



# what are the elements of software design?

Daniel Jackson · MIT

Northwestern University · Chicago · February 29, 2016

three  
software design  
problems

#1

email categories

# gmail's categories

Primary			Social <span>23 new</span>		Promotions <span>100+ new</span>		+
<input type="checkbox"/>	<input type="star"/>	<input type="arrow"/>	<b>Google</b>	<b>New sign-in from Chrome on Mac</b> - New sign-in from Ct		<b>12:30 pm</b>	
<input type="checkbox"/>	<input type="star"/>	<input type="arrow"/>	<b>Keith Muhammad at DeMont.</b>	<b>DeMontrond Auto Group</b> - 14101 North Freeway Housto		<b>12:19 pm</b>	
<input type="checkbox"/>	<input type="star"/>	<input type="arrow"/>	<b>AT&amp;T High Speed Internet.</b>	<b>AT&amp;T High Speed Internet Service Activation</b> - Your A1		<b>10:37 am</b>	
<input type="checkbox"/>	<input type="star"/>	<input type="arrow"/>	<b>Keith Muhammad at DeMont.</b>	<b>DeMontrond Auto Group</b> - 14101 North Freeway Housto		<b>Aug 26</b>	
<input type="checkbox"/>	<input type="star"/>	<input type="arrow"/>	<b>betterbatonrougejobs.com</b>	<b>Job Update -- 2015-08-26</b> - Looking For An Advantage W		<b>Aug 26</b>	



# category tab settings

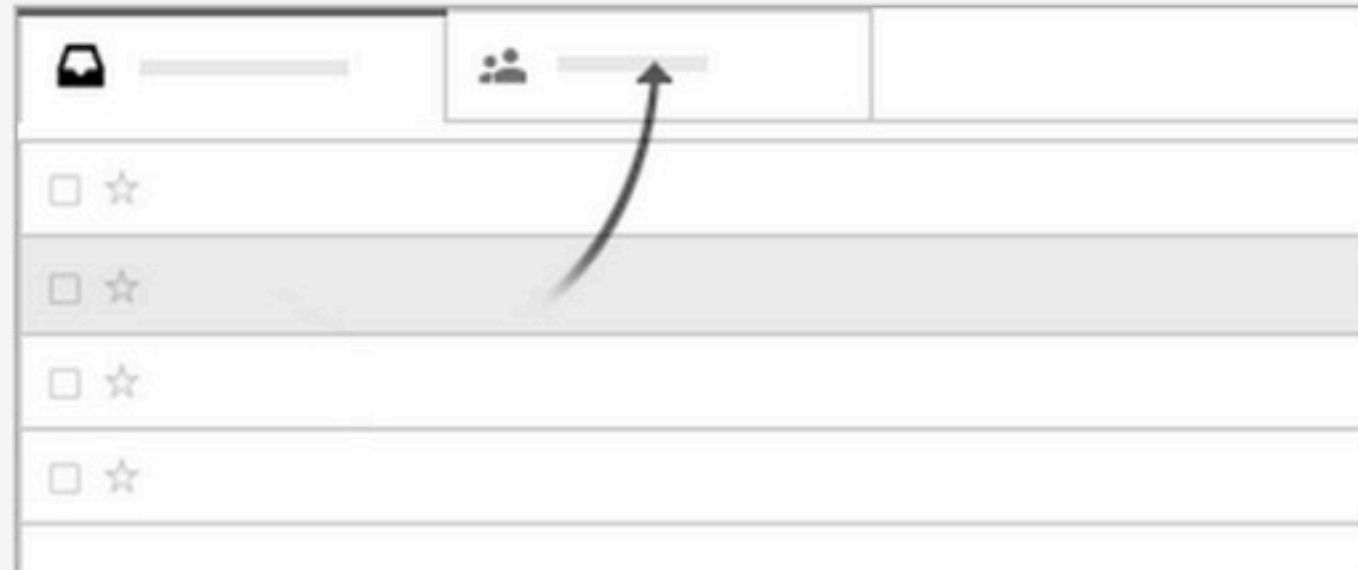
## Categories:

[Learn more](#)

- Primary
- Social
- Promotions
- Updates
- Forums

## Starred messages

- Include starred in Primary



Choose which message categories to show as inbox tabs. Other messages will appear in the Primary tab.

# some reactions

## Google gets it terribly, terribly wrong with Gmail tabs and makes me angry



By [Mark Wilson](#)

Published 2 years ago

Follow

71 Comments

Like 55

Share 11

37

Tweet 30

Like many Gmail users, I greeted the [news of the introduction of tabs to the interface](#) with a degree of anticipation -- now it was just a matter of waiting for the feature to roll out so I could try it for myself. Earlier today I was randomly signed out of my Gmail account, and after signing back in and checking the settings menus, I could see that tabs were now available to me. Excitement was short-lived, however; it quickly became apparent that this new feature is a disaster.



# categories? labels?

## Why the Tabs Are So Confusing

The tabs do give you a convenient way to automatically sort your inbox according to Gmail's preset categories and get notifications at a glance for when new emails come in.

However, the tabbed view introduces a new, not-so-clear element in Gmail called "categories."

The problem is, you already have labels that *also* match these categories. Gmail, for example, adds Social Updates, Promotions, and Forums as SmartLabels in the left menu. The "Notifications" SmartLabel corresponds to the Updates tab (I wonder why they didn't just call the tab Notifications), but

**SmartLabels are not the same as Categories.** Gmail's pre-designed SmartLabel filters makes it seem like that, but they're really two different things.

# how google explains labels (!)

Gmail Help



GMAIL



FORUM

## Using labels

Labels help you organize your messages into categories – work, family, to do, read later, jokes, recipes, any category you want. Labels do all the work that folders do, but with an added bonus: you can add more than one to a message.

# what you can't do

## **associate tabs with labels**

feature available only for categories

## **use tabs outside inbox**

tabs disappear when you filter on a label



#2

camera settings

my camera fuji x100s



# image quality setting





# aspect ratio



# image size setting





# non-standard ratio + raw?



# what you can't do

**non-standard aspect ratio + raw**  
even though raw images get nice nondestructive crop!

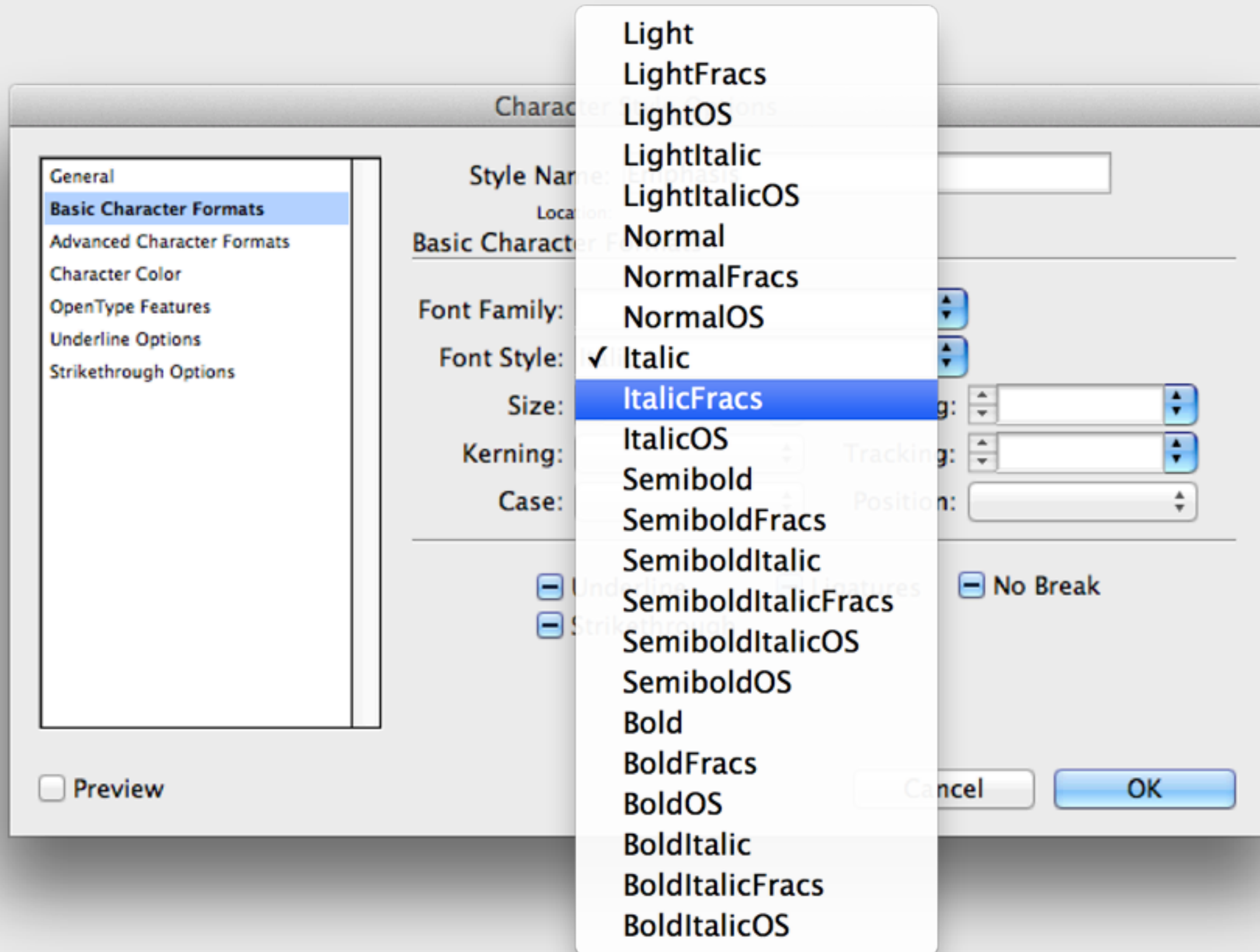


#3

fonts & styles



# what's a font?



# what you can't do

**define a style that italicizes**

Arno Regular to Arno Italic

Futura Book to Futura Book Oblique

Magma Light to Magma Light Italic



# what kind of problems are these?

**minor nitpicks?**

in all cases, can't do useful things

**coding bugs?**

code seems to meet a coherent spec

**user interface flaws?**

interfaces are clear and faithful to function

research goals

# elements of software design?

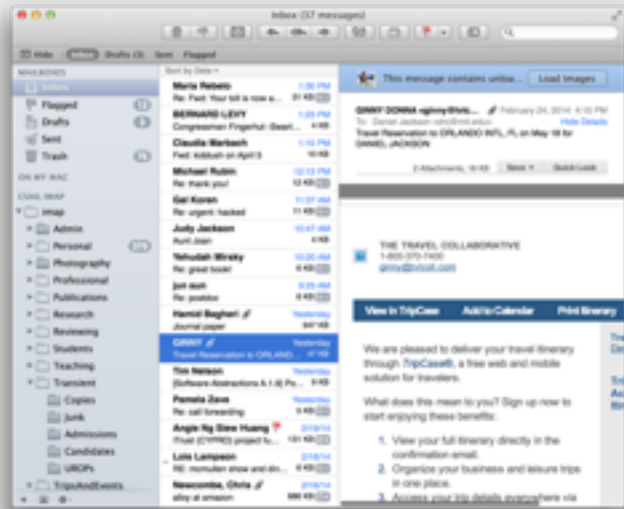
	designer	engineer
building	facade, entry flow, access, light	beam, wall structural integrity
software	?	function, datatype decoupling, localization

what's an  
app about?

# what characterizes an app?

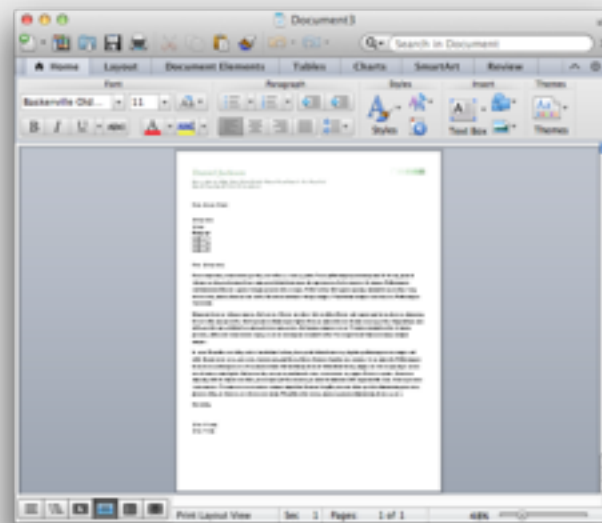
concepts!

Apple Mail



EmailAddress  
Message  
Folder or Label

Microsoft Word



Paragraph  
Format  
Style

Twitter



Tweet  
Hashtag  
Following

Photoshop



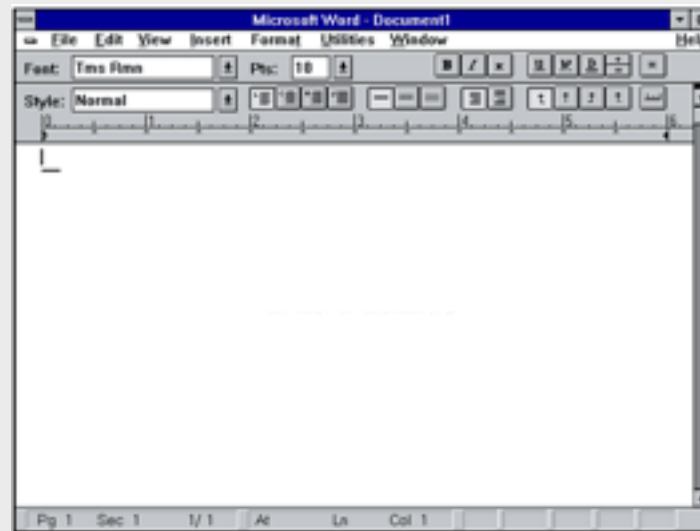
PixelMap  
Layer/Mask  
Adjustment



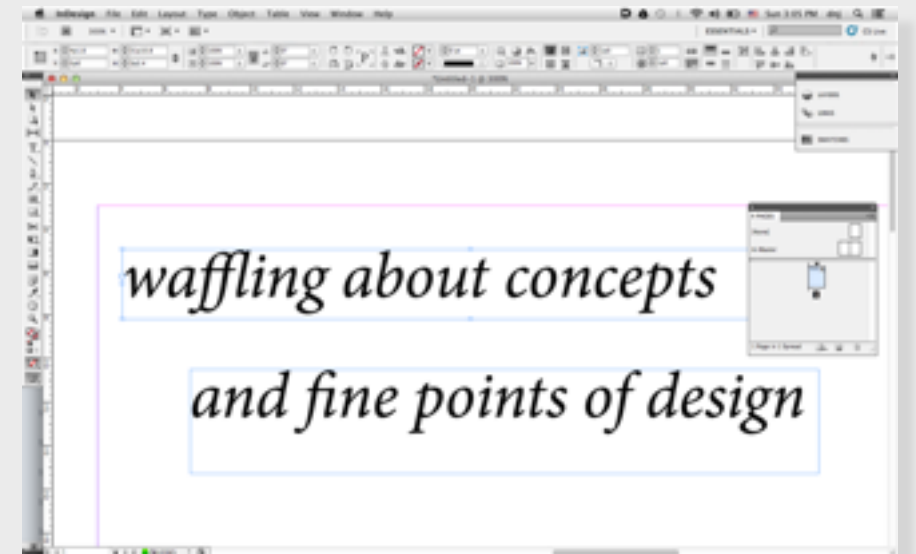
# concepts define classes



text editor  
line  
buffer



word processor  
paragraph  
format  
style



desktop publishing app  
stylesheet  
text flow  
page template

**jamonh**

Oct 22, 2013 7:19 PM

Just upgraded to the new Pages and can't find a way to link text boxes anymore like

<http://www.macobserver.com/tmo/article/pages-linking-text-boxes>

Am I missing something, or is it really not possible anymore?

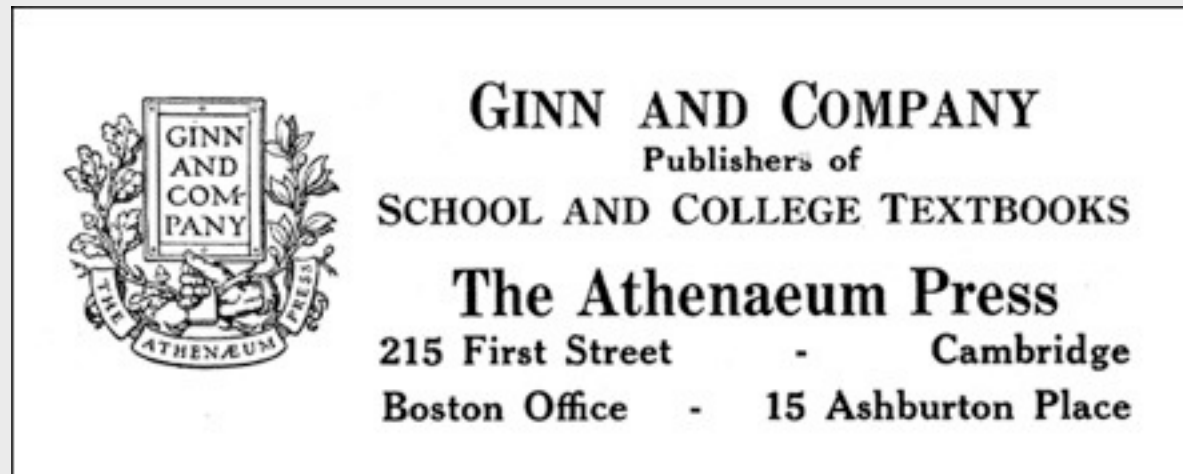
# where are Word's concepts from?



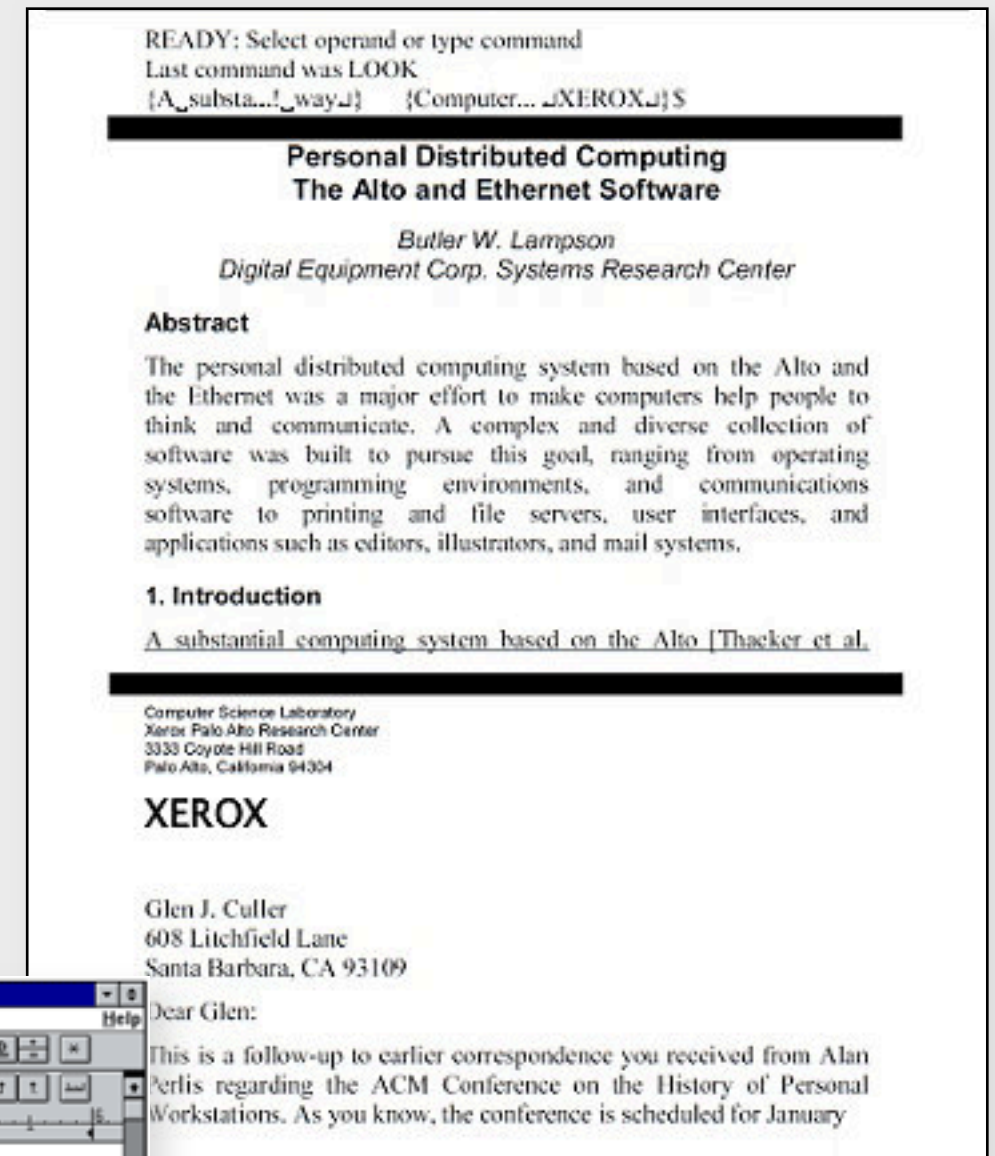
Charles Simonyi: brought key concepts to Word from Xerox PARC



# rich concepts have long journeys



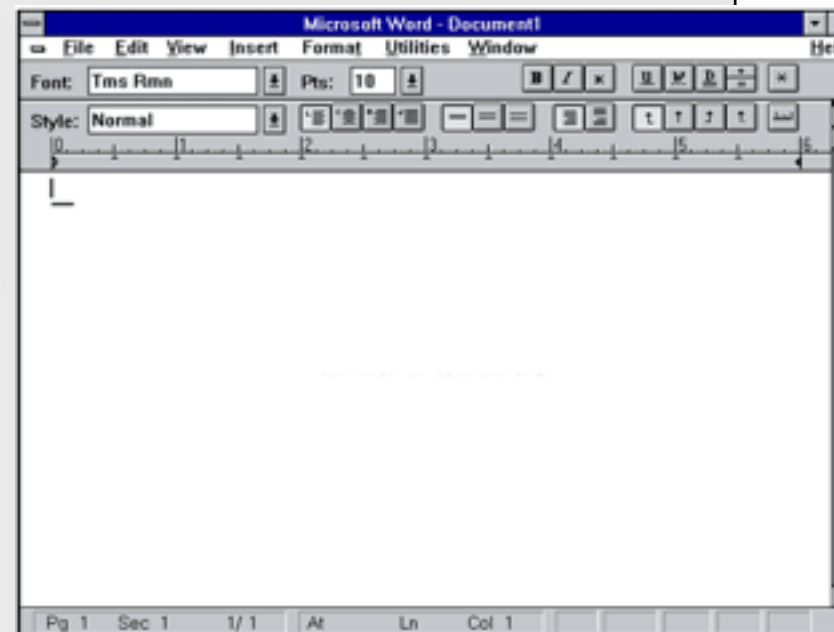
Ginn & Co, since 1868



Bravo, 1974



Apple Pages, 2005



Microsoft Word, 1983

# kinds of concept

even these were  
invented

## given concepts

electoral vote

reservation

social security number

calendar event

analogical,  
or new

## instrumental concepts

hashtag

label

friend

follower

solve a hard design  
problem

## enabling concepts

relative reference

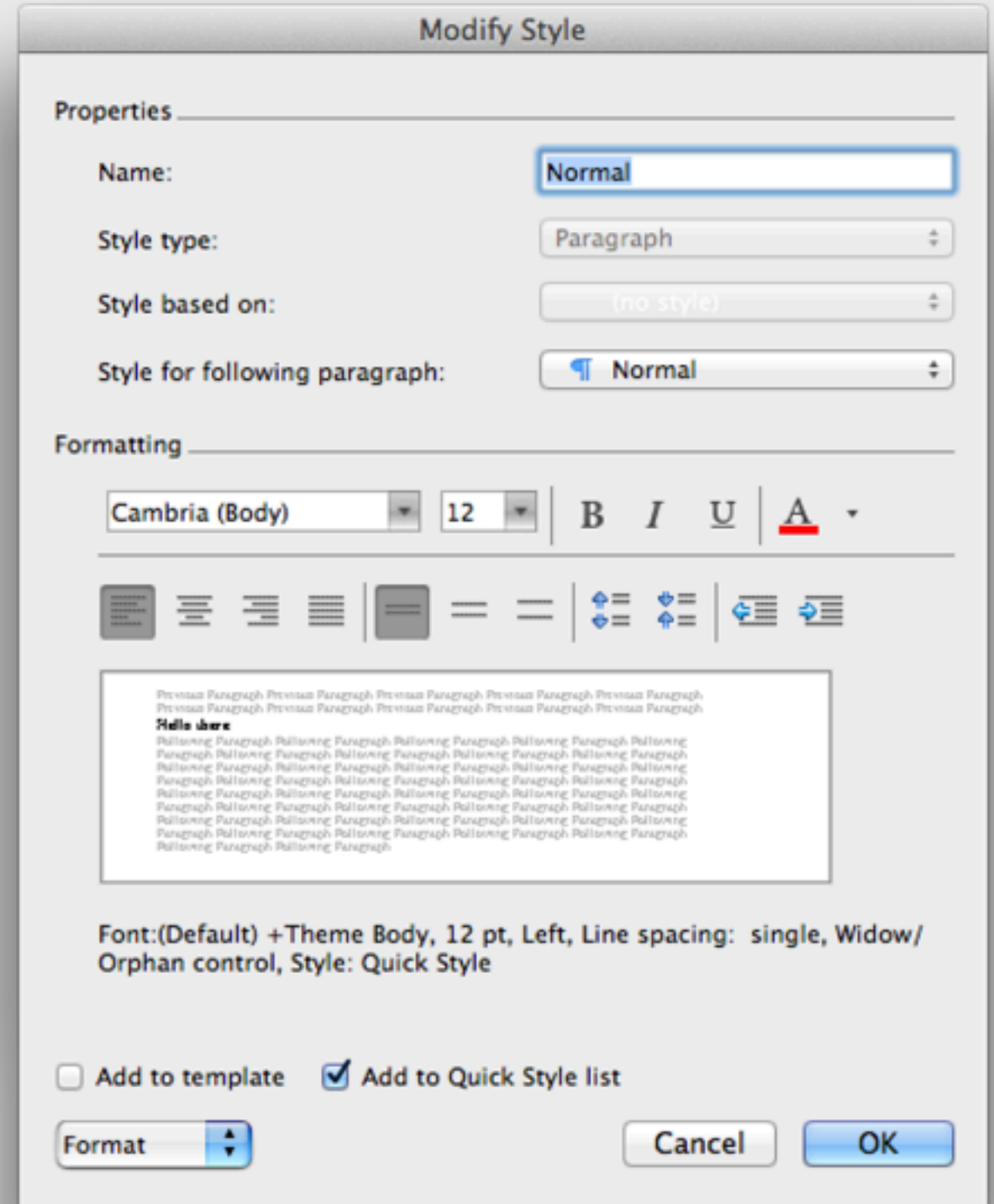
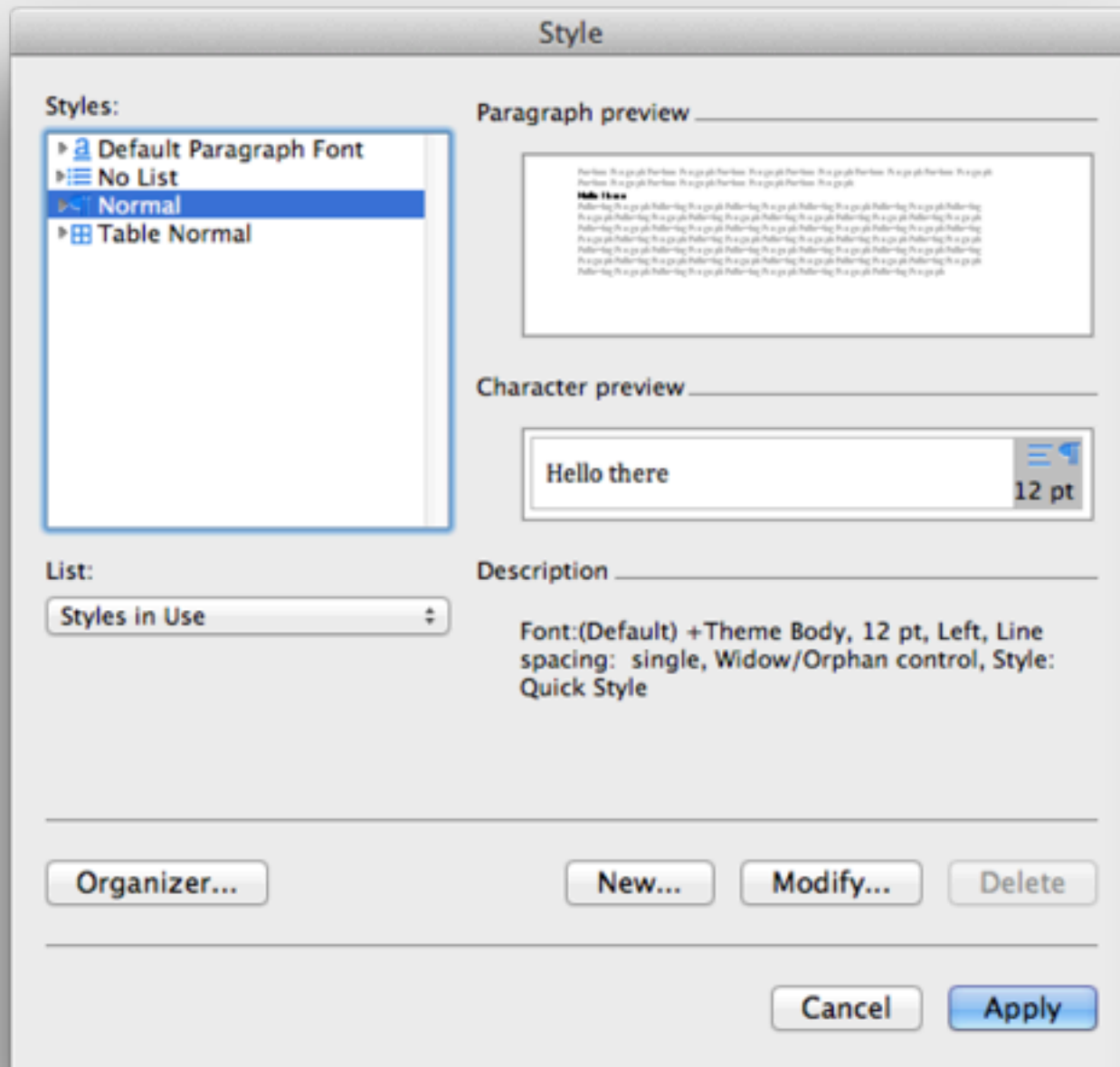
public key

layer mask

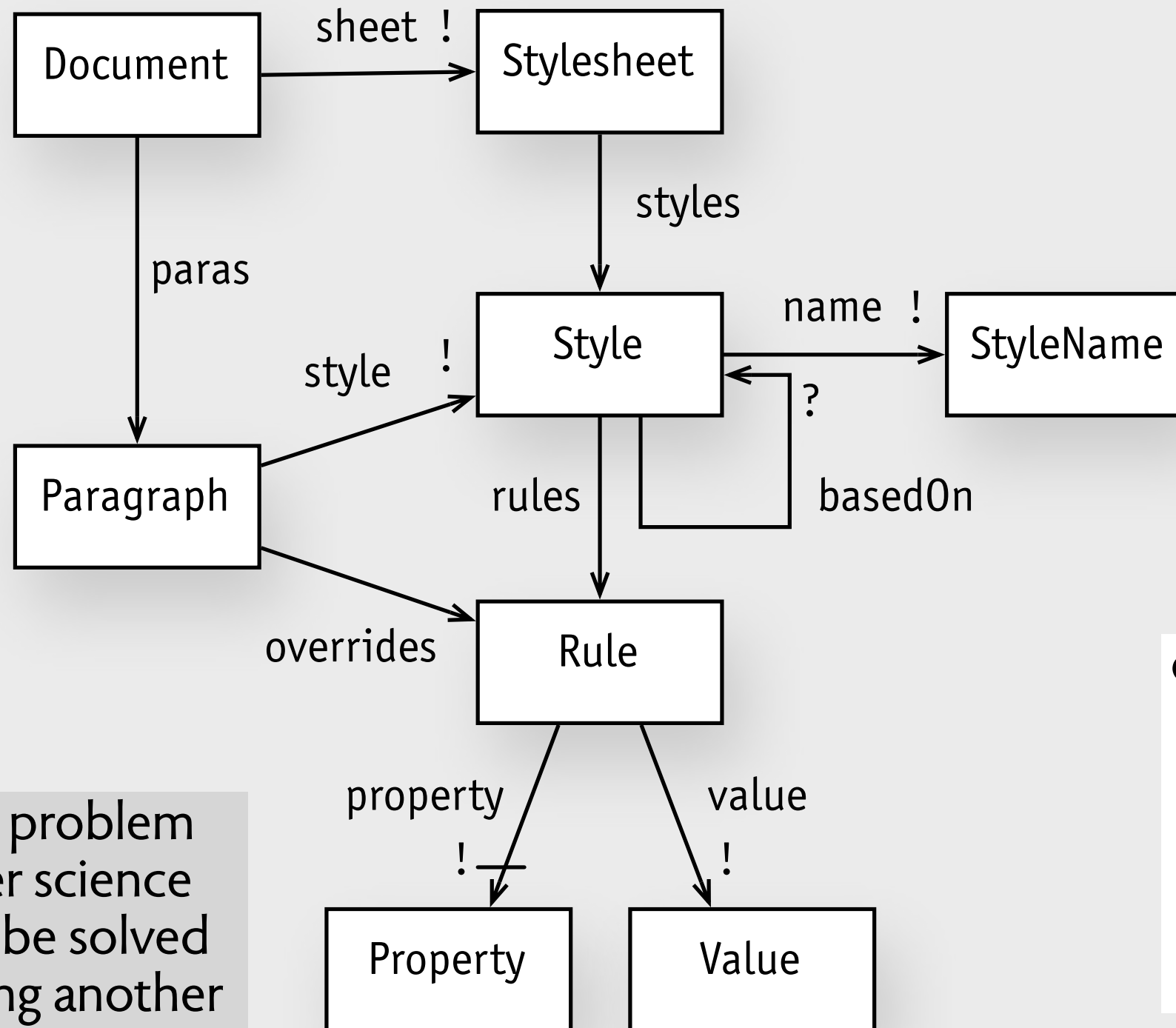
conference call

concepts  
are machines

# example word styles



# concept model word styles



There is no problem  
in computer science  
that cannot be solved  
by introducing another  
level of indirection.  
*David Wheeler*

