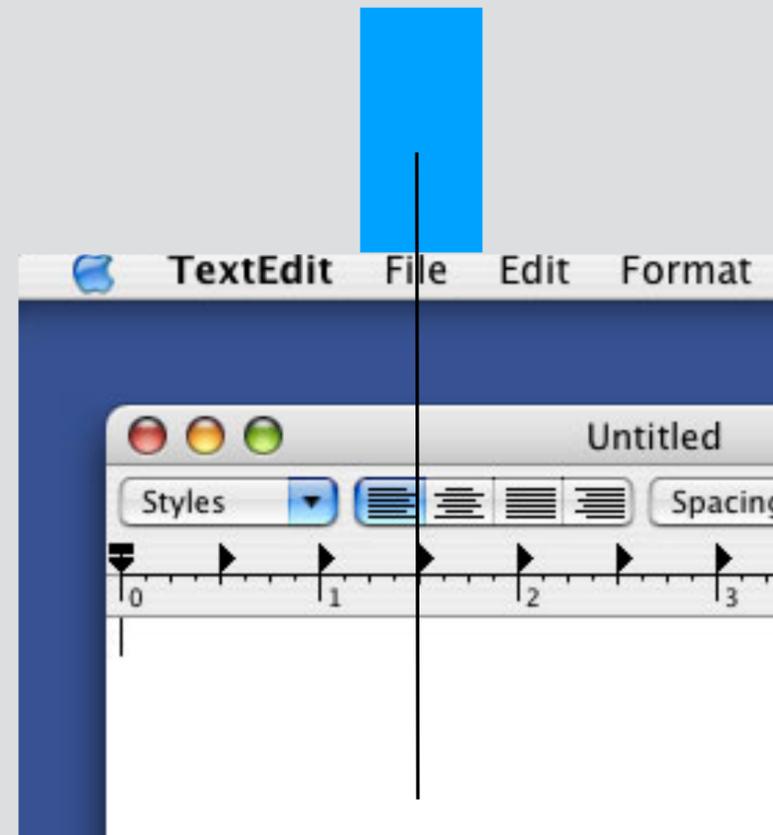
discussion: windows vs mac



“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?

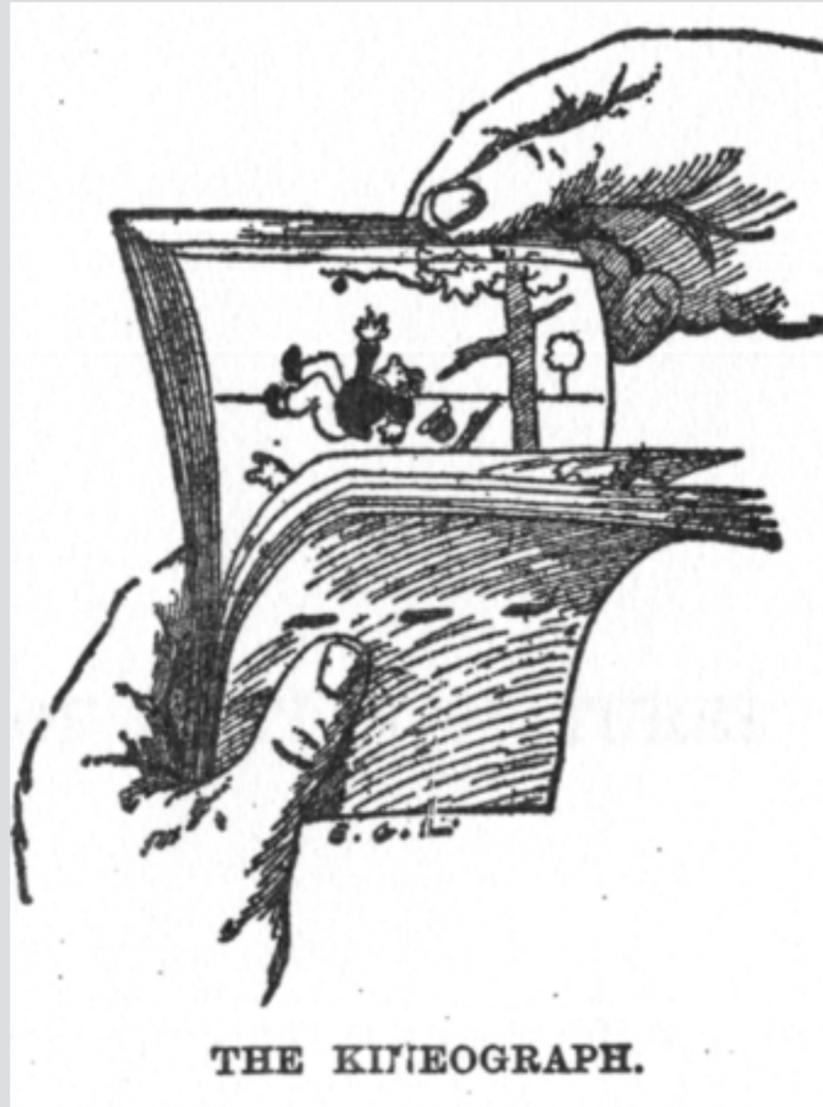
applying fitt: windows vs mac



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

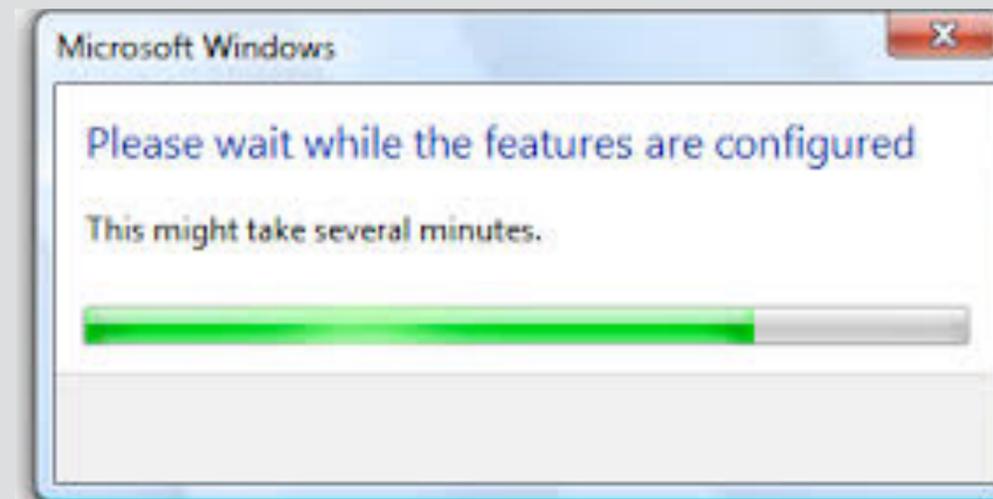
perceptual fusion

heuristics
avoid delays > 0.1s
for longer, show progress



an early flipbook

stimuli within 100ms are fused
less than this feels instantaneous



progress bar

gestalt principles of grouping

username
password

username
password

USER
password

heuristic
use visual layout
to convey structure

example: Massachusetts tax payments site

<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

The screenshot shows the Google Groups interface for the 'alloytools' group. At the top, there is a search bar and navigation buttons: 'NEW TOPIC', a refresh icon, 'Mark all as read', 'Actions', and 'Filters'. The left sidebar contains navigation options: 'My groups' (Home, Starred), 'Favorites' (with a yellow callout box), and 'Recently viewed' (listing 'Alloy Board', 'alloytools', 'tlaplus', 'Mongoose Node.JS ODM', and 'microsoft.public.mac.office.word'). The main content area shows the group header 'alloytools Shared privately' with '14 of 14 topics (11 unread)'. Below is a welcome message and a group image. A list of topics follows, with the first topic 'What is a deterministic state machine? (4)' having a checked checkbox. The 'Actions' button and the checked checkbox are both highlighted with blue circles, and a line connects them.

Google

Search for messages

Groups

NEW TOPIC

Mark all as read

Actions

Filters

My groups

Home

Starred

▼ Favorites

Click on a group's star icon to add it to your favorites

▼ Recently viewed

Alloy Board

alloytools

tlaplus

Mongoose Node.JS ODM

microsoft.public.mac.office.word

▶ Recently posted to

Privacy - Terms of Service

alloytools Shared privately

14 of 14 topics (11 unread) ☆

Welcome to the Alloytools discussion group.

