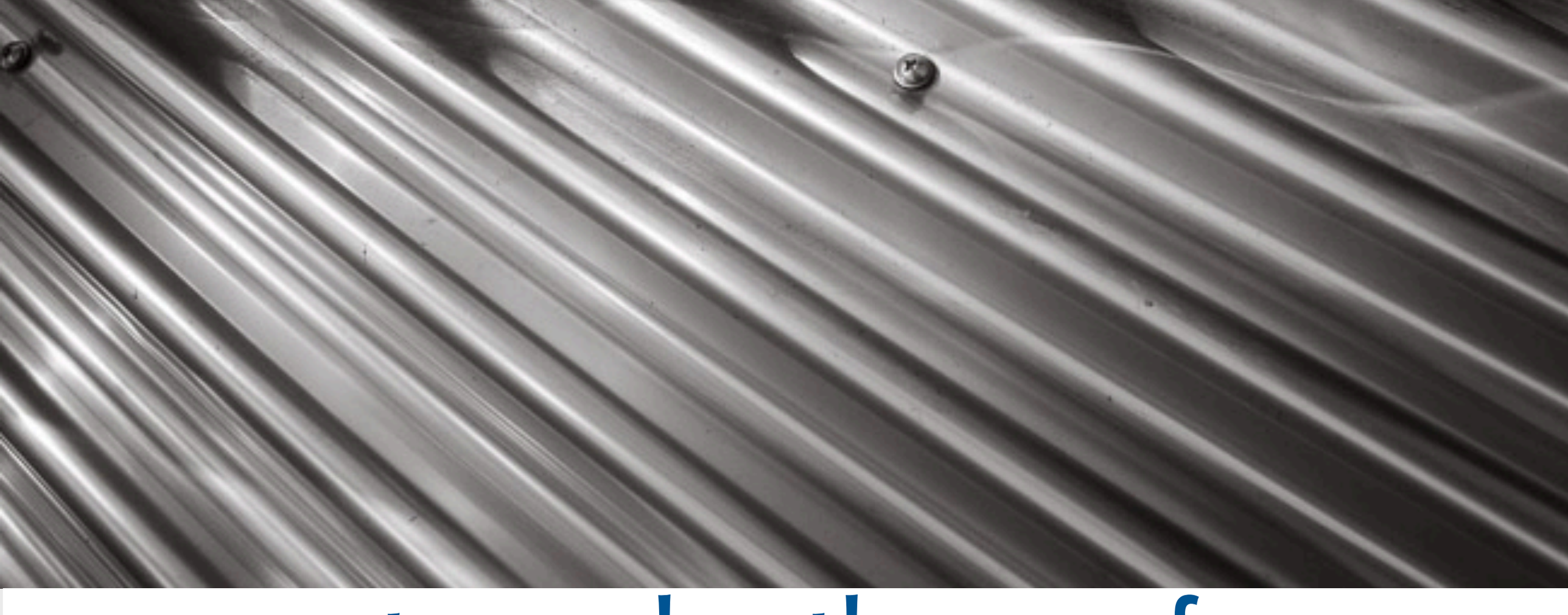

towards a theory of conceptual design for software

Daniel Jackson · MIT

Onward, SPLASH · Pittsburgh · October 29, 2015

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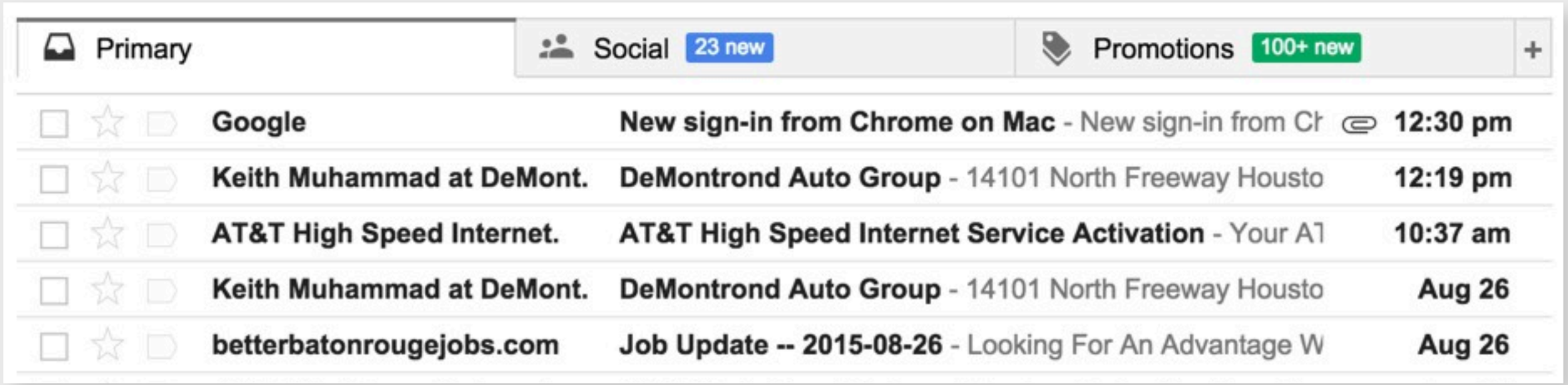
three
software design problems

#1

email categories

gmail's categories



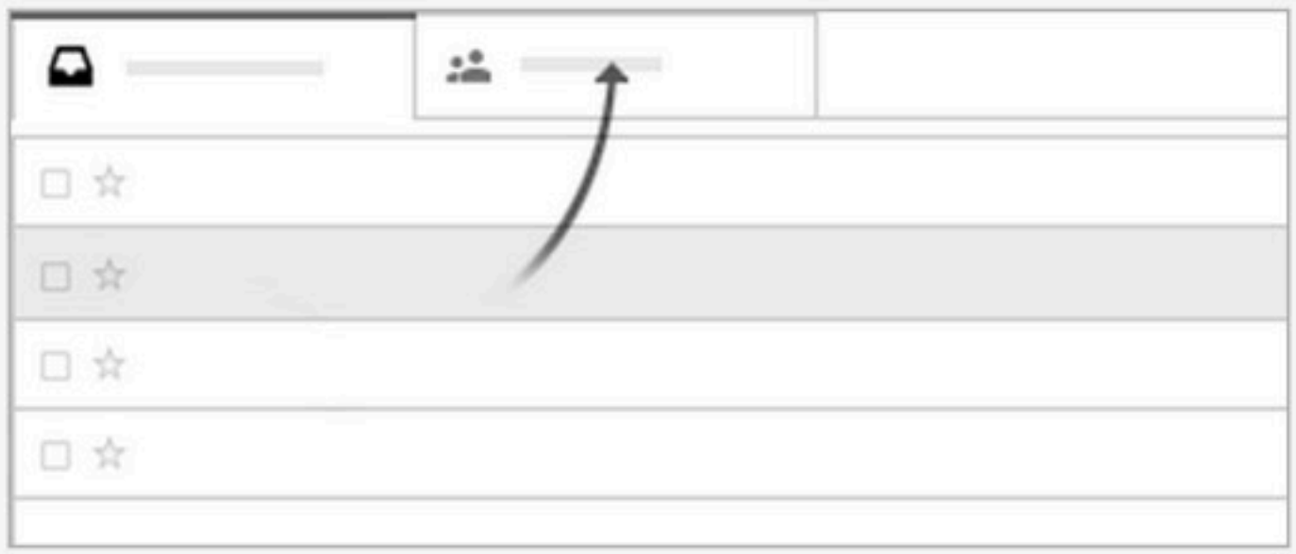
category tab settings

Categories:
Learn more

- [x] **Primary**
- [x] **Social**
- [x] **Promotions**
- [ ] **Updates**
- [ ] **Forums**

Starred messages

- [x] **Include starred in Primary**



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

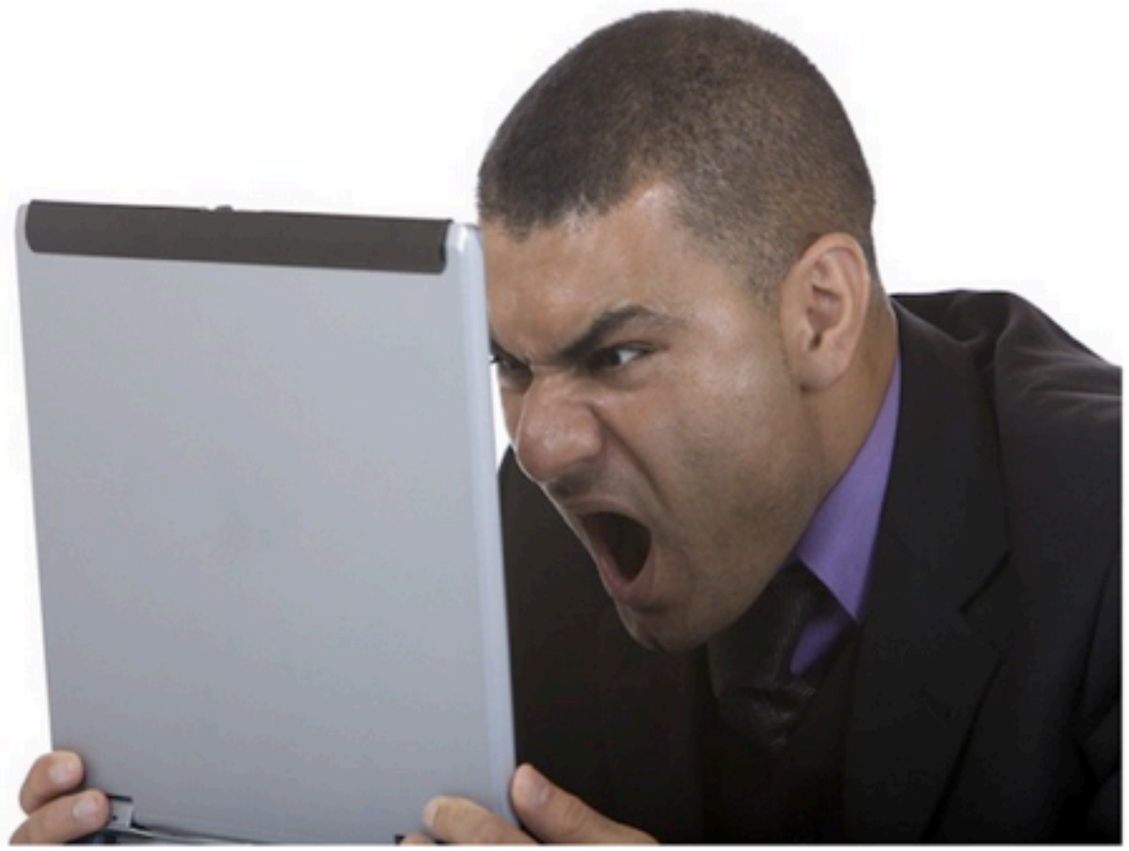
some reactions

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 | +1 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

