conceptual design of software
approaches to improving design
optimize organization & task structure
Taylor (1880s), Toyota JIT (1980s), CMM (1990s), agile (2000s)
“new” activities

- brainstorming
- user studies
- prototypes
Dieter Rams, 1958
pocket transistor radio T3

Henry Hobson Richardson, 1877
Trinity Church, Boston

Alfonso Bialetti, 1933
La Moka coffee maker

Leica, 1953
M3 rangefinder camera
broadening

anthropology

psychology

art

economics
seeking the essence
### designer vs engineer

<table>
<thead>
<tr>
<th></th>
<th>designer</th>
<th>engineer</th>
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<tbody>
<tr>
<td>building</td>
<td>facade, entry flow, access, light</td>
<td>beam, wall structural integrity</td>
</tr>
<tr>
<td>software</td>
<td>purpose, concept fitness for purpose</td>
<td>function, datatype decoupling, localization</td>
</tr>
</tbody>
</table>
concepts & software
what characterizes an app?

concepts!

Apple Mail
- EmailAddress
- Message
- Folder or Label

Microsoft Word
- Paragraph
- Format
- Style

Twitter
- Tweet
- Hashtag
- Following

Photoshop
- PixelMap
- Layer/Mask
- Adjustment
concepts differentiate classes

- text editor
  - line, buffer, character set

- word processor
  - paragraph, format, style

- desktop publishing app
  - text flow, link, page template
where are Word’s concepts from?

Charles Simonyi: brought key concepts to Word from Xerox PARC
rich concepts have long journeys

Ginn & Co, since 1868

Apple Pages, 2005

Microsoft Word, 1983

Bravo, 1974
where do concepts come from?

<table>
<thead>
<tr>
<th>domain concepts: exist in problem domain</th>
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<tbody>
<tr>
<td>photo, movie, song</td>
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<tr>
<td>account, balance</td>
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<tr>
<td>social security number</td>
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<tr>
<td>typeface, ligature</td>
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<tr>
<th>analogic concepts: based on known notions</th>
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<tbody>
<tr>
<td>blog post, email, tweet</td>
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<tr>
<td>desktop, folder, file</td>
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<tr>
<td>layer, mask, stacking</td>
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<tr>
<td>cart, order, item</td>
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<tr>
<th>synthetic concepts: invented for software</th>
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<tbody>
<tr>
<td>friend, follower</td>
</tr>
<tr>
<td>relative reference</td>
</tr>
<tr>
<td>selection, buffer</td>
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<tr>
<td>permission, capability</td>
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</table>
so what exactly is a concept?
a behavioral model

![Diagram showing a model with states and transitions labeled as `ON` and `-ON`, with arrows indicating transitions labeled as `tick`, `toggle(day)`, and `toggle(night)`.]
a conceptual model

on: bool
time: Slot

**schedule:** set Slot

inv on = (time ∈ schedule)
tick ≜ time := next(time)
toggle (s: Slot) ≜
  if s ∉ schedule then schedule := schedule ⊔ {s}
  else schedule := schedule \ {s}
concepts as explanatory state

a concept is part of the internal state modifiable by user actions indirectly affecting the external world

examples

- **style** (Word): affects formatting
- **tag** (Facebook): affects view permission
- **selection** (Finder): affects result of delete, move, etc
concept story

if you use the concept like this, the outcome will be...

“if you change a style’s format, then all paragraphs of that style will change format accordingly”

“if you tag a photo, then all friends of the person tagged will be able to see the photo”

“if you select a file, then pressing delete will move the file to the trash”
exercise:

concepts
what are the key concepts?
what are the key concepts?
what are the key concepts?
purposes
designing for a purpose

- purpose
  - motivates
  - fulfills
- concept
- story
- misfit
an example

if you select an object and delete it, it will be in the trash; if you empty the trash, it’s gone, but if not you can move it out.

if there are many objects in the trash, and you delete an object and don’t remember its name, you won’t be able to find it again.
one purpose/concept

purpose

motivates

concept

application

purpose

motivates

concept
example

- maintain consistent format
  - motivates
  - style
  - word processor

- provide formatting unit
  - motivates
  - paragraph
concept-purpose map

- concept -> purpose
- concept -> purpose
- concept -> purpose
- concept -> unmotivated
- concept -> purpose
- concept -> purpose
- confused -> purpose
- unfulfilled -> purpose


exercise:
purposes
what’s the purpose of ...?

these apps?
Dropbox
Photoshop
WhatsApp

tagging (in Facebook)
buffers (in emacs)
relative references (in Excel)
concept
criteria
concept criteria

**compelling:** clear story, one purpose

**controllable:** fulfills purpose without interference

**complete:** general and uniform over concept’s scope

**consistent:** represented consistently in the user interface

**conventional:** reuses existing concepts when applicable
compelling

simple story & motivated by one purpose

trash (OS X)

**story:** delete moves to special folder; emptying it removes contents for good

**purpose:** allow undo of deletions

layer (Photoshop)

**story:** resulting pixel map is background map with composition of functions given by layers

**purpose:** non-destructive edits
faucets

compelling

not compelling
refrigerator controls


internal mechanism

controls
more uncompelling concepts

no single clear purpose
  Git’s staging area
  JPEG quality and resolution
  Gmail’s categories (vs labels)

no simple operational principle
  CSS’s dimensions (inches, pixels)
  Tumblr’s answers vs comments

serves someone else’s purpose
  direct flight (legs share flight number)
controllable
fulfills purpose without interference from other concepts

skip slide
make parent
make parent and skip

skipping and hierarchy do not interfere in Apple Keynote
Hi Daniel, Santiago,

I am not sure whether this falls into one of the conceptual design issues that you have been analyzing, but here's a little annoyance that I just ran into using labels in Gmail.