The purpose of this group is to discuss Alloy development and promoting Alloy.

alloy

Edit welcome message Clear welcome message

☆ What is a deterministic state machine? (4)

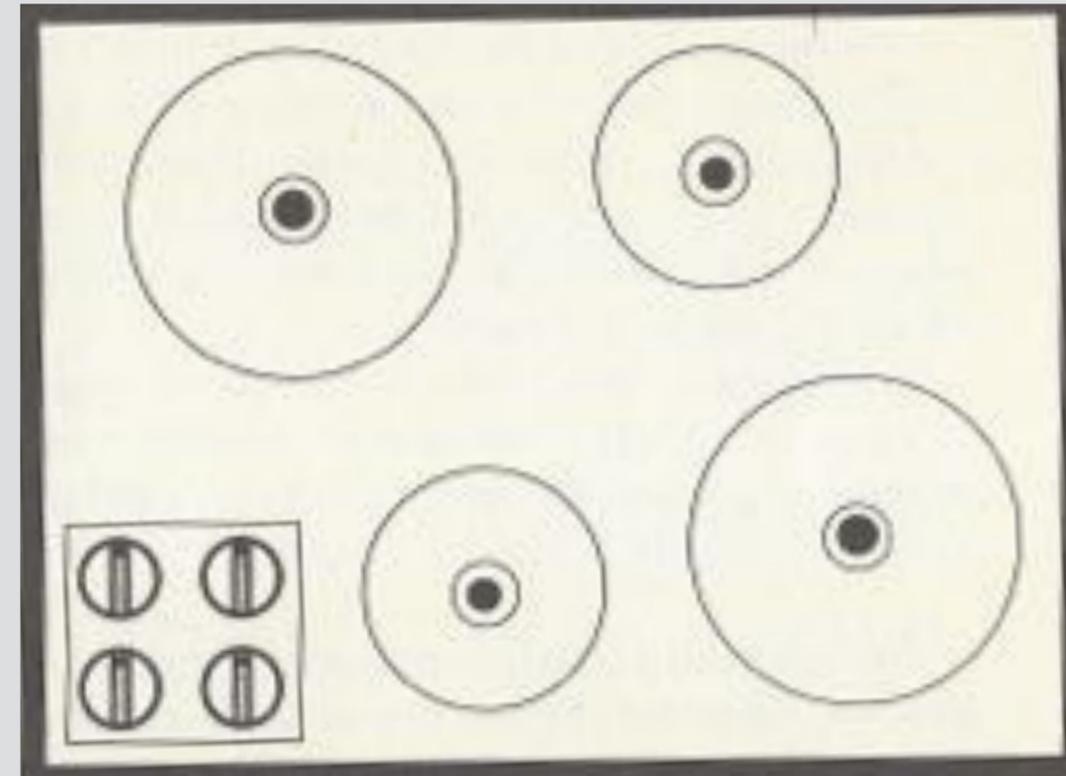
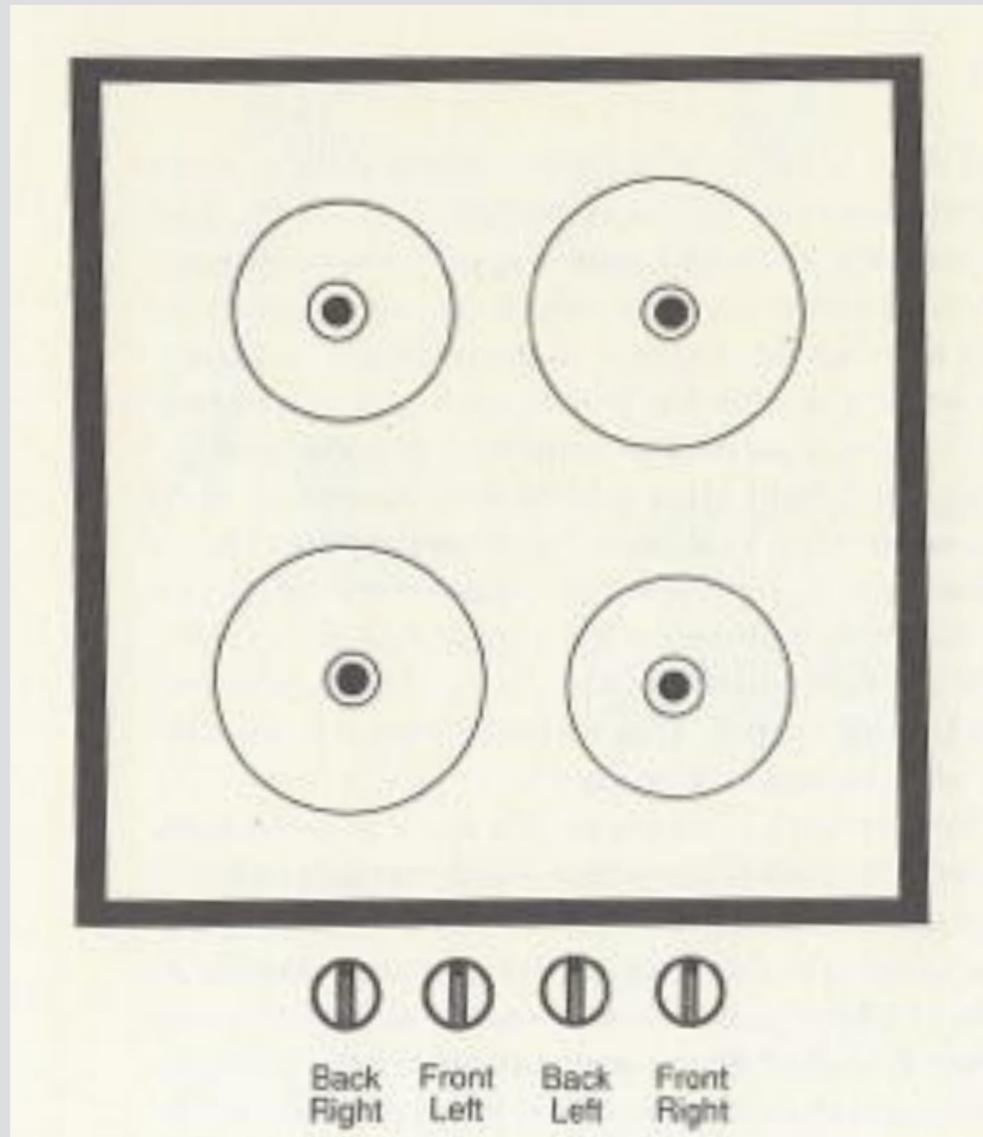
☆ ABZ 2018 call for contributions (1)

☆ Alloy grammar (4)

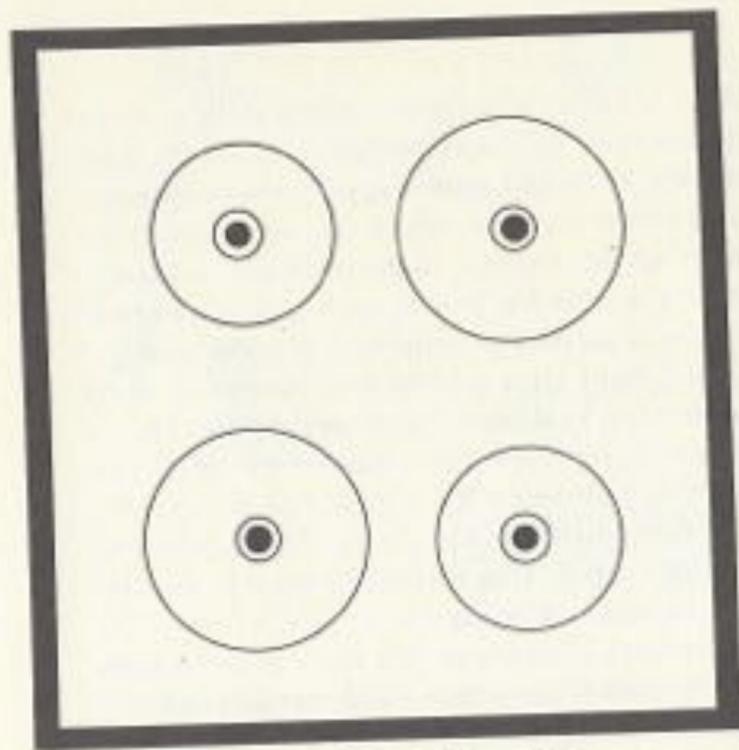
☆ When, What, Why of Alloy models (1)

mapping

heuristic
make layout consistent
with function



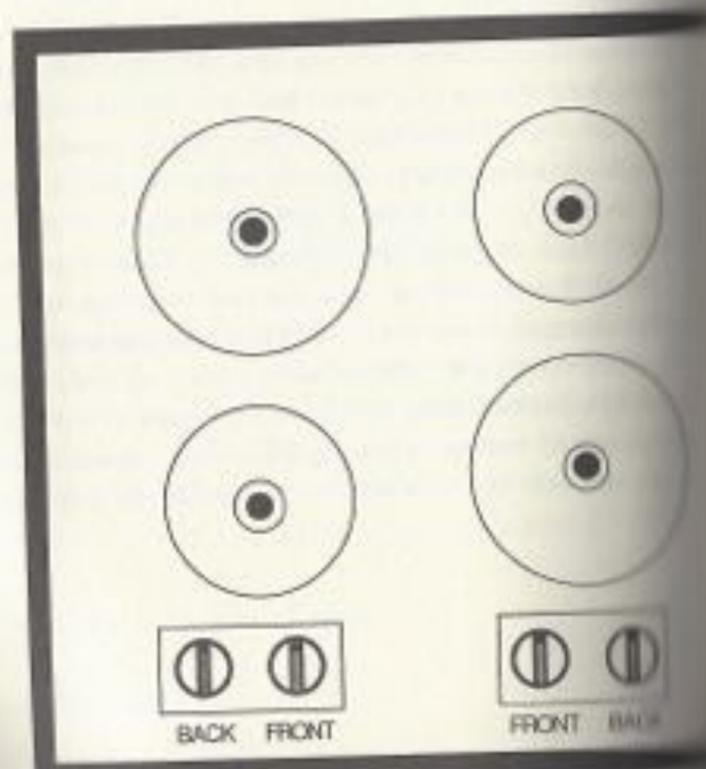
from: Donald Norman, The Design of Everyday Things