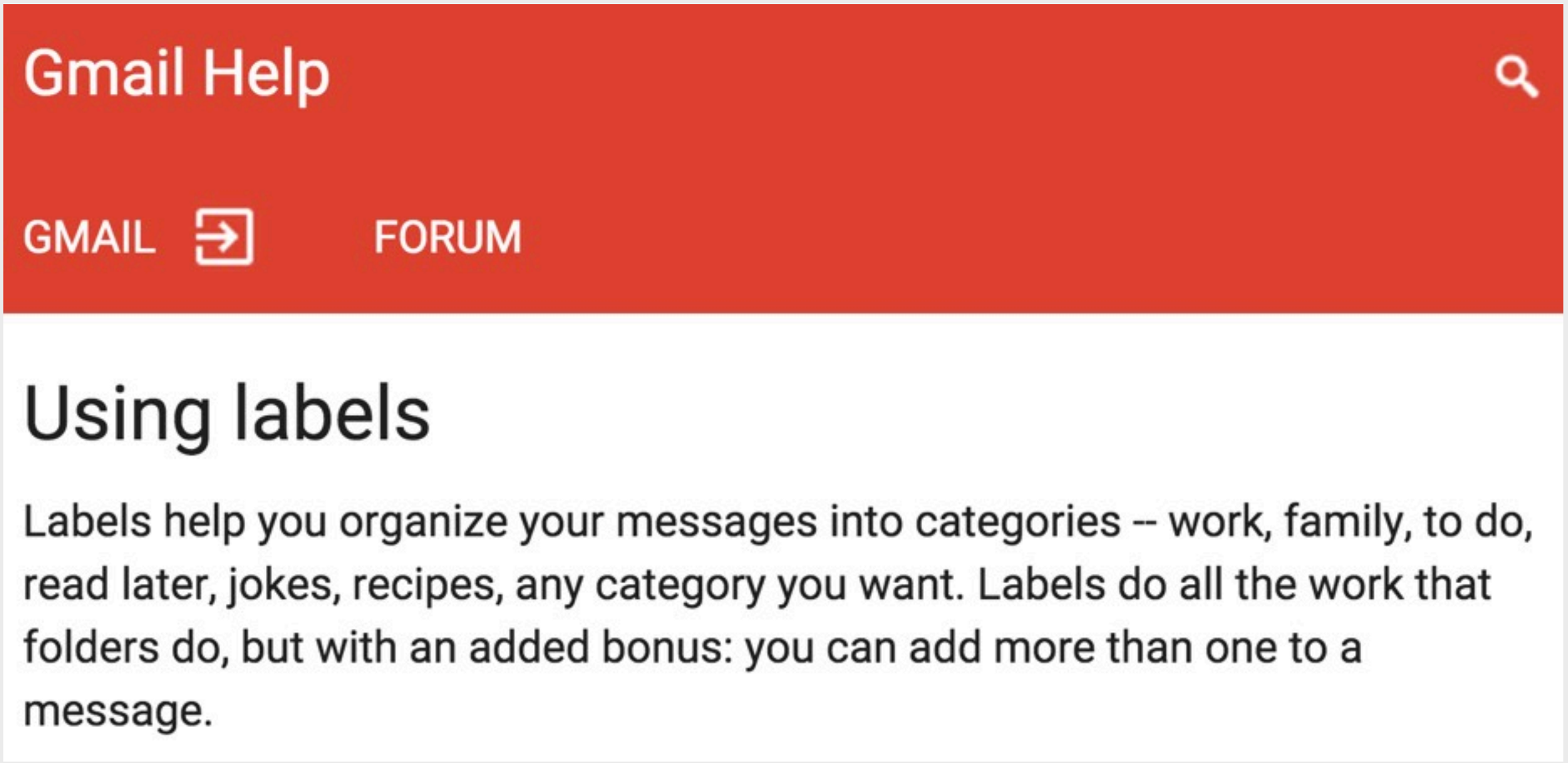
The tabs do give you a convenient way to automatically sort your inbox according to Gmail's preset categories and get notifications at a glance for when new emails come in.

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 (!)



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

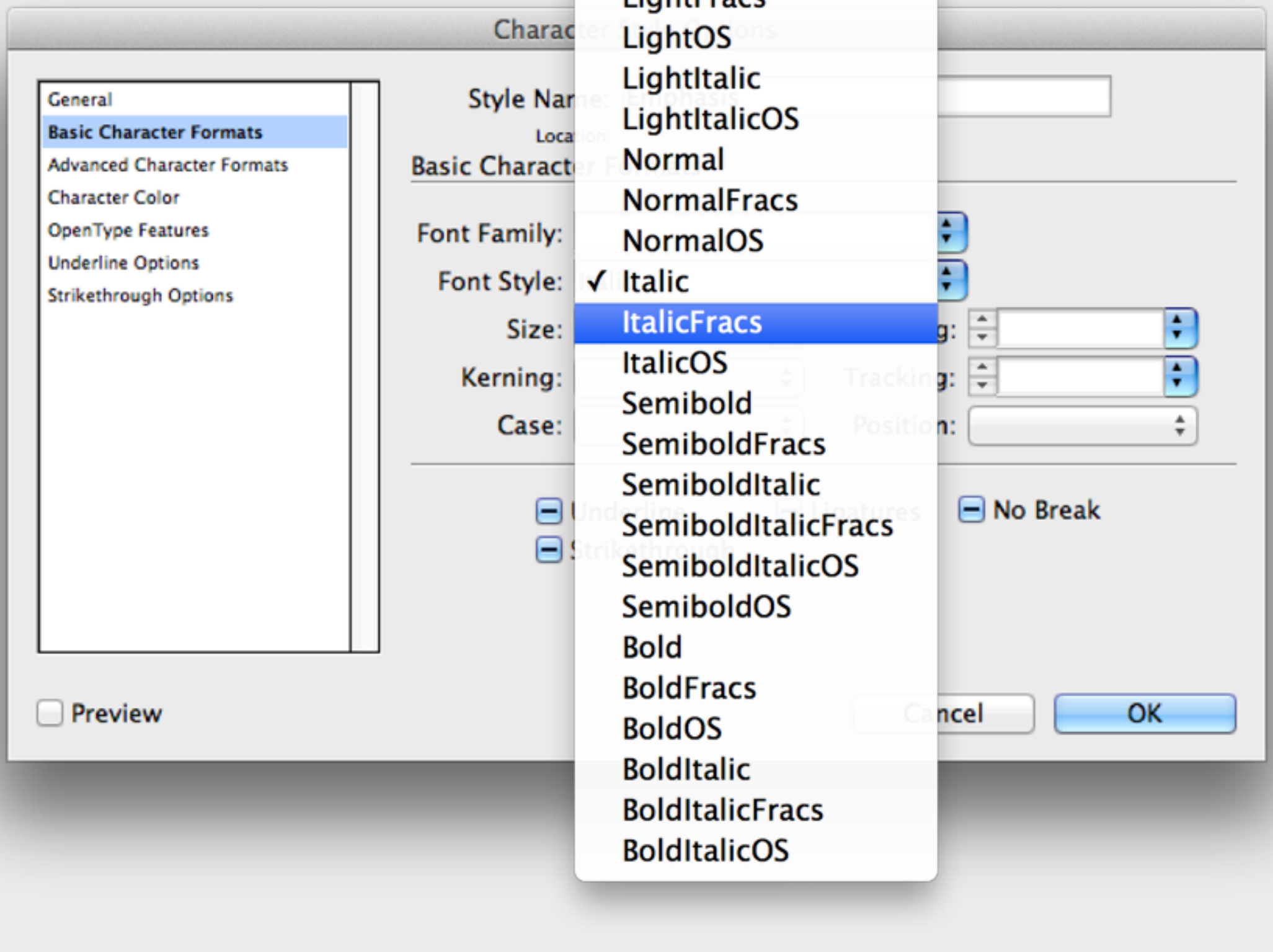
non-standard aspect ratio + raw

even though raw images get nice nondestructive crop!

#3

fonts & styles

what's a font?


General
Basic Character Formats
Advanced Character Formats
Character Color
OpenType Features
Underline Options
Strikethrough Options
Font Family:
Font Style:
Size:
Kerning:
Case:
No Break
Preview
OK
Light
LightFracs
LightOS
LightItalic
LightItalicOS
Normal
NormalFracs
NormalOS
✓ Italic
ItalicFracs
ItalicOS
Semibold
SemiboldFracs
SemiboldItalic
SemiboldItalicFracs
SemiboldItalicOS
SemiboldOS
Bold
BoldFracs
BoldOS
BoldItalic
BoldItalicFracs
BoldItalicOS

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?

manifestations

constrained functionality

confusion & complexity

coding errors?

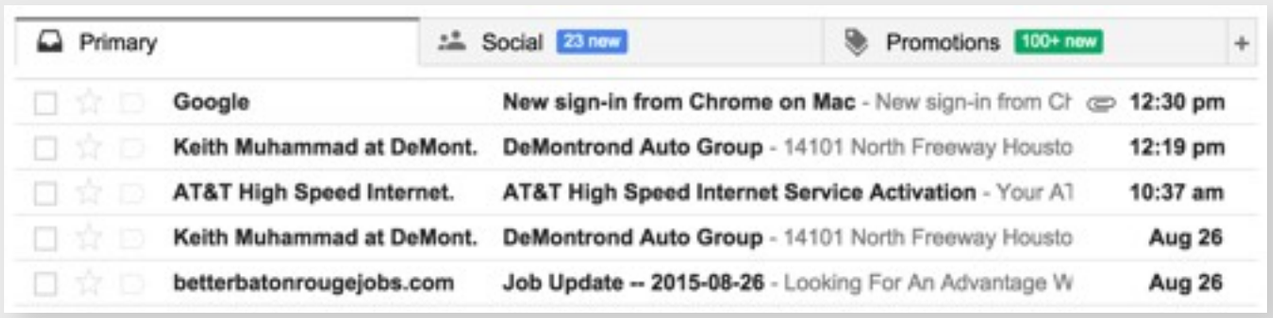
no, code seems to meet the spec

user interface design errors?

no, interfaces are clear and faithful to function

these are conceptual flaws

image size:
a confusing concept



categories:
a redundant concept

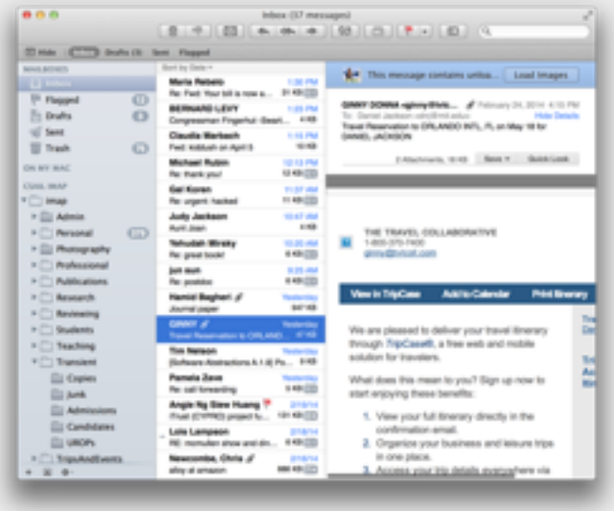
subfamily:
a missing concept

what's an app about?

what characterizes an app?

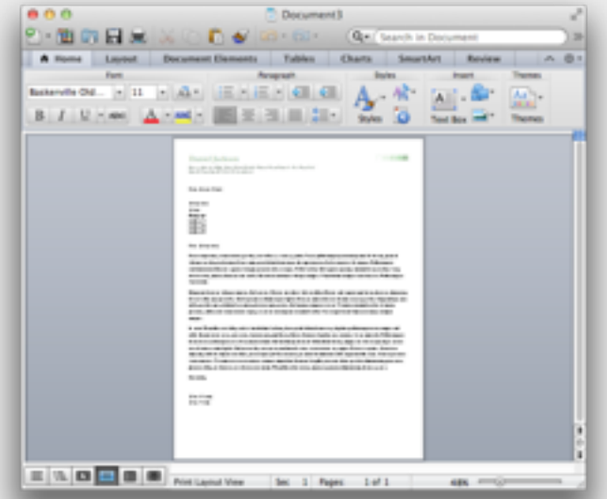
concepts!

Apple Mail



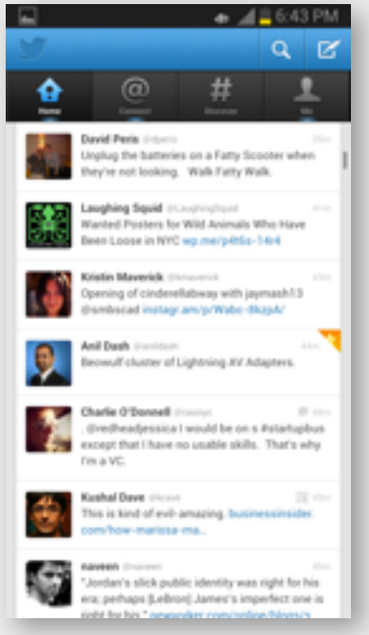
EmailAddress
Message
Folder or Label

Microsoft Word



Paragraph
Format
Style

Twitter



Tweet
Hashtag
Following

Photoshop

PixelMap
Layer/Mask
Adjustment

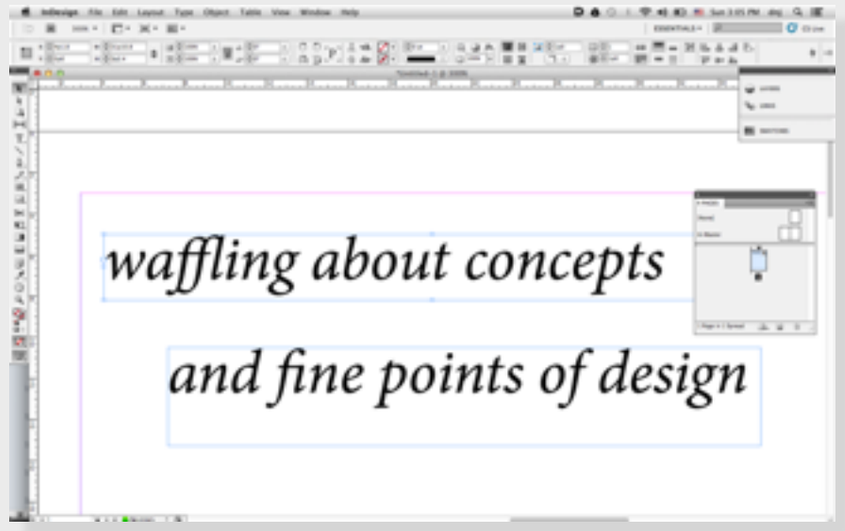
concepts define classes

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

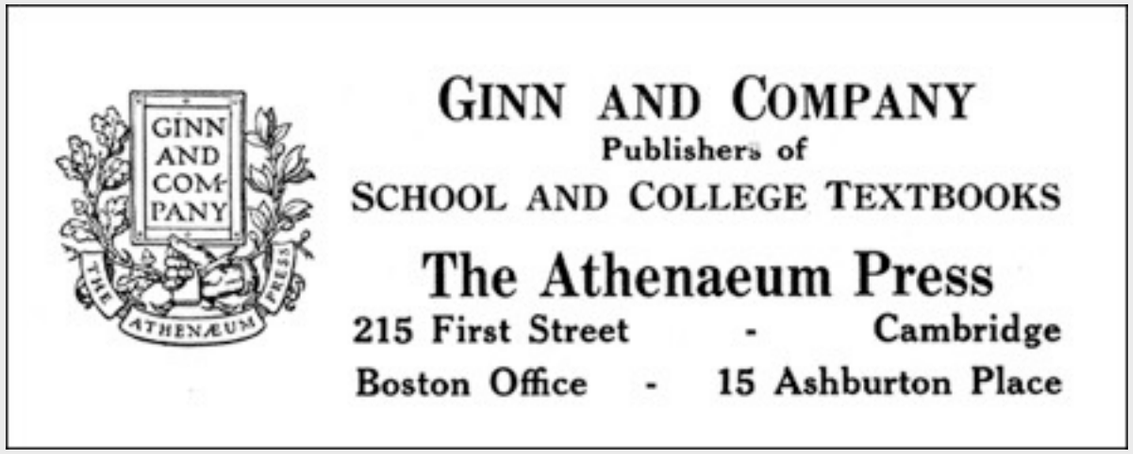
http://www.macobserver.com/tmo/article/pages-linking-text-boxes

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

where are Word's concepts from?