**operations**  
add  
delete  
modify  
update  
apply

# concept characteristics

**concepts are closed**

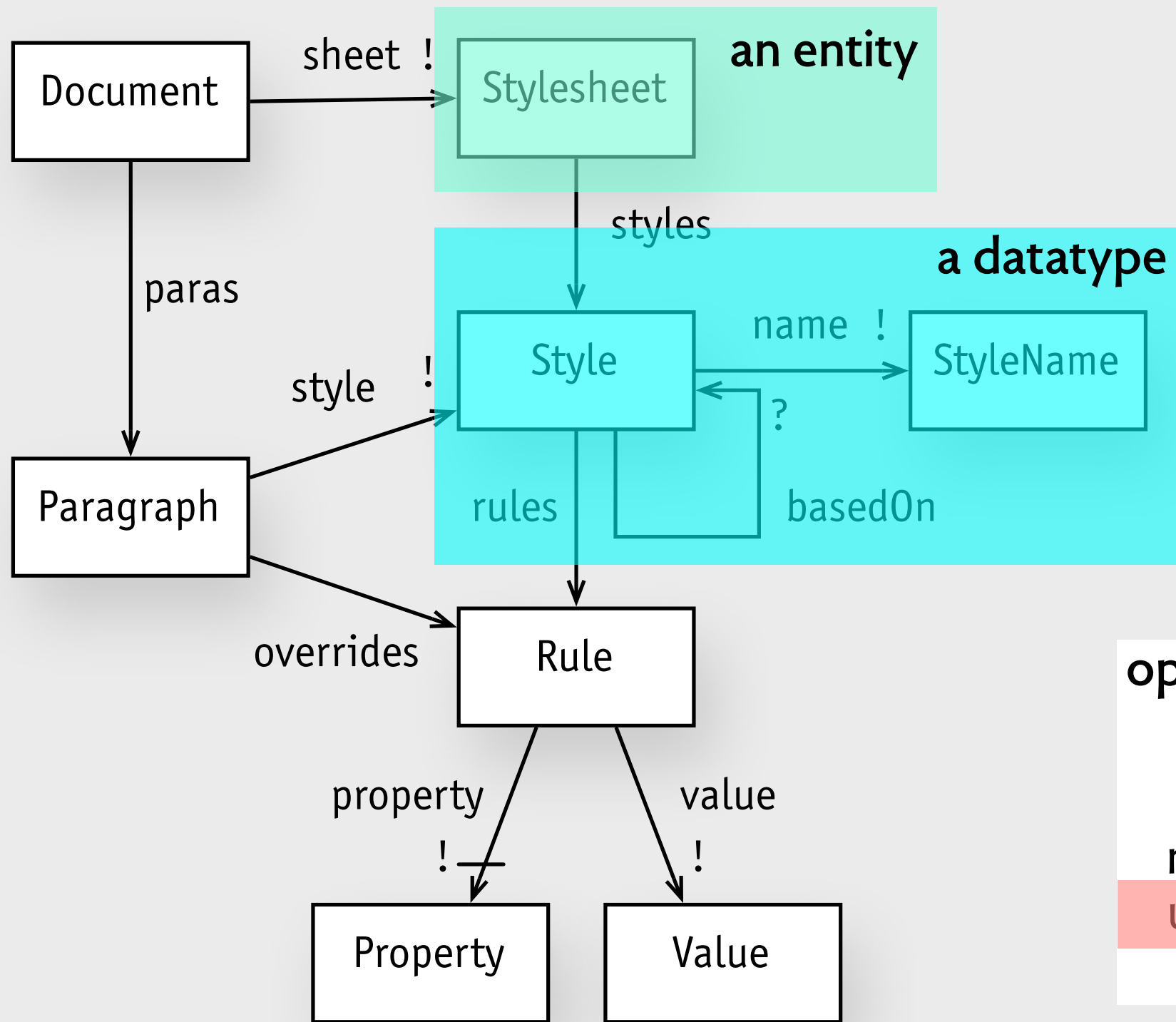
state & all relevant operations

**concepts are situated**

not awaiting composition



# so a concept is not ...



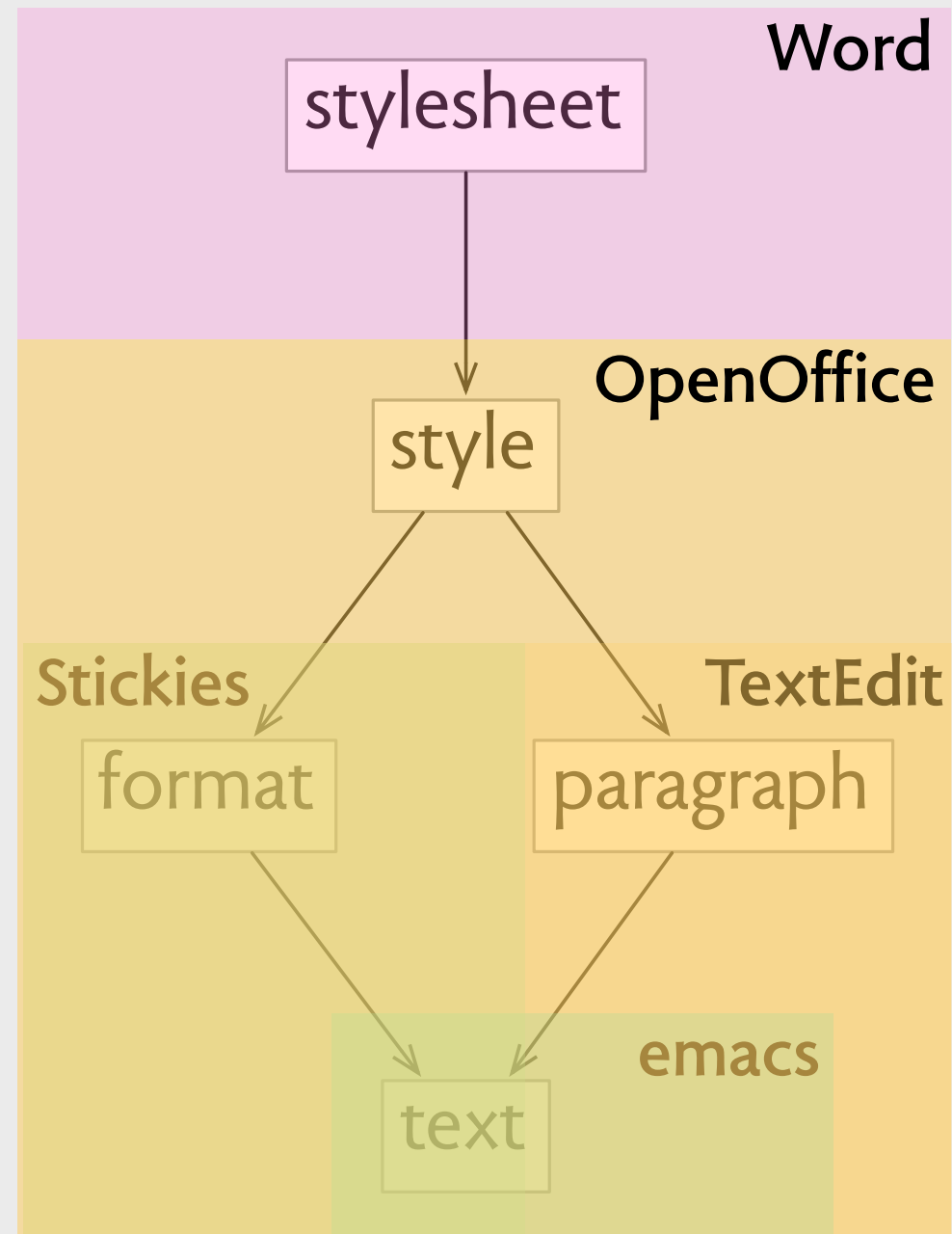
- operations**
- add
  - delete
  - modify
  - update**
  - apply

**a feature**

apps are  
concept families

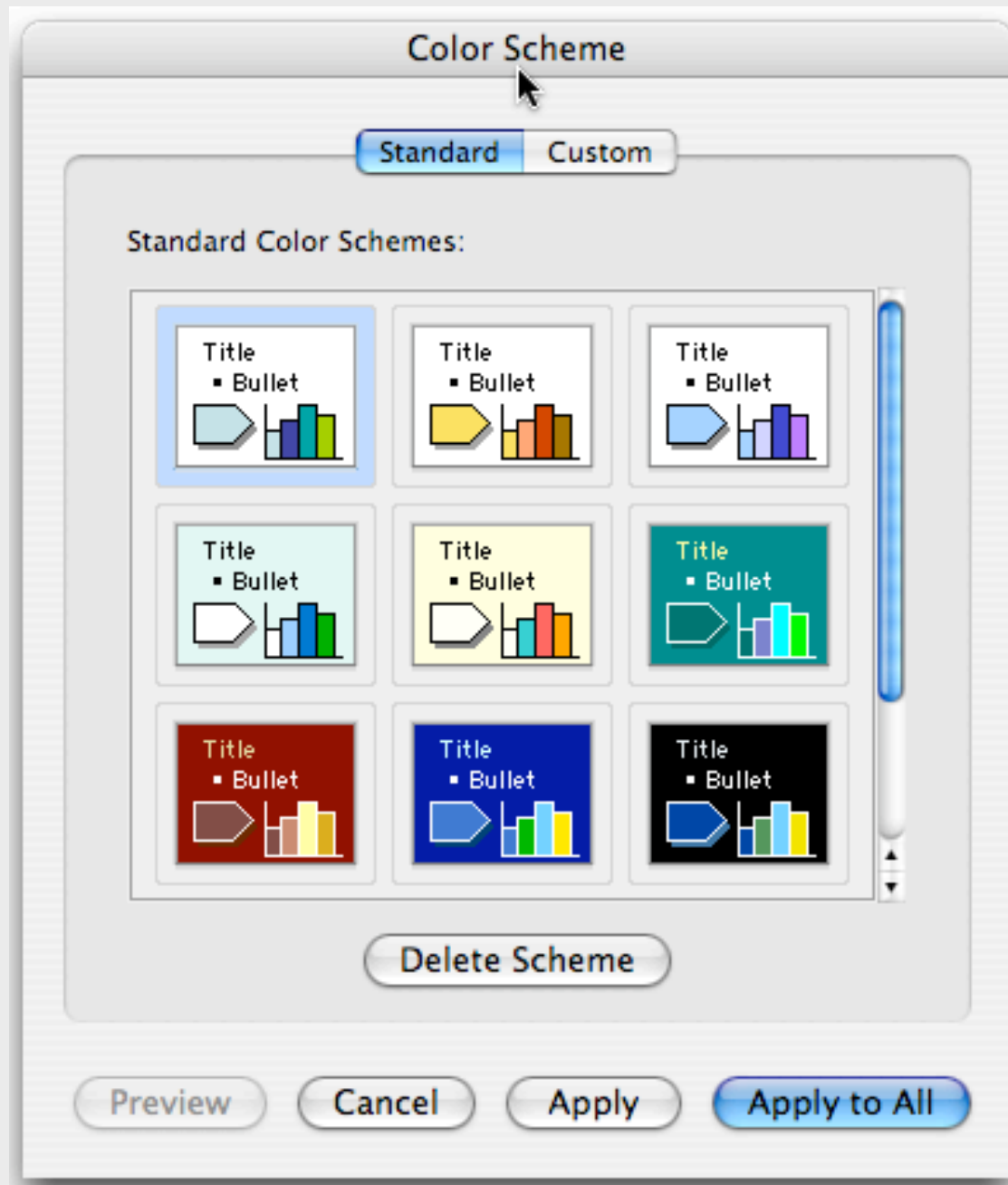
# concept dependences

$\langle c, c' \rangle \in \text{depends} \Leftrightarrow \forall a: \text{apps} \cdot c \in \text{concepts}(a) \Rightarrow c' \in \text{concepts}(a)$

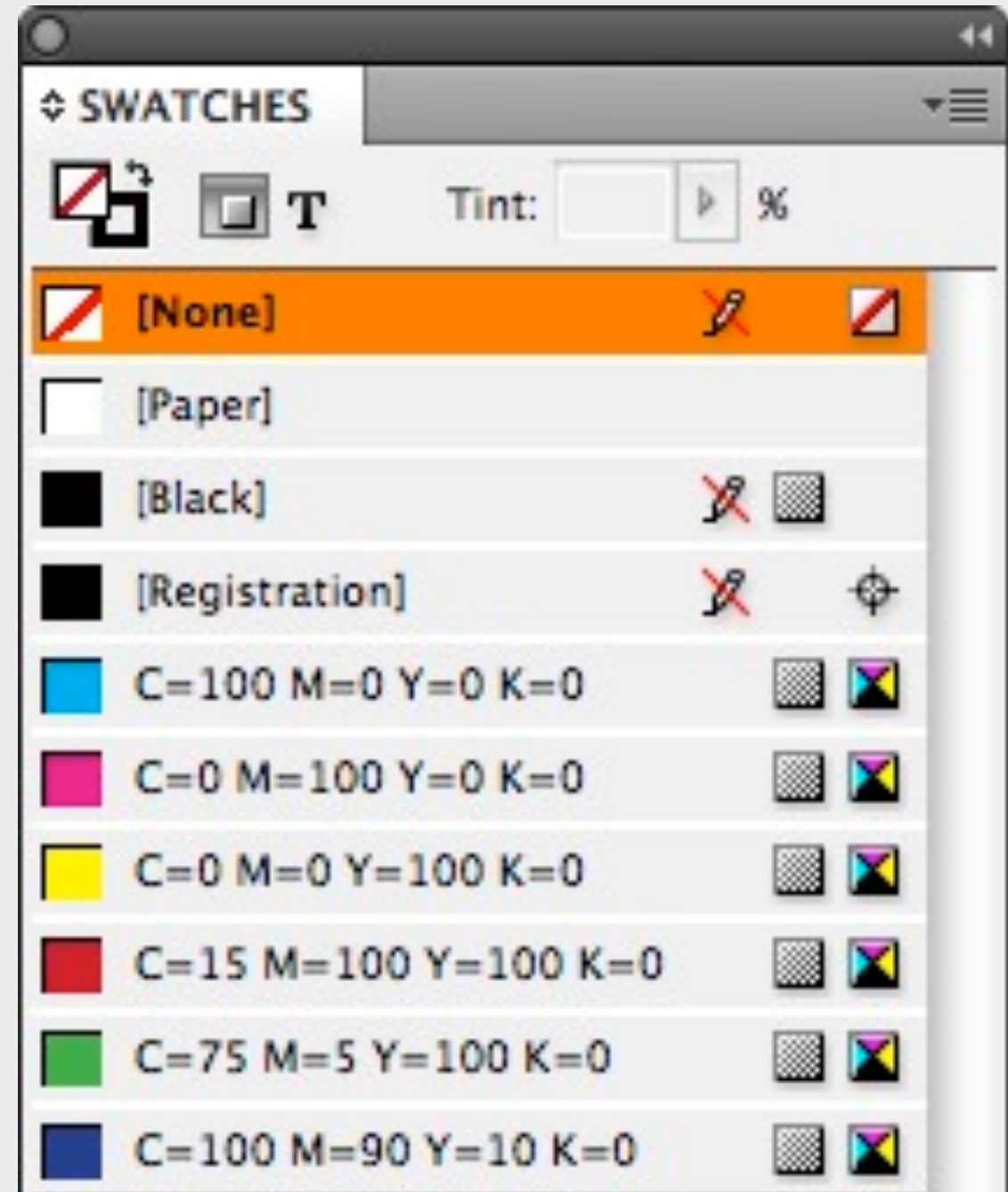


generic  
concepts

# other instantiations style

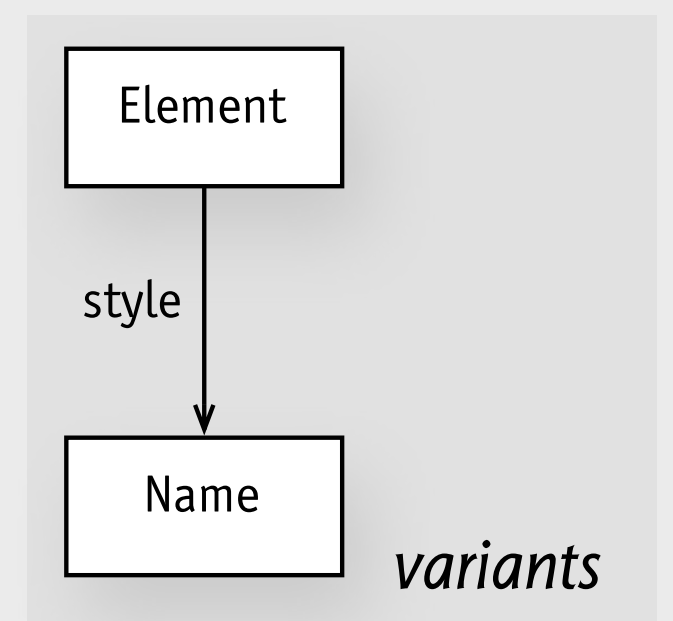
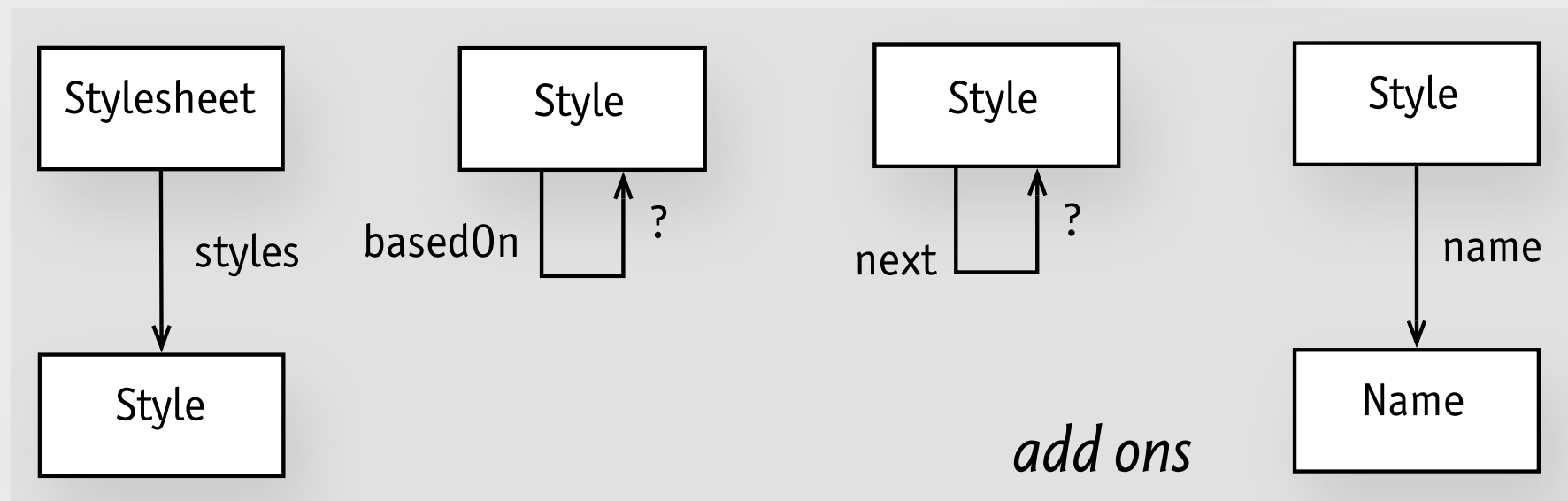
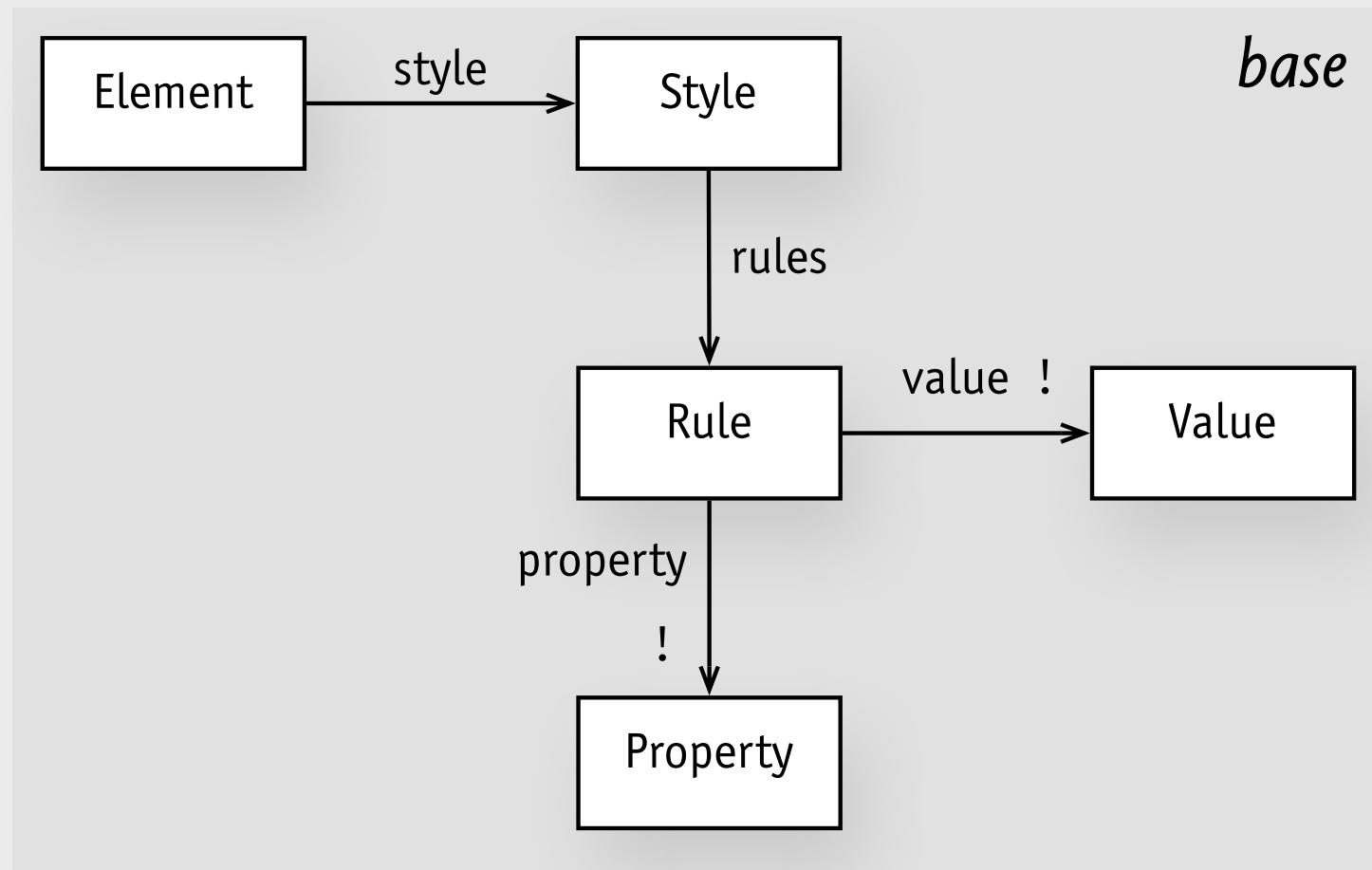


Powerpoint schemes



Indesign swatches

# style generic concept





# generic concept parts

part	example
name	<b>Style</b>
purpose	make it easy to maintain consistent format across set of elements
sample uses	Text formatting in word processors/layout apps (Word, Indesign, Pages, etc); rules in CSS; color themes in Powerpoint.
model	<i>base, add-ons, variants</i>
operations	add, delete, modify, apply, update
related to	<b>StyleBuffer, Stencil, Master</b>
issues	optional rules problem