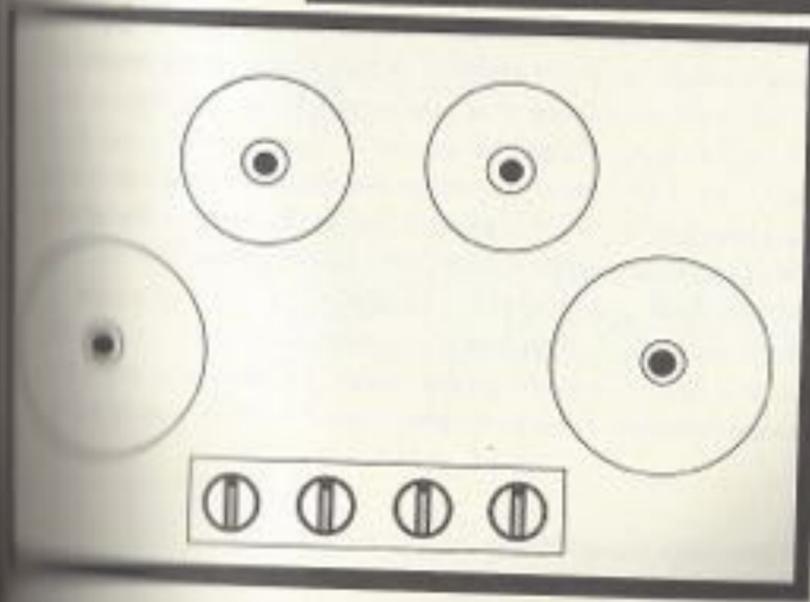
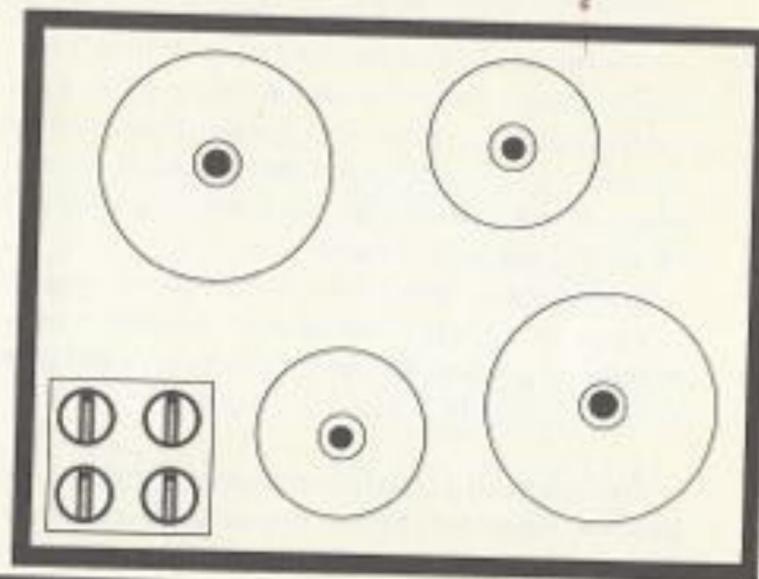
 Back Right Front Left Back Left Front Right



3.3 Arbitrary Arrangement of Stove Controls (top of opposite page). Couple the usual rectangular arrangement of burners with this arbitrary row of controls, and there is trouble: which control goes with which burner? You don't know unless the controls are labeled. The memory load for this arrangement is high: there are twenty-four possible arrangements, and you have to remember which of the twenty-four this one is. Fortunately, the controls are seldom arranged quite this arbitrarily.

3.4 Paired Stove Controls (bottom of opposite page). This is the type of partial mapping of controls to burners in common use today. The two controls on the left work the left burners, and the two controls on the right work the right burners. Now there are only four possible arrangements (two for each side). Even so, confusion is possible (and, I can assure you, it occurs often).

3.5 Full Natural Mapping of Controls and Burners (below). Two of the Possible Ways. There is no ambiguity, no need for learning or remembering, no need for labels. Why can't all stoves be like these?