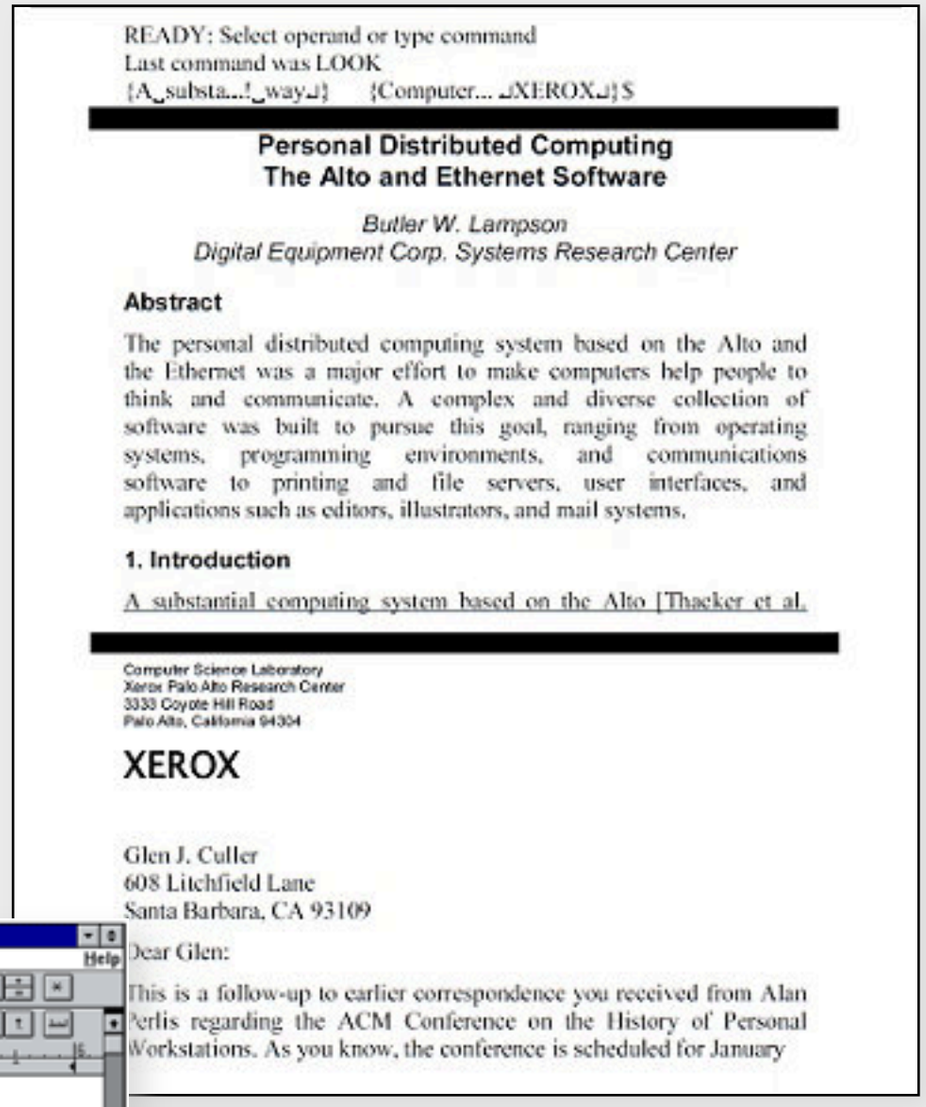
Charles Simonyi: brought key concepts to Word from Xerox PARC

rich concepts have long journeys

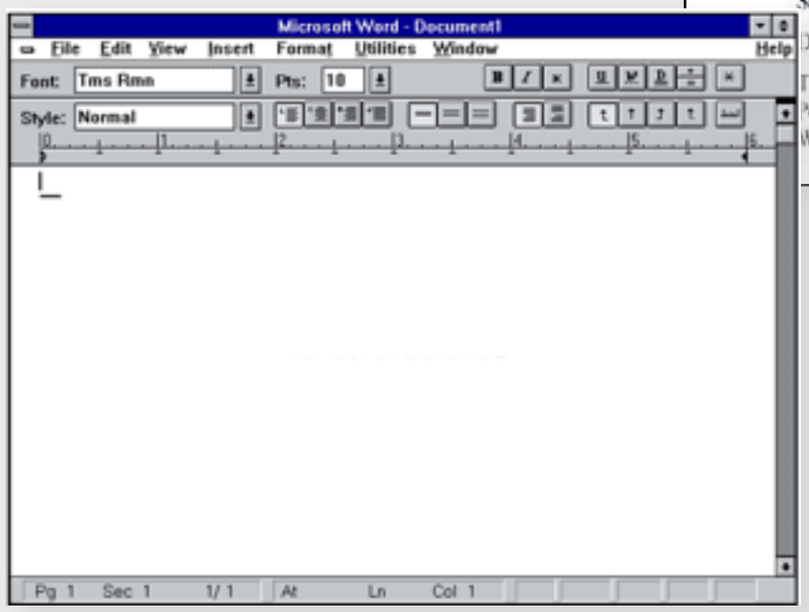


Ginn & Co, since 1868

Apple Pages, 2005



Bravo, 1974

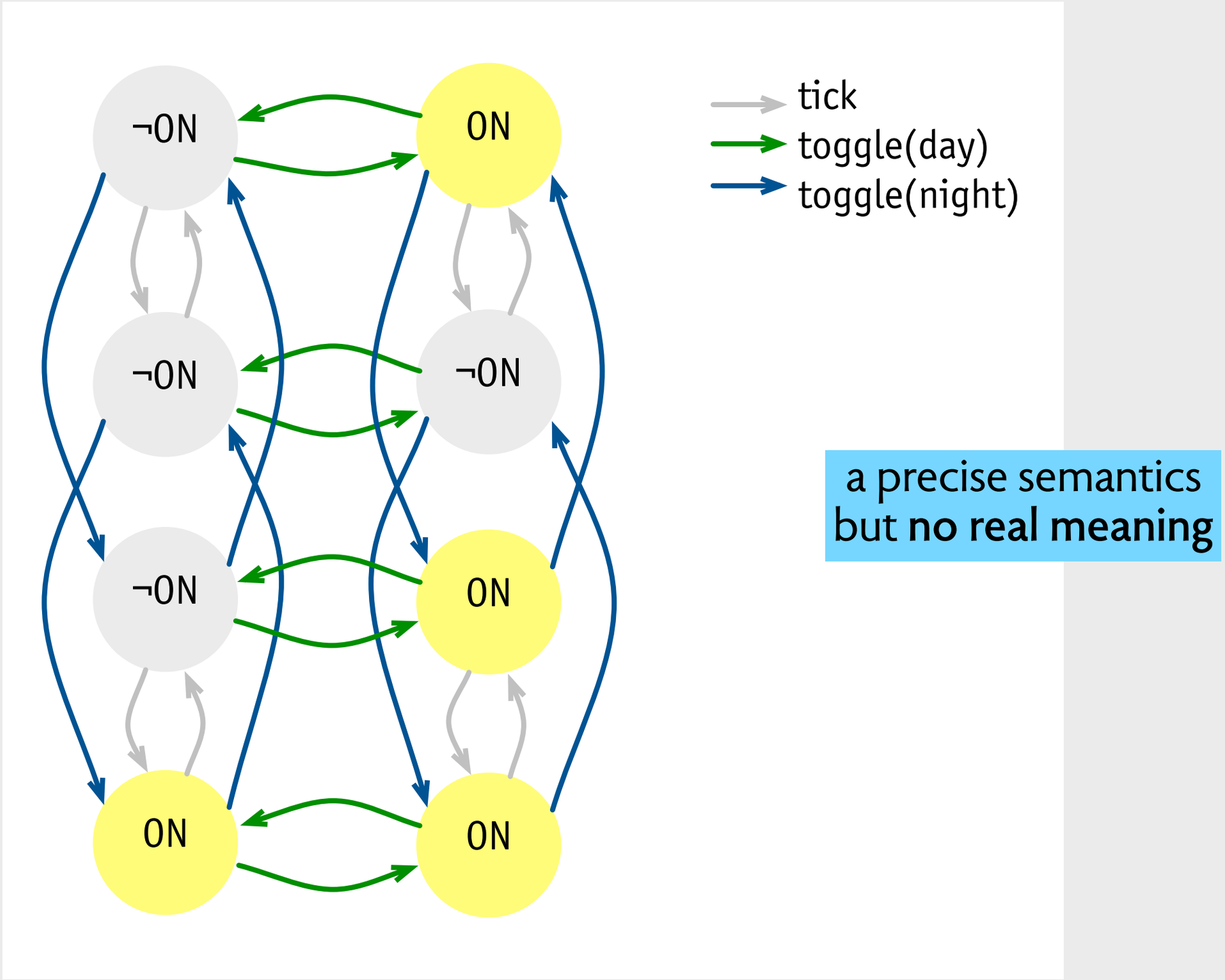


Microsoft Word, 1983

so what
exactly is
a concept?

a timer

a non-conceptual description



a precise semantics
but **no real meaning**

a conceptual explanation

purpose

using this timer, you can program a light
to be on at certain times each day

data model

the concept!

the day's divided into time slots
there's a set of slots called the schedule
and a current time slot

operational principle

if you put a slot in the schedule, then
when the time is in that current slot, the light will be on

user interface

each tab is a time slot
the current time is where the arrow points

the operational principle

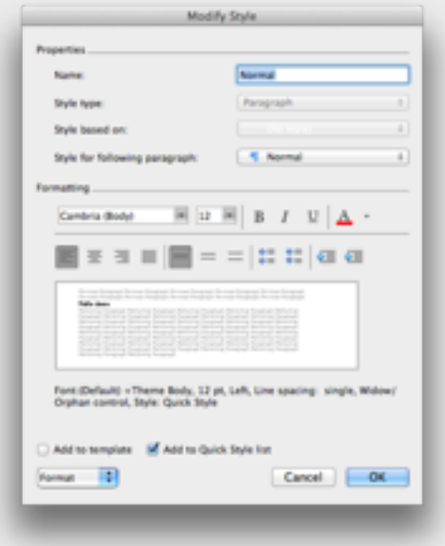
a way to define & explain a concept

an archetypal scenario
separates essential from accidental aspects
shows how purpose is fulfilled
by combination of user & system actions

Michael Polanyi

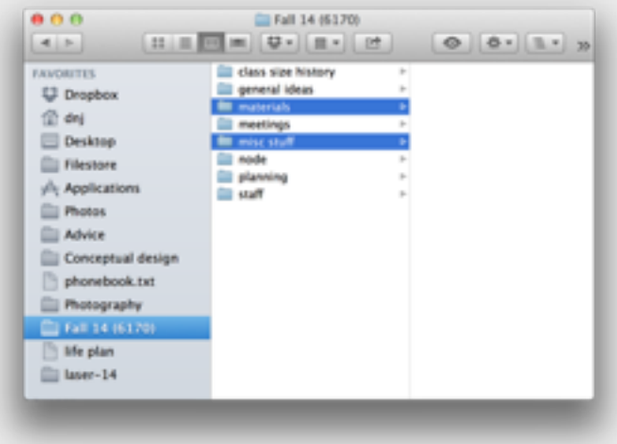
"**if** you pull a tab out, **then** when that time slot comes around, the light will go on"