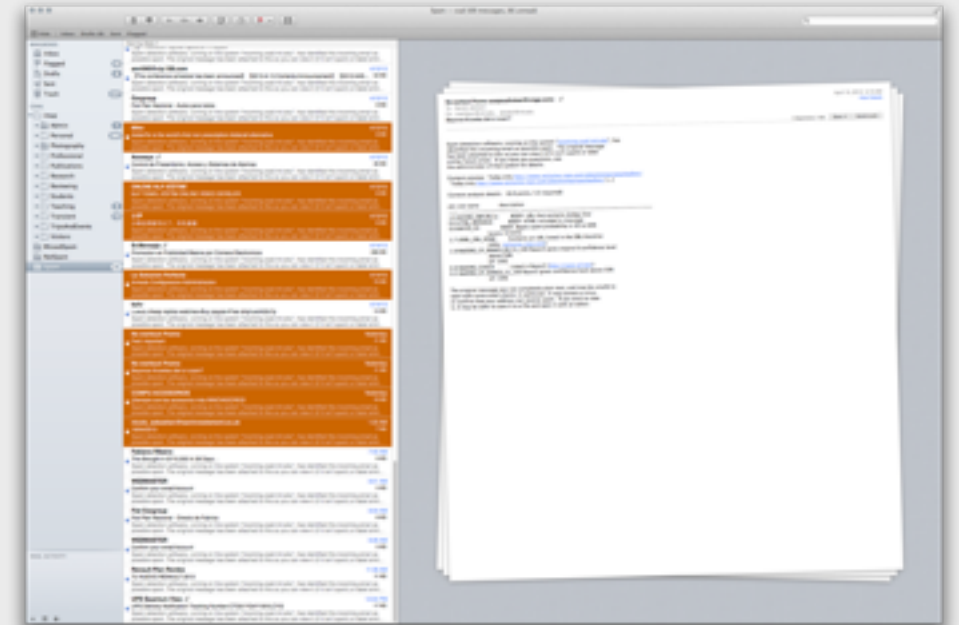
# concept selection



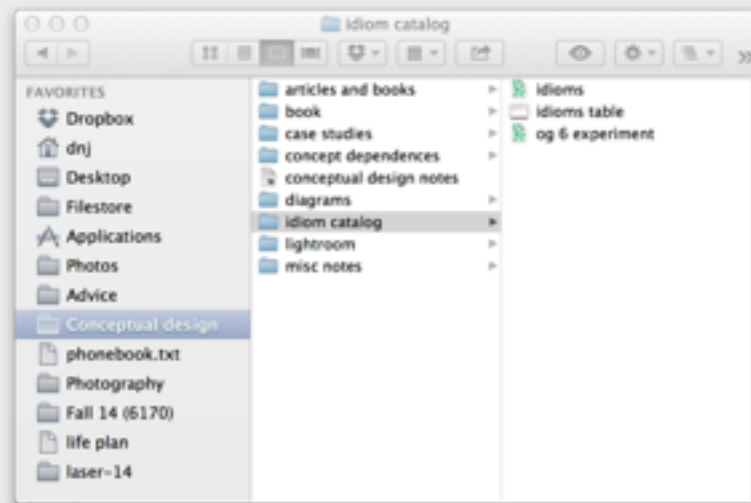
slides in Keynote



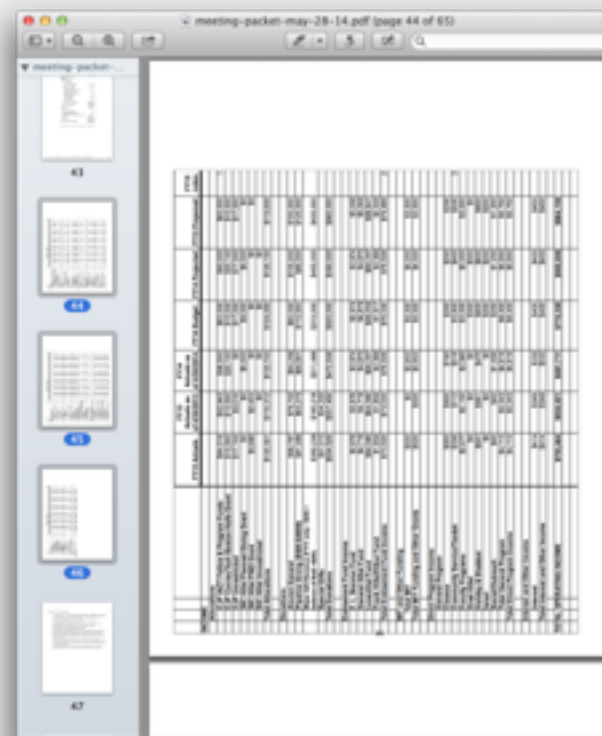
photos in Adobe Lightroom



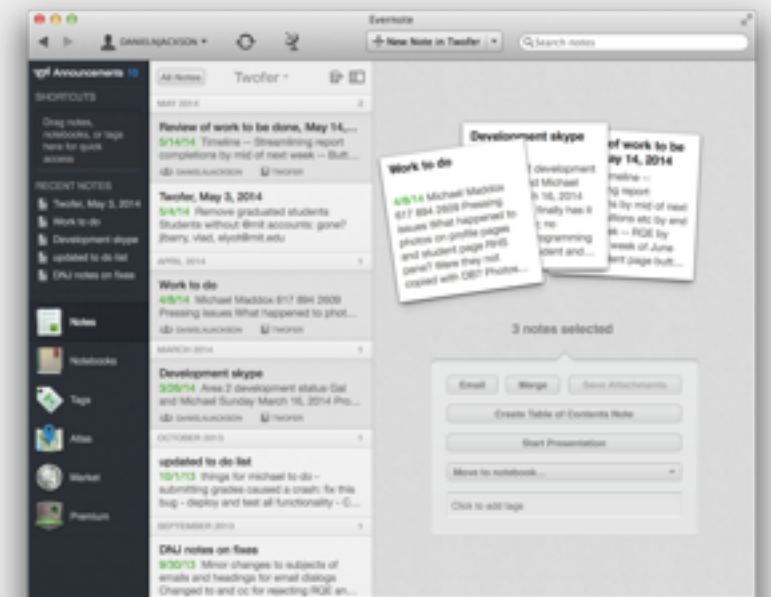
messages in Apple Mail



objects in OS X Finder

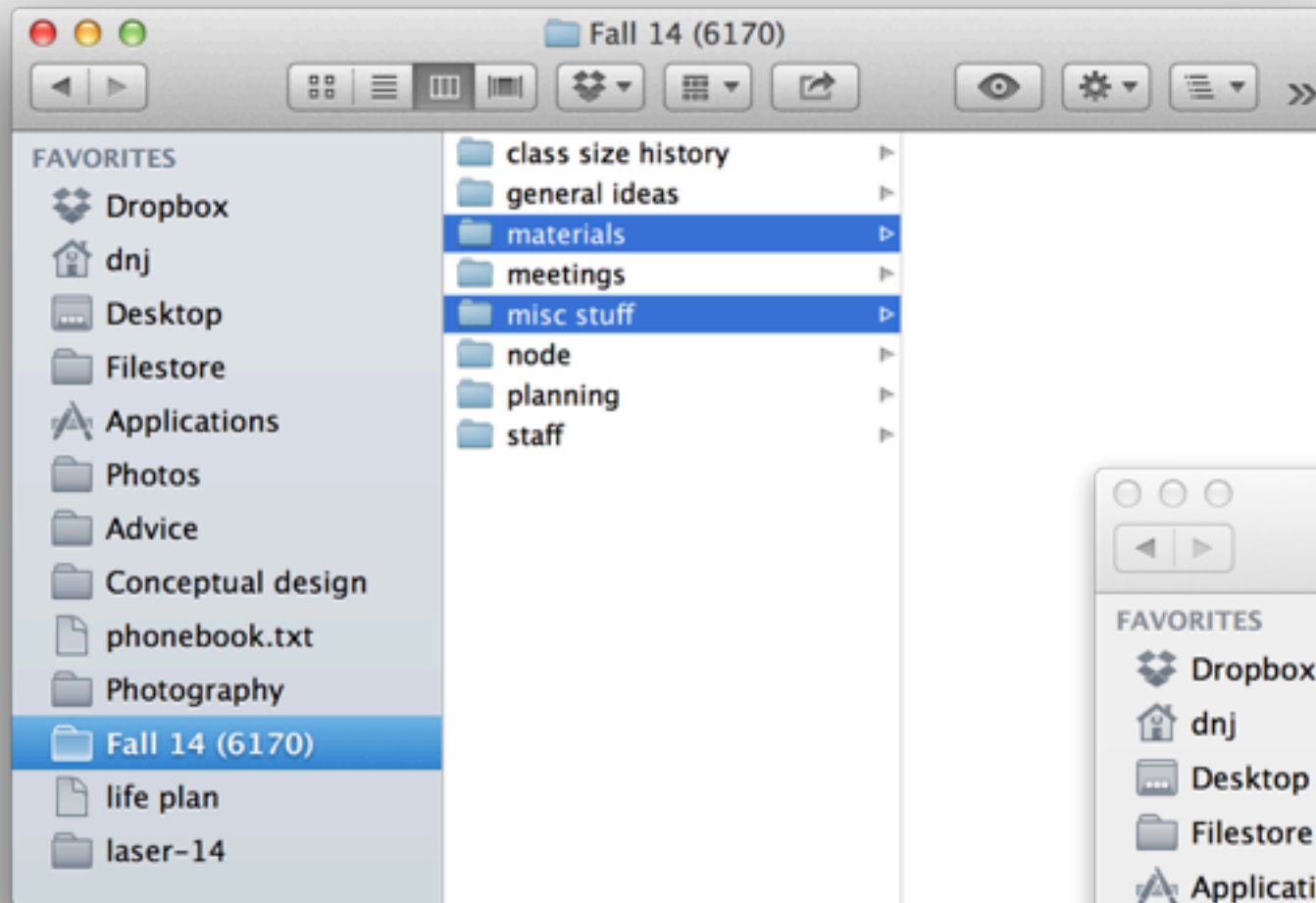


thumbnails in Preview

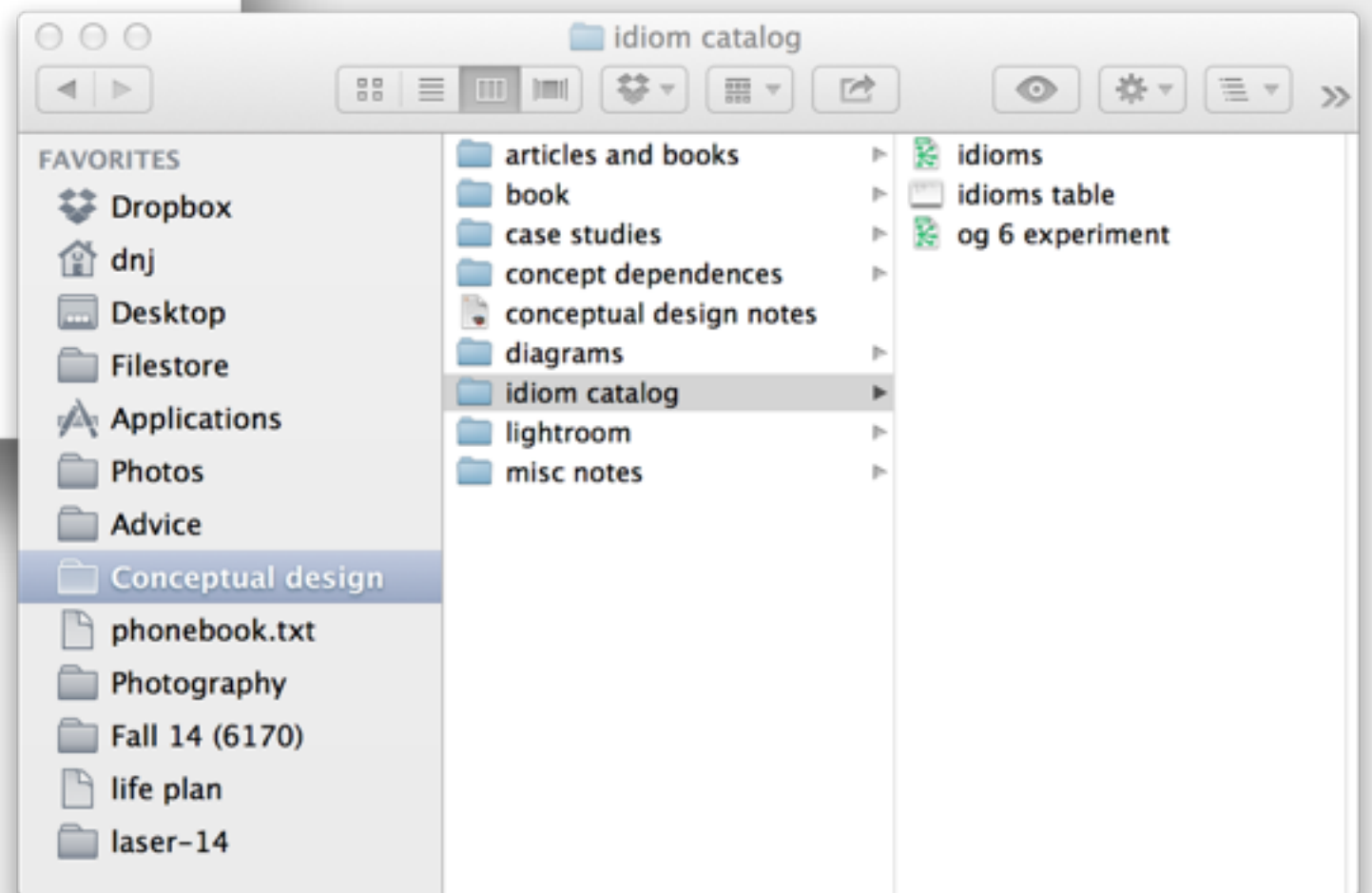


notes in Evernote

# subtlety selection scope



subset of selection in scope



subset of selection out of scope

# subtlety active element



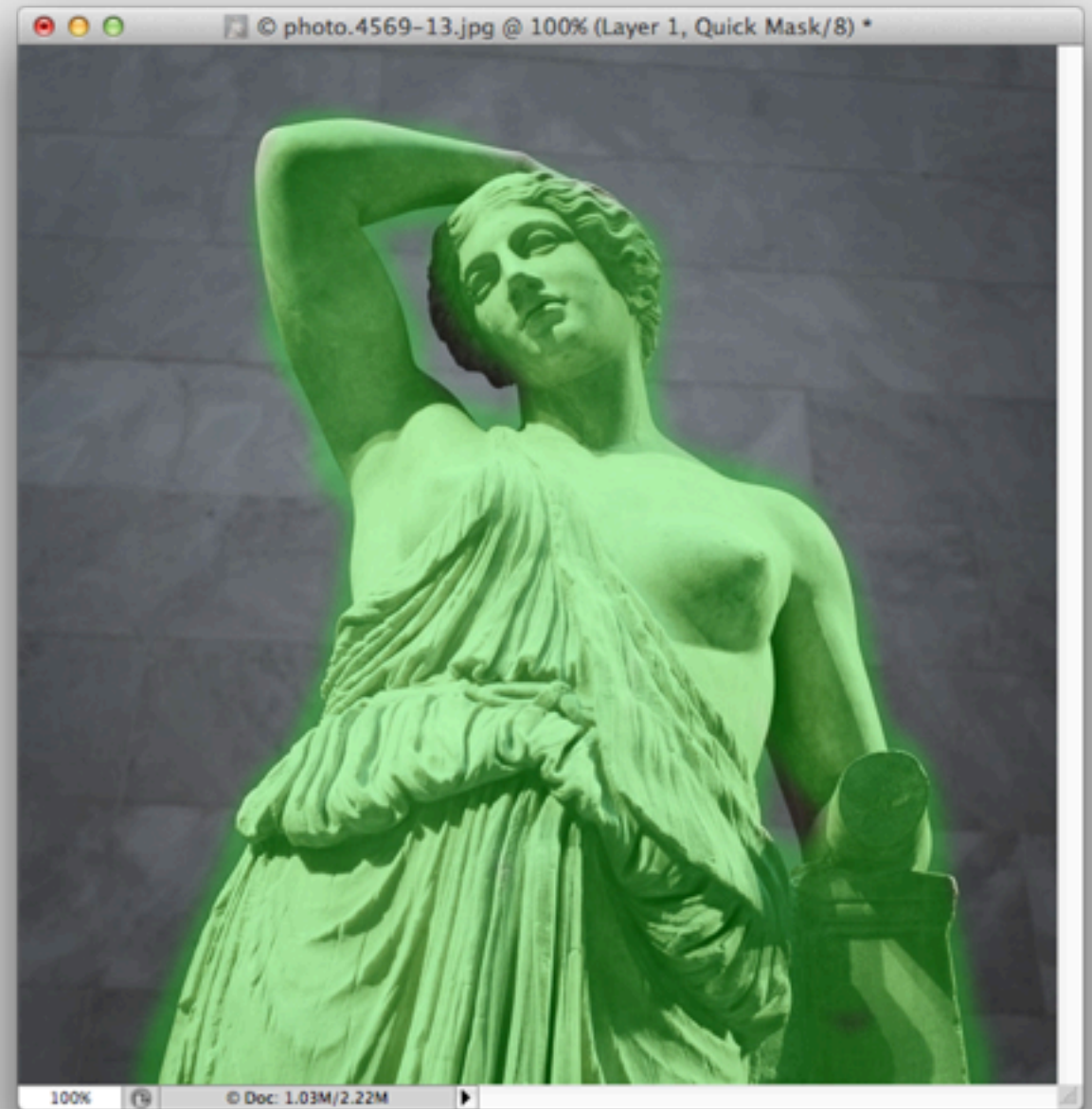
Adobe Lightroom: brightest thumbnail is the “active photo”



# subtlety continuous selection



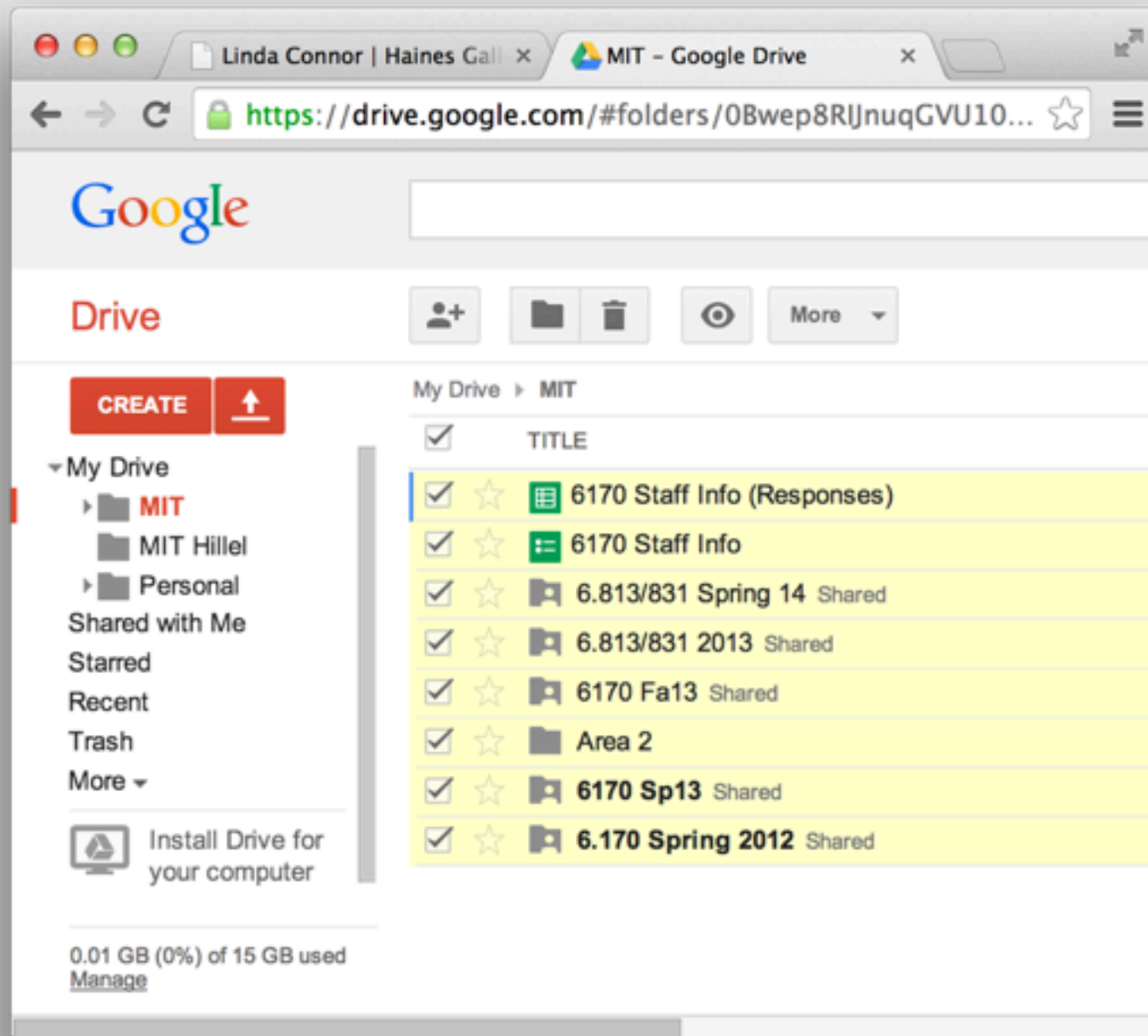
Photoshop: outline shown with  
"marching ants"



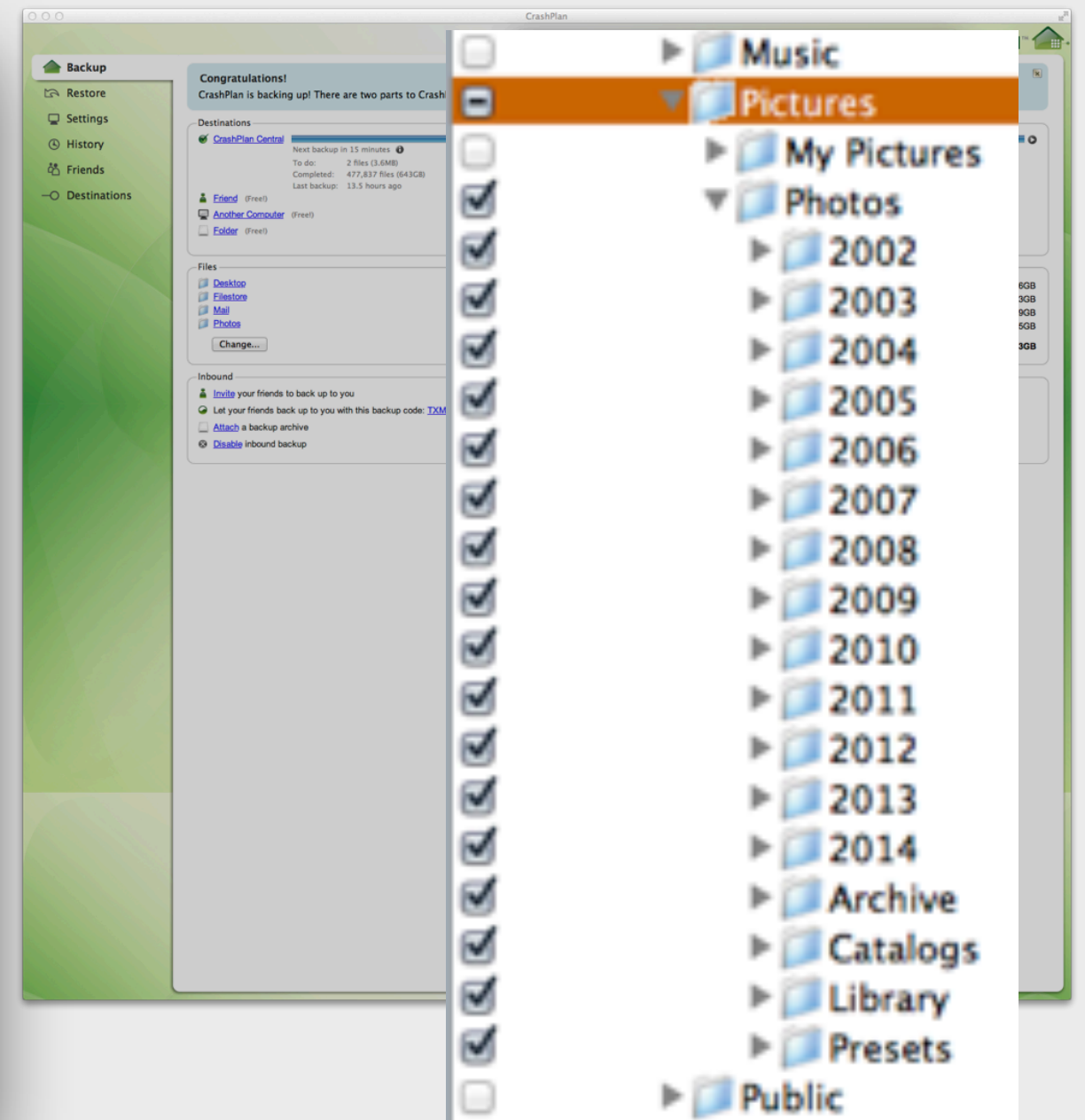
Photoshop: selection shown in  
Quick Mask mode



# subtlety folder selection

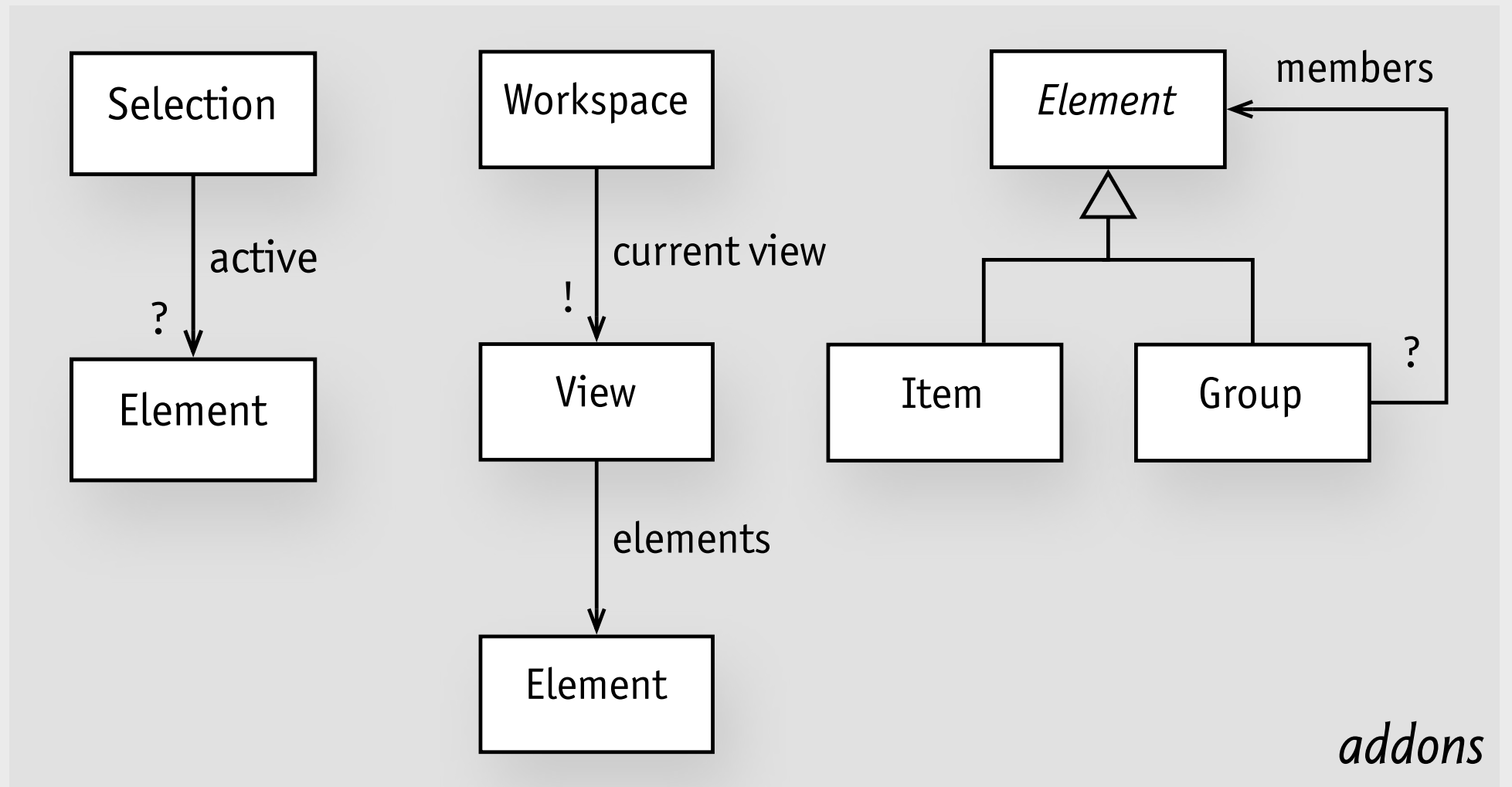
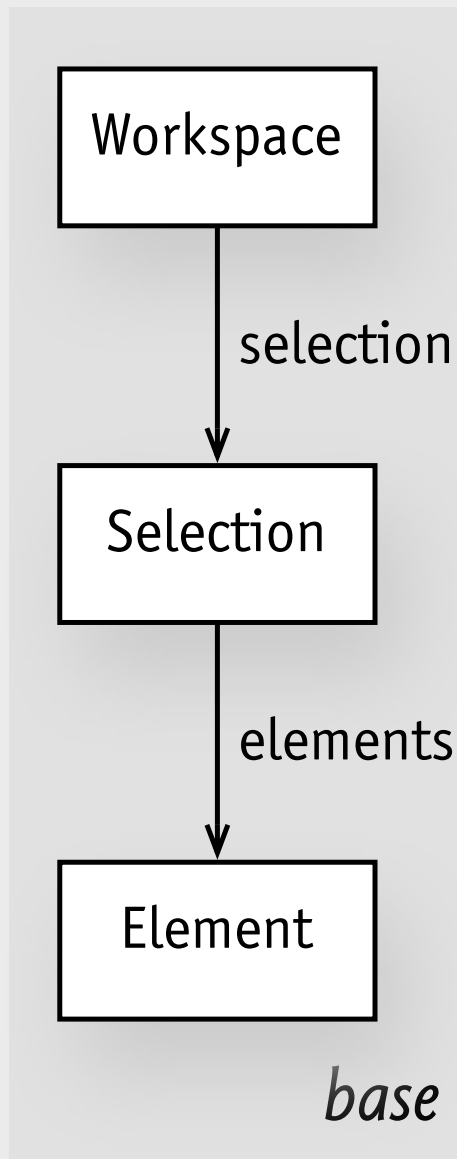


Google Drive: selecting folder = selecting children



CrashPlan: selecting folder = selecting all future children

# concept selection



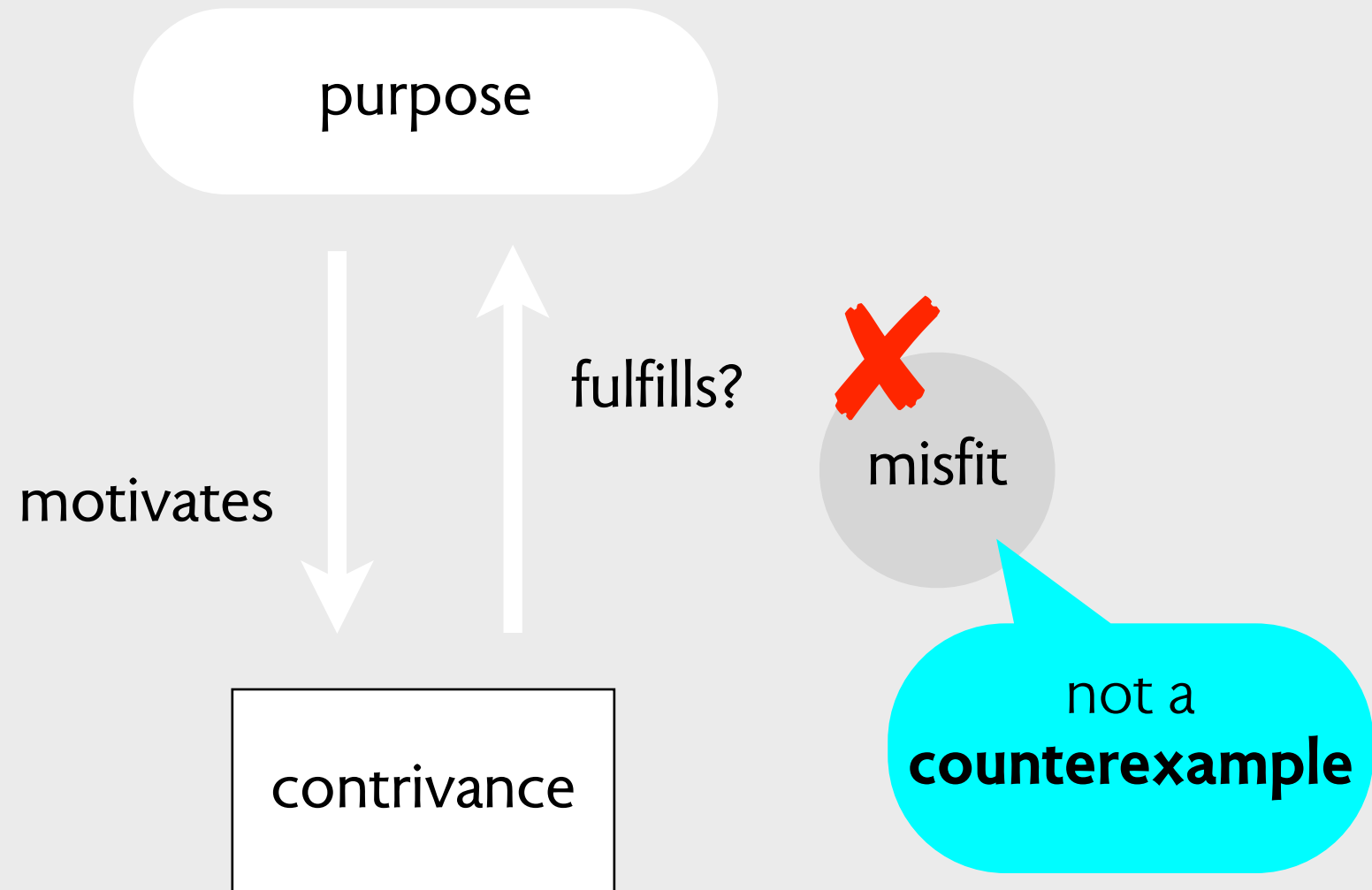
Purposes: apply action in aggregate to many items at once

# concept catalog (so far)

<i>instantiate</i>	<i>organize</i>	<i>relate</i>	<i>resource</i>	<i>save</i>	<i>communicate</i>	<i>personalize</i>
<b>stylesheet</b>	<b>selection</b>	<b>friend</b>	<b>access token</b>	<b>history</b>	<b>message</b>	<b>account</b>
<b>master</b>	<b>folder</b>	<b>clique</b>	<b>notification</b>	<b>buffer</b>	<b>posting</b>	<b>karma</b>
<b>stencil</b>	<b>group</b>	<b>invitation</b>	<b>reservation</b>	<b>cursor</b>		<b>OOBA</b>
<b>style buffer</b>	<b>label</b>		<b>REST</b>	sync		<b>rating</b>
	<b>layer</b>		cart	export		status
	<b>stack</b>		subscription			
	<b>alias</b>		purchase order			
	<b>preset</b>		RMA			
	<b>cursor</b>		coupon			
	<b>filter</b>		catalog			
	<b>property</b>					
	<b>metadata</b>					