situational context



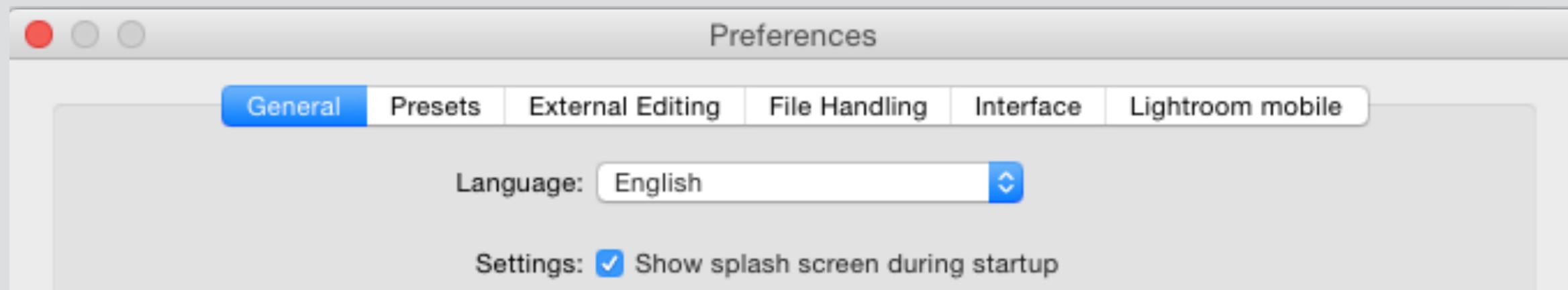
pagination

Library of Congress > Collections > Fine Prints

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

Refined by: Sites and Collection: Fine Prints × Location: Italy ×

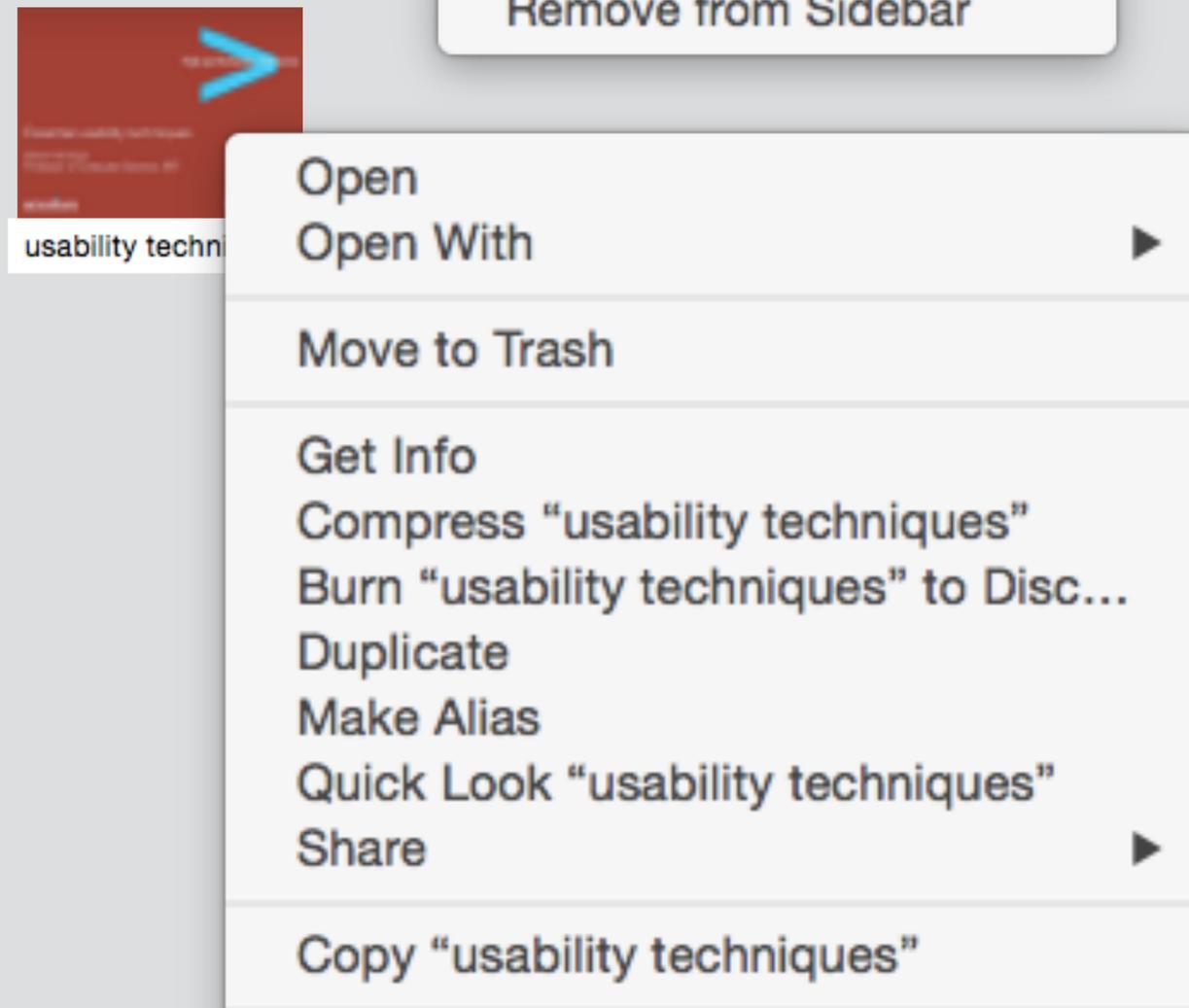
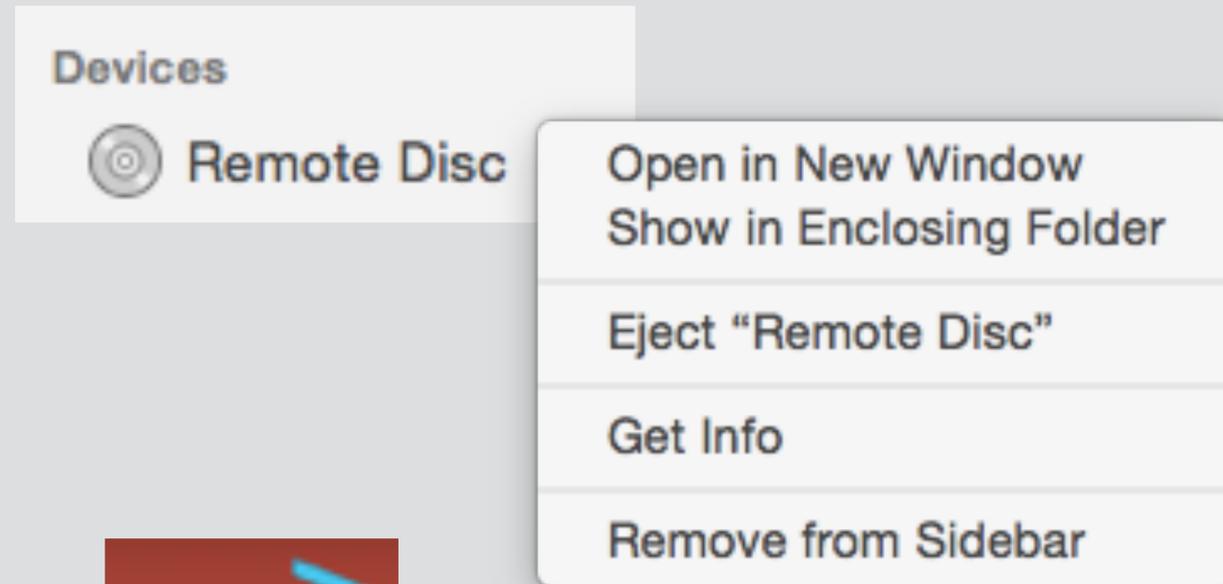
filters from <http://www.loc.gov>



tabs from Adobe Lightroom

heuristic
make user's location
(and state) visible

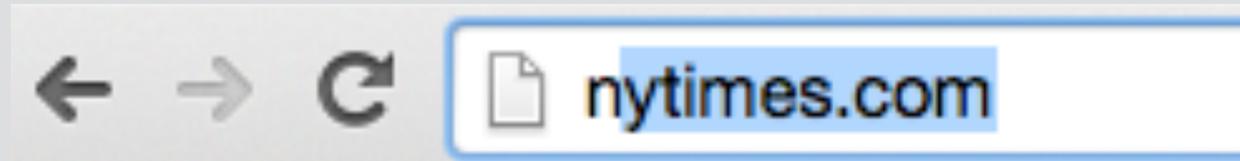
anticipation & context



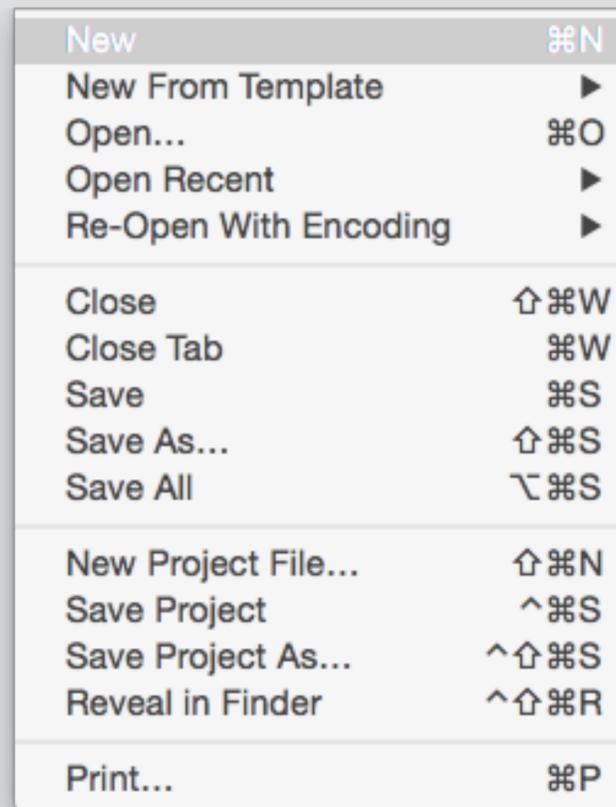
heuristic
put items together that user is expected to need; make available actions appropriate for context

accelerators

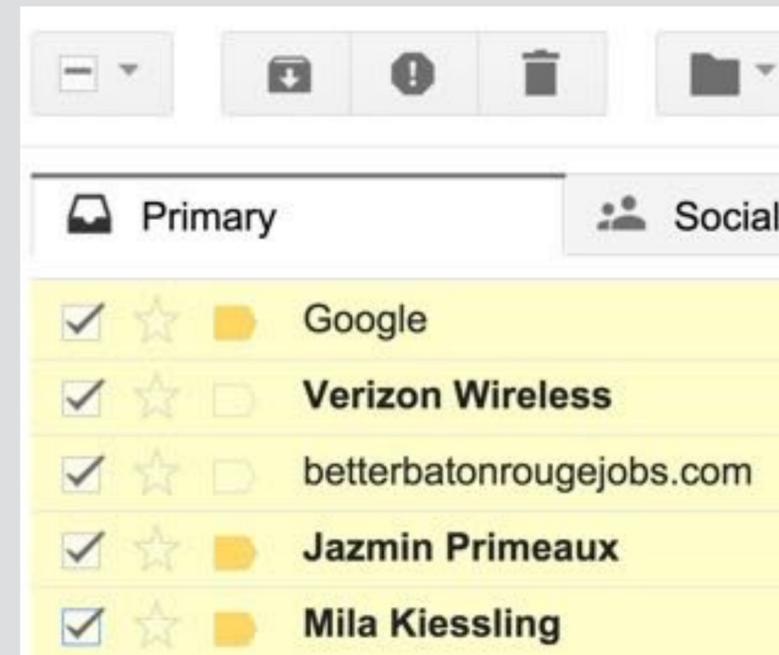
heuristic
provide accelerators for
expert users