"**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"

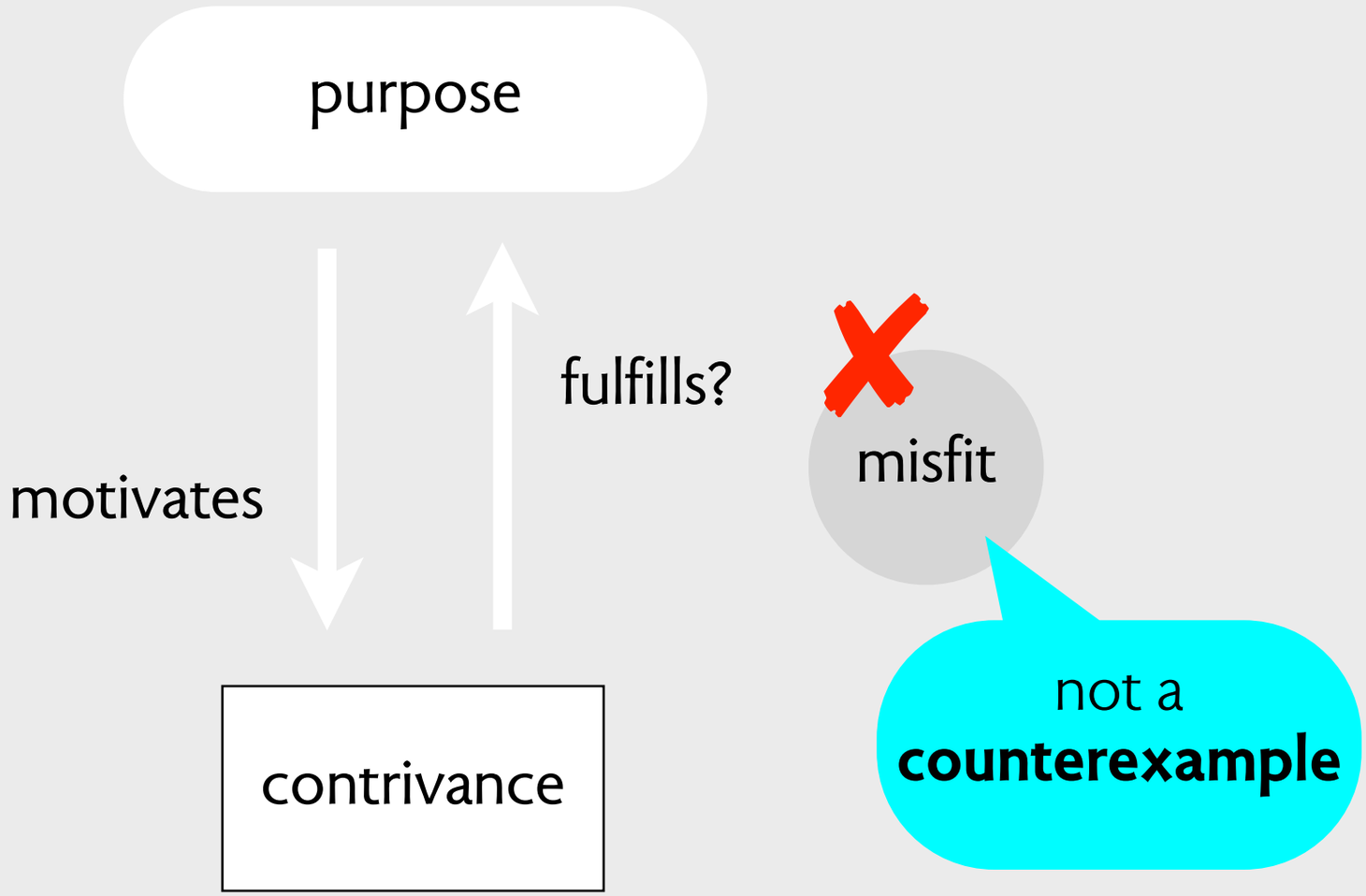
"**if** you tag a photo, **then** all friends of the person tagged will be able to see the photo"



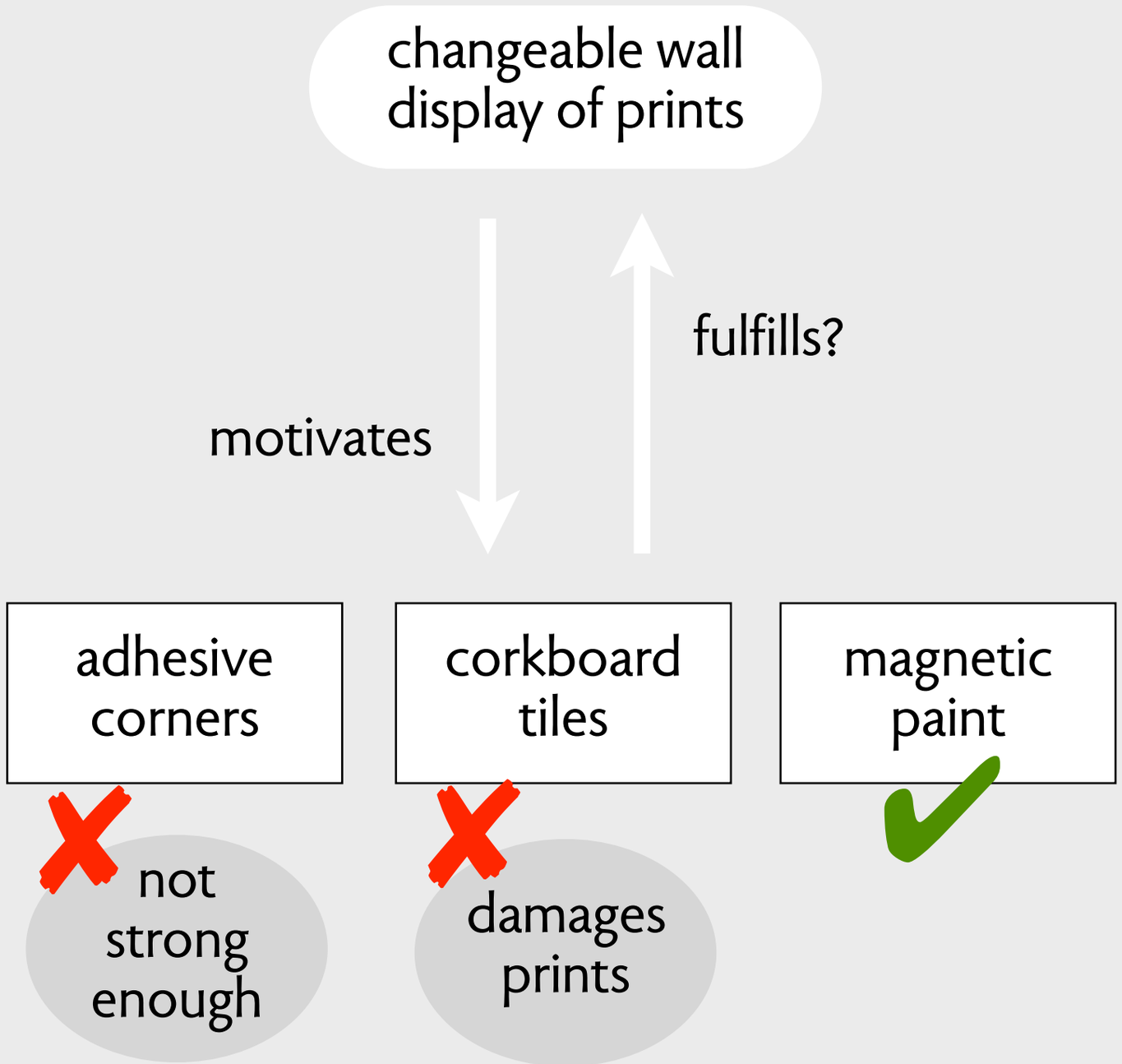
"**if** you select some files and they belong to a folder with keyboard focus, **then** pressing delete will move the files to the trash"