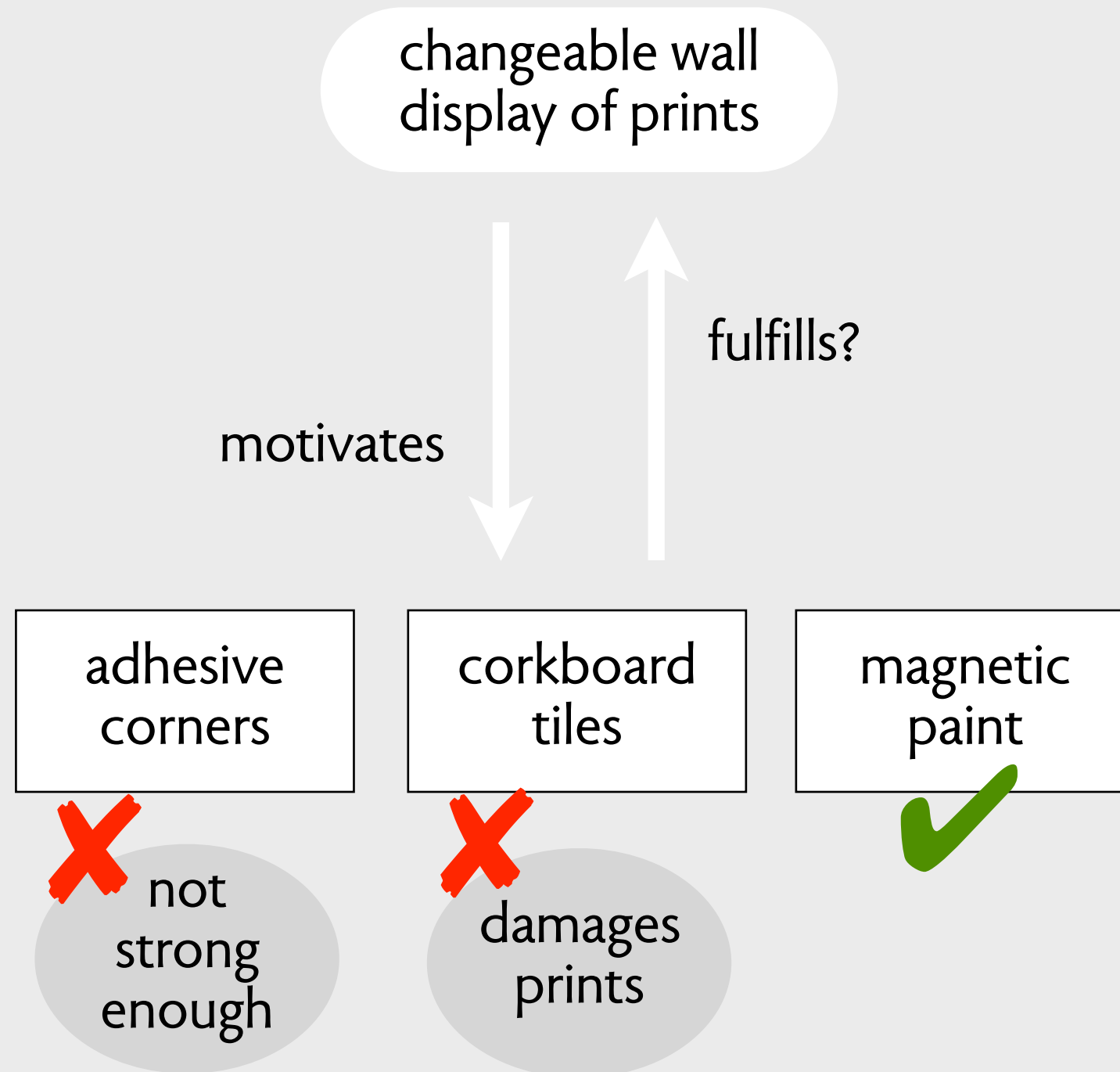
designing  
on purpose

# design is driven by purpose





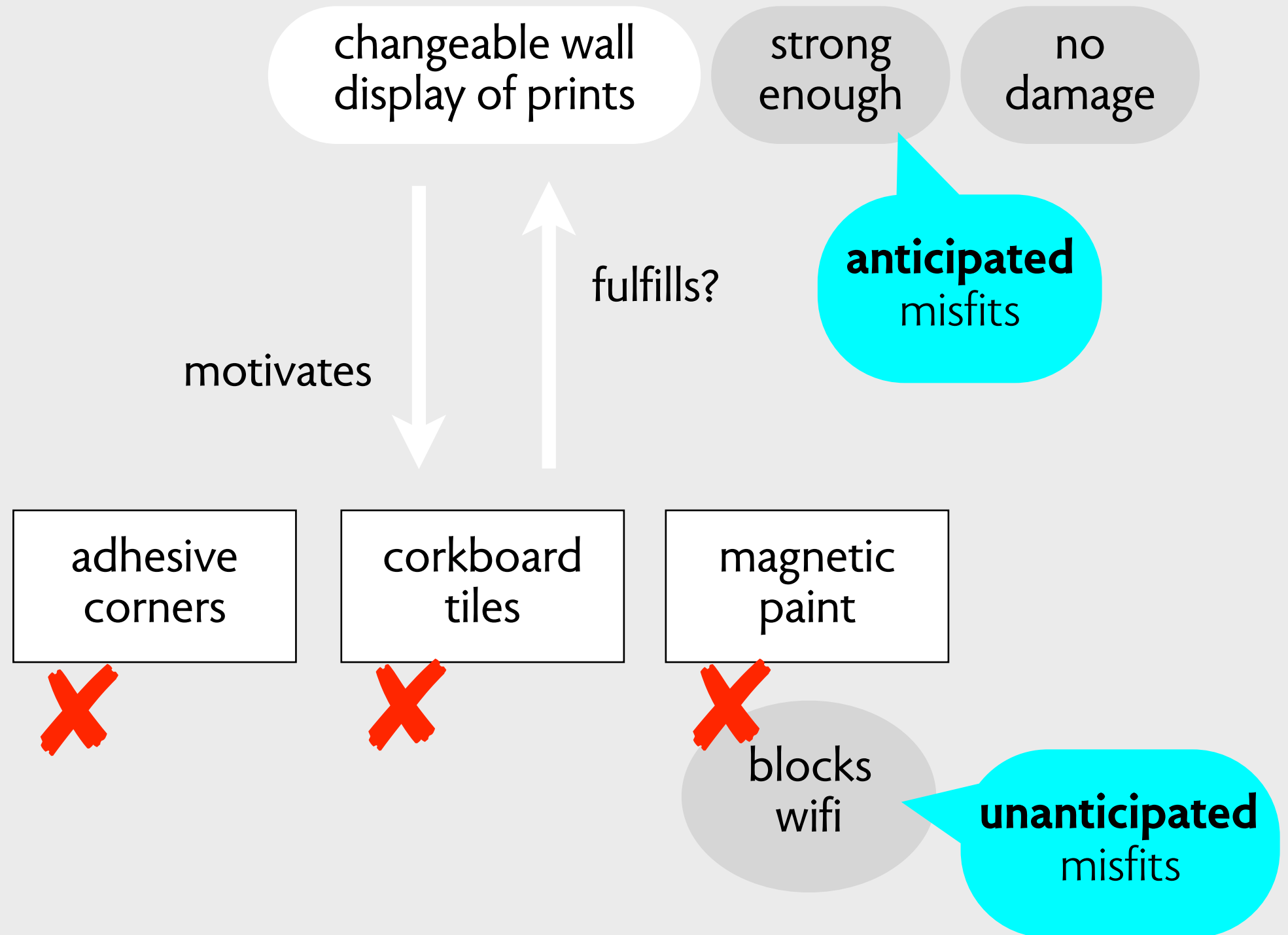
# example: a photo wall



as implemented



# refining the purpose with misfits



Copyright Material

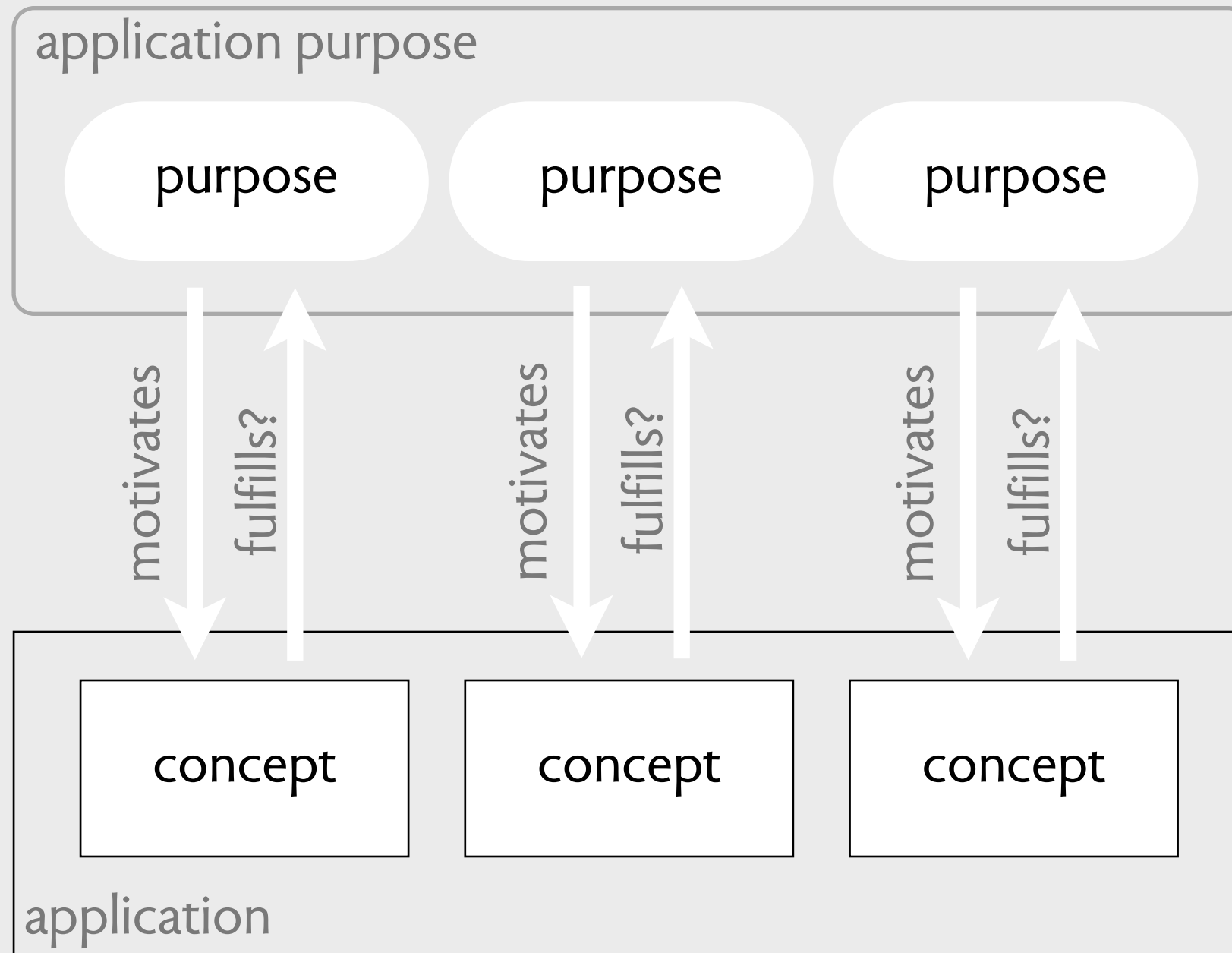
# NOTES ON THE SYNTHESIS OF FORM

CHRISTOPHER ALEXANDER

Copyright Material

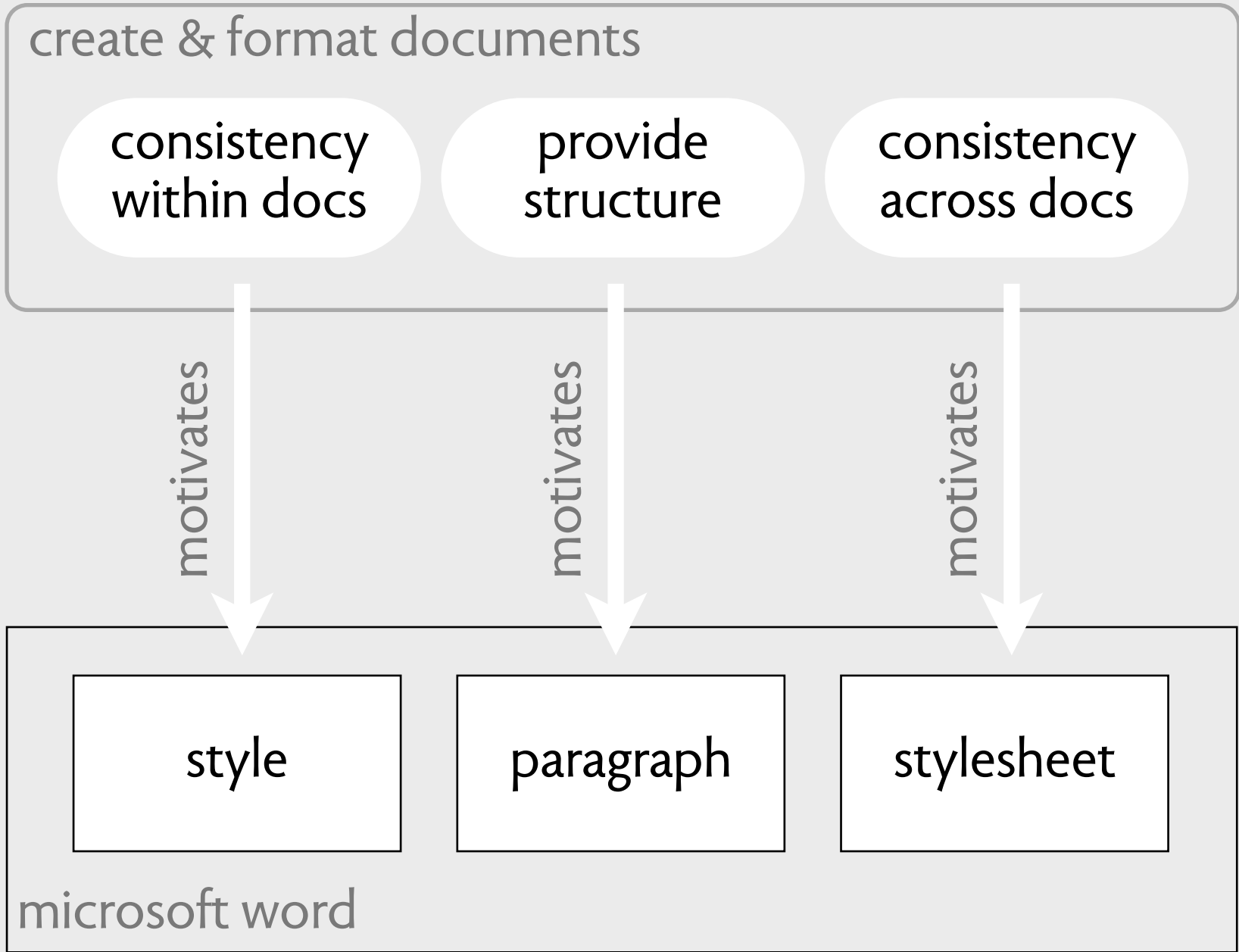
Such a list of requirements is potentially endless... But if we think of the requirements from a negative point of view, as potential misfits, there is a simple way of picking a finite set.

# concepts driven by purposes too





# example: microsoft word



how to explain  
a concept

**how would you explain this?**



# the operational principle

a way to explain a concept

## an archetypal scenario

separates essential from accidental aspects

shows how purpose is fulfilled

by combination of user & system actions



Michael Polanyi



“if you pull a tab out, **then** when that time slot comes around, the light will go on”



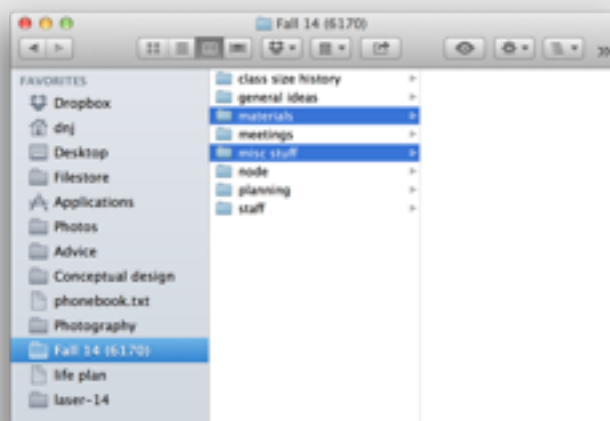
“if you pull a tab out, **then** when that time slot comes around, the light will go on”



“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 some files and they belong to a folder with keyboard focus, **then** pressing delete will move the files to the trash”

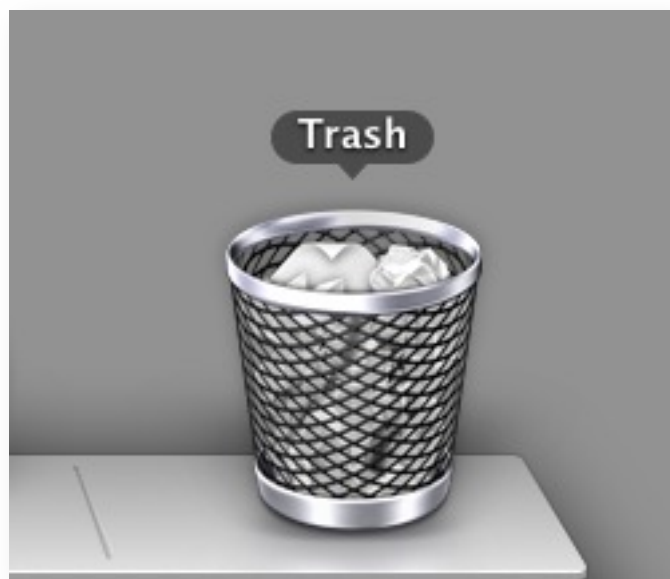
# purposes, principles & misfits

**purpose:** allow undo of deletions

**operational principle:** if you delete a file, it moves to a special folder; you can restore from there, but emptying it removes contents for good (and makes space on disk)

**misfit:** if you delete a file on an external drive, you cannot reclaim the space until you empty the trash, but then you'll lose the ability to restore files deleted from the main drive

**misfit:** if you delete an old file and change your mind, you may not be able to find it again in the trash (if there are many deleted files and you forgot the file's name)



**concept:** trash



# characteristics of the OP

**connects to purpose**

so OP for trash must include restore

**has sufficient span**

so OP for secure trash must go up to data recovery

**separates essential from accidental**

so OP for trash doesn't say files disappear when eject disk

concept  
design criteria

# the fundamental principle

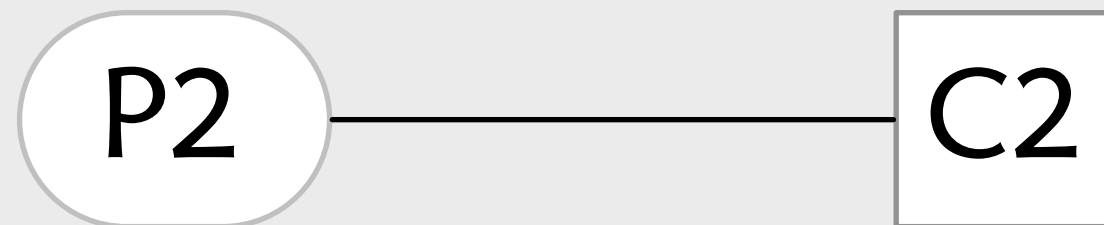
in a well-designed system  
each concept is motivated by one purpose



# the ideal mapping

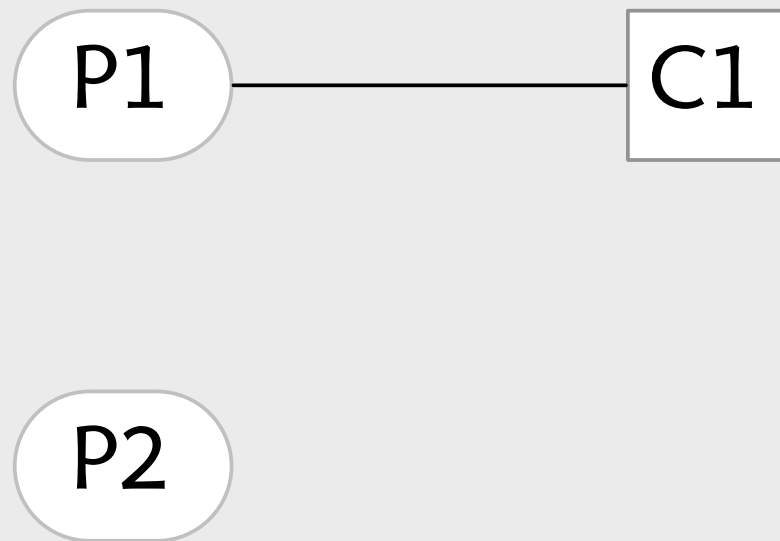
*purposes*

*concepts*

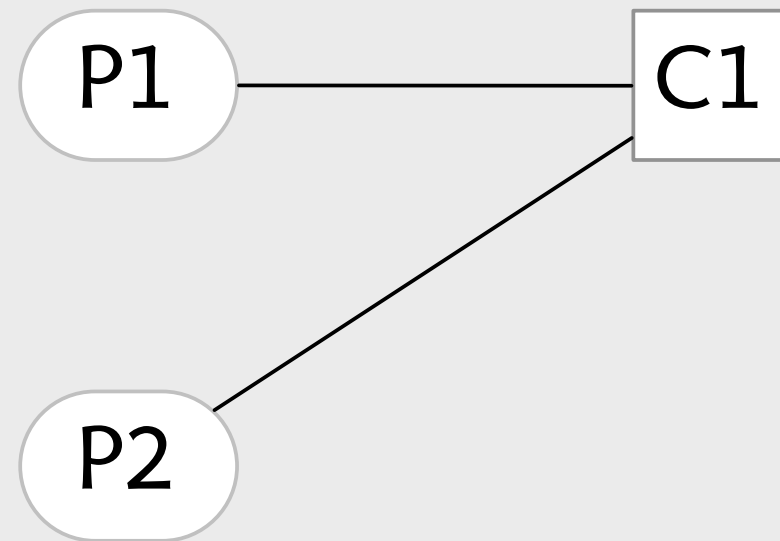


# 4 bad smells

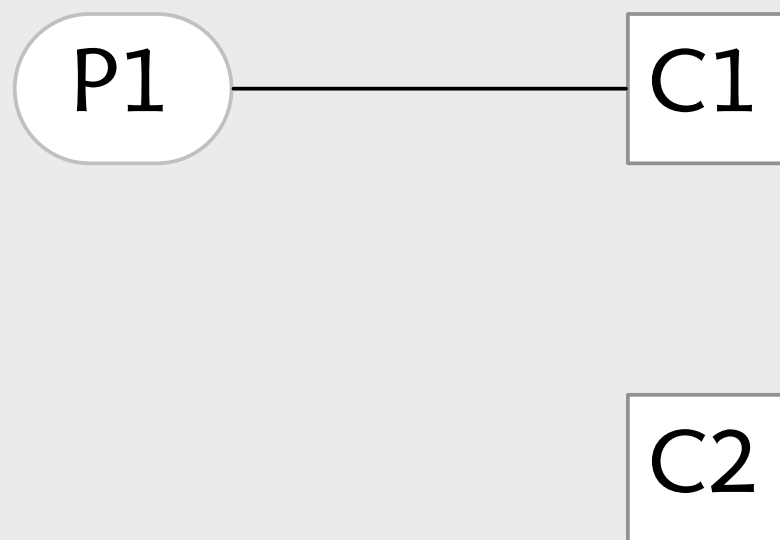
unfulfilled purpose



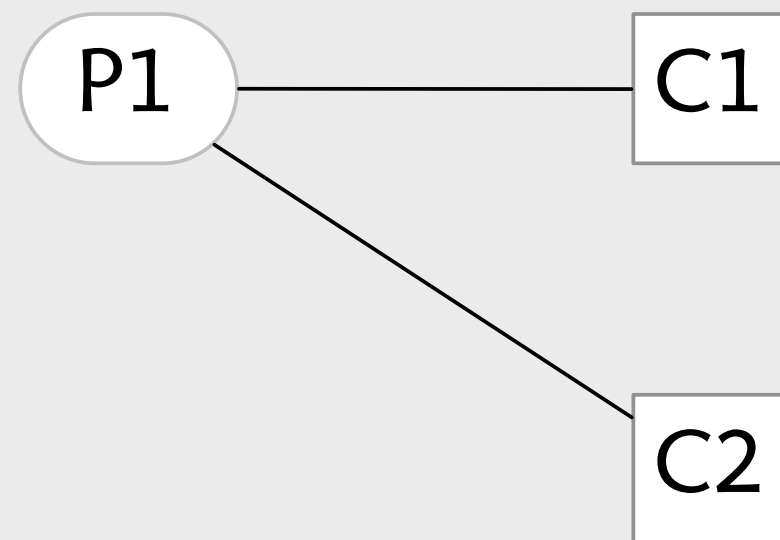
overloaded concept



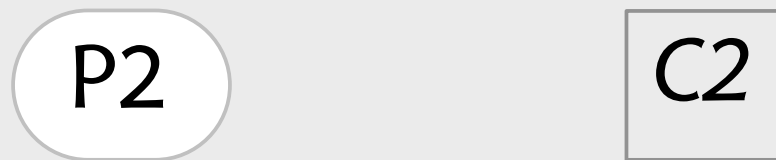
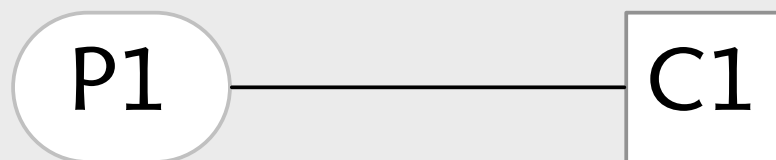
unmotivated concept



redundant concepts



# unfulfilled purposes



allow  
typeface  
independent  
styling

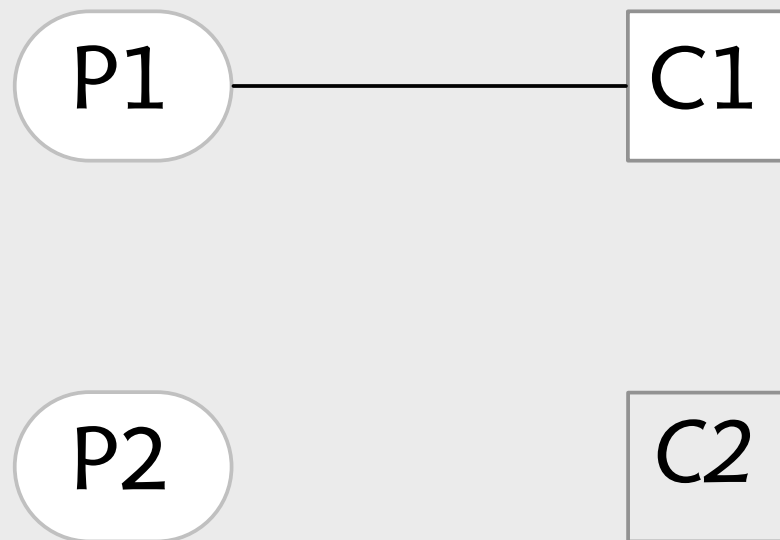
subfamily

- Light
- LightFracs
- LightOS
- LightItalic
- LightItalicOS
- Normal
- NormalFracs
- NormalOS
- ✓ Italic
- ItalicFracs**
- ItalicOS
- Semibold
- SemiboldFracs
- SemiboldItalic
- SemiboldItalicFracs
- SemiboldItalicOS
- SemiboldOS
- Bold
- BoldFracs
- BoldOS
- BoldItalic
- BoldItalicFracs
- BoldItalicOS

Adobe Indesign:  
**an unfulfilled purpose**



# unfulfilled purposes (more)



**user** (Apple Mail, Gmail)

'identify parties to communication'  
weak search, no authentication

**slide hierarchy** (Powerpoint)

'structure slides in a tree'  
sections provide just one level

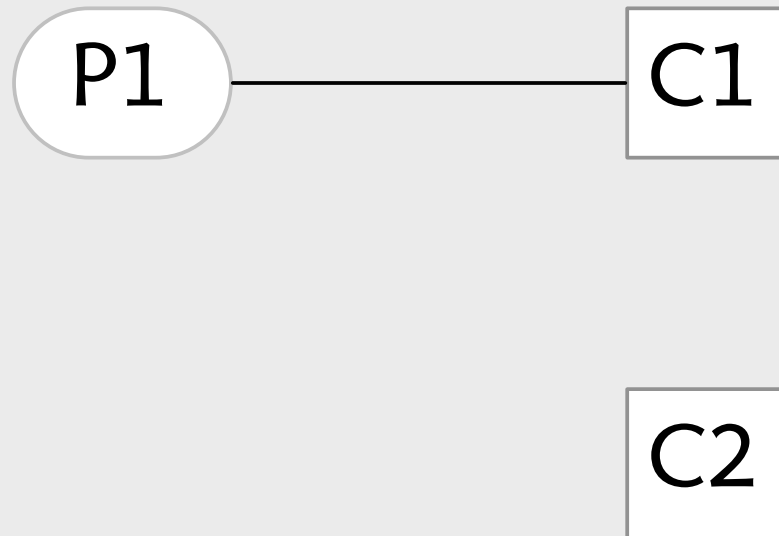
**eject-after-import** (Lightroom)

'prevent accidental writing'  
feature removed (and reinstated!)