Google search bar autocompletion



Textmate shortcuts



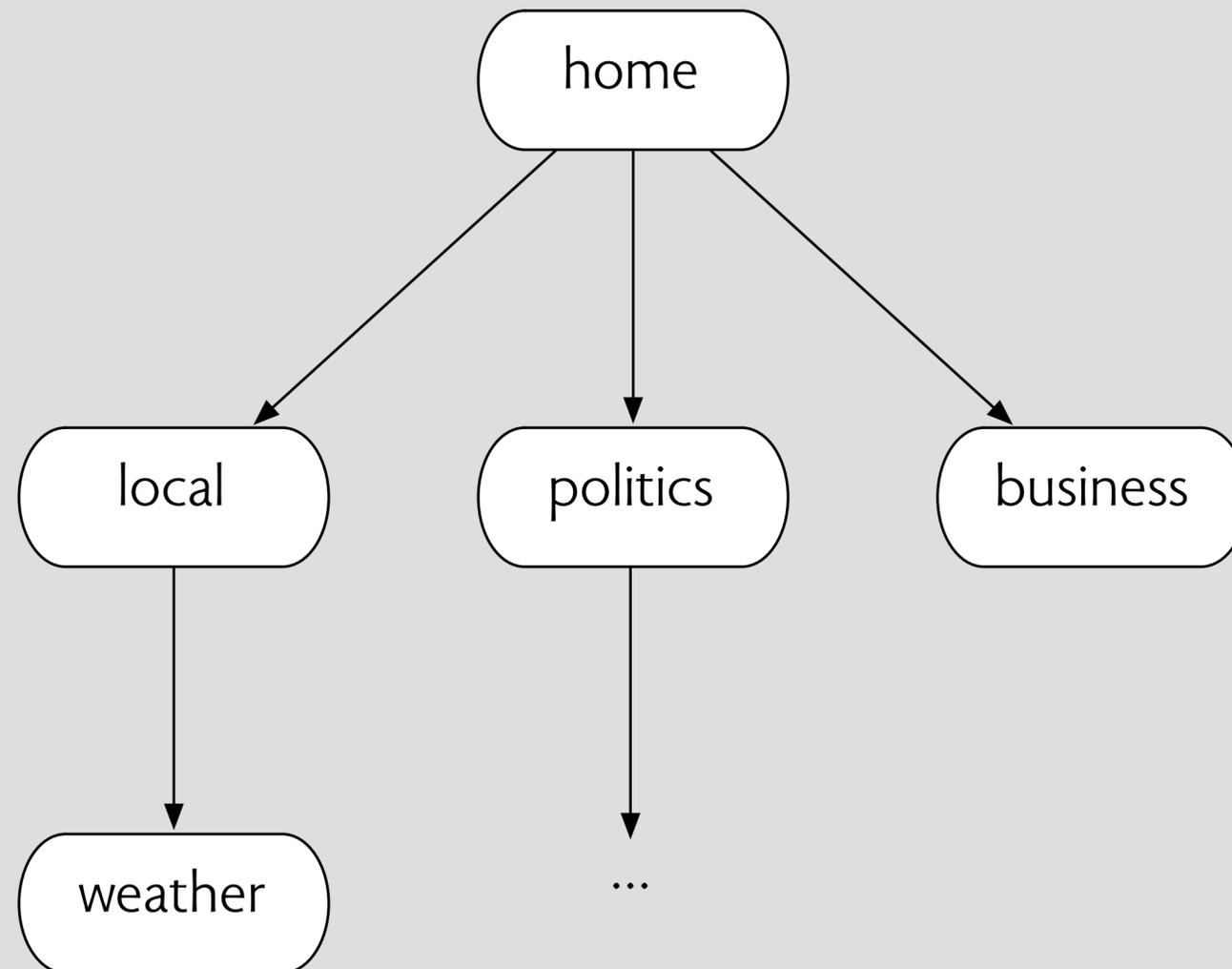
Gmail aggregation

discussion: accelerators

what other accelerators have you used?
which work well? which are learnable?



short paths



heuristic
minimize steps to reach
common functions

The screenshot shows the top section of the New York Times website. At the top left is a search icon and a menu icon. The navigation bar includes links for U.S., INTERNATIONAL, CANADA, ESPAÑOL, and 中文. The main title 'The New York Times' is prominently displayed in the center. To the right, there is a 'PLAY THE CROSSWORD' button and an 'Account' dropdown. Below the title, the date 'Monday, October 19, 2020' is shown on the left, and 'Today's Paper' is on the right. A secondary navigation bar lists various sections: World, U.S., Politics, N.Y., Business, Opinion, Tech, Science, Health, Sports, Arts, Books, Style, Food, Travel, Magazine, T Magazine, Real Estate, and Video. At the bottom, there are four promotional tiles: 'The Morning' with a yellow circle, 'Listen to 'The Field'' with a hand icon, 'Neediest Cases Fund' with a hand icon, and a weather forecast for Newtonville, MA showing 56°F, 63°, and 49°.

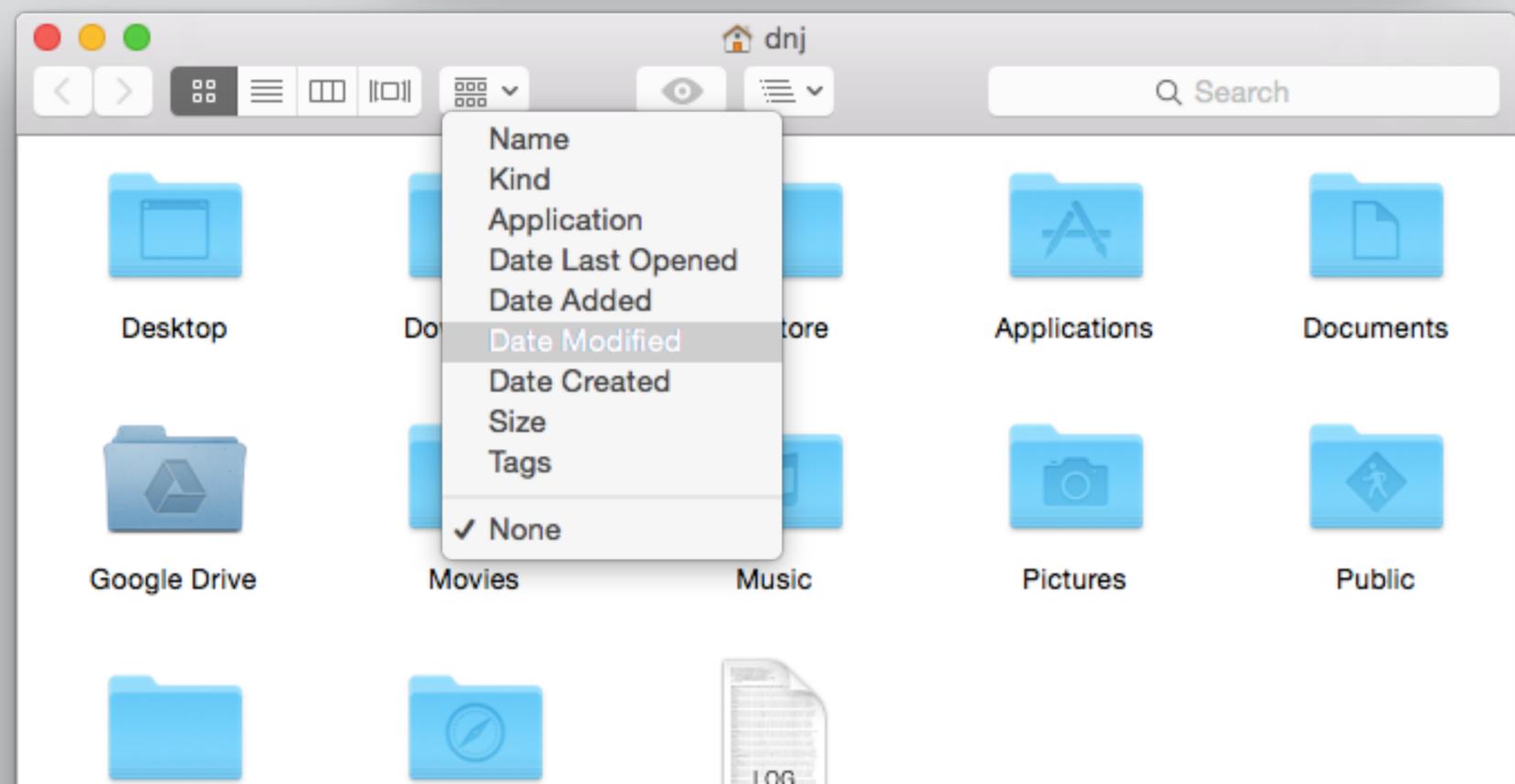
New York Times: weather on front page

recognition vs. recall

```
Terminal — tcsh — 65x17
[bravo:~] dnj% ls -lt
total 50312
drwx----- 15 dnj  501      510 Jul 10 16:22 Desktop
drwx-----  5 dnj  501      170 Jul 10 16:15 Documents
-rw-----  1 dnj  501 25756205 Jul 10 12:00 unison.log
drwx----- 10 dnj  501      340 Jul  6 17:49 Downloads
drwxr-xr-x  6 dnj  501      204 Jun 28 12:12 Pictures
drwx--x--x 27 dnj  501      918 Jun 22 17:48 Filestore
drwx-----@ 56 dnj  501    1904 Apr 16 22:36 Library
drwx----- 21 dnj  501      714 Mar 25 16:09 Repositories
drwx-----@  8 dnj  501      272 Mar 11  2014 Google Drive
drwx-----  6 dnj  501      204 Feb 22  2013 Music
drwxr-xr-x  2 dnj  501      68 Jan 11  2013 Applications
drwx-----  5 dnj  501      170 Jan 10  2013 Movies
drwxr-xr-x+  3 dnj  staff  102 Jan 10  2013 Sites
drwxr-xr-x  5 dnj  501      170 Dec  3  2012 Public
[bravo:~] dnj%
```