designing on purpose

design is driven by purpose

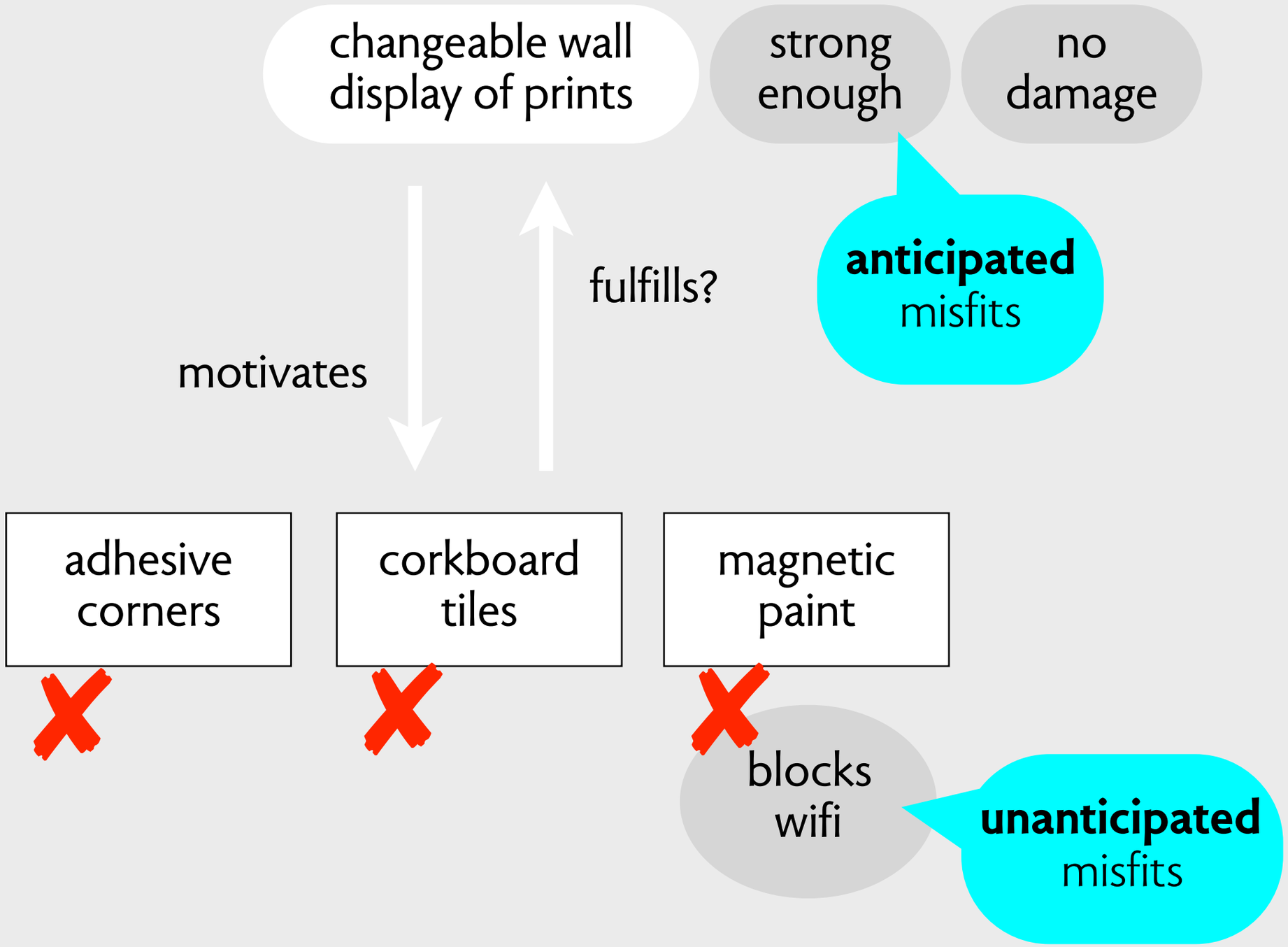


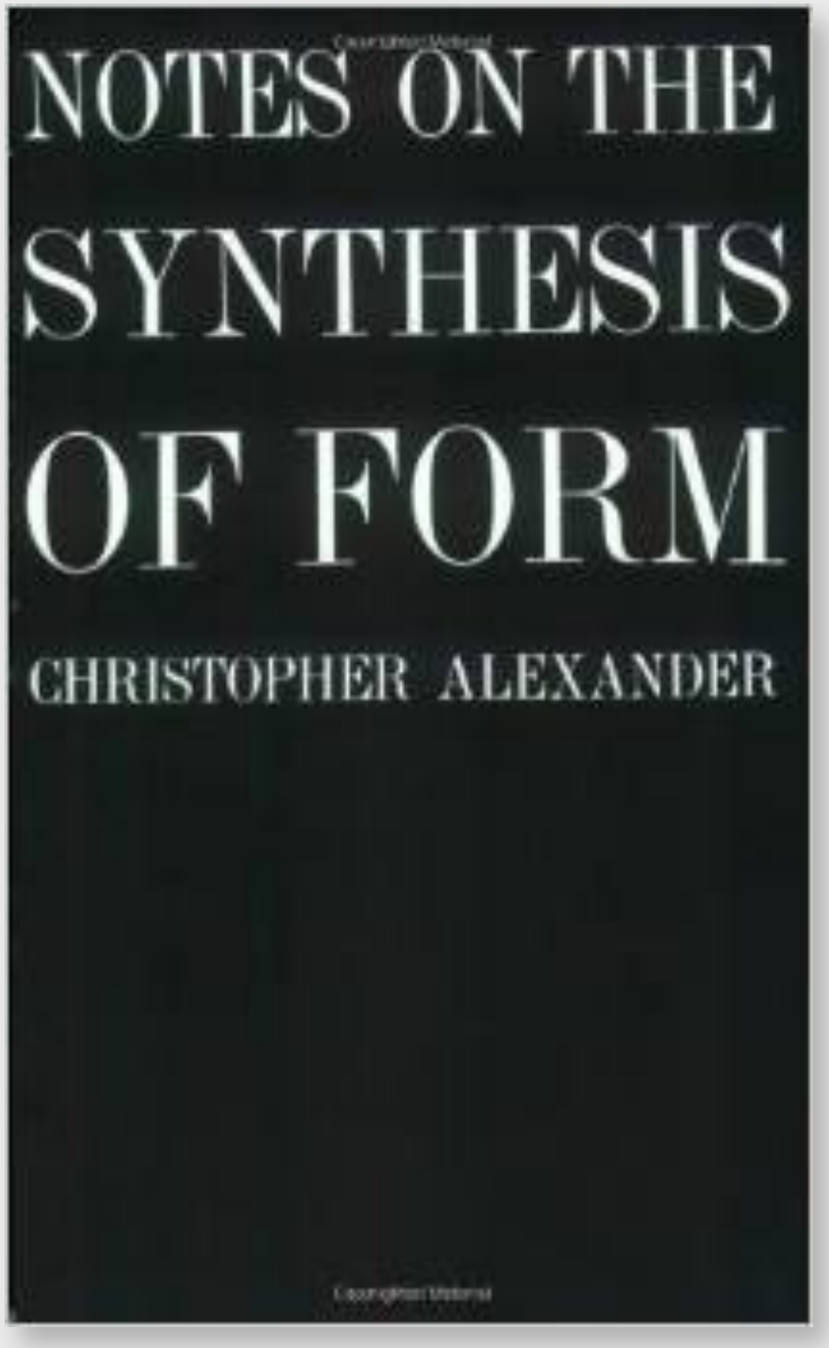
example: a photo wall



as implemented

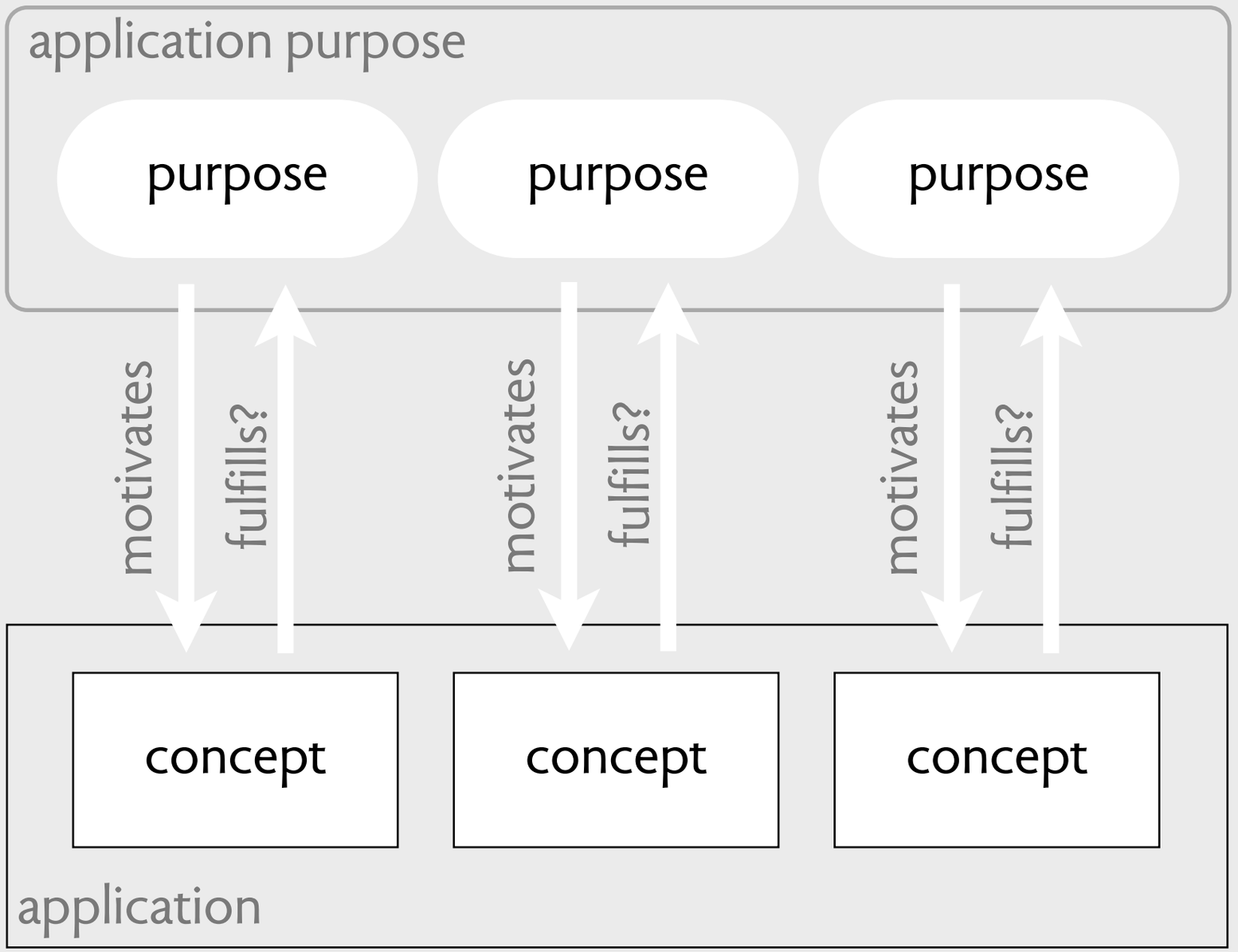
refining the purpose with misfits



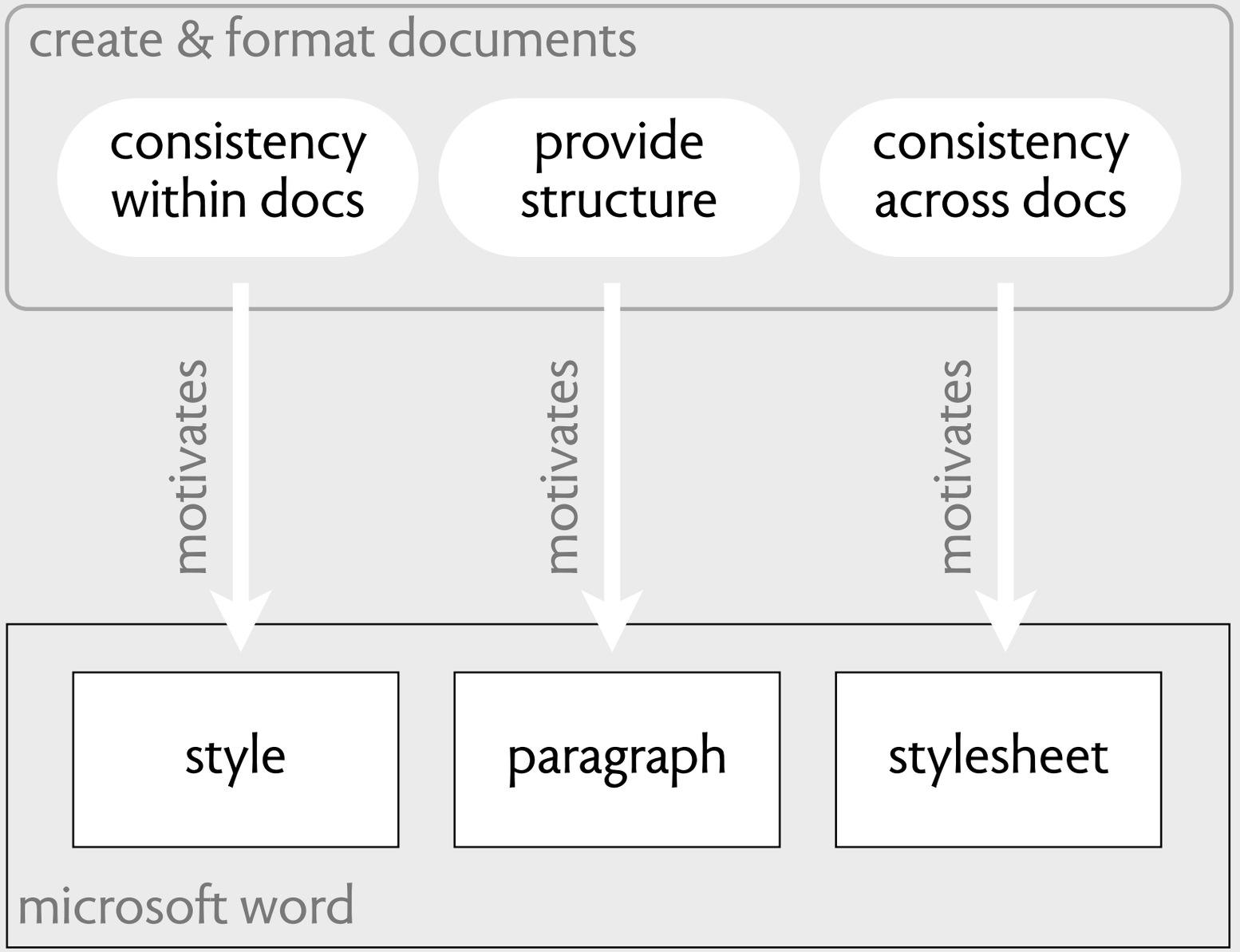


Such a list of requirements is potentially endless... But if we think of the requirements from a negative point of view, as potential misfits, there is a simple way of picking a finite set.