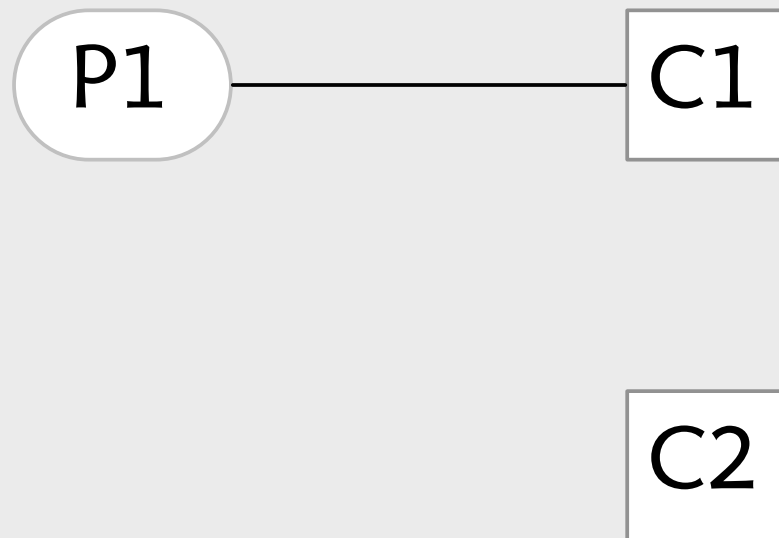
**binder** (Preview, Acrobat)

'maintain composite PDF doc'  
can insert pages, but forgets source

# unmotivated concepts



# unmotivated concepts (more)



**buffer** (text editors)

Apple got rid of it

**stash** (Git)

addresses branching misfits

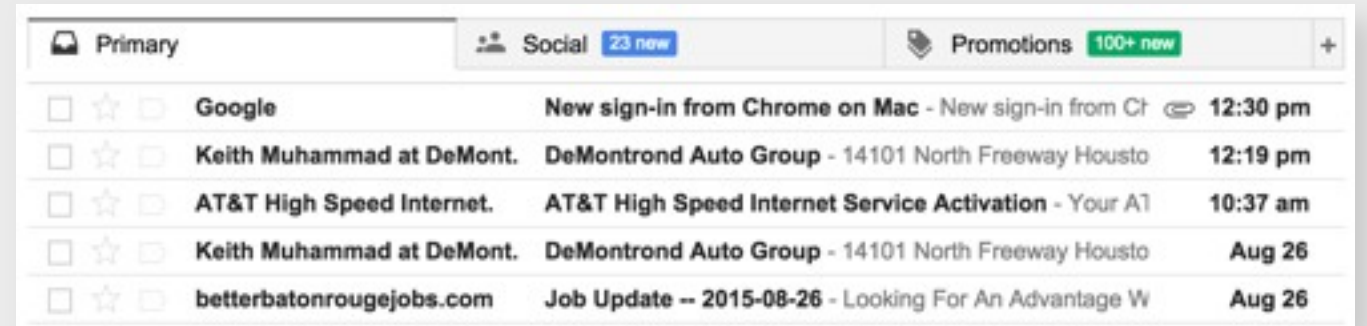
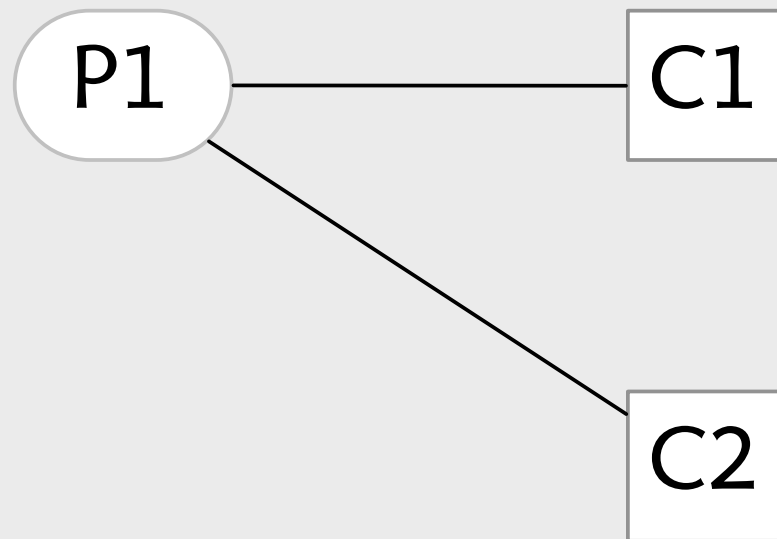
**boxing** (Java)

addresses primitives vs objects misfit

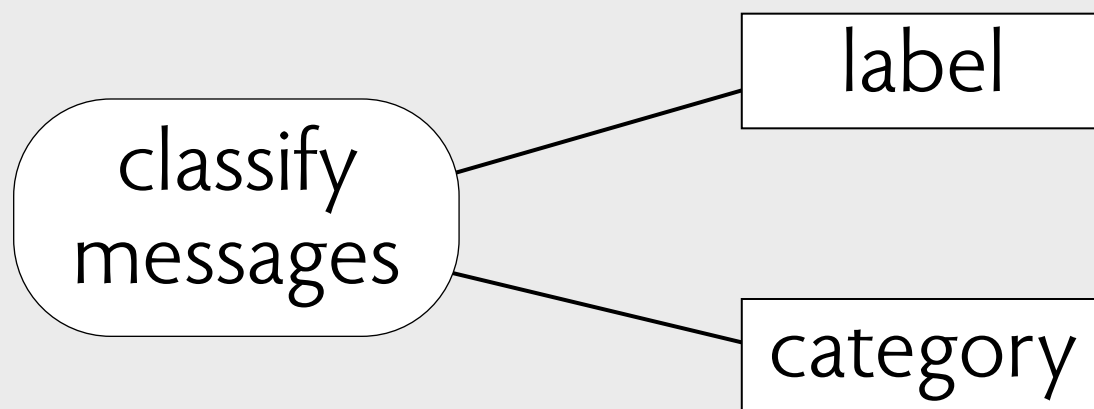
**null** (Javascript)

when undefined is too vague

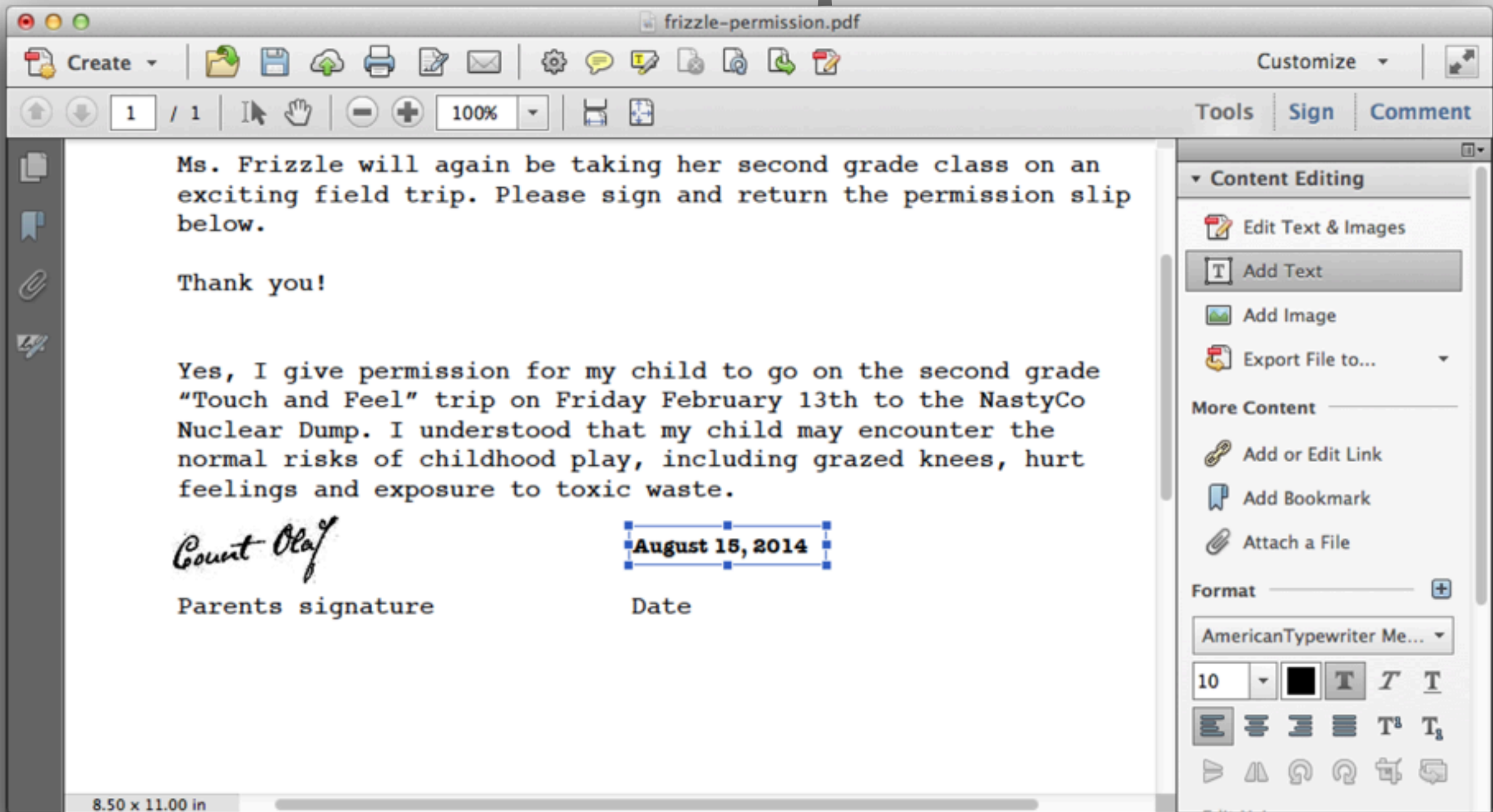
# redundant concepts



category in Gmail  
**a redundant concept**



# redundant concepts in acrobat

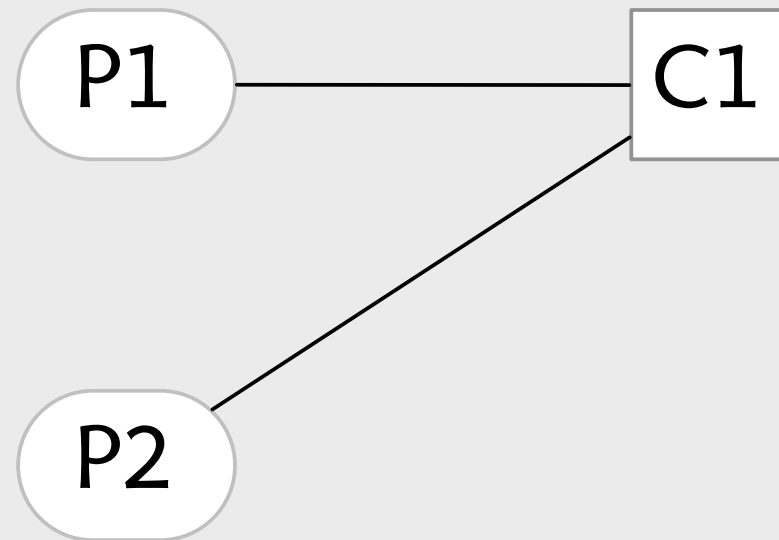


text object, text box, document text (Acrobat)  
all subtly different (Acrobat 10)  
merged into one (Acrobat 11)



# overloaded concepts

No one can serve two masters. Either you will hate the one and love the other, or you will be devoted to the one and despise the other. [Matthew 6:24]



3 forms of overloading:

**piggybacking** new purpose hacked onto old concept

**false convergence** two purposes looked the same

**emergent purpose** users found second purpose for concept

# piggybacking fuji camera

new purpose hacked onto old concept

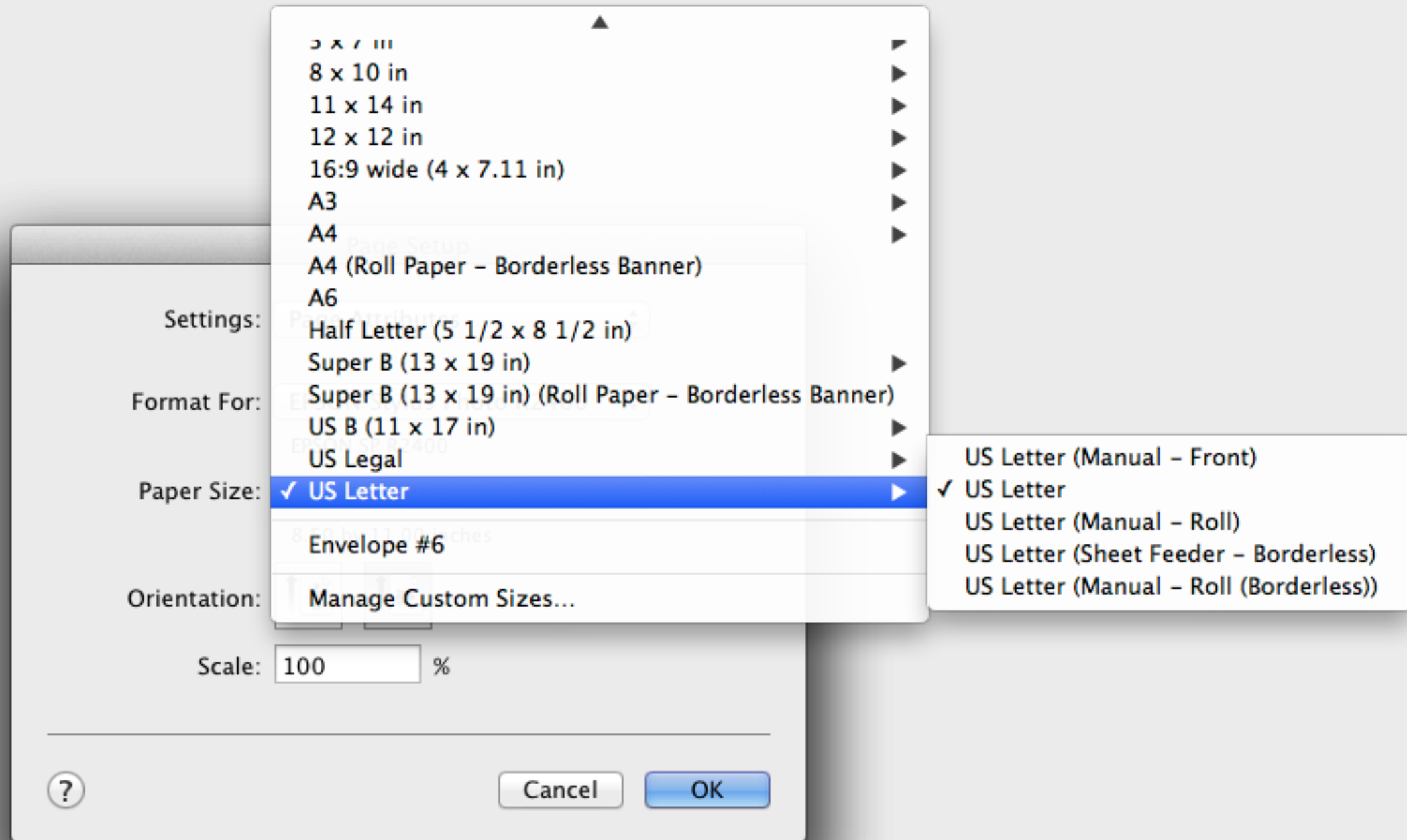


L	3:2	664
L	16:9	681
L	1:1	702
M	3:2	707
M	16:9	719
M	1:1	734
S	3:2	746

image size

aspect ratio piggybacked  
on JPEG dimensions

# piggybacking epson driver



result: can't create custom size for front loading  
also, page size presets in Lightroom hold feed setting

# false convergence

two purposes looked the same

## Performance Review Form 2016

---

### Performance Summary

**Evaluate and discuss the employee's performance.** Base your evaluation on the position requirements, [MIT Core Competencies](#), achievement of the goals established during the past year, and your assessment of the employee's accomplishments.

---

### Goal Setting

**State and discuss the expectations and goals for the upcoming review period.** Give examples of how these goals can be met (e.g., training). How will you support the employee to accomplish these goals? [Reference here](#)

evaluation & goal setting  
**incompatible purposes**

# false convergence

two purposes looked the same



filter incoming posts  
control access to my posts  
**distinct purposes**

2011: Facebook added  
subscribe/follow



# emergent purpose

users found second purpose for concept

To: Daniel Jackson <dnj@mit.edu>

Re: Catch me if you can in real life!

concept: email subject

**initial purpose: summarize content**

To: csail-related@lists.csail.mit.edu

Re: [csail-related] turn off the lights?

**emergent purpose: show sender**

nasty result (thanks to Shriram Krishnamurthi)

if you bcc a list, subject reveals to-address

To: Daniel Jackson <dnj@mit.edu>

your trip reservation

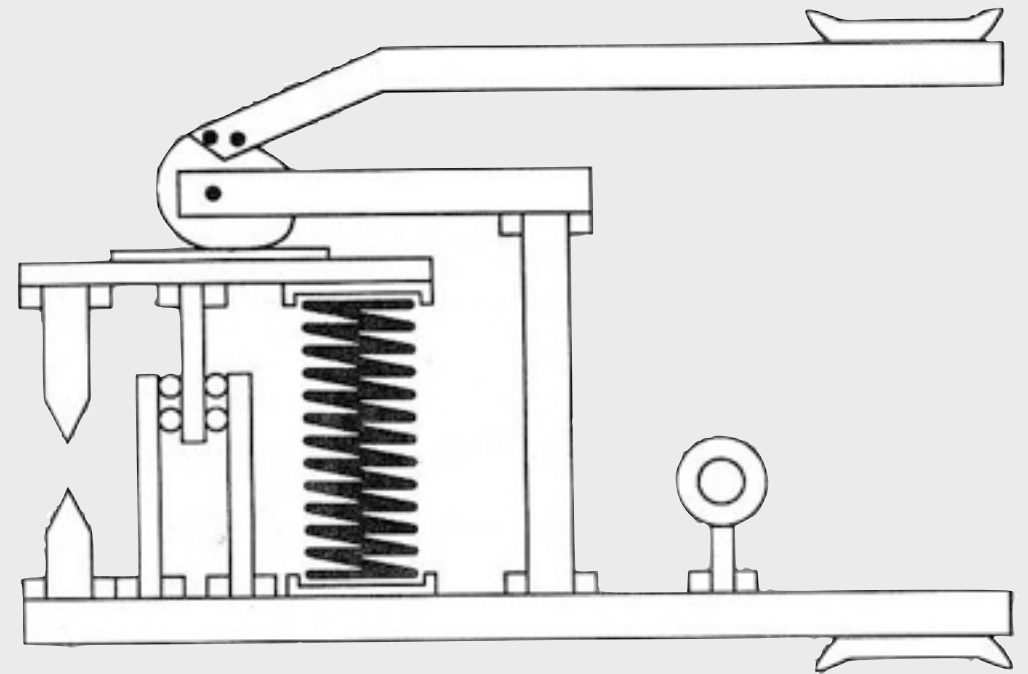
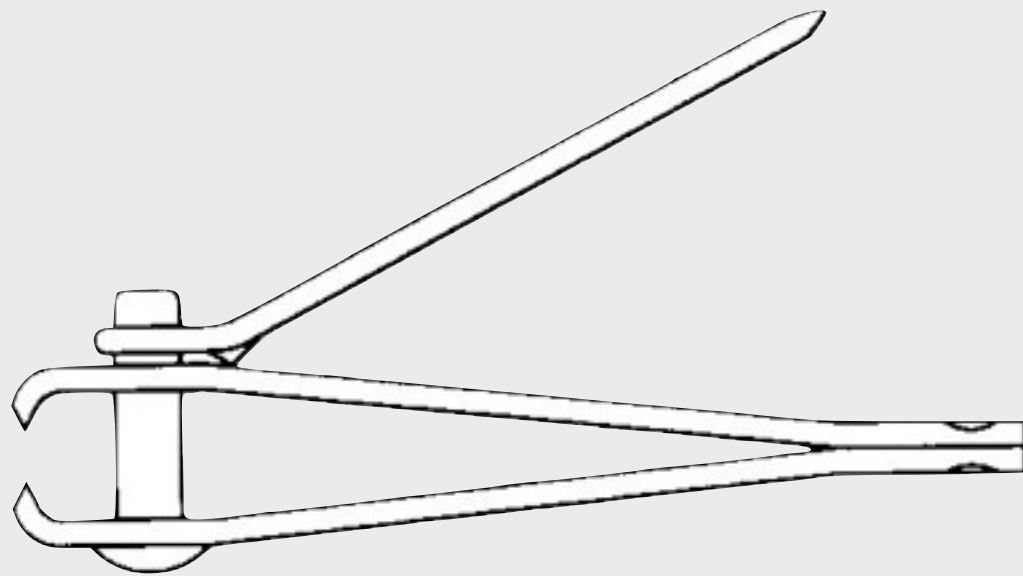
**emergent purpose: group by conversation**

nasty result (thanks to Eunsuk Kang)

can't label reservations from Expedia by trip

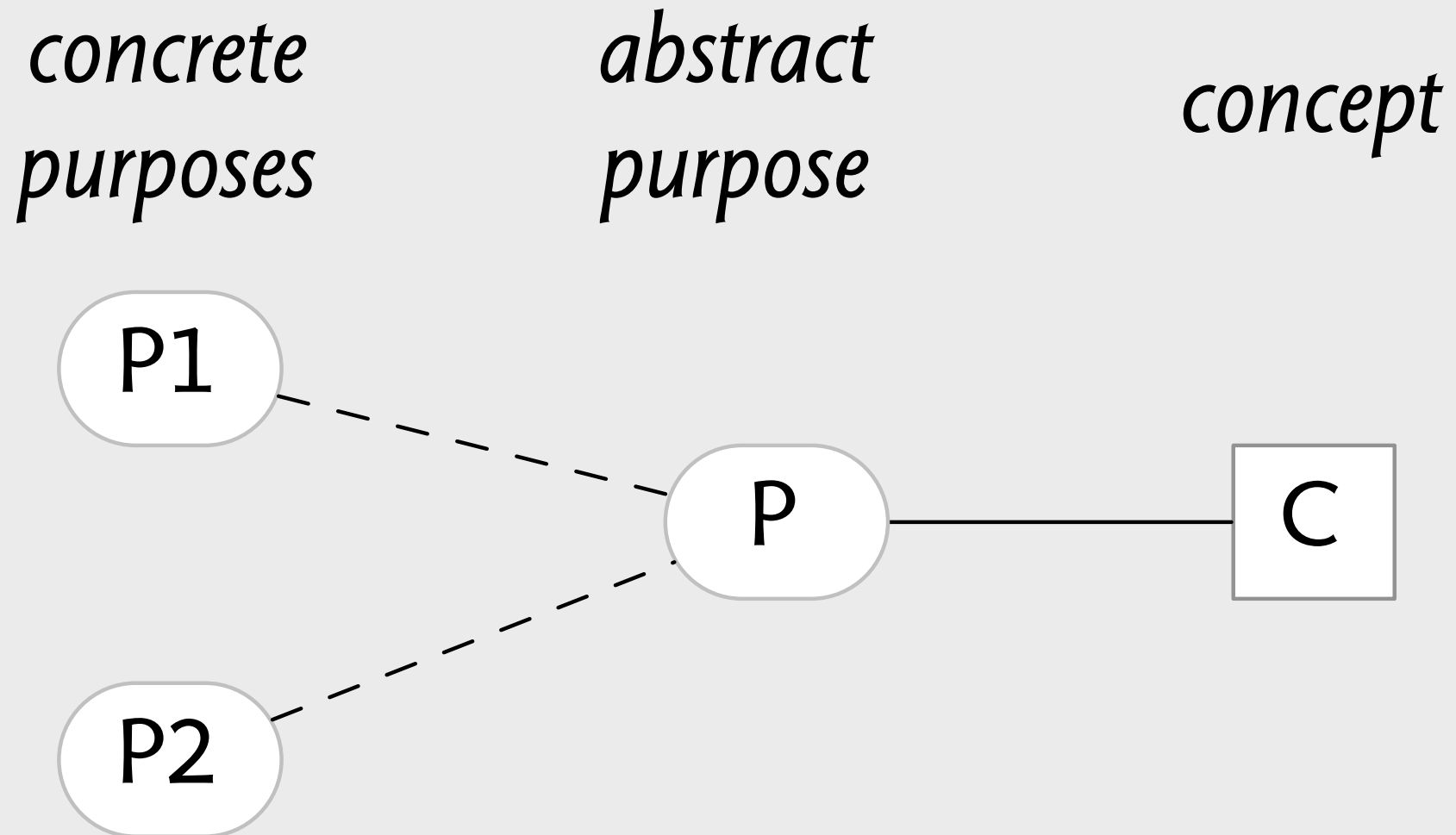
efficiency  
in design

# sharing: the essence of good design?



from Karl Ulrich, *Computation and Pre-Parametric Design* (1988)  
thanks to Yishai Feldman

# when overloading is acceptable



# shared concept amazon lists

Your Lists

Your Friends

Find Items Across Your Lists

Wish List (15)

Private

Shopping List (2)

Private

## Wish List



Save an idea. Shop for it later.

Add to list



### Before They Pass Away

by Jimmy Nelson (Hardcover)

★★★★★ (149)

\$99.37 ✓ Prime

Price dropped 13% (was \$115.20 when added to List)

In Stock. Offered by Amazon.com.

53 Used & New from \$95.32

[Add comments, quantity & priority](#)



### What Can We Believe Where?: Photographs of the American West (Yale University Art Gallery)

by Robert Adams, Joshua Chuang, Jock Reynolds

(Paperback)

★★★★★ (5)

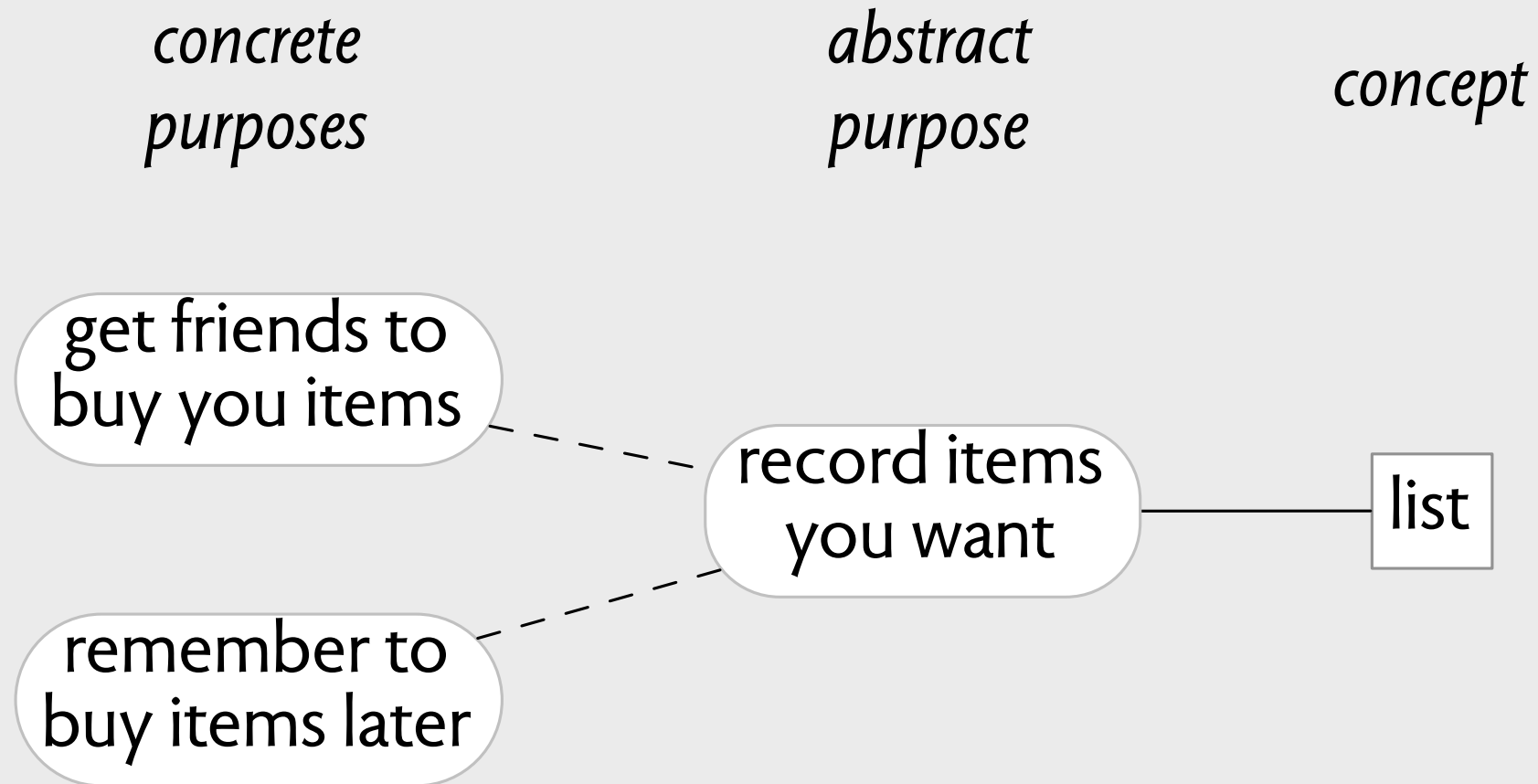
\$23.11 ✓ Prime

Only 7 left in stock--order soon. Offered by Amazon.com.

50 Used & New from \$13.64

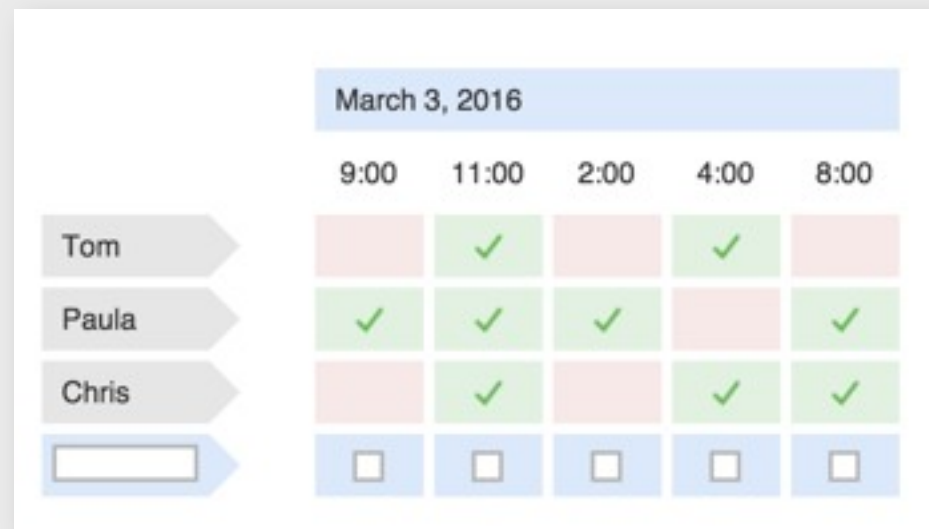
[Add comments, quantity & priority](#)

# abstract purpose amazon lists





# shared concept doodle poll



concrete purpose: schedule a meeting



concrete purpose: vote on a choice

# shared concept grayscale image in Ps



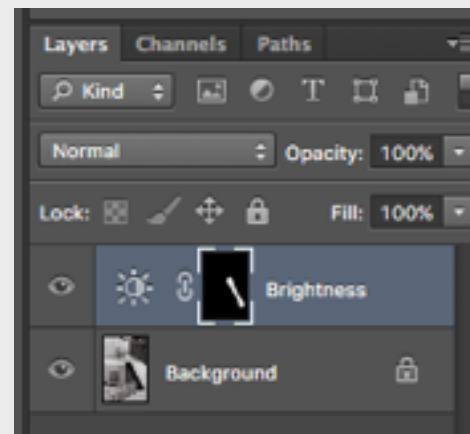
greyscale image



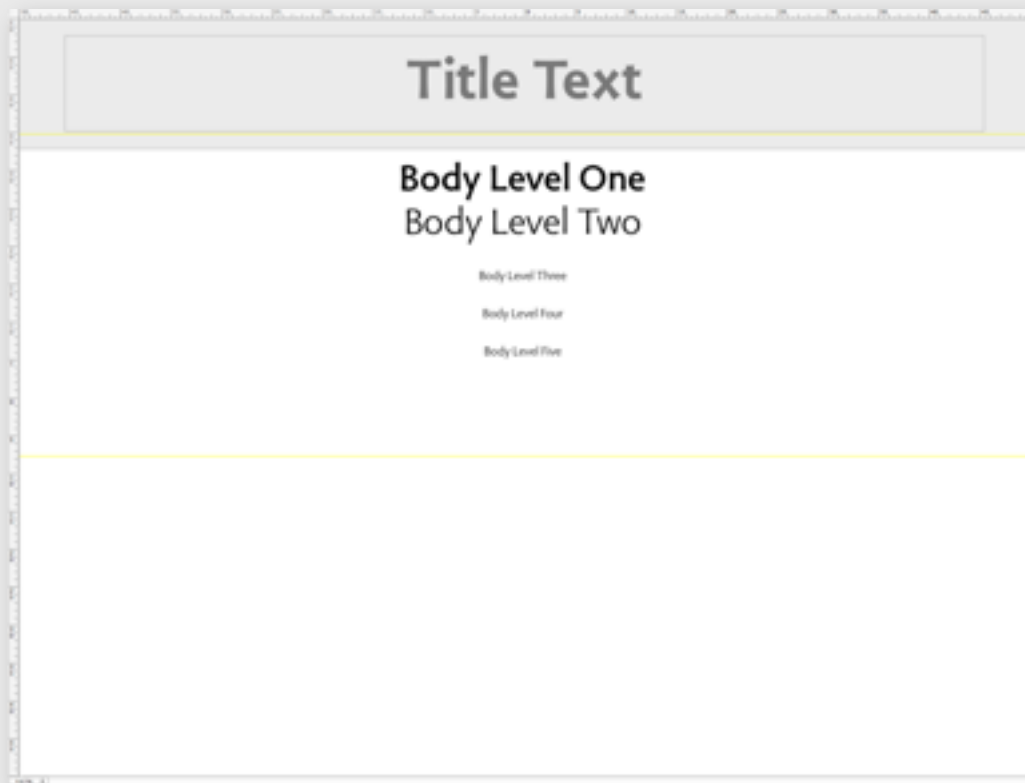
brushing pixels



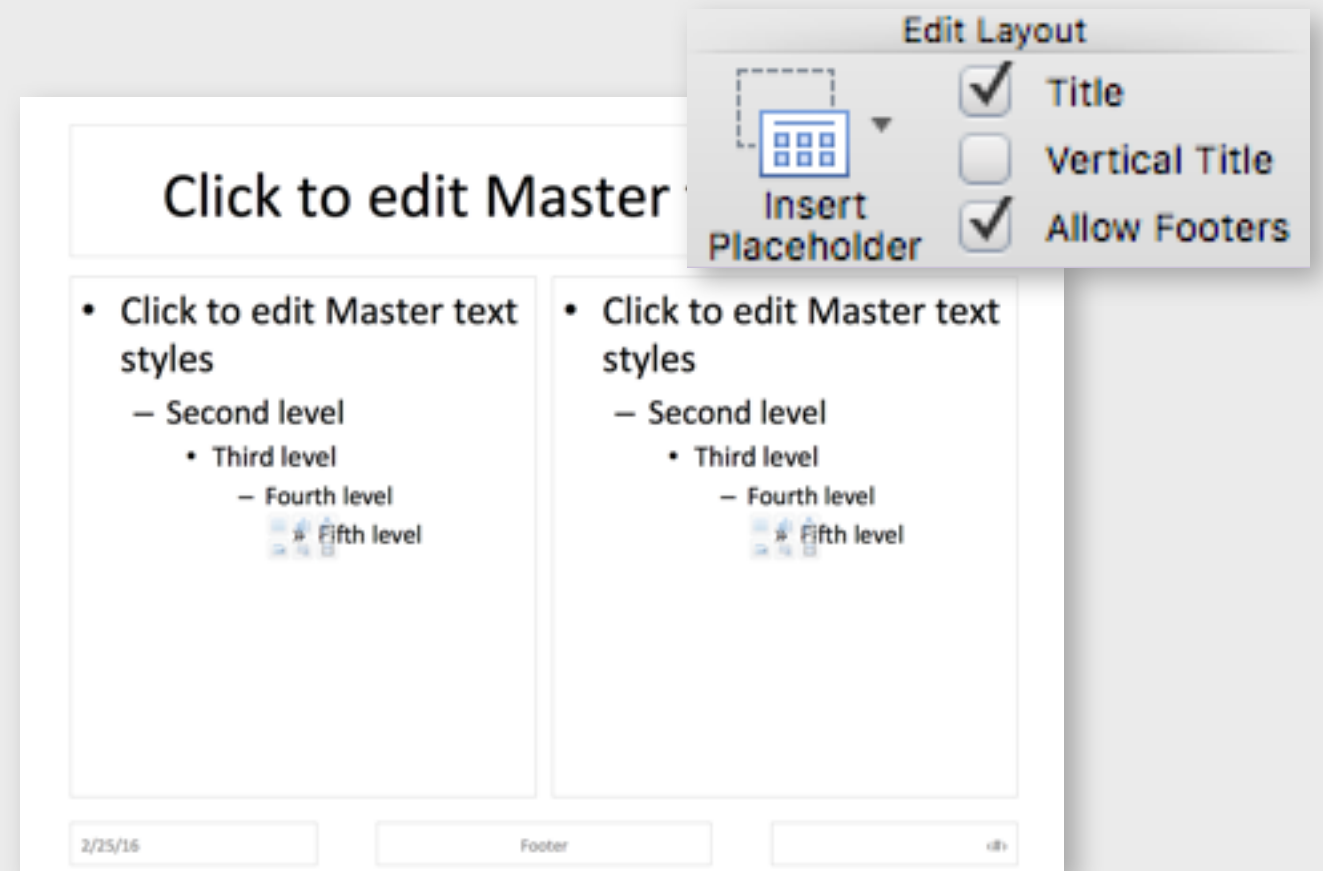
brushing pixels in layer mask



# shared concept placeholder



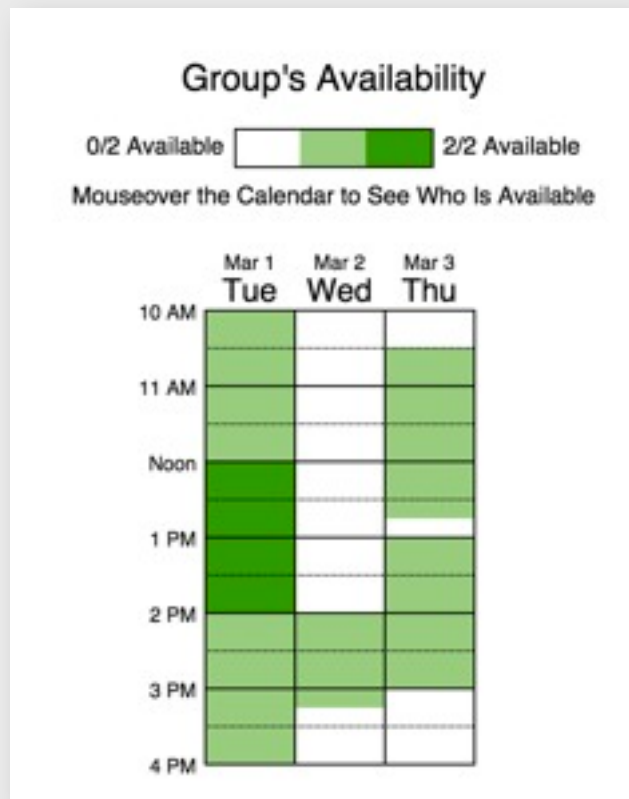
Keynote: no shared concept for title & body