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

names matter

MY MEETINGS ⊕

My Personal Meeting

Meeting ID: 973 8730 4444

CSAIL Seminar

Host: Daniela Rus

Meeting ID: 973 1234 0095

MY UPCOMING EVENTS ⊕

Wed, Oct 12

Meeting with Arvind

8:00 PM - 8:30 PM

Host: Arvind Satyanarayan

Meeting ID: 973 8730 6219

6.1040 Lecture

2:30 PM - 4:00 PM

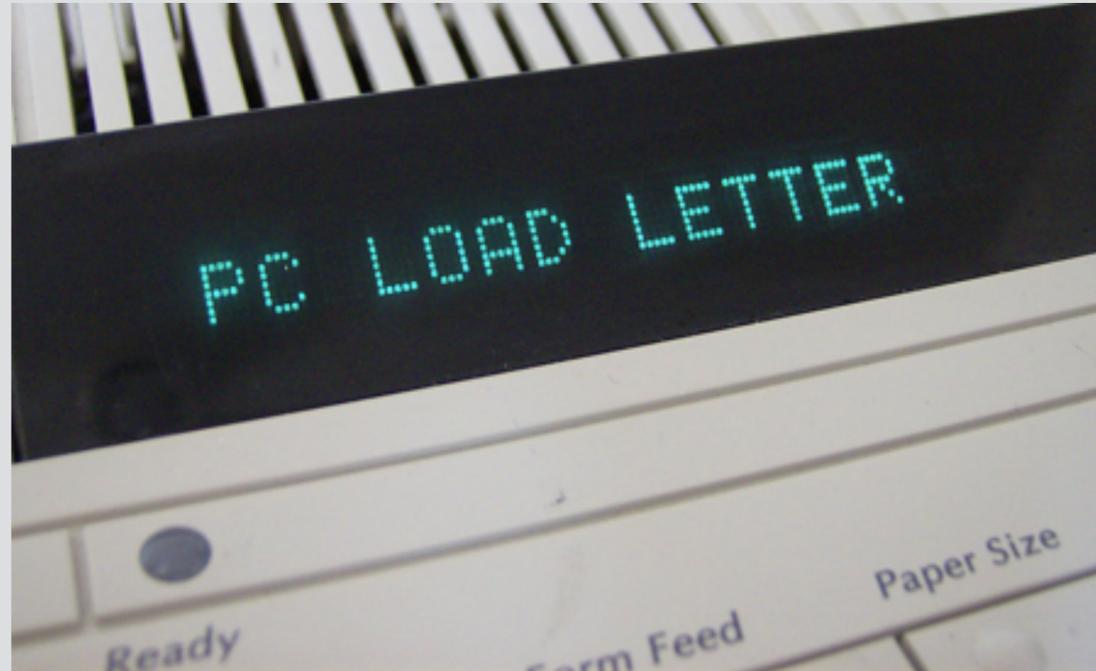
Host: Daniel Jackson

Meeting ID: 973 8730 6220

heuristics

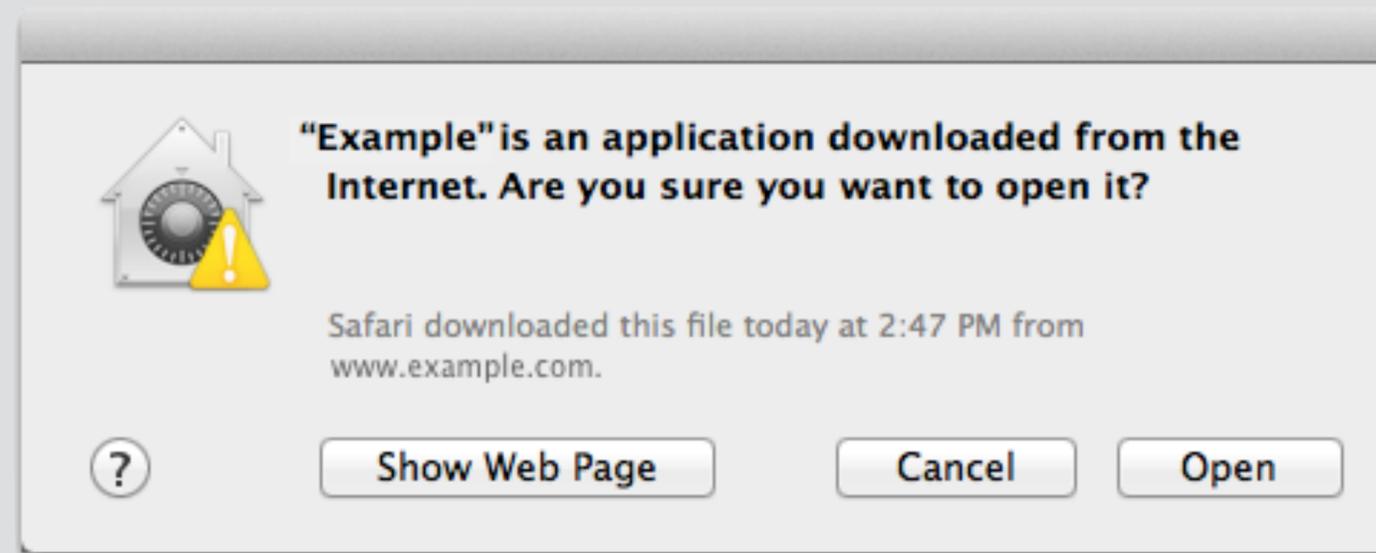
pick names for concepts
& actions carefully!

Speak the user's language



infamous HP printer error

heuristics
use simple terms
word very carefully
never blame the user



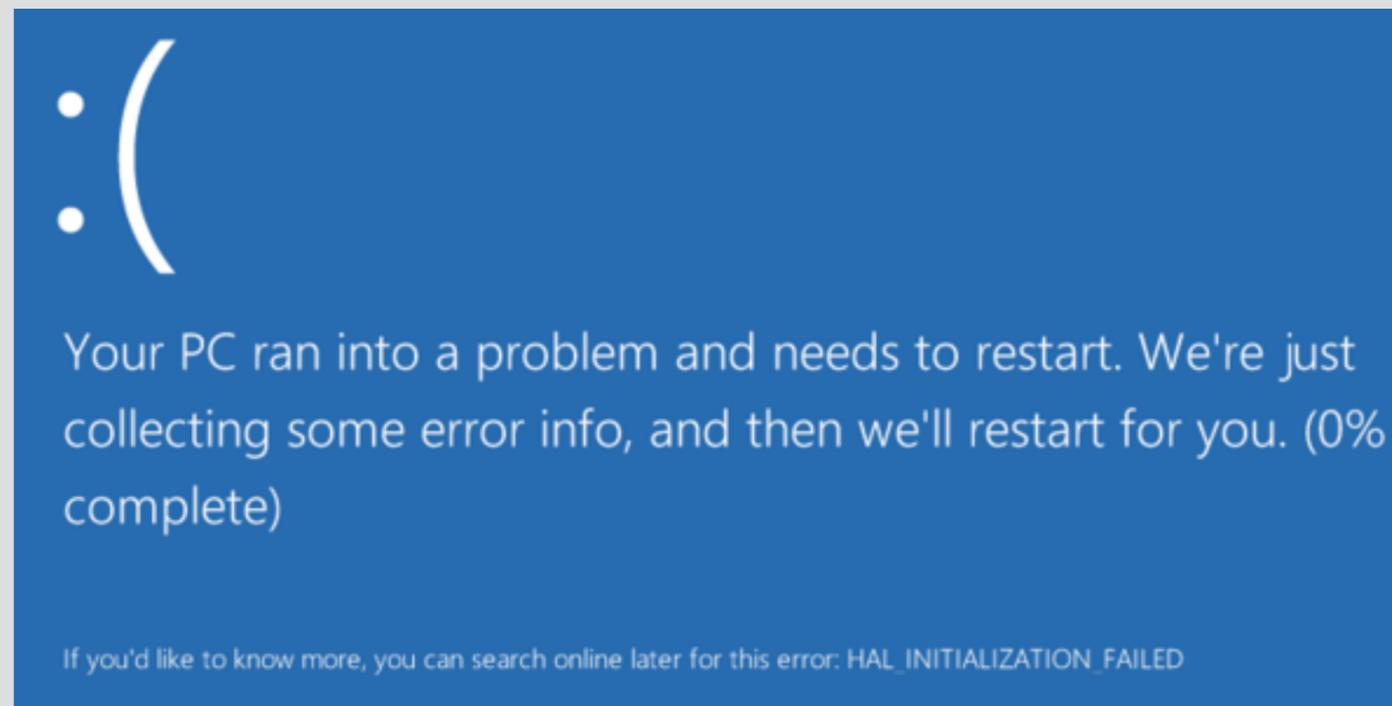
a helpful and informative message

crash messages

A black rectangular box with red monospaced text. The text reads: "Software Failure. Press left mouse button to continue." followed by "Guru Meditation #00000004.0000AAC0" on the next line.