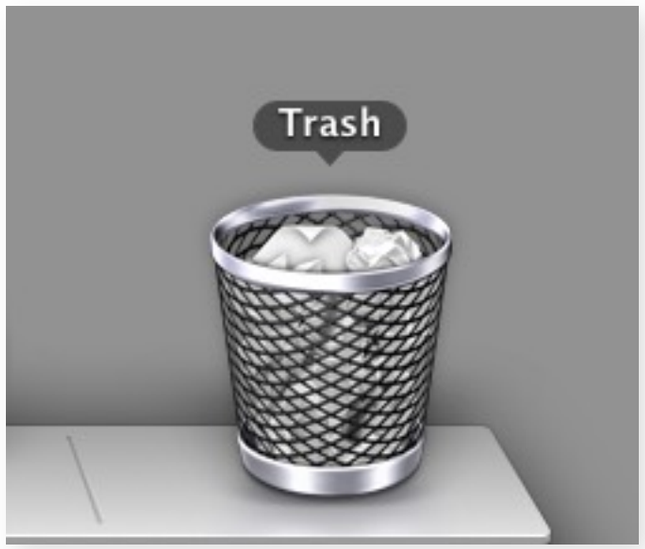
concepts driven by purposes too



example: microsoft word



purposes, principles & misfits



concept: trash

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

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

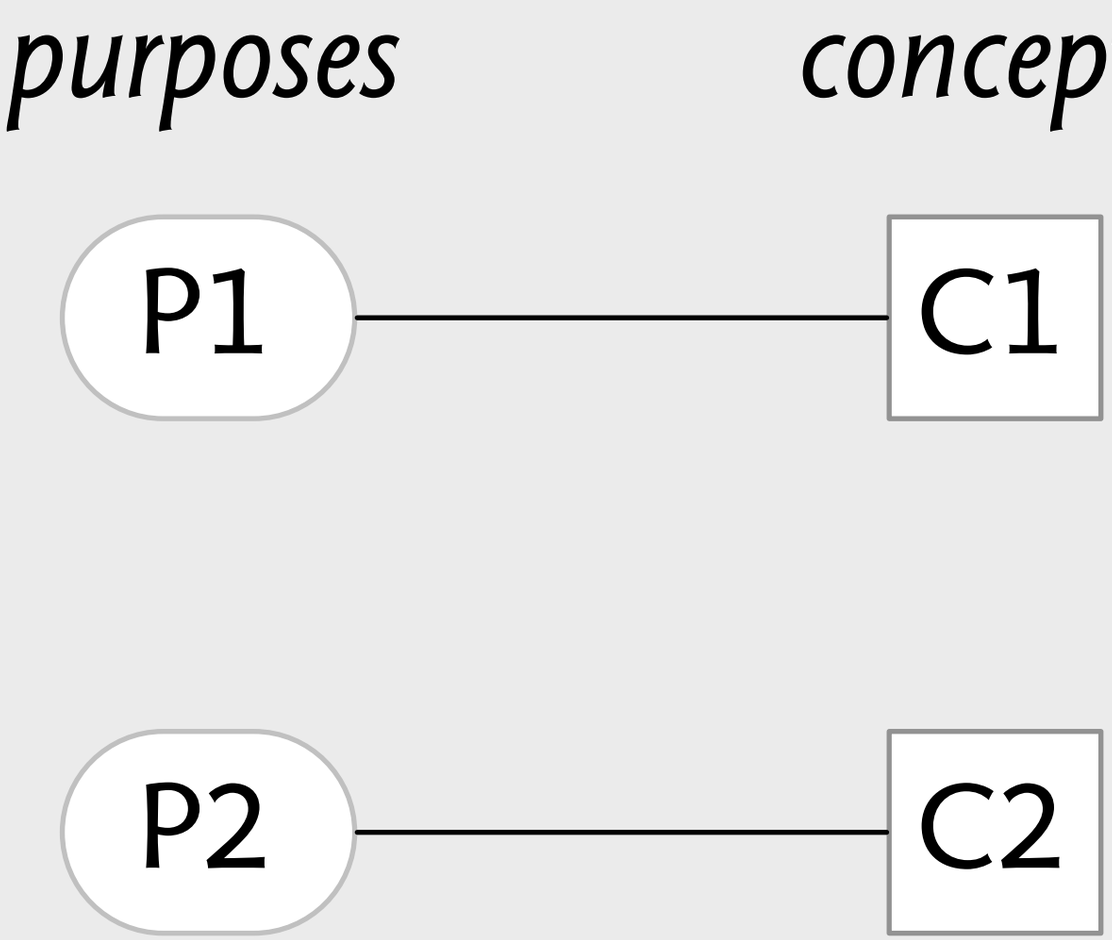
misfit: if you delete an old file and change your mind, you may not be able to find it again in the trash (if there are many deleted files and you forgot the file's name)

the fundamental principle

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

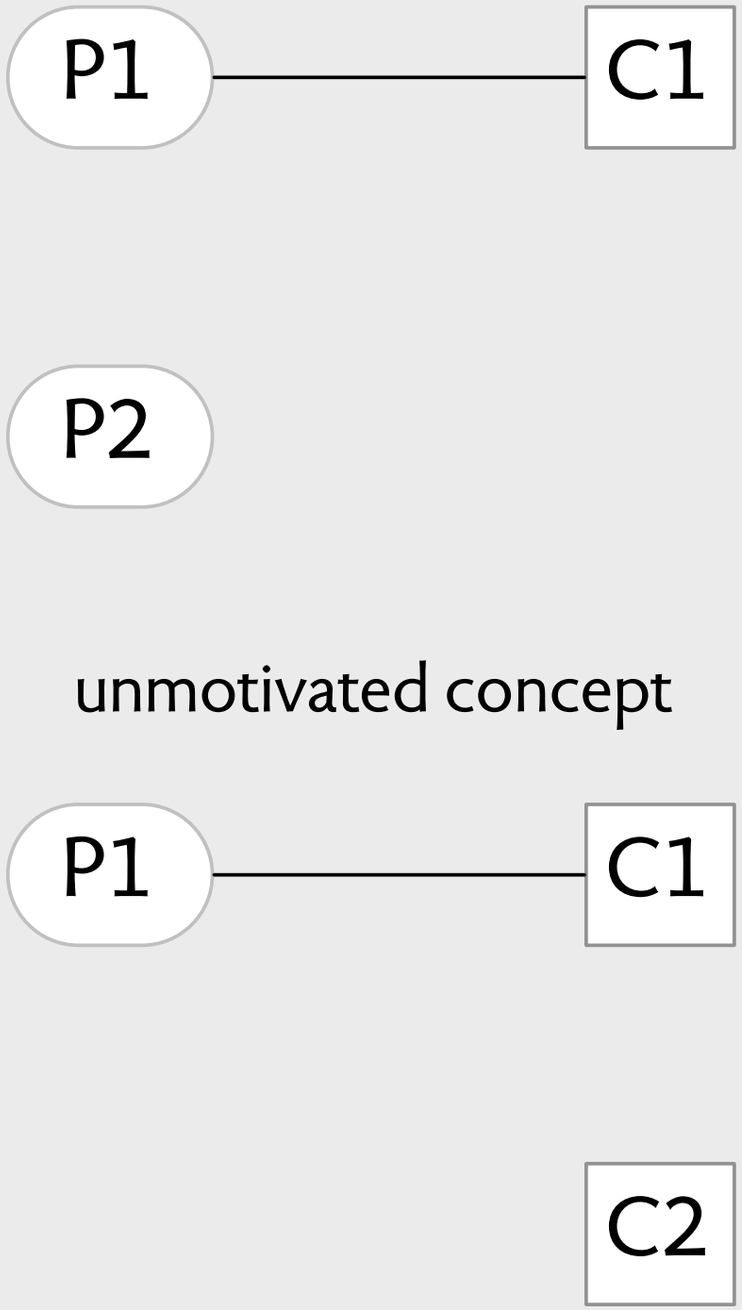
analyzing concepts

the ideal mapping

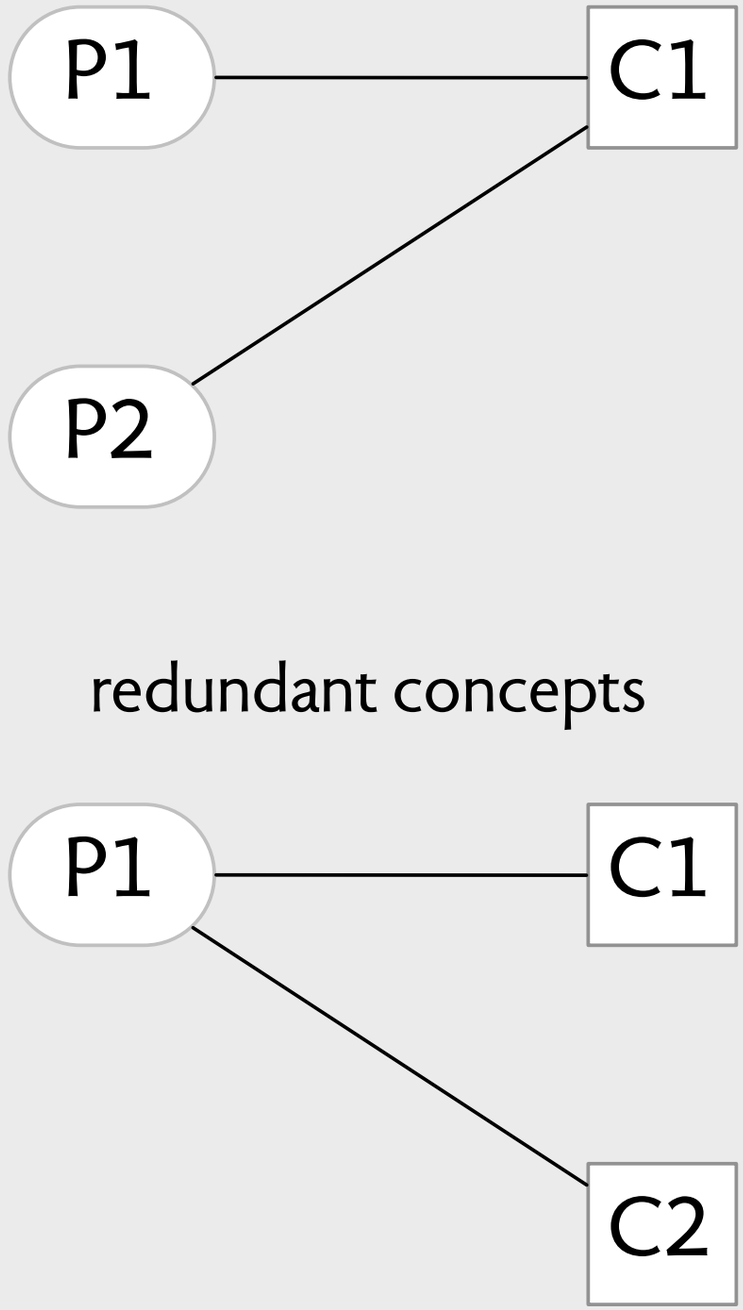


4 bad smells

unfulfilled purpose



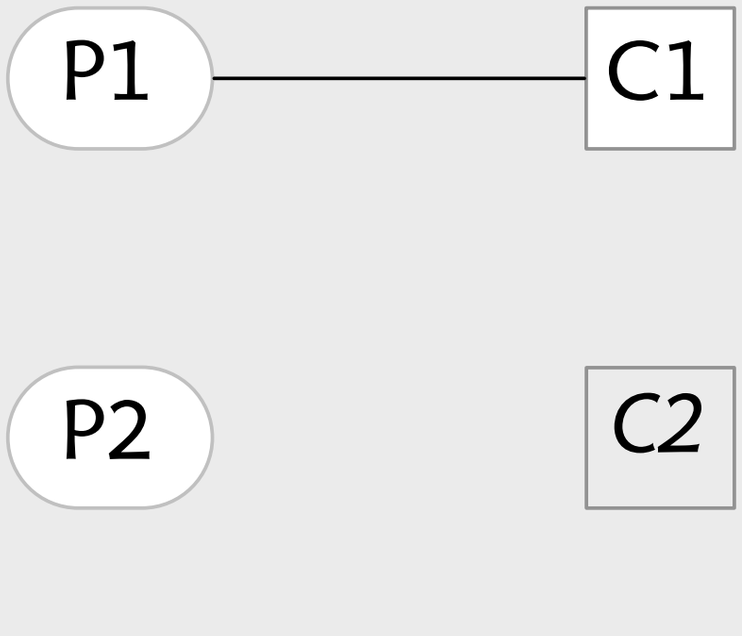
overloaded concept



unmotivated concept

redundant concepts

unfulfilled purposes



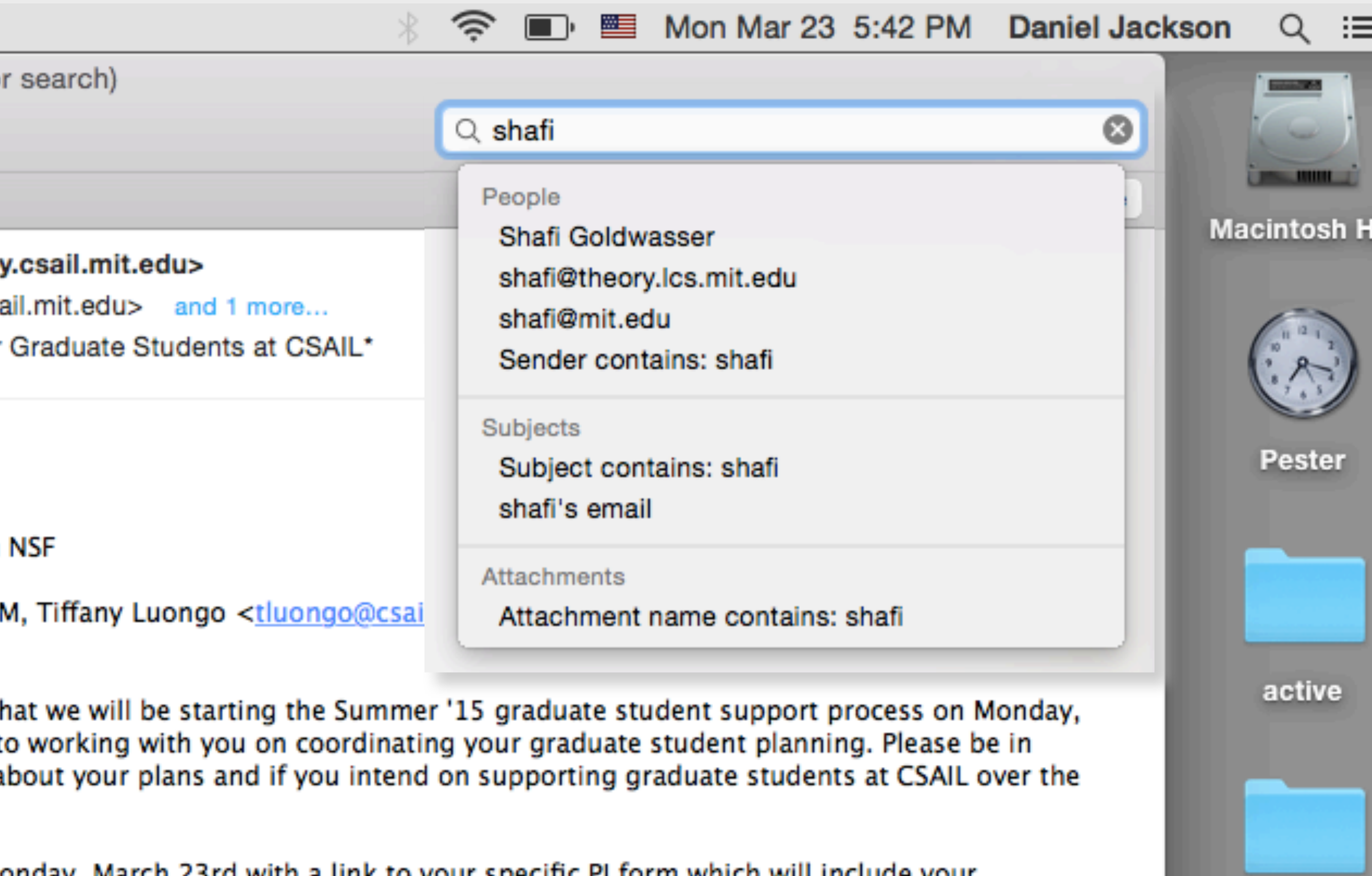
user (Apple Mail, Gmail)
'identify parties to communication'
weak search, no authentication

slide hierarchy (Powerpoint)
'structure slides in a tree'
sections provide just one level