Keynote: shared concept of placeholder

# risks of shared concepts

limited functionality for concrete purpose



Doodle doesn't offer some scheduling specific functionality that when2meet offers

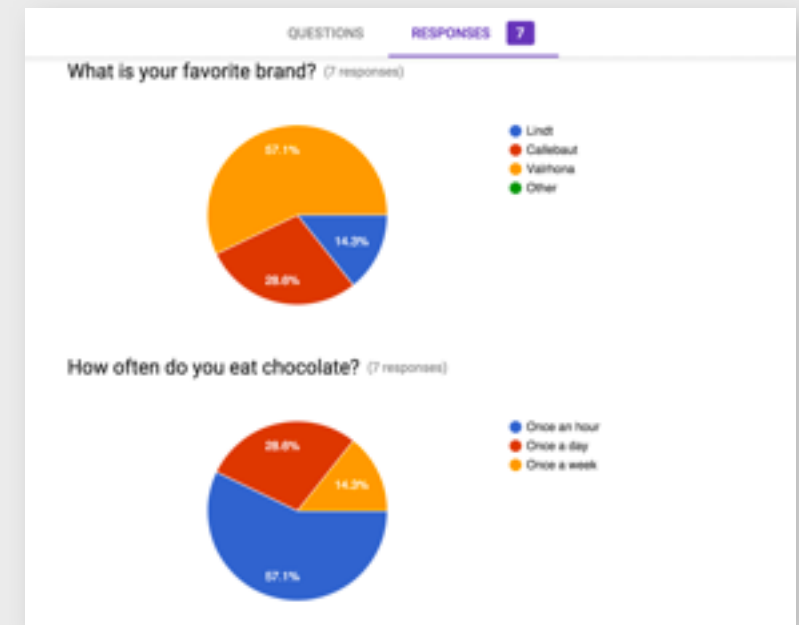
security & safety oversights



Amazon wishlists privacy risk

<http://www.dailymail.co.uk/news/article-2984542>

unexpected couplings



	A	B	C
1	Timestamp	What is your favorite brand?	How often do you eat chocolate?
2	2/25/2016 8:56:31	Valrhona	Once an hour
3	2/25/2016 8:56:38	Lindt	Once a day
4	2/25/2016 8:56:44	Valrhona	Once a day
5	2/25/2016 8:56:50	Callebaut	Once a week
6	2/25/2016 8:57:11	Callebaut	Once an hour
7	2/25/2016 8:57:17	Valrhona	Once an hour
8	2/25/2016 8:57:22	Valrhona	Once an hour

Google forms: spreadsheet not synced with responses

conclusions

# thoughts on agile development

## the achille's heel of agile

hacking scenario by scenario  
risk is you end up with CSS

## questions

what is the right granularity?  
how do scope an MVP?  
how do you justify an increment?

**concepts?**  
**dependences?**  
**purposes?**



# elements of software design?

	designer	engineer
building	facade, entry flow, access, light	beam, wall structural integrity
software	<b>purpose, concept</b> <b>fitness for purpose</b>	function, datatype decoupling, localization

# a common view of software design

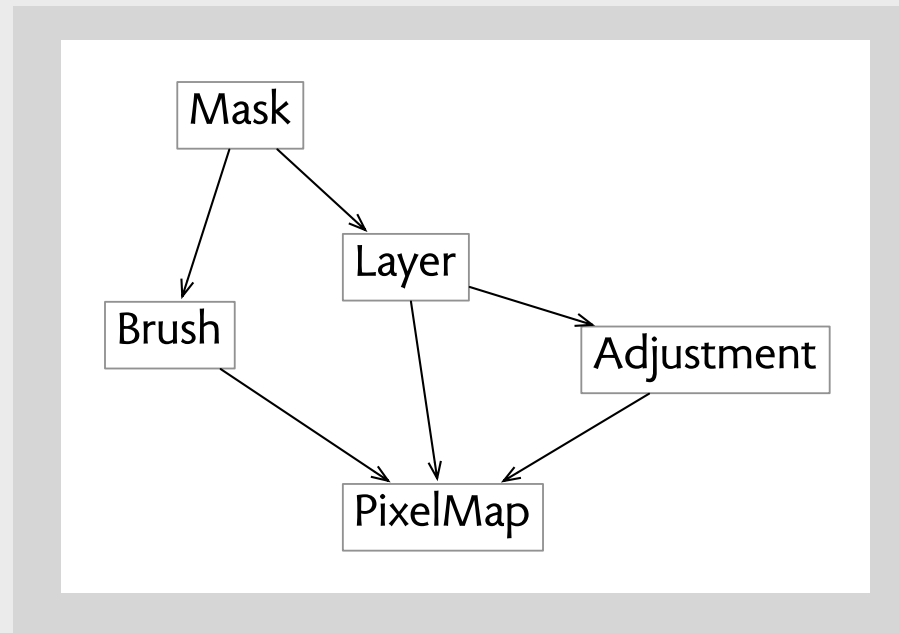


**UI design**  
soft & human  
about presentation

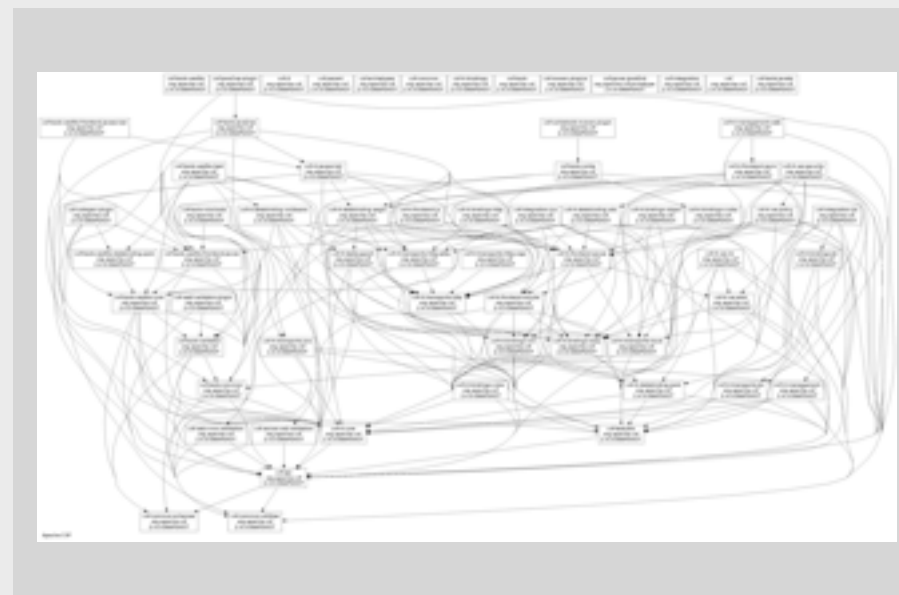


**programming**  
hard & technical  
about content

# a better view of software design



**conceptual design:**  
essential concepts  
& behavior



**representation design:**  
organization & performance

backup  
material

case  
studies

# gitless: a reworking of git

## Gitless: a version control system

Fork me on GitHub

### About Gitless

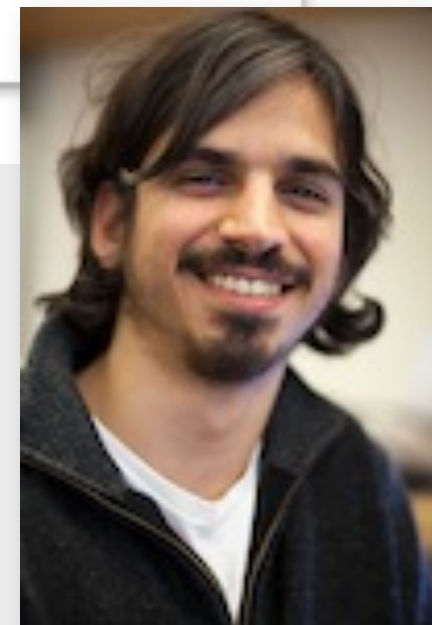
Gitless is an experimental version control system built on top of Git. Many people complain that Git is hard to use. We think the problem lies deeper than the user interface, in the concepts underlying Git. Gitless is an experiment to see what happens if you put a simple veneer on an app that changes the underlying concepts. Because Gitless is implemented on top of Git (could be considered what Git pros call a "porcelain" of Git), you can always fall back on Git. And of course your coworkers you share a repo with need never know that you're not a Git aficionado.

Check out the [documentation](#) to get started. If you are a novice user that never used any version control system the documentation should be enough to get you started. If you are a Git pro looking to see what's different from your beloved Git you'll be able to spot the differences by glancing through the [Gitless vs. Git](#) section.

### Download

- [Mac OS X Binary \(.tar.gz\)](#)
- [Linux Binary \(.tar.gz\)](#)
- [Source Code \(.tar.gz\)](#)

For installation instructions [see the readme file](#). After installation, you should be able to execute the `gl` command. The current Gitless version is 0.7 which was released on 4/2015 ([release notes](#)).

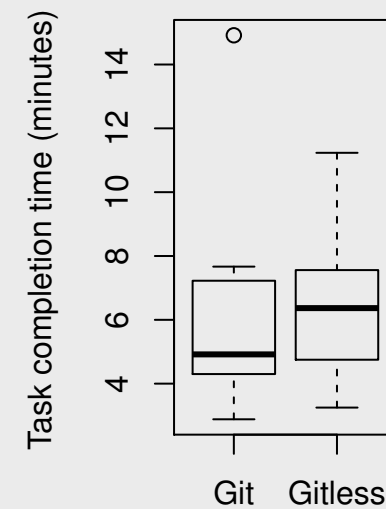
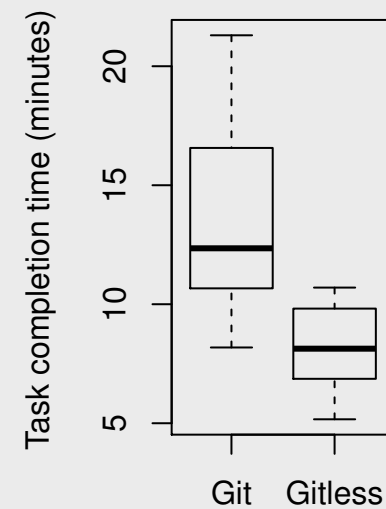
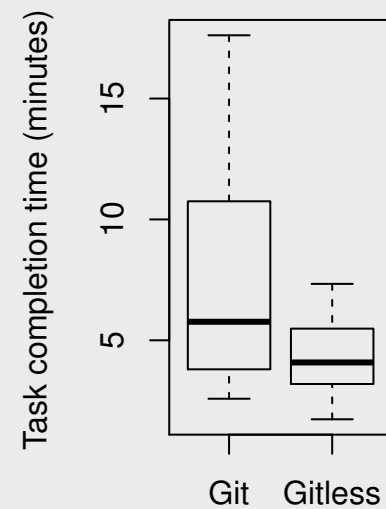
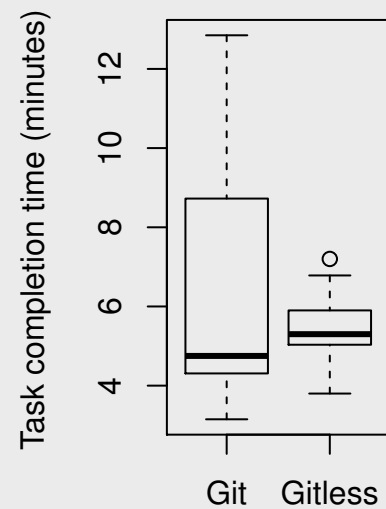
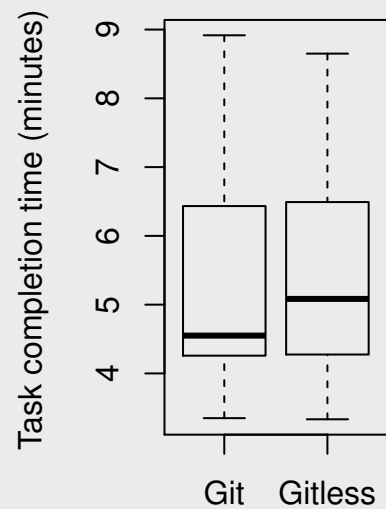
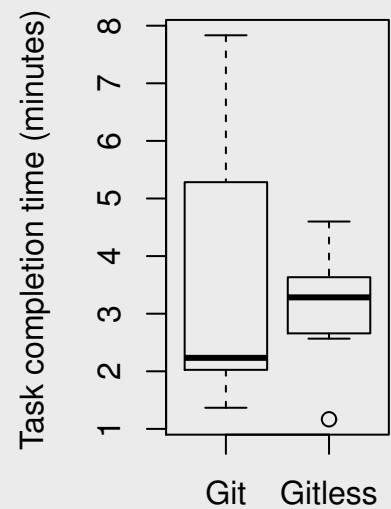
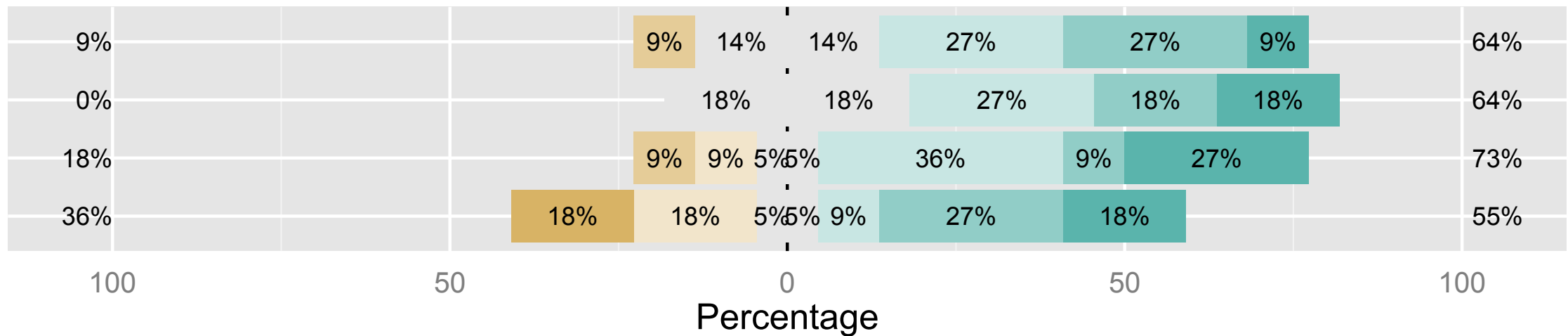


Santiago  
Perez De Rosso



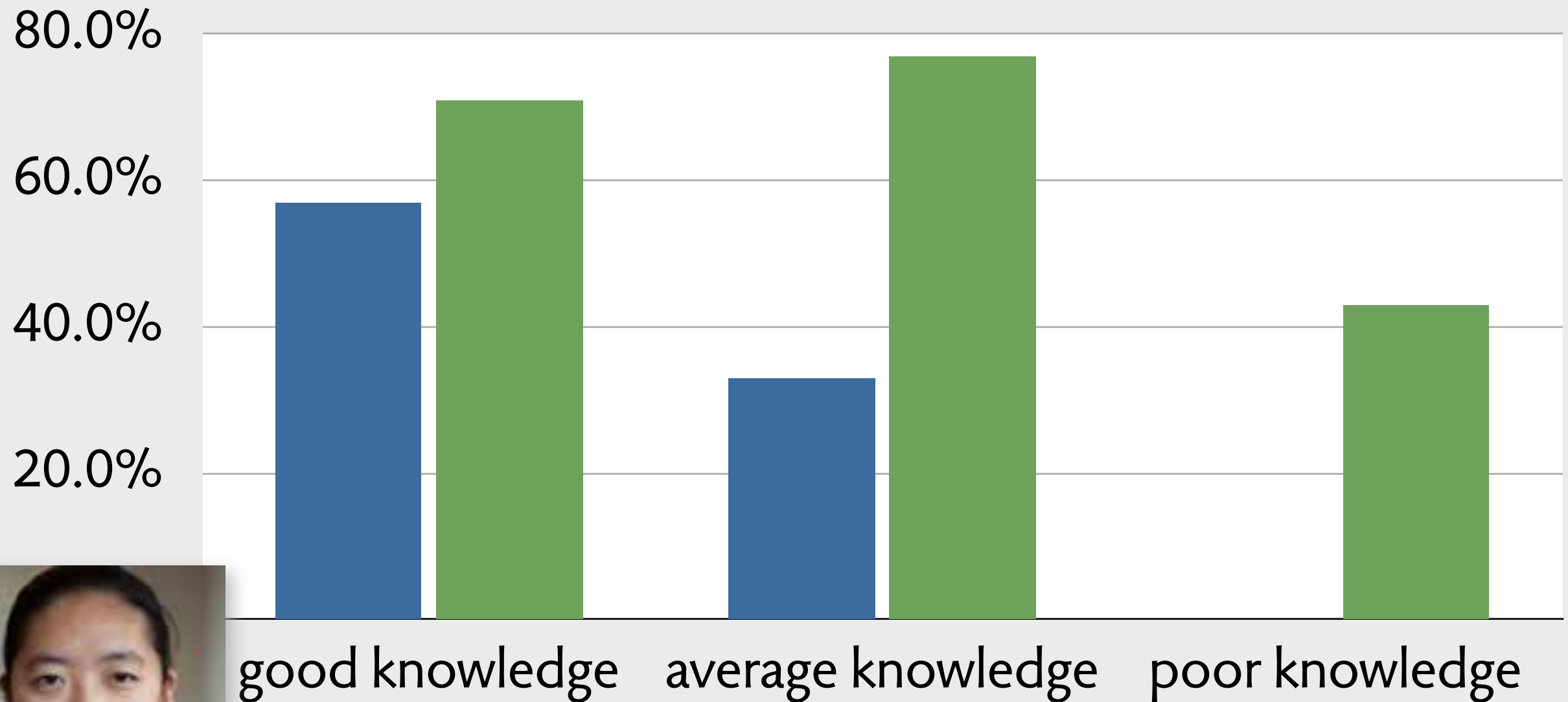
# results of a user study

I enjoyed using Gitless  
 I found Gitless to be easier to learn than Git  
 I found Gitless to be easier to use than Git  
 I would continue using Gitless if I could



# small survey of MIT dropbox users

correctly predicting behavior



Kelly Zhang

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

# the root of the problem

The rôle of a formal functional specification is simply to act as a logical firewall between two completely different concerns... The **pleasantness problem** concerns the question whether a system... would satisfy our needs... The correctness problem concerns the question whether a given design meets such-and-such a formal functional specification. The logical firewall ... isolates computing science's well-carved niche from the pleasantness problem to which science has little to contribute. Please note that I did not say that the one problem is more important than the other; after all, no chain is stronger than its weakest link.



Edsger Dijkstra  
EWD952

# user interface levels

*shallower*

physical level

linguistic level

navigation level

conceptual level

*deeper*



concept  
distinctions

# given vs instrumental concepts

instrumental:  
invented for app

given:  
preexisted in  
domain

banking app  
overdraft protection loan  
automatic bill payment  
available funds balance

account balance

social networking app

friendship

tag

post

photo

URL

note that all concepts, even given  
concepts are a means to an end

travel app

itinerary

agony factor

passenger profile

flight number

reservation



# these are not concepts...

search

authentication

*purposes*

*concepts*

search string

certificate

DOM element

HTTP request

*implementation details*

*concepts*

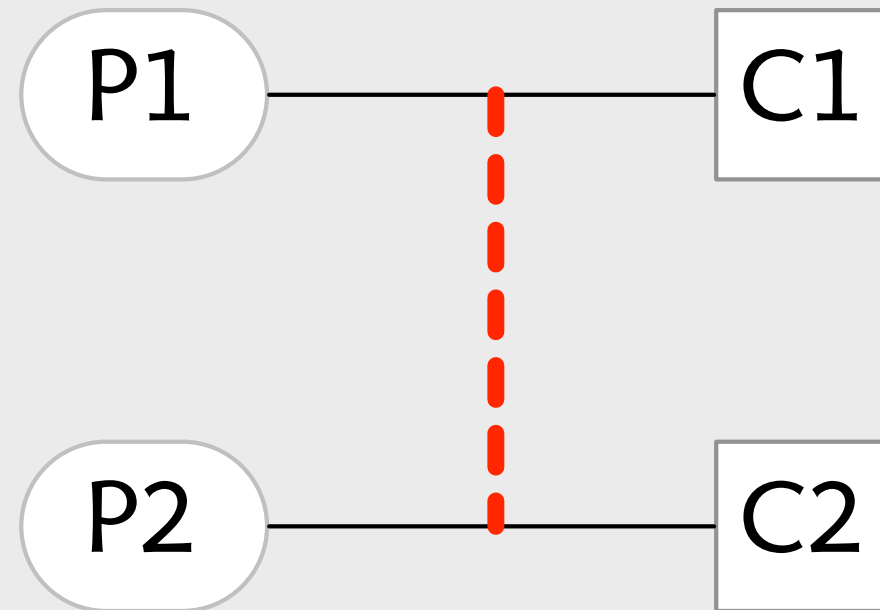
web page

link

but this is a concept for a user of the jQuery API (vs. a user of Chrome)

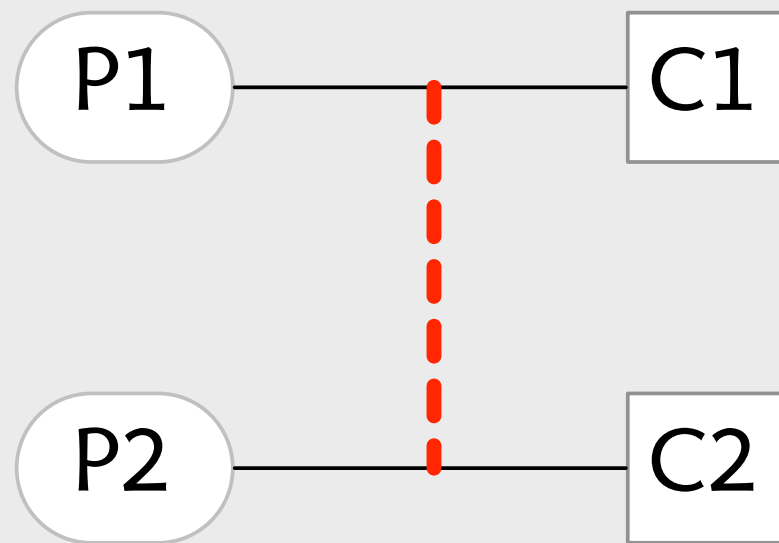
orthogonality  
& uniformity

# orthogonality



orthogonality is violated when one concept's fitness for purpose is undermined by another concept

# non-orthogonal concepts



Shriram Krishnamurthi  
BCC example

**origin, space, exclusion (CSS)**  
4 position values for  $2 \times 3 \times 2$  options

**conversation & label (Gmail)**  
same subject, get same label

**listserv & bcc (SMTP)**  
modified subject reveals target

**title & reply (Tumblr)**  
adding ? to title enables replies (!)

**group & selection (many old apps)**  
can't select object in a group

**group & connector (Keynote 5.3)**  
can't select box if connected

# non-orthogonal concepts gmail

from Eunsuk Kang

**Eunsuk Kang <eskang@csail.mit.edu>**

December 11, 2014 2:27 AM

To: Daniel Jackson <dnj@MIT.EDU> , Santiago Perez De Rosso <sperezde@csail.mit.edu>

[Hide Details](#)

an example of bad coupling in gmail?

[Conceptual Design](#) ↑

Hi Daniel, Santiago,

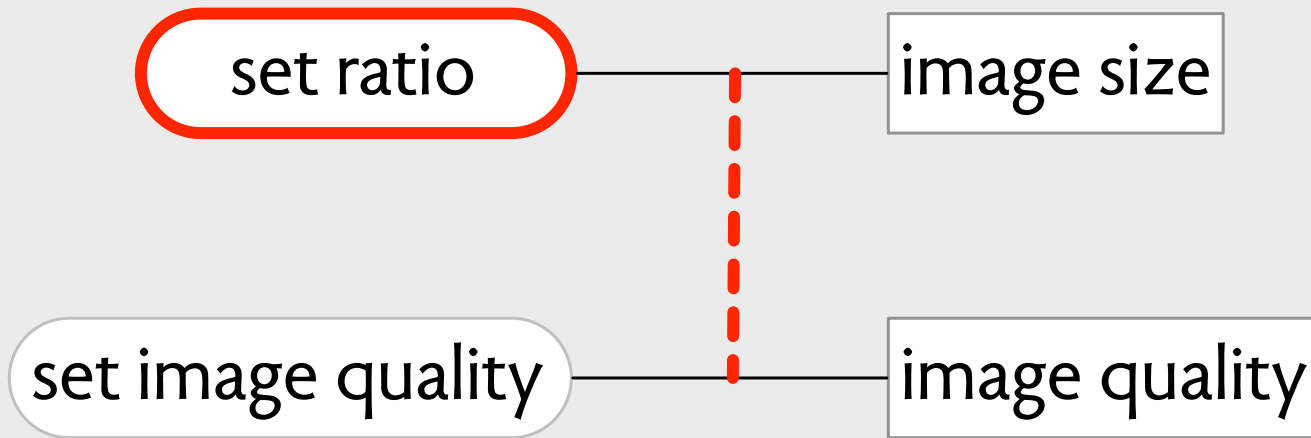
I am not sure whether this falls into one of the conceptual design issues that you have been analyzing, but here's a little annoyance that I just ran into using labels in Gmail.

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!

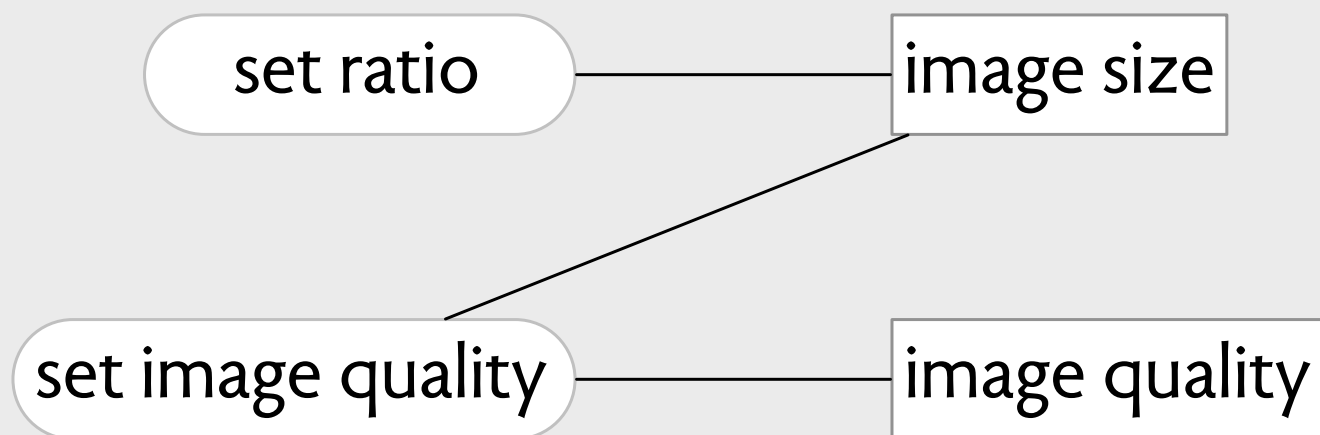
(By the way, is it possible to take an e-mail out of a conversation? Either this is impossible or the Gmail UI does not make this easy).