Software Failure. Press left mouse button to continue.
Guru Meditation #00000004.0000AAC0

Commodore Amiga crash

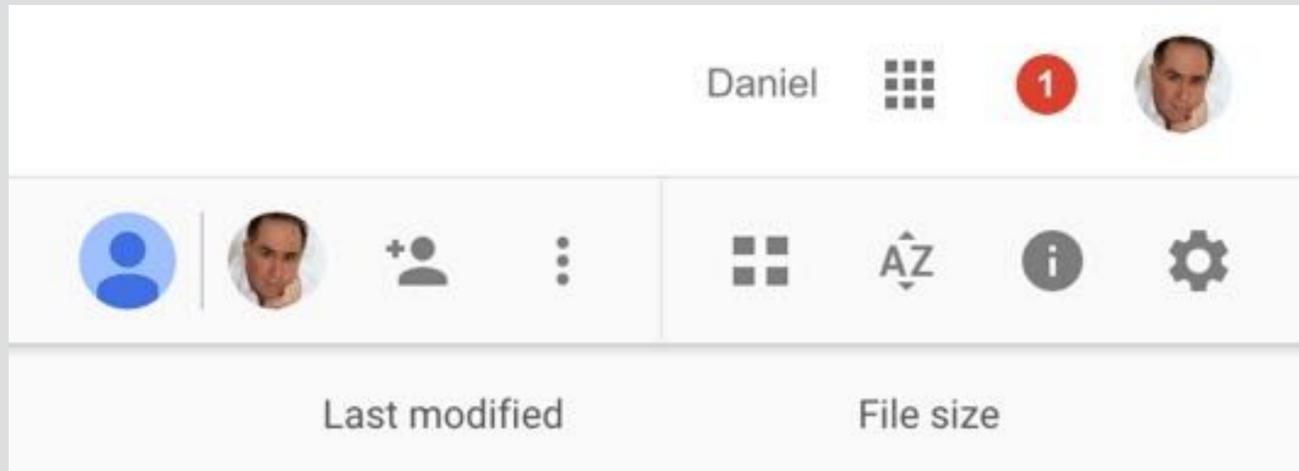


Windows blue screen of death

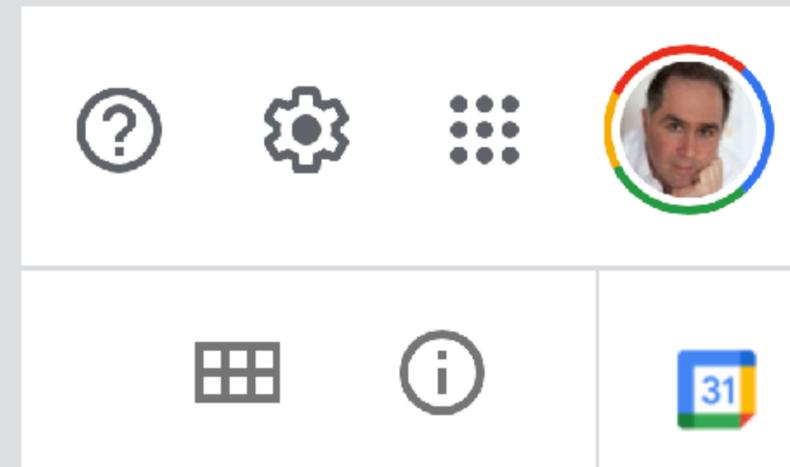


early Apple Macintosh crash

consistent naming & icons

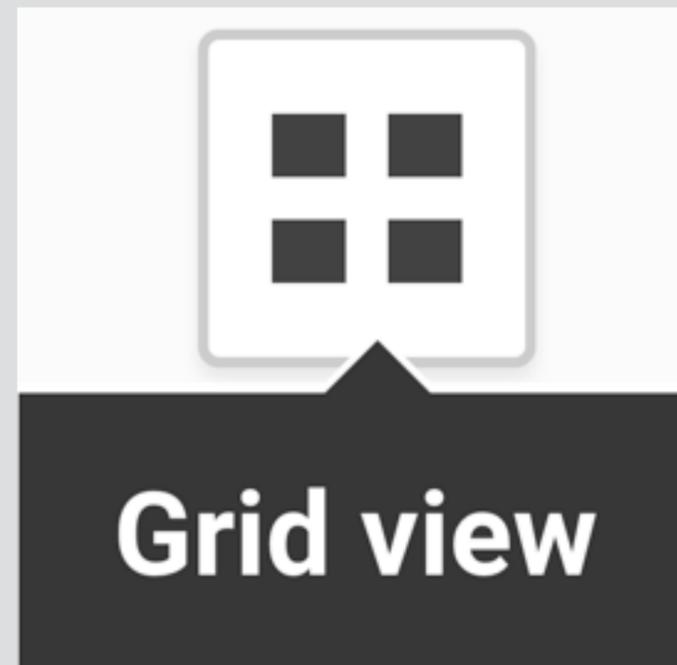
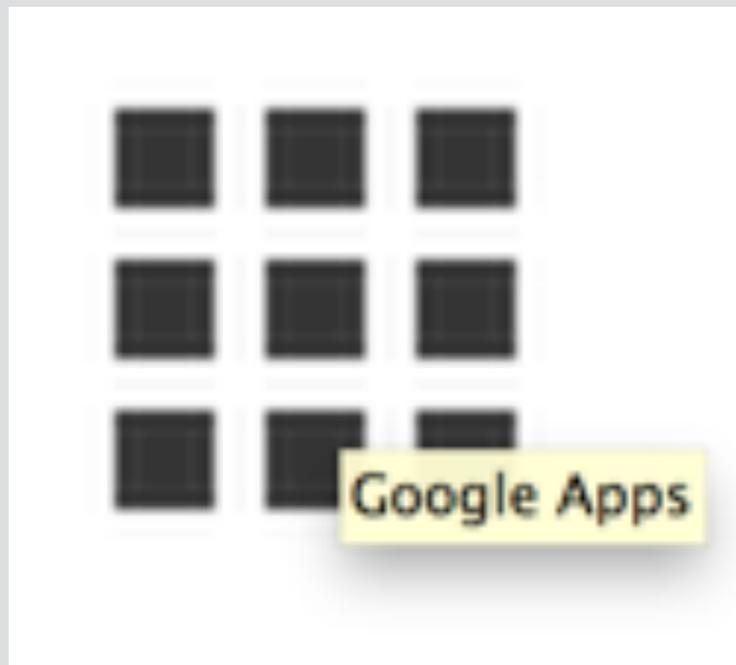


icons shown in Google Drive, c. 2020



2022

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



consistency
across
application,
platform,
domain

cross-platform consistency

lesson
beware of violating conventions

Chrome

About

History

Extensions

Settings

About



Google Chrome
A web browser built for speed, simplicity, and security

Get help with using Chrome

Report an issue

Version 43.0.2357.130 (64-bit)

Nearly up-to-date! Relaunch Google Chrome to finish updating.

Set Up Automatic Updates for All Users

Relaunch

why is 'History' greyed out?



Settings

Search settings

- You and Google
- Autofill
- Privacy and security
- Appearance**
- Search engine
- Default browser
- On startup

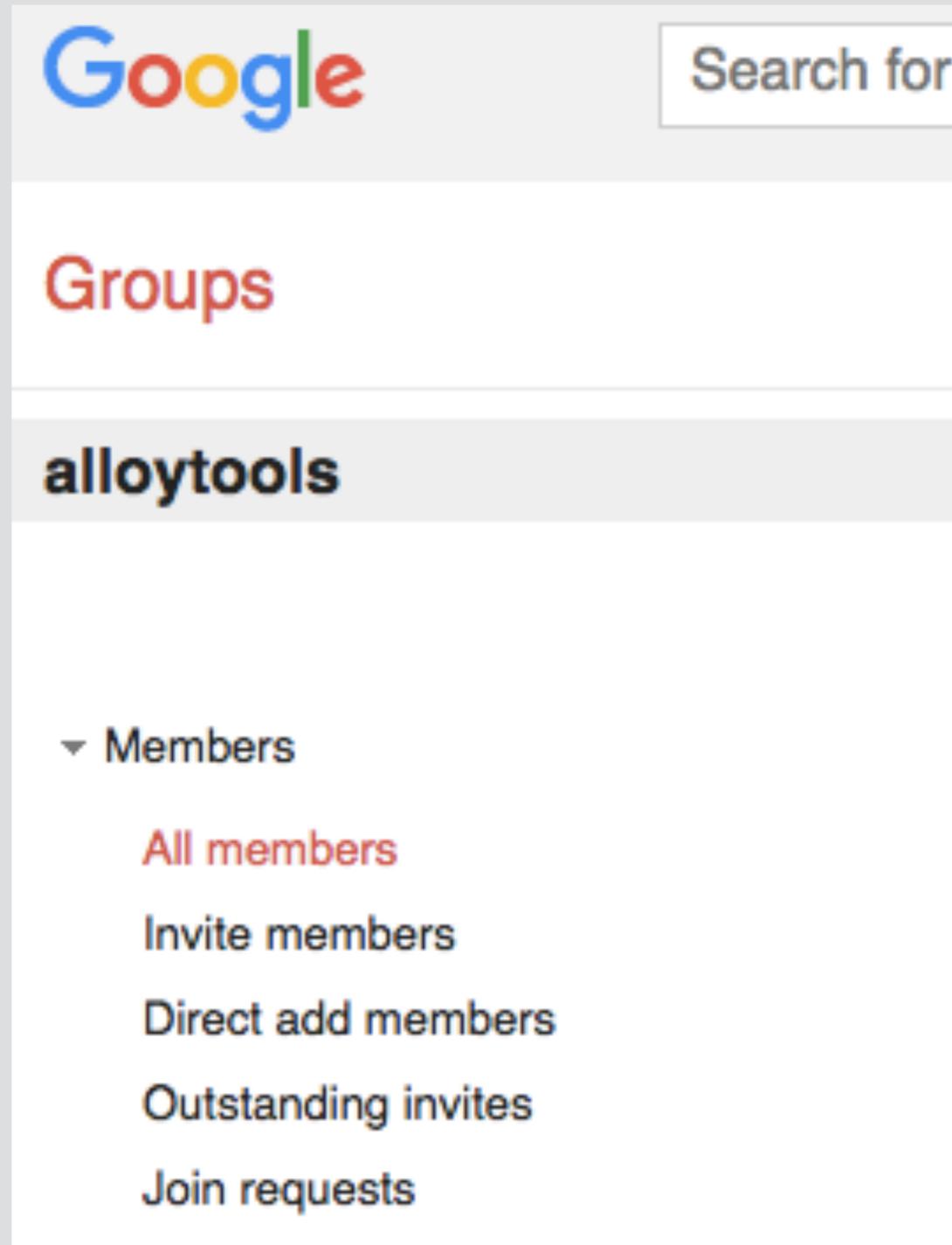
- Languages
- Downloads
- Accessibility
- System
- Reset settings