This evening, I made two separate reservations with Enterprise (one in Phoenix and another one in Vegas), and the company sent me a confirmation e-mail for each one of them. Usually, I tag travel-related e-mails using a label (e.g. "Vegas Trip 2014") so that I can easily find all the relevant e-mails for a particular trip. Now, the problem is that Gmail automatically grouped the two Enterprise emails into a single conversation. It turns out that in Gmail, a label applied to an e-mail in a conversation is applied to every other e-mail in the same conversation. This means I can't assign separate labels to the two car rentals! Uggh!

(By the way, is it possible to take an e-mail out of a conversation? Either this is impossible or the Gmail UI does not make this easy).

Eunsuk
aspect ratio fuji x100s
image quality setting
aspect ratio
"image size" setting
non-standard ratio + RAW?

image quality interferes with image size
consistent

represented consistently in the user interface

- **interface elements**
  - E1
  - E2
  - E3

- **concepts**
  - C1
  - C2
  - C3

- **conflation**
  - E1
  - E2
  - E3

- **consistent**
  - E1
  - E2
  - E3

- **deviation**
  - E1
  - E2
  - E3
deviation in OS X apps

OmniGraffle: control key
Apple apps: option key

⌥⌘C

⌥⌘C

copy style
Conflation in Unix

```plaintext
> touch readme
> ls
readme
> mv readme -README
> ls
-README
> rm -README
rm: illegal option -- E
usage: rm [-f | -i] [-dPRrvW] file ...
```
Someone accidentally deleted thousands of files in my company. How can I quickly undelete them?
Friends don't let friends delete shared Dropbox items

Christopher Breen
@BodyofBreen

Sep 9, 2013 5:00 AM

Reader Paul Cramblett has a problem with others who just don’t know how to share. He writes:

I maintain a Dropbox folder that I use to share files with a select group of friends. I've tried to explain how Dropbox works to these people but someone invariably drags all the files out of the folder, which means they’re no longer available to the rest of us. Is there some way to prevent files from being removed by someone who doesn’t understand the difference between “copy” and “move”? 
alyssa & ben plan a party
alyssa spoils everything

Are you sure you want to delete **party** from your Dropbox?

Are you sure you want to delete **invitations** from your Dropbox?
How do I leave a shared folder?

“by changing the folder’s settings or by deleting it”

You can leave a shared folder at any time by changing the folder's settings on the Dropbox website or deleting it. If you change your mind or leave a folder accidentally, you can *rejoin it* later.
small survey of MIT dropbox users

correctly predicting behavior

<table>
<thead>
<tr>
<th>Knowledge Level</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>good knowledge</td>
<td>60.0%</td>
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<tr>
<td>average knowledge</td>
<td>20.0%</td>
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<tr>
<td>poor knowledge</td>
<td>80.0%</td>
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</table>

- delete shared folder results in leaving
- delete shared subfolder removes it

study by Kelly Zhang
conventional

reuses existing concepts when applicable

collection of idiomatic concepts

some apps are just cliches

social app = {profile, post, friend, notify}

concept idioms: across apps
style: separate formatting from element
selection: select objects to apply action to set

subtle issues & their solution
reapply in different context
eg, partial styles
concept idiom selection

slides in Keynote

photos in Adobe Lightroom

messages in Apple Mail

objects in OS X Finder

thumbnails in Preview

notes in Evernote
subtlety selection scope

subset of selection in scope

subset of selection out of scope
subtlety active element

Adobe Lightroom: brightest thumbnail is the “active photo”
Photoshop: outline shown with “marching ants”

Photoshop: selection shown in Quick Mask mode
subtlety folder selection

Google Drive: selecting folder = selecting children

CrashPlan: selecting folder = selecting all future children
concept idiom selection

Purposes: apply action in aggregate to many items at once
<table>
<thead>
<tr>
<th>instantiate</th>
<th>organize</th>
<th>relate</th>
<th>resource</th>
<th>save</th>
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<th>personalize</th>
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exercise: criteria
cropping in photoshop
cropping in photoshop (part 2)

what criterion is violated here?
what's the misfit story?
applying to your project
purpose
what is the purpose of your app?
express it as an advertising slogan:
“track your favorite blogs!”

concepts
what are they?
give them good names
which are conventional? novel?
which are essential?

stories
what’s the purpose of each concept?
a (tweet-length) story to explain how?
background
mitch kapor on designers

Architects work in the medium of buildings, graphic designers work in paper and other print media, industrial designers on mass-produced manufactured goods, and software designers on software. The software designer should be the person with overall responsibility for the conception and realization of the program.

A Software Design Manifesto, 1996
To design something really well, you have to get it. You have to really grok what it’s all about. It takes a passionate commitment to really thoroughly understand something, chew it up, not just quickly swallow it. Most people don’t take the time to do that.
a metaphor

software design:
smoothing rough & sharp edges
big picture by attention to small details

“That’s quite obsessive, isn’t it?”
Jonathan Ive
https://www.youtube.com/watch?v=zaLMOSWAwdw