Eunsuk

conversations interfere with labels



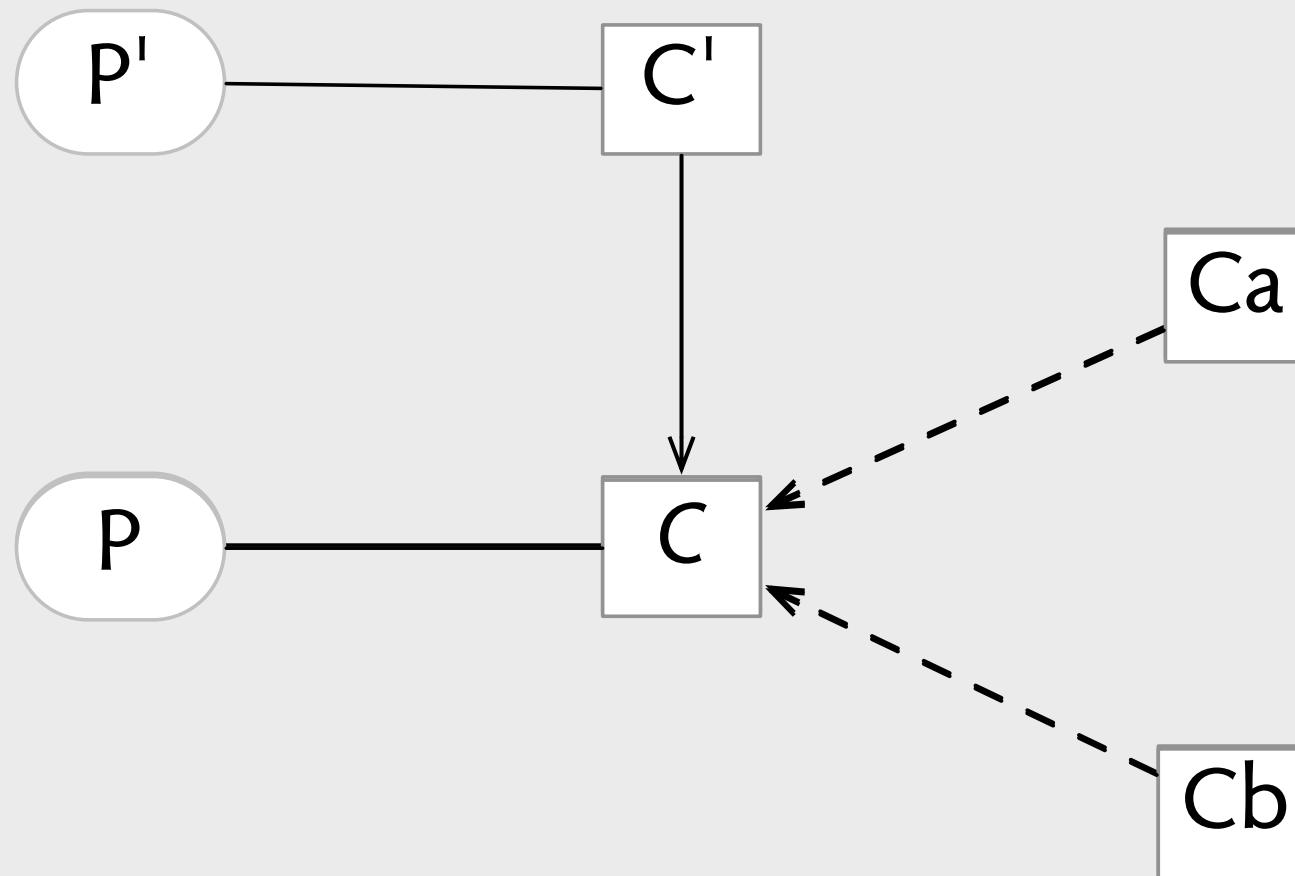
an orthogonality violation



overloaded concept too



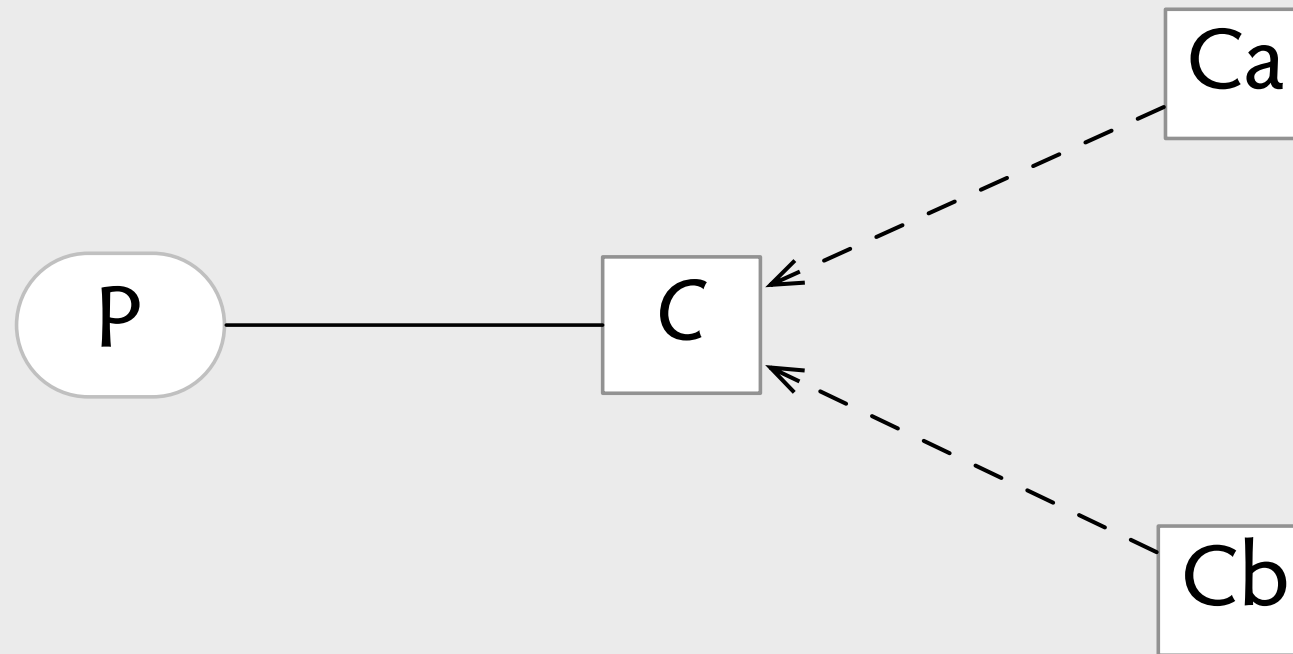
# uniformity



uniformity is violated when instantiations differ with respect to fulfillment of purpose

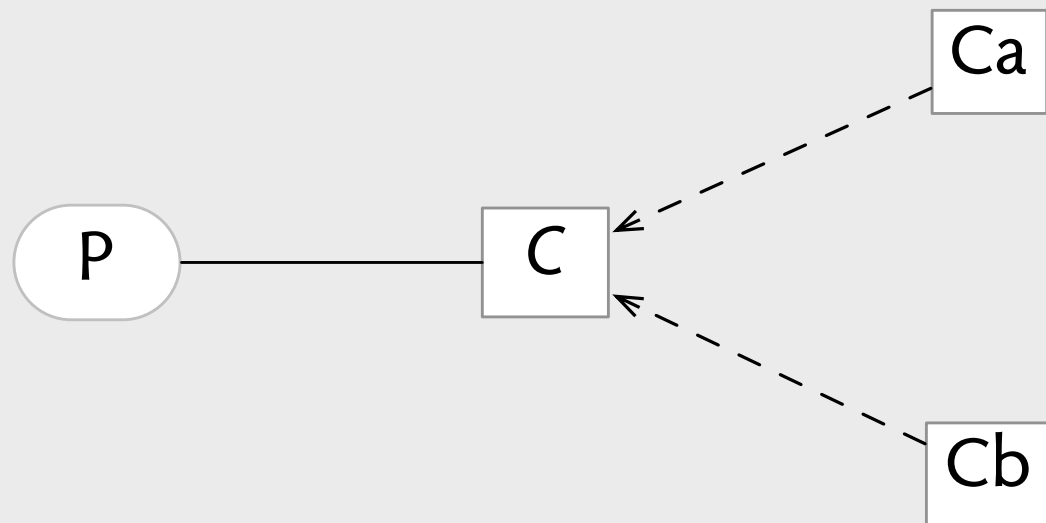
... directly or indirectly

# uniformity



uniformity is violated when a concept has different versions or instantiations that behave differently for no good reason

# non-uniform concepts



**deposits by check** (banking)  
funds arrive before clearing

**primitive type** (Java)  
not like a class type

**direct flight** (Official Airline Guides)  
1 flight number, but >1 stop

**alerts** (Apple iCal)  
can't select email alerts for default

**custom settings** (Fuji x100s)  
only some settings selectable

conceptual  
acrobatics

## Field Trip Permission Form

Dear Parents:

Ms. Frizzle will again be taking her second grade class on an exciting field trip. Please sign and return the permission slip below.

Thank you!

Yes, I give permission for my child to go on the second grade "Touch and Feel" trip on Friday February 13th to the NastyCo Nuclear Dump. I understood that my child may encounter the normal risks of childhood play, including grazed knees, hurt feelings and exposure to toxic waste.

*Count Olaf*

February 11, 2013

---

Parents signature

Date

# acrobat to the rescue

The image shows a screenshot of the Adobe Acrobat application interface on a Mac. The main window displays the 'Tools' menu, which is open, showing options like 'Comment & Markup', 'Select & Zoom', 'Advanced Editing', 'Typewriter', 'Analysis', and 'Multimedia'. The 'Advanced Editing' option is highlighted, and its sub-menu is visible, listing tools such as 'Select Object Tool', 'Button', 'Article Tool', 'Crop Tool', 'Link Tool', 'TouchUp Text Tool', 'TouchUp Reading Order Tool', and 'TouchUp Object Tool'. The 'TouchUp Object Tool' is currently selected. In the foreground, a text editor window titled 'acrobat-sig-paste.txt' is open, displaying the following text:

```
1 how to add a signature in acrobat
2 -- open document in acrobat
3 -- Tools->Advanced Editing->Touchup Object Tool
4 -- right click at desired point | Place Image...
5 then select jpg
6
7 how to add date
8 -- Tools->Typewriter
9
```



# what we hate ... & love



Adobe Acrobat is a family of computer programs developed by Adobe Systems, designed to view, create, manipulate and manage files ... »

47% Love Acrobat



Tweet 1



207 Positive Opinions out of 444



Adobe Photoshop is a graphics editing program developed and published by Adobe Systems Incorporated.

70% Love Photoshop



Tweet 87



30,305 Positive Opinions out of 43,283



Adobe Photoshop Lightroom is a photography software program developed by Adobe Systems for Mac OS X and Microsoft Windows, designed ... »

89% Love Lightroom



Tweet 3



2,335 Positive Opinions out of 2,632



Adobe Acrobat is a family of computer programs developed by Adobe Systems, designed to view, create, manipulate and manage files ... »

53% Hate Acrobat



Tweet 15

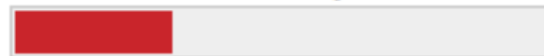


237 Negative Opinions out of 444



Adobe Photoshop is a graphics editing program developed and published by Adobe Systems Incorporated.

30% Hate Photoshop



Tweet 105

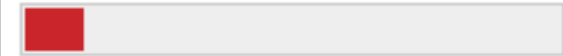


12,978 Negative Opinions out of 43,283



Adobe Photoshop Lightroom is a photography software program developed by Adobe Systems for Mac OS X and Microsoft Windows, designed ... »

11% Hate Lightroom



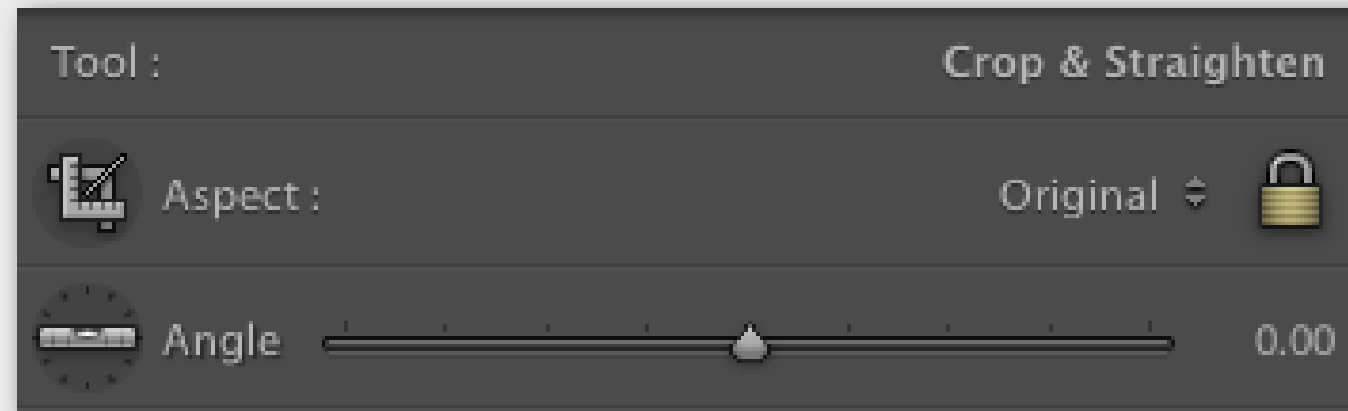
Tweet 5





297 Negative Opinions out of 2,632



# cropping in adobe lightroom



# cropping photoshop

 Width:  Height:  Resolution:  pixels/inch 



# cropping the whole image

Resolution: 72





# it's all about the concepts



**Acrobat**  
text box  
object  
document text

incoherent  
concepts, no clear  
purpose



**Photoshop**  
channel  
layer  
mask

powerful concepts  
with low level  
purposes



**Lightroom**  
action  
treatment  
effect

simple  
concepts with  
purposes aligned to  
common tasks

# all's well that ends well

## **acrobat 9**

deeply troubled

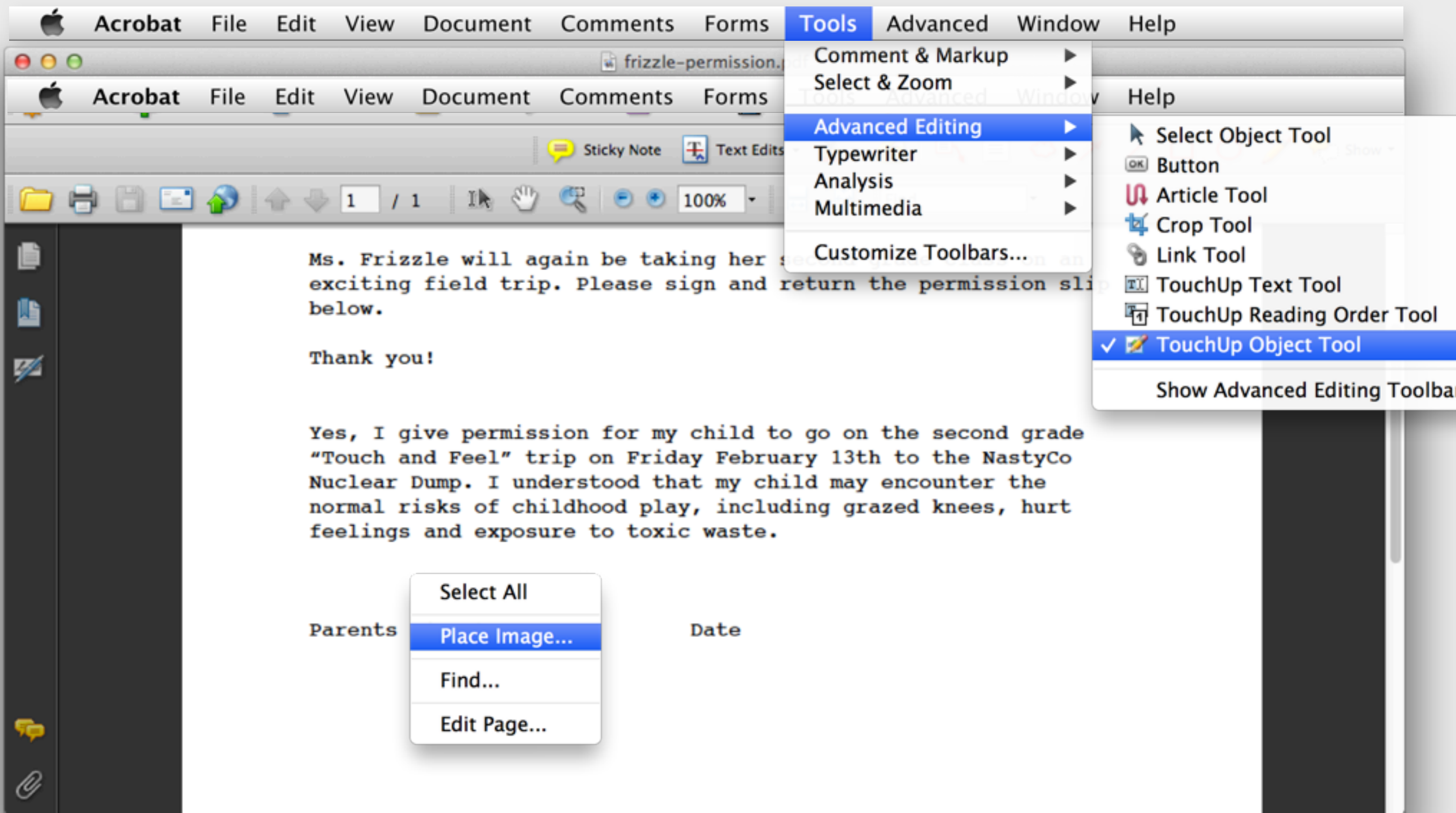
## **acrobat 10**

user interface tweaks

## **acrobat 11**

conceptual reworking

# acrobat (version 09)

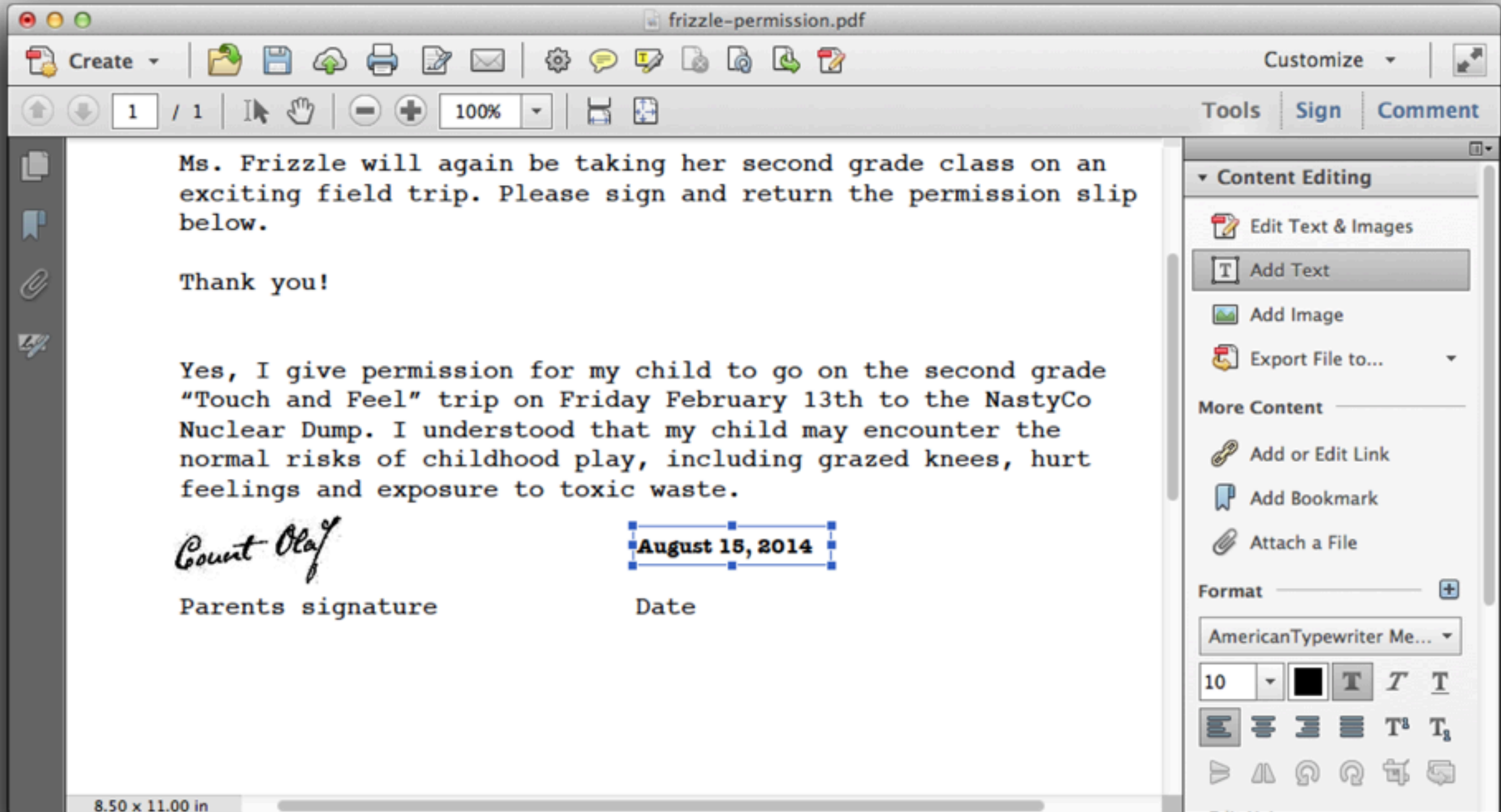


hard to discern any compelling concepts





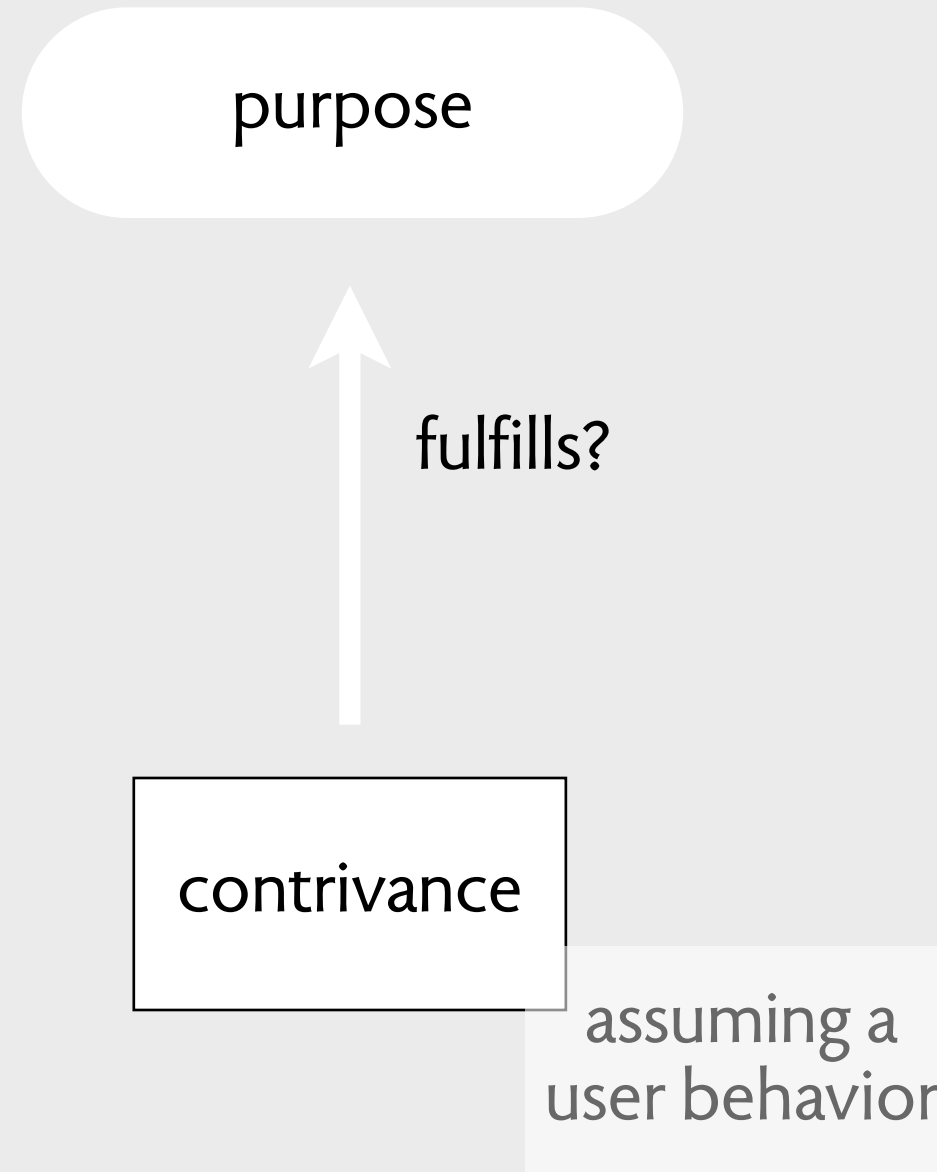
# acrobat (version 11)



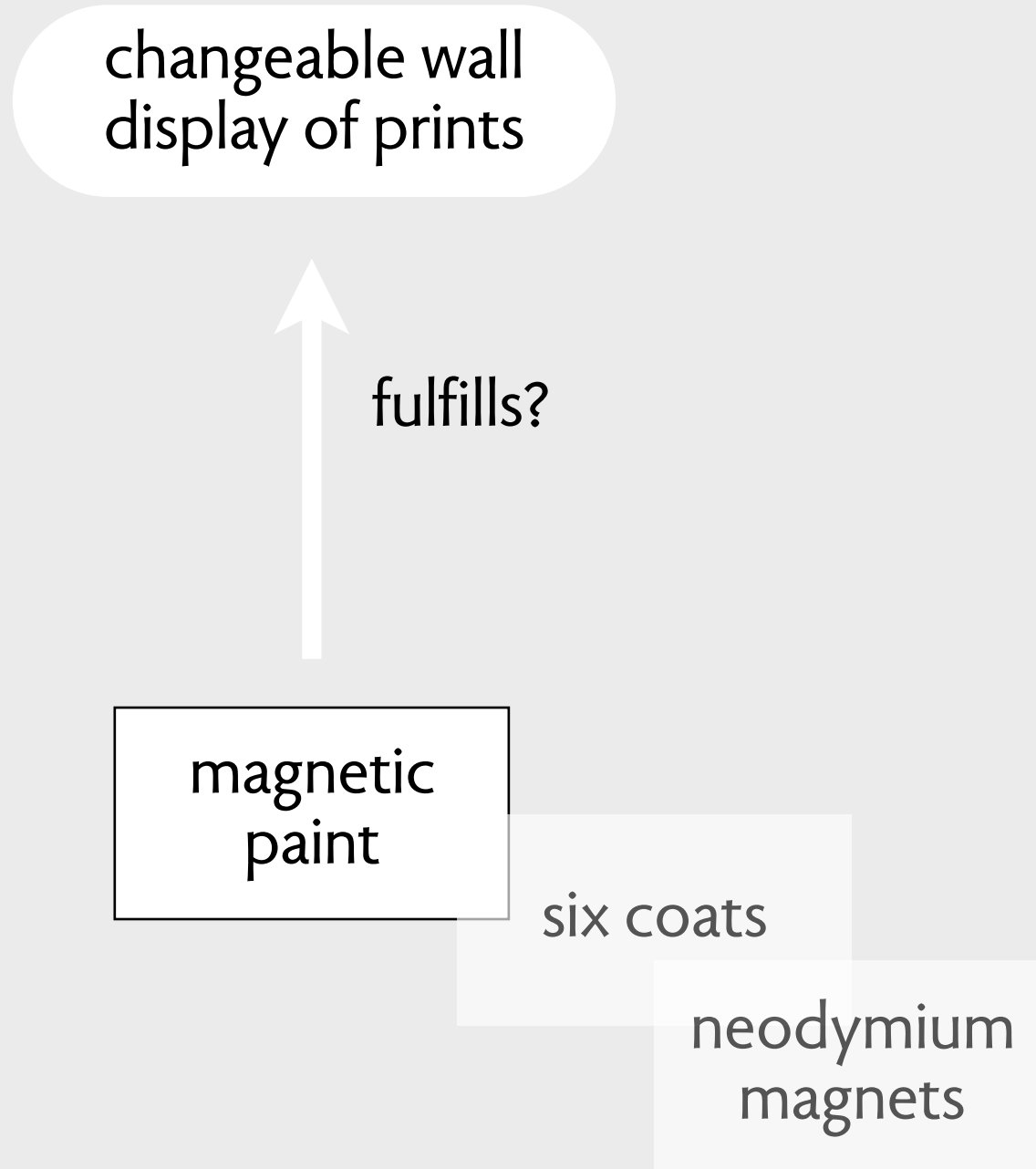
conceptual reworking: now just *text*

designing  
the user

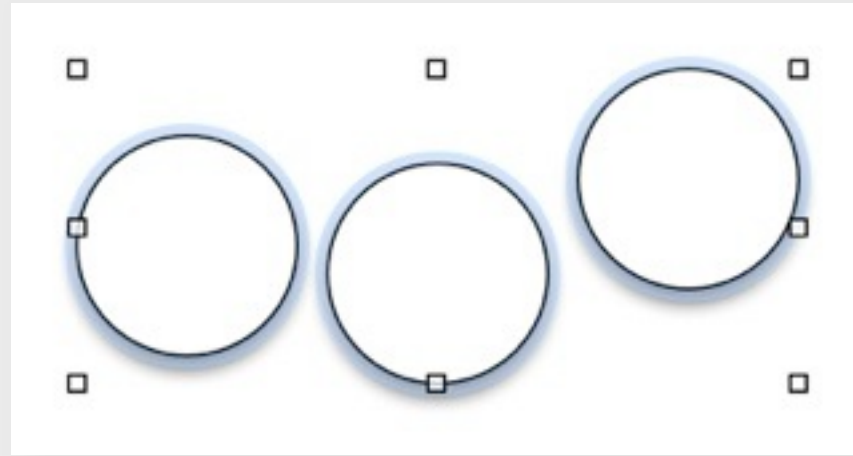
# designing the user too



# example: magnetic paint



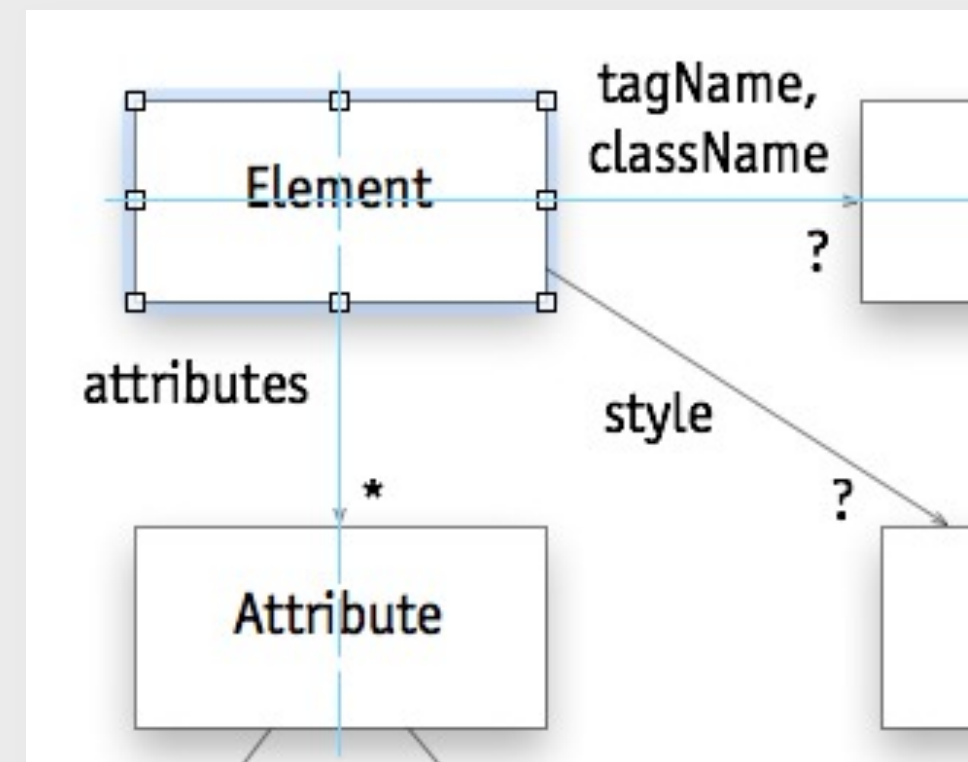
# example: aligning elements



purpose: help align objects

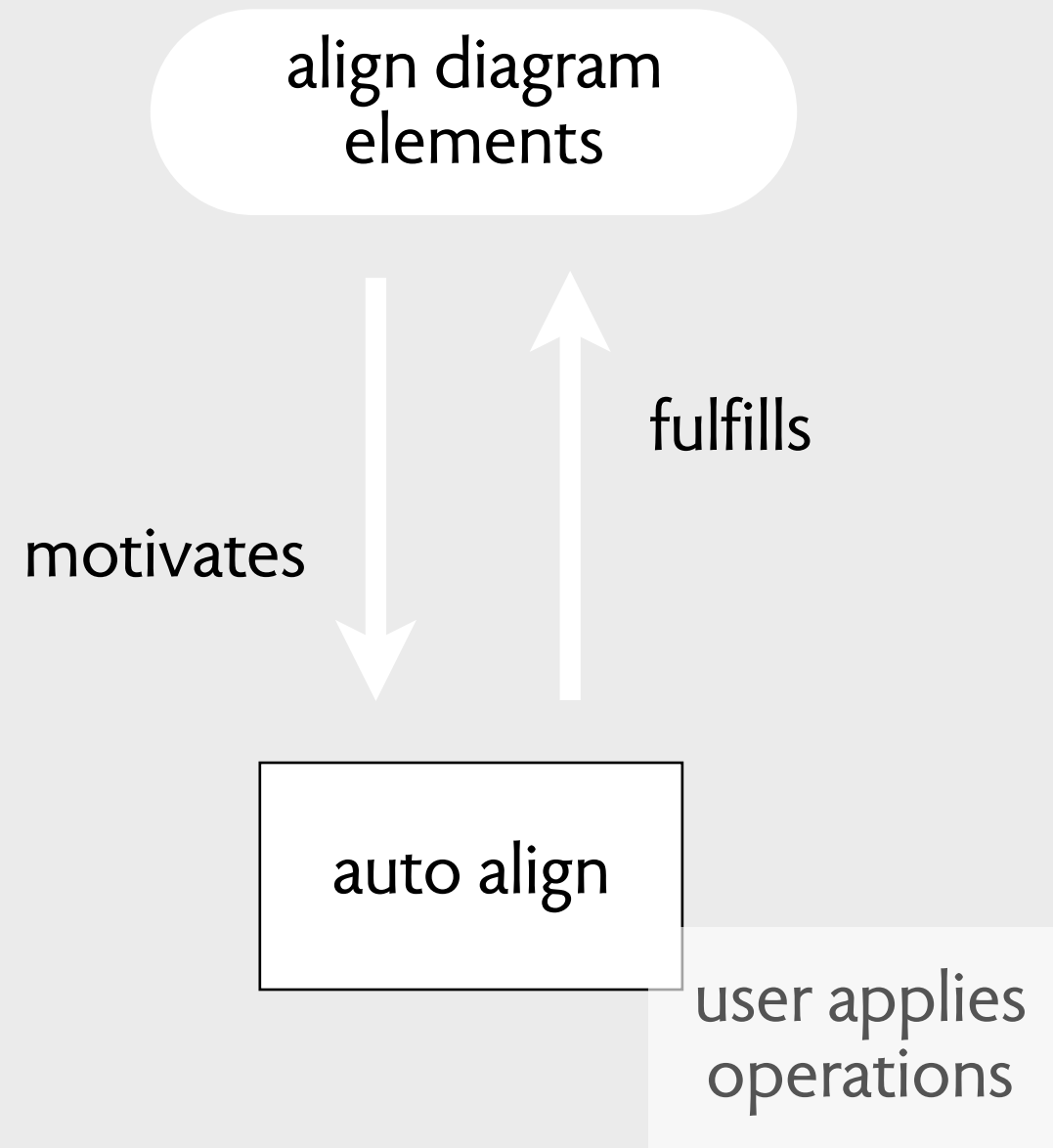
- Align Left Edges
- Align Right Edges
- Align Top Edges
- Align Bottom Edges
- Align Vertical Centers
- Align Horizontal Centers
- Make Centered Row
- Make Centered Column