- Extensions
- About Chrome

Appearance

Theme	Open Chrome Web Store
Show home button	Disabled <input type="checkbox"/>
Show bookmarks bar	<input type="checkbox"/>
Font size	Medium (Recommended) ▼
Customize fonts	▶
Page zoom	100% ▼
Pressing Tab on a webpage highlights links, as well as form fields	<input checked="" type="checkbox"/>
Show warning before quitting with ⌘Q	<input checked="" type="checkbox"/>

parts of speech



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

information scent

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

heuristic
use 'scent' to aid
information 'foraging'

has Apple
gone rogue?

invisible controls

★ Daniel Jackson <dnj@mit.edu> 
To: Daniel Jackson <dnj@csail.mit.edu>
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April 11, 2014 5:39 PM
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In the Beginning was the
Command Line.pdf

- Save All (967 KB)...
-  In the Beginning was the Command Line.pdf
- Quick Look

about about



ambivalent scrollbars

The image shows a screenshot of a web browser displaying a New York Times article. The browser's address bar shows the URL: www.nytimes.com/2014/04/11/arts/design/in-lost-kingdoms-national-treasures-from-asian-countries.html?ref=arts. The page features the New York Times logo and navigation links like 'SECTIONS', 'HOME', and 'SEARCH'. A horizontal menu of article teasers is visible, including 'Gathering of Gods From Places Long Forgotten', 'Minimalist Show, Minimally Revised', and 'Michael Lewis: By the Book'. A large black banner with the 'CNN go there' logo is positioned below the menu. The main article title is 'Gathering of Gods From Places Long Forgotten' with the subtitle 'In 'Lost Kingdoms,' National Treasures From Asian Countries'. The author is listed as 'By HOLLAND COTTER' and the date as 'APRIL 10, 2014'. The article's main image shows ancient stone carvings. A vertical scrollbar is located on the right side of the page, and a 'CNN go there' banner is overlaid on the right side of the article image.

In "Lost Kingdoms," Nation: x

www.nytimes.com/2014/04/11/arts/design/in-lost-kingdoms-national-treasures-from-asian-countries.html?ref=arts

SECTIONS HOME SEARCH

The New York Times TRY TIMES PREMIER dnjackson0

ART REVIEW **Gathering of Gods From Places Long Forgotten**

ART REVIEW Minimalist Show, Minimally Revised

INSIDE ART An Auctioneer Comes Back to the Business

Michael Lewis: By the Book

BOOK And

CNN go there

ART & DESIGN | ART REVIEW

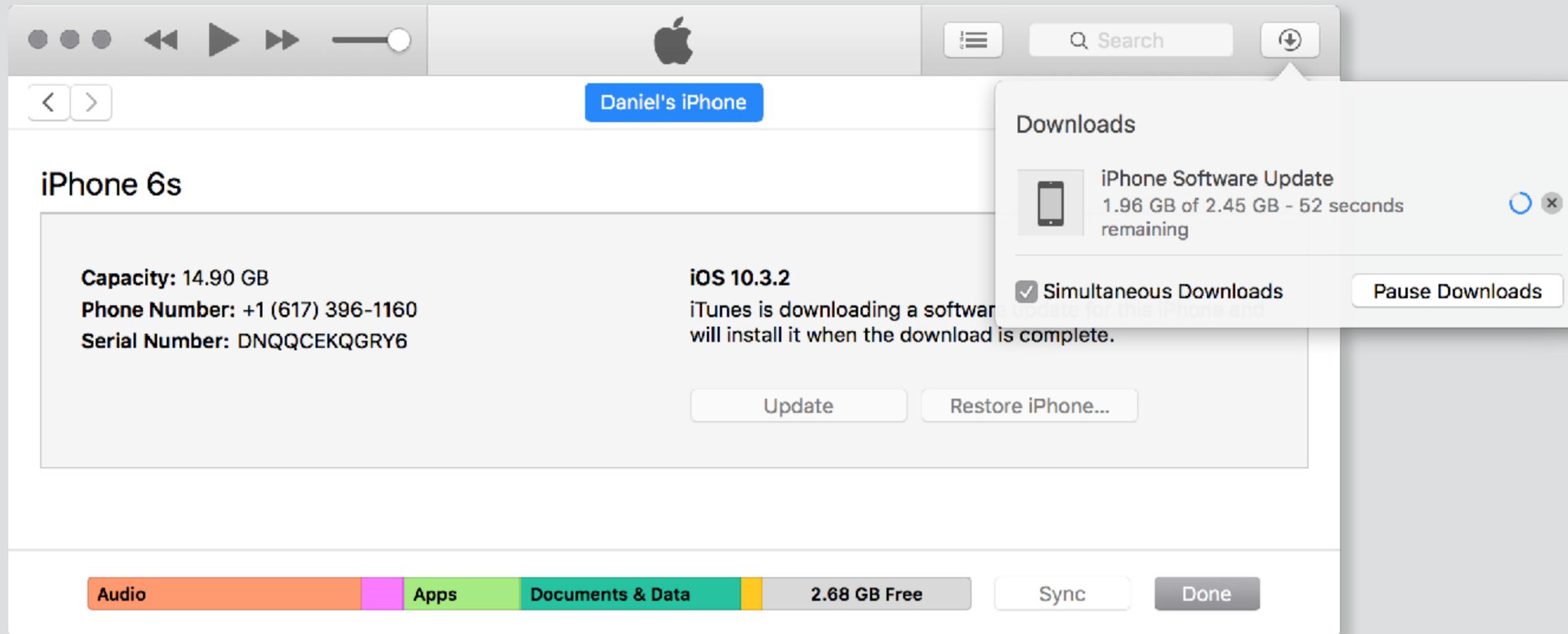
Gathering of Gods From Places Long Forgotten

In 'Lost Kingdoms,' National Treasures From Asian Countries

By HOLLAND COTTER APRIL 10, 2014

CNN go there

what are you waiting for?



11.10.15

How Apple Is Giving Design A Bad Name

For years, Apple followed user-centered design principles. Then something went wrong.



BY DON NORMAN AND BRUCE TOGNAZZINI LONG READ

<https://www.fastcodesign.com/3053406/how-apple-is-giving-design-a-bad-name>

**let's evaluate
some websites!**

YALE SCHOOL OF ART

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- About the School
- Apply to the School
- Exhibitions
- Publications
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- Public Events

Pause animations ||

This website exists as an ongoing collaborative experiment in digital publishing and information sharing. Because this website functions as a wiki, all members of the School of Art community—graduate students, faculty, staff, and alumni—have the ability to add new content and pages, and to edit most of the site's existing content.

Content is the property of its various authors. When you contribute to this site, you agree to abide by Yale University academic and network use policy, and to act as a responsible member of our community.

The Yale School of Art is a **graduate school** that confers MFAs in Graphic Design, Painting/Printmaking, Photography, and Sculpture; and offers undergraduate-level art courses to Yale College students. Our website exists as an **ongoing collaborative experiment** in digital publishing and information sharing. It functions as a wiki—all members of the School of Art community have the ability to add new, and edit most existing content.

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HAPPENING AT SOA

Fall 2022 Visiting Artist lectures are underway! [Find the schedule + posters here >](#)

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Page history

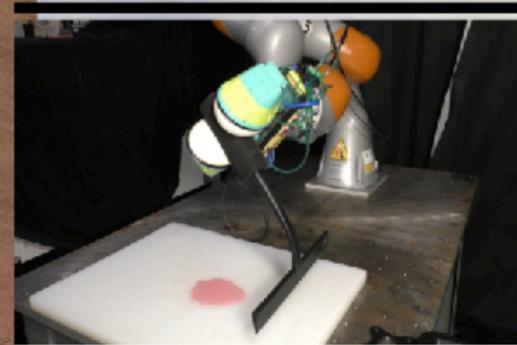


Robotics

[40 People](#), [54 Projects](#), [9 Groups](#)



MIT system “sees” the inner structure of the body during physical rehab



Soft robots that grip with the right amount of force

AI & ML

[122 People](#), [68 Projects](#), [24 Groups](#)



AI system makes models like DALL-E 2 more creative



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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 = clobber

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

mv = move

```
$ ls  
f1.c f2.c ... f1.o f2.o ...  
$ rm *>o  
$ ls
```

*look at where >
is on keyboard*

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

*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	