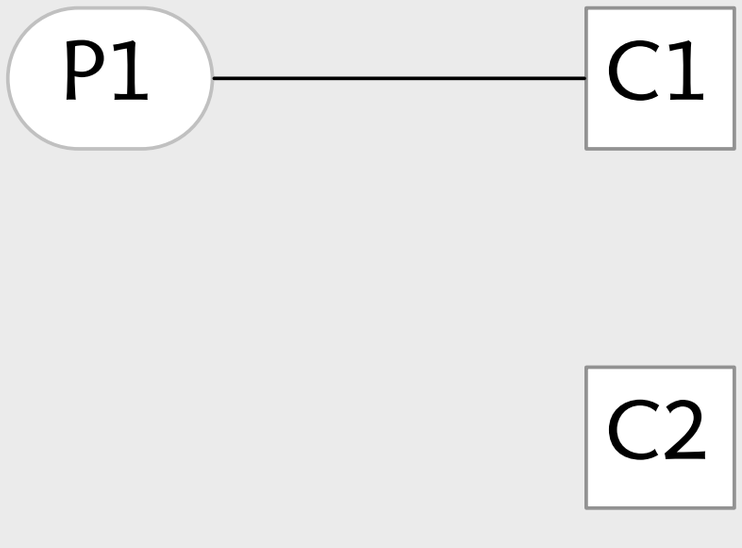
aspect ratio (Sony A7Rii, Canon 5D3)
'take square image'
can't view in finder or save setting

binder (Preview, Acrobat)
'maintain composite PDF doc'
can insert pages, but forgets source

unfulfilled purpose Apple Mail



unmotivated concepts



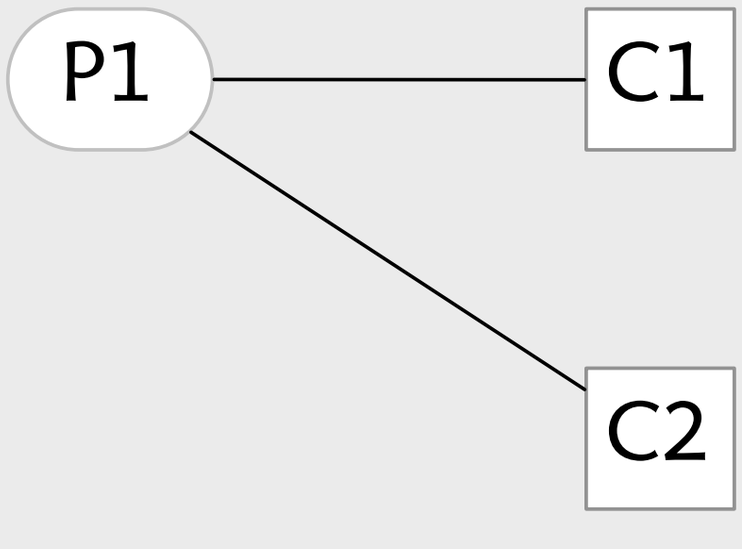
buffer (emacs)
no reason not to save to file

stash (Git)
addresses branching misfits

staging area (Git)
what's it for?

boxing (Java)
addresses primitives vs objects misfit

redundant concepts



rating stars (Lightroom)
colors, flags, stars, oh my!

rules & **searches** (Apple Mail)
two ways to specify set of messages

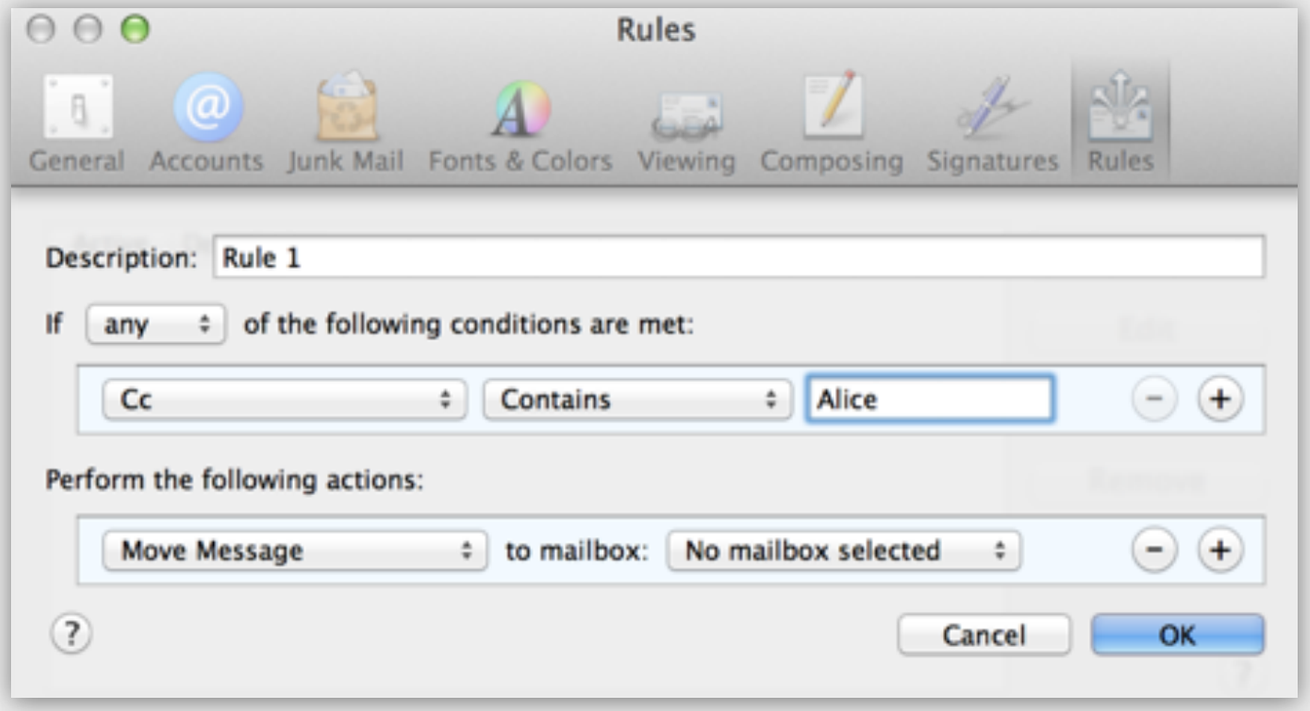
labels & **categories** (Gmail)
two ways to classify messages

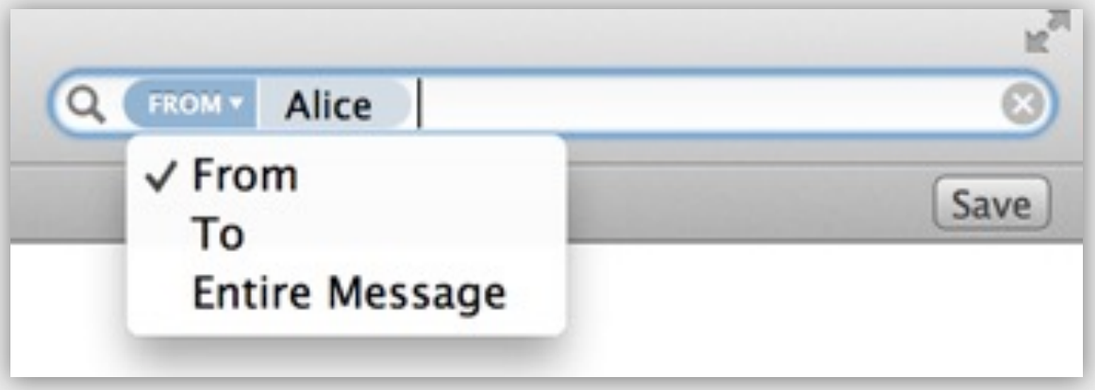
text object & **text box** (Acrobat 10)
document text too: all different

permissions (AFS)
coexist with Unix permissions

headline, title, caption (IPTC)
original purposes lost

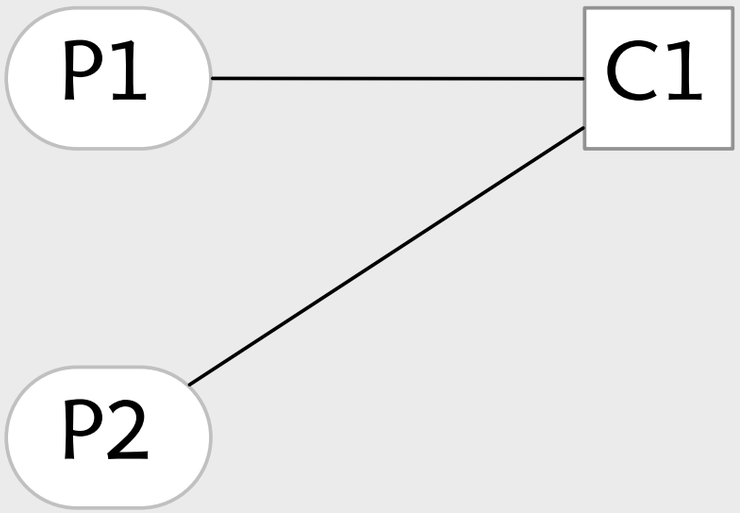
redundant concepts apple mail





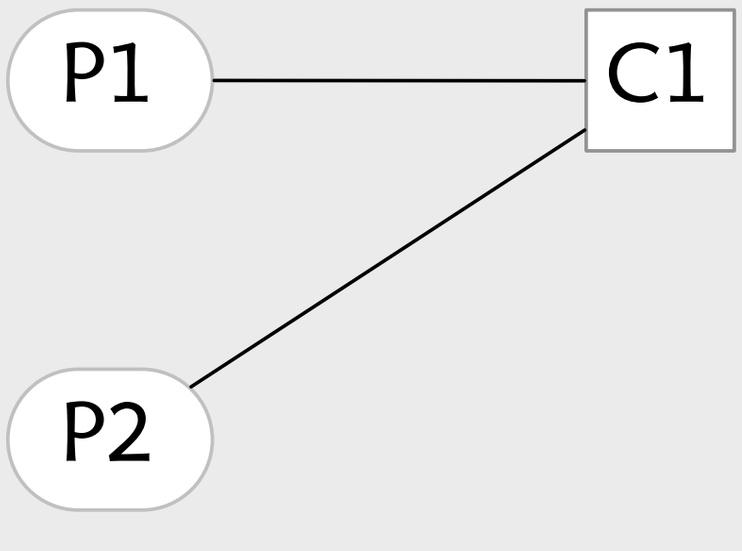
overloaded concepts

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]