a contrivance: autoalign



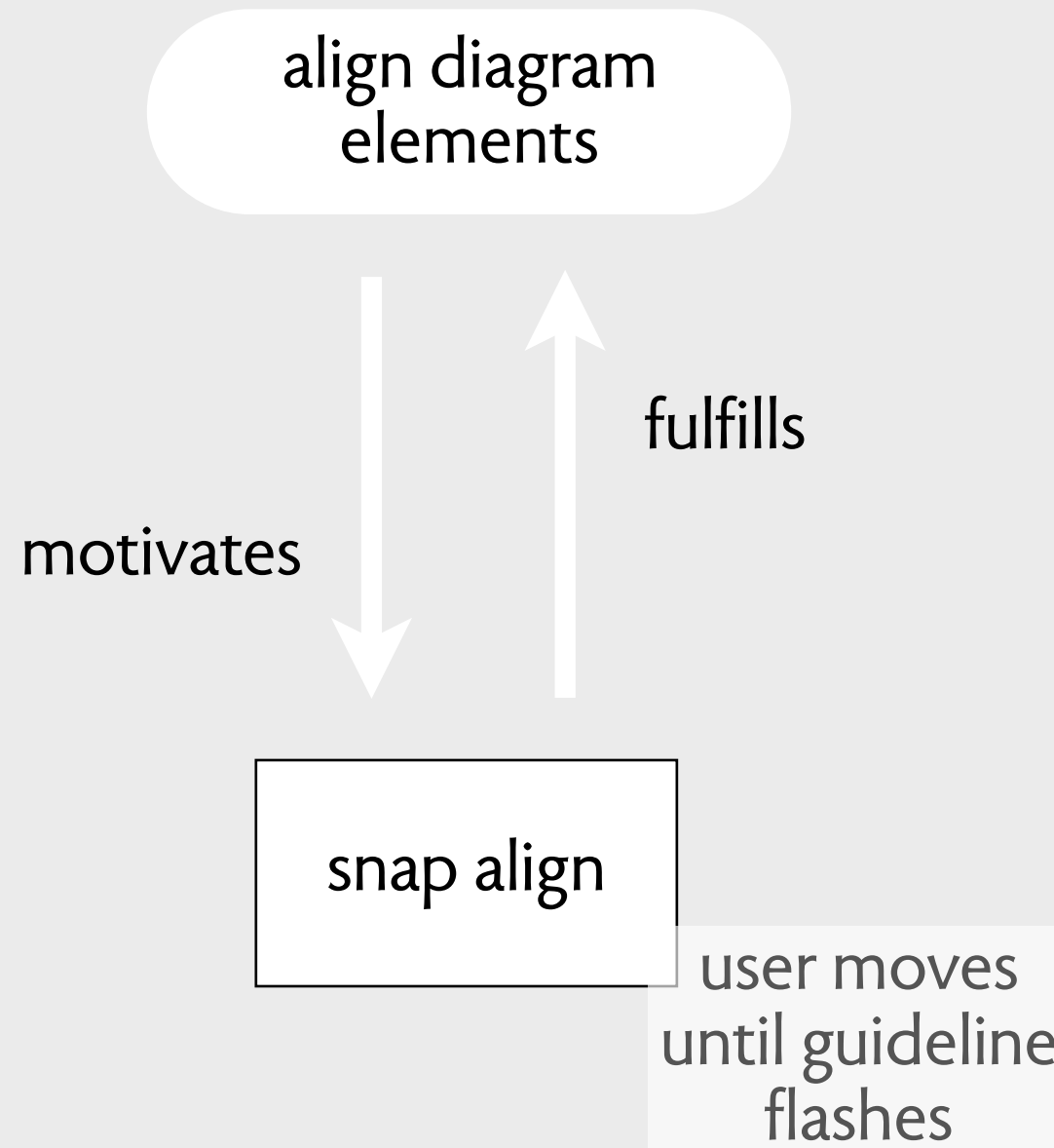
a better contrivance: snap align

# example: auto align

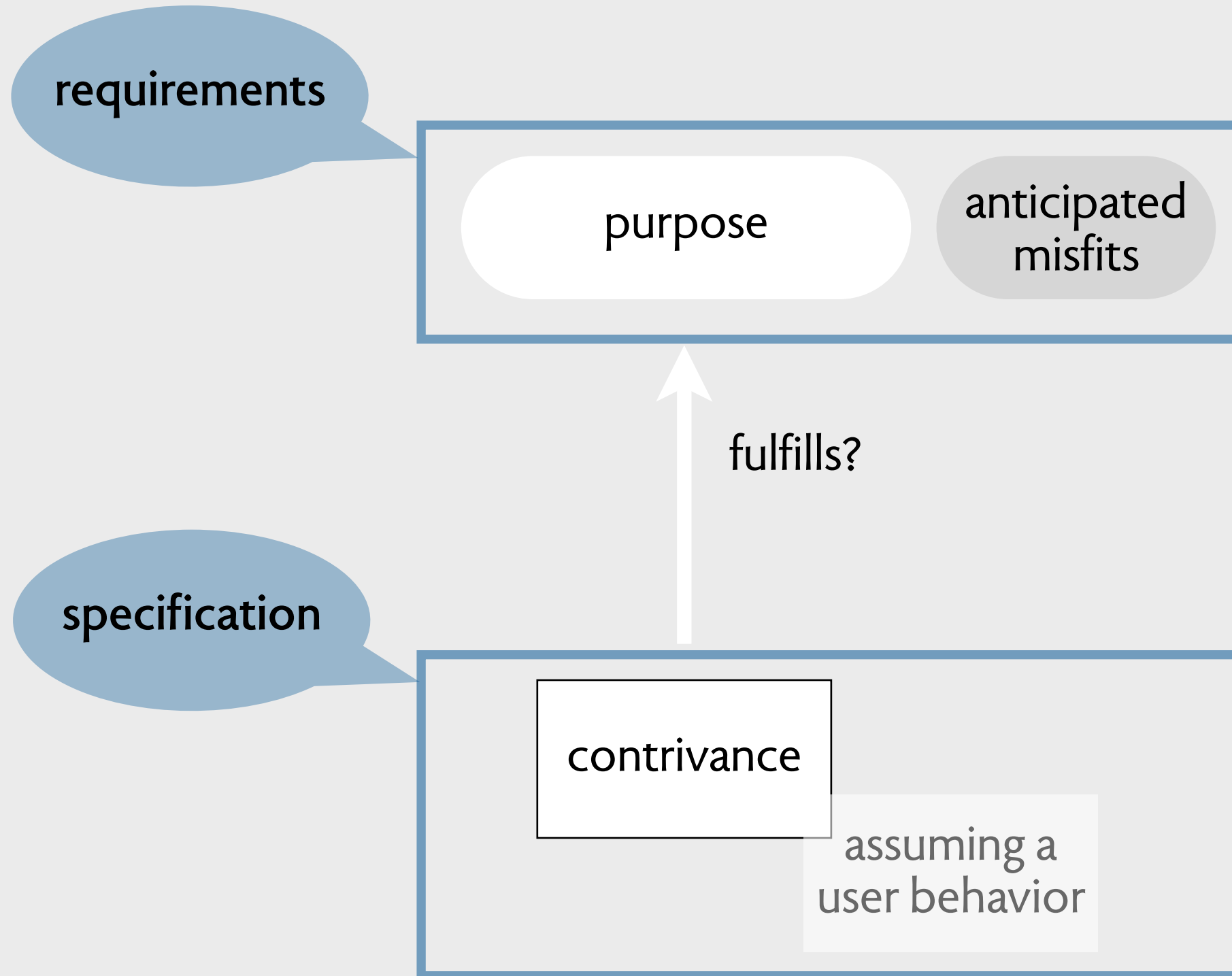




# example: snap align

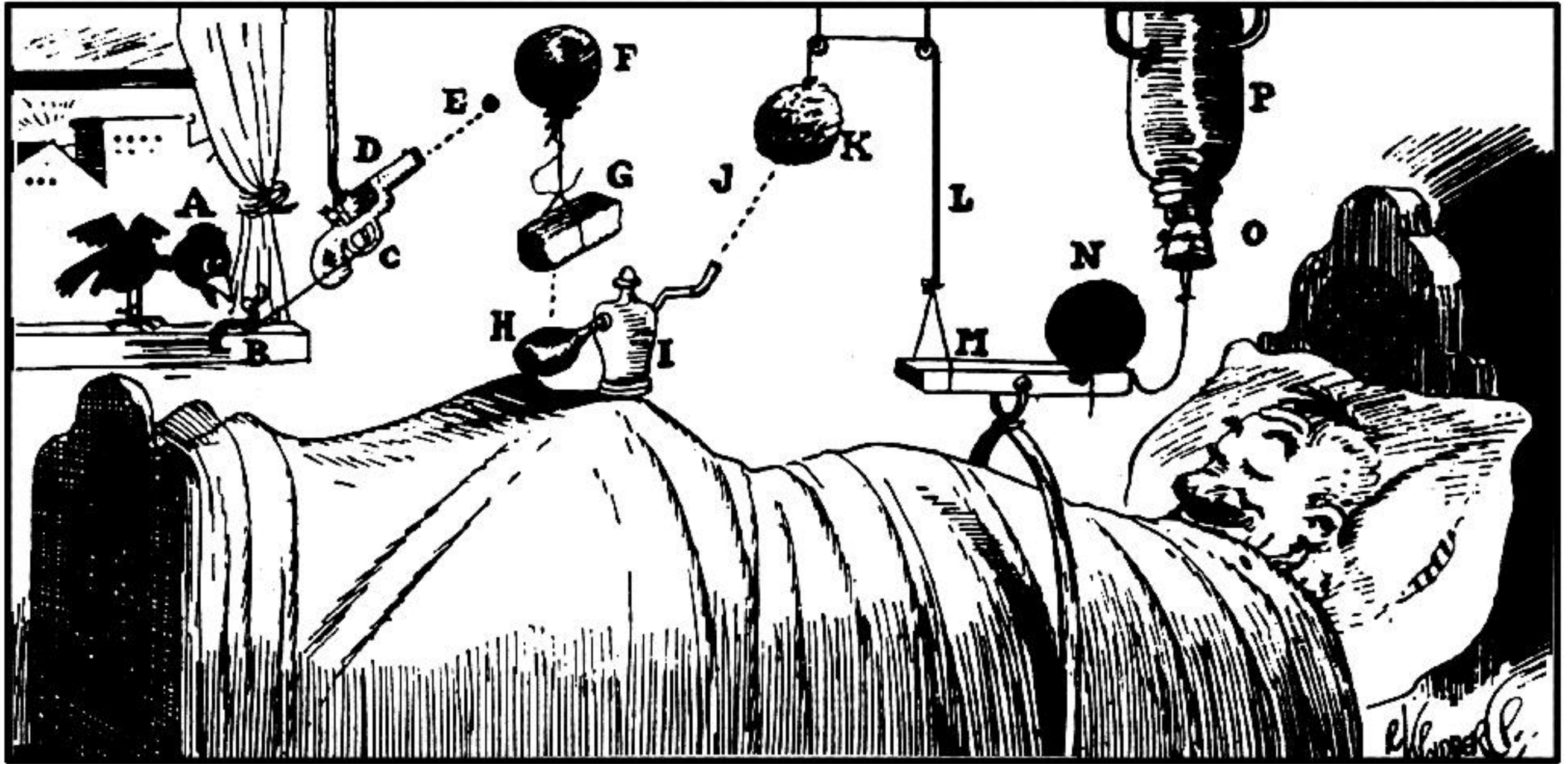


# in conventional software terms



abstract  
affordances

# Simple Alarm Clock



The early bird (A) arrives and catches worm (B), pulling string (C) and shooting off pistol (D). Bullet (E) busts balloon (F), dropping brick (G) on bulb (H) of atomizer (I) and shooting perfume (J) on sponge (K)—As sponge gains in weight, it lowers itself and pulls string (L), raising end of board

(M)—Cannon ball (N) drops on nose of sleeping gentleman—String tied to cannon ball releases cork (O) of vacuum bottle (P) and ice water falls on sleeper's face to assist the cannon ball in its good work.


New Alarm

Time Alarm

Alarm Time: 6:00 AM 

Alarm Date:

One time alarm

4/17/2013 

Repeating alarm

Sun Mon Tue Wed Thu Fri Sat

Enable Alarm

Delete

Cancel

OK

✓ 06:00 AM Tomorrow

New Alarm...

New Timer...

New Stopwatch...

About Alarm Clock 2

Check for updates...

Preferences...

Quit





Edit

Alarm



4:30 AM

Mexico trip



5:45 AM

Exercise morning



6:00 AM

Non-exercise morning



6:40 AM

Alarm



7:00 AM

Camping



World Clock



Alarm



Stopwatch



Timer

# THE DESIGN OF EVERYDAY THINGS

previously published as  
THE PSYCHOLOGY  
OF EVERYDAY THINGS

D O N A L D A . N O R M A N



Donald Norman



James Gibson (1977): "action possibilities" latent in environment

Donald Norman (1988): action possibilities that are perceivable



# a door with good affordances



# “norman doors”



push or pull?



door with user manual

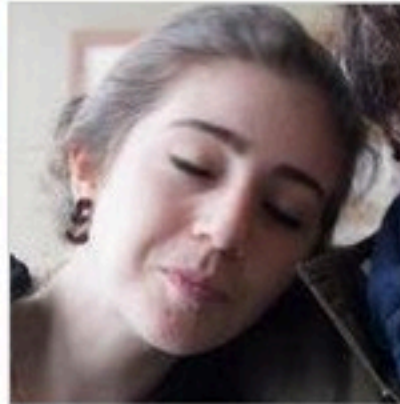
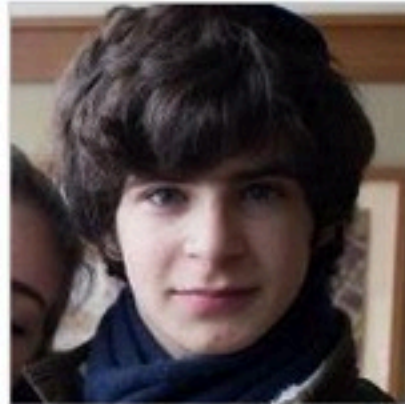


conflicting instructions



### Who Is in These Photos?

To tag your friends, review the suggested names and click Save Tags at the bottom of this page. If a name is missing or incorrect, list a new name and press Enter. Remember: If someone doesn't like a photo, they can untag themselves or ask you to take it down.



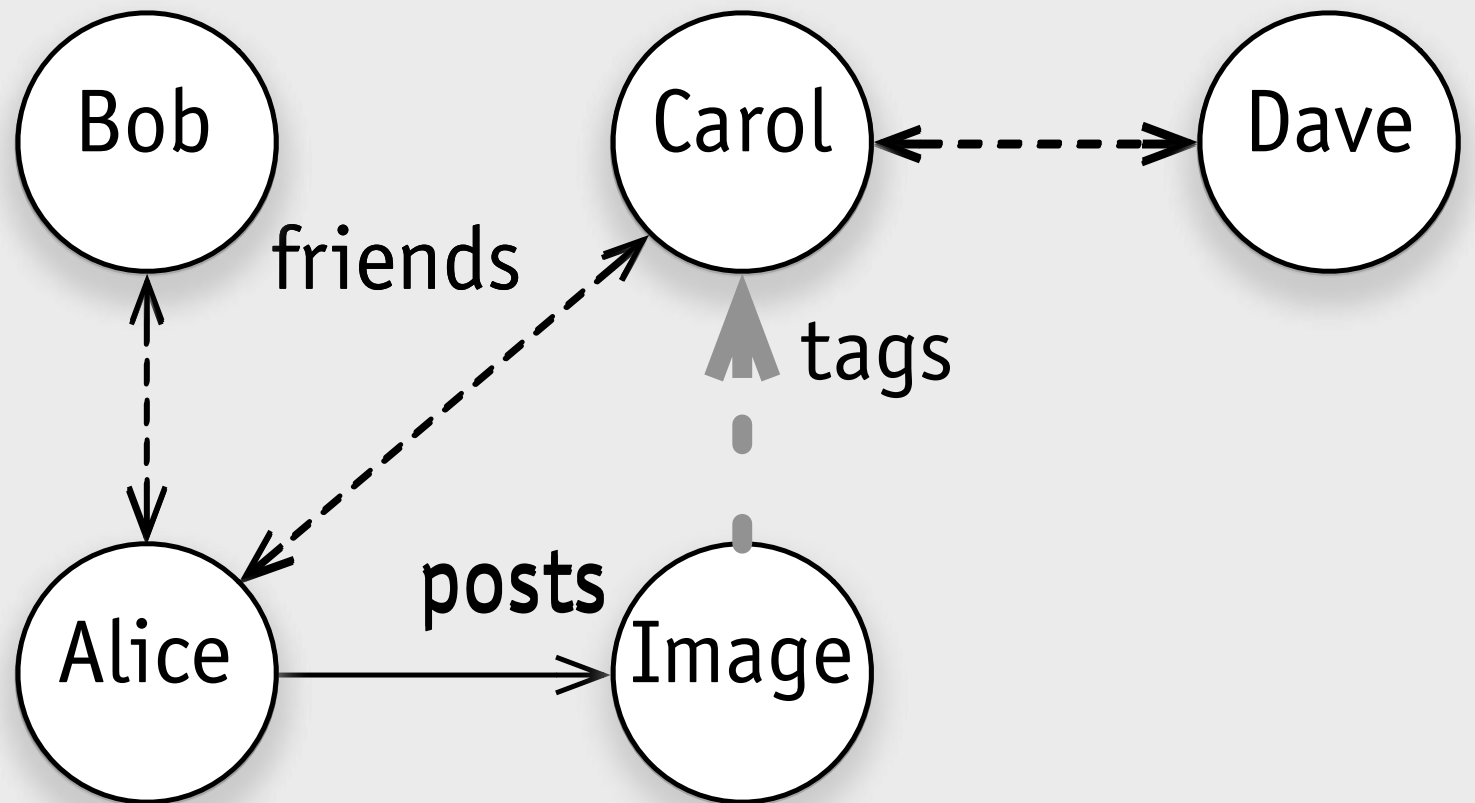
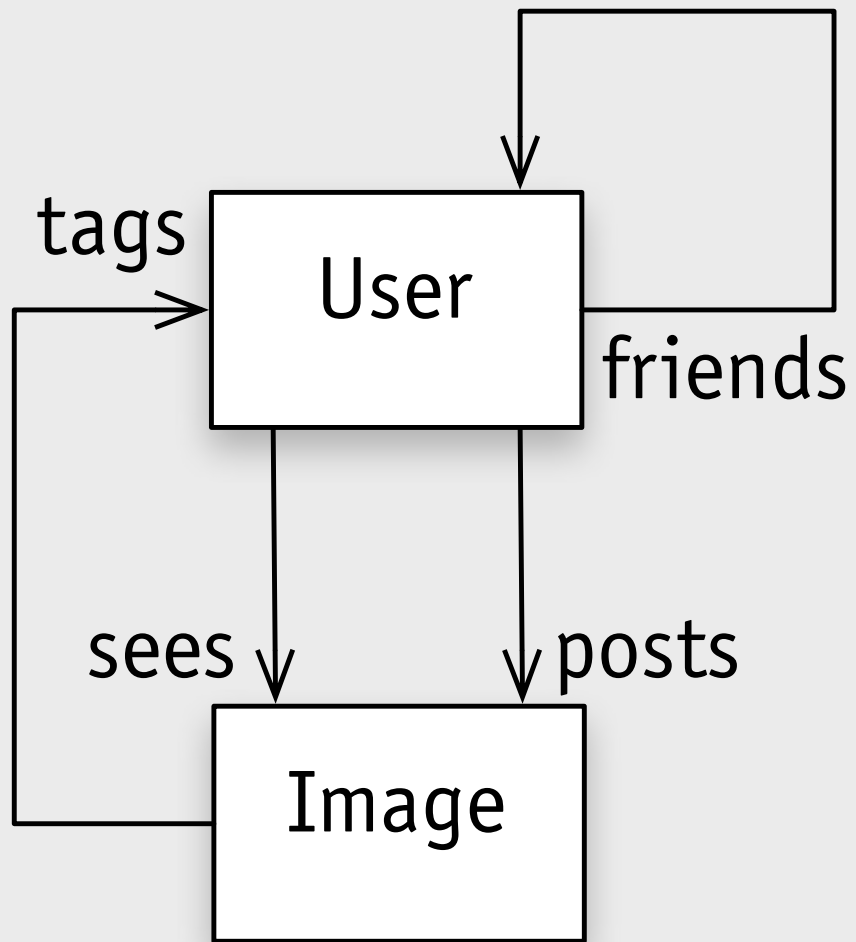
Who is this?

Who is this?

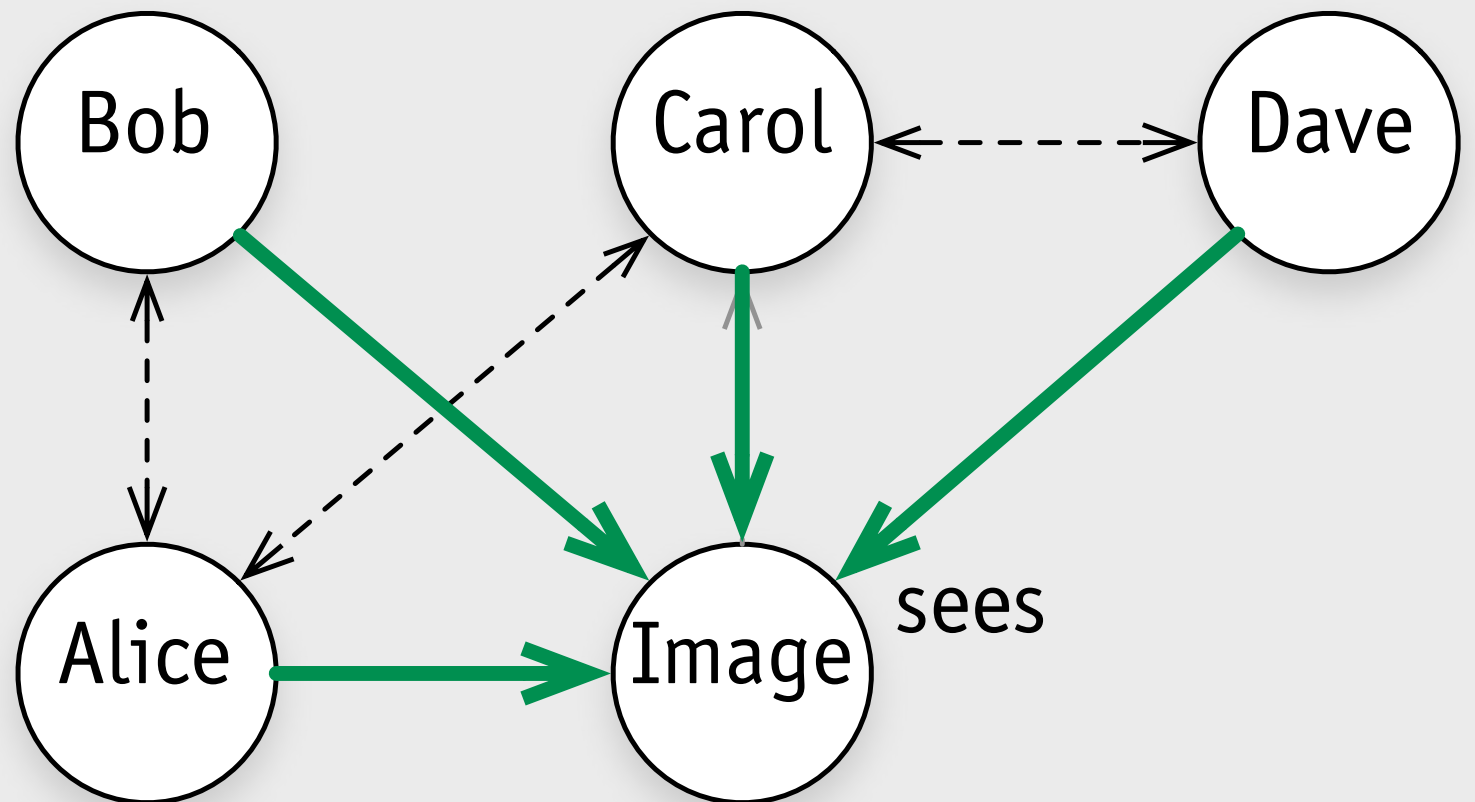
[Skip Tagging Friends](#)

[Save Tags](#)





who can see the image?



# what facebook says

## **When someone adds a tag to a photo or other post I shared, who can see it?**

When someone adds a tag to something you shared, it's visible to:

- The audience you chose for the post or photo
- The person tagged in the post and their friends

as a textual constraint in Alloy:

all i: Image | sees.i = (posts.i).friends + (i.tags).friends

# what facebook should say

When a psychopathic stranger takes a photo of me at a party and tags me, who can see it?

When someone adds a tag to something you didn't share, it's visible to:

- All of their friends and fellow psychopaths
- All of your future employers, boyfriends, girlfriends and in-laws

# lesson

## **for physical designs**

effects are clear, if hard to predict  
affordances connect actions to effects

## **for software designs**

effects are often not clear  
affordances become 'abstract'

## **so we need to**

convey to users effects of actions  
challenge: effects are indirect

design  
thinking

# process



**optimize organization & task structure**

Taylor (1880s), Toyota JIT (1980s), CMM (1990s), agile (2000s)



# “new” activities



brainstorming



user studies



prototypes

# style



**Dieter Rams, 1958**  
pocket transistor radio T3



**Henry Hobson Richardson, 1877**  
Trinity Church, Boston



**Alfonso Bialetti, 1933**  
La Moka coffee maker

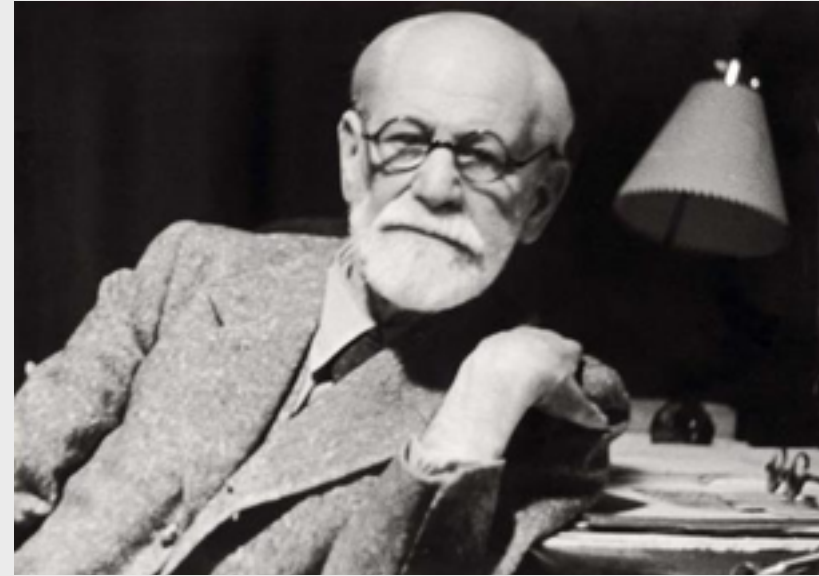


**Leica, 1953**  
M3 rangefinder camera

# broadening



anthropology



psychology



art



economics

nature of  
software  
design



# fred brooks: essence and accident

[T]o see what rate of progress one can expect in software technology, let us examine the difficulties of that technology. Following Aristotle, I divide them into **essence**, the difficulties inherent in the nature of software, and **accidents**, those difficulties that today attend its production but are not inherent.

The **essence of a software entity is a construct of interlocking concepts**: data sets, relationships among data items, algorithms, and invocations of functions. This essence is abstract in that such a conceptual construct is the same under many different representations. It is nonetheless highly precise and richly detailed.

I believe **the hard part** of building software to be the specification, design, and testing of **this conceptual construct, not the labor of representing it** and testing the fidelity of the representation. We still make syntax errors, to be sure; but they are fuzz compared with the conceptual errors in most systems.

mental  
models