Nam Suh
independence
axiom

overloaded concepts



conference review
feedback vs. selection

call forwarding
follow-me vs. delegate

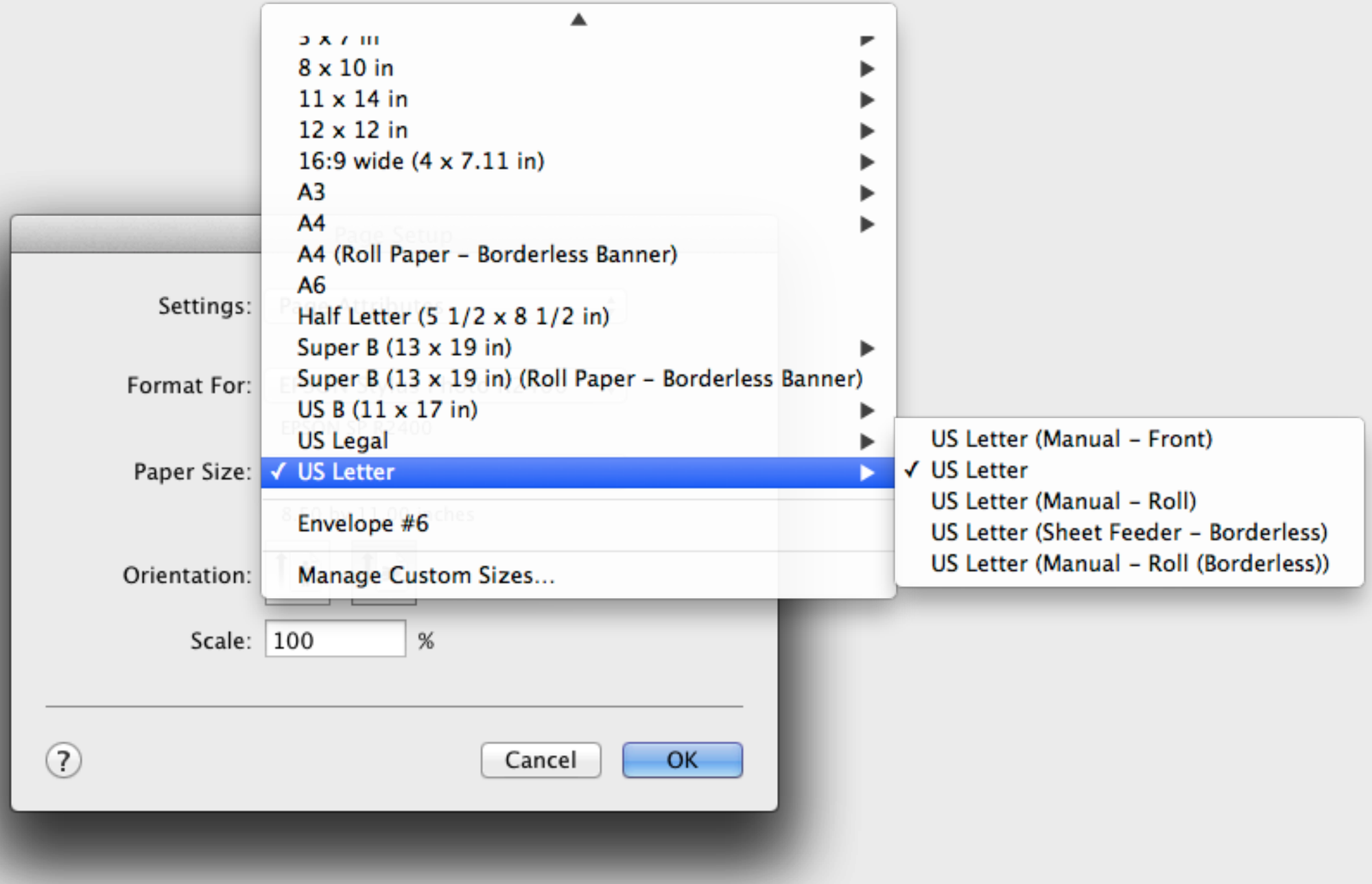
contact (Apple address book)
shortcut vs. format addressee

friends (Facebook)
filter posts vs. limit access

signature (Acrobat 9)
digital vs. physical

paper size (Epson printer driver)
dimensions vs. source

overloaded concepts epson driver



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

case studies

gitless: a reworking of git

Gitless: a version control system

Fork me on GitHub

About Gitless

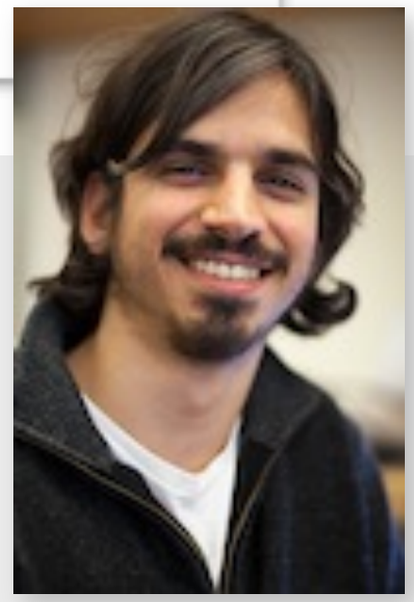
Gitless is an experimental version control system built on top of Git. Many people complain that Git is hard to use. We think the problem lies deeper than the user interface, in the concepts underlying Git. Gitless is an experiment to see what happens if you put a simple veneer on an app that changes 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

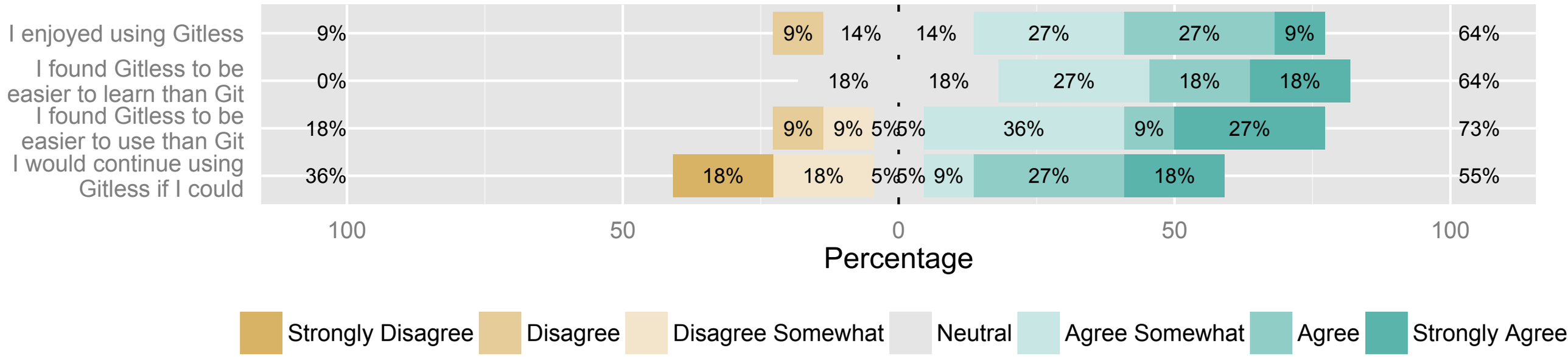
- Mac OS X Binary (.tar.gz)
- Linux Binary (.tar.gz)
- Source Code (.tar.gz)

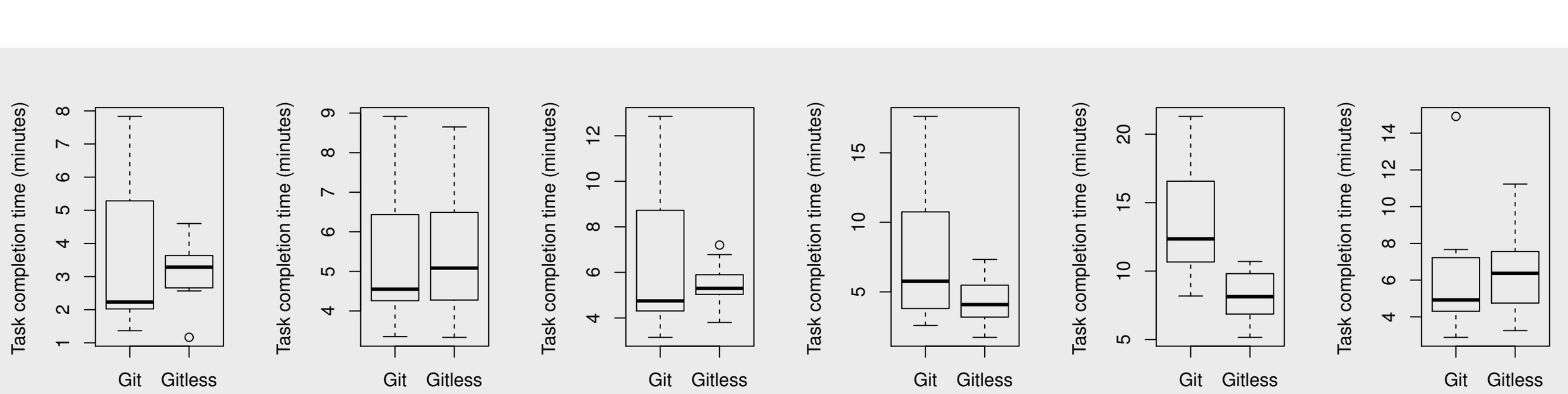
For installation instructions see the readme file. After installation, you should be able to execute the `gl` command. The current Gitless version is 0.7 which was released on 4/2015 (release notes).



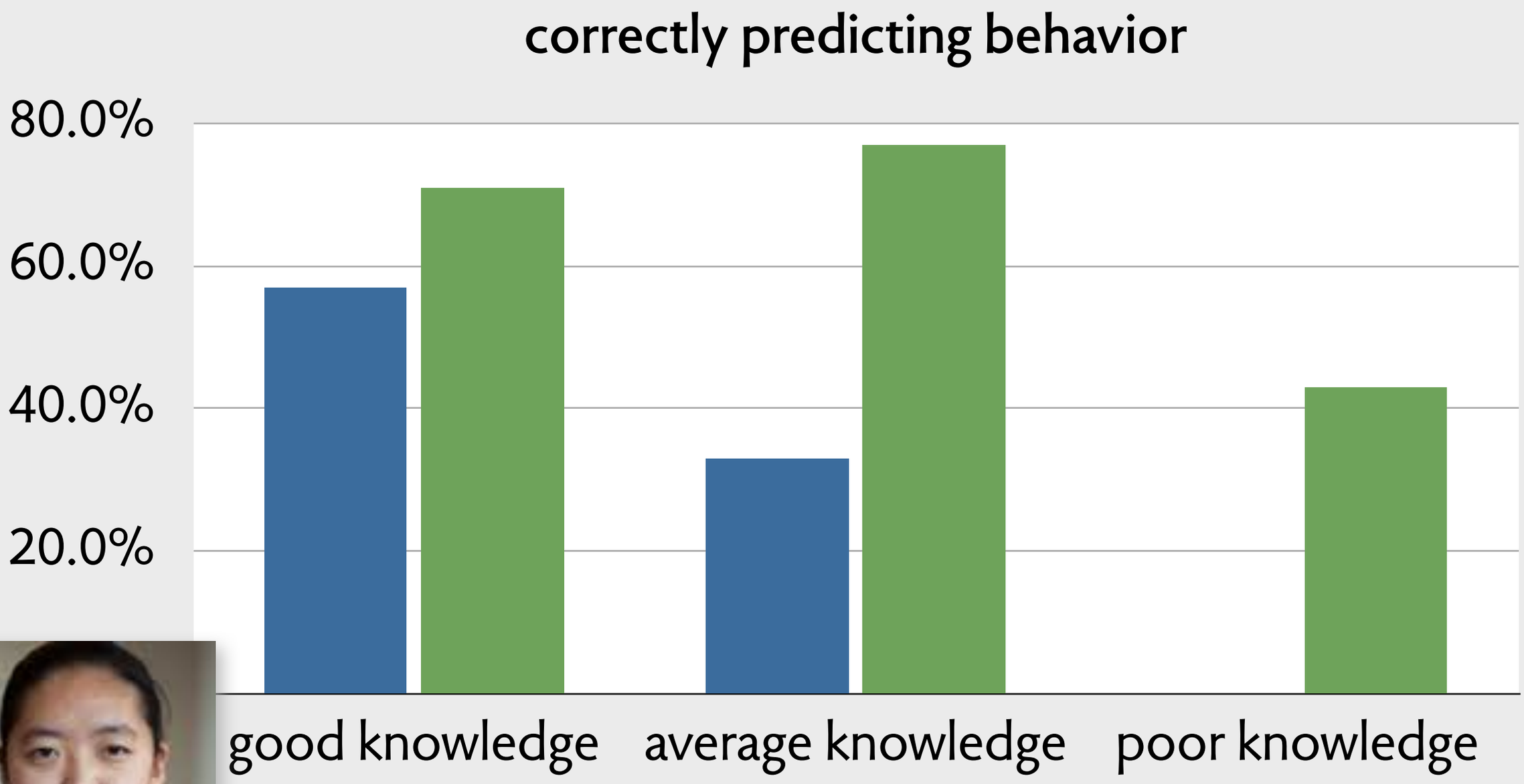
Santiago
Perez De Rosso

results of a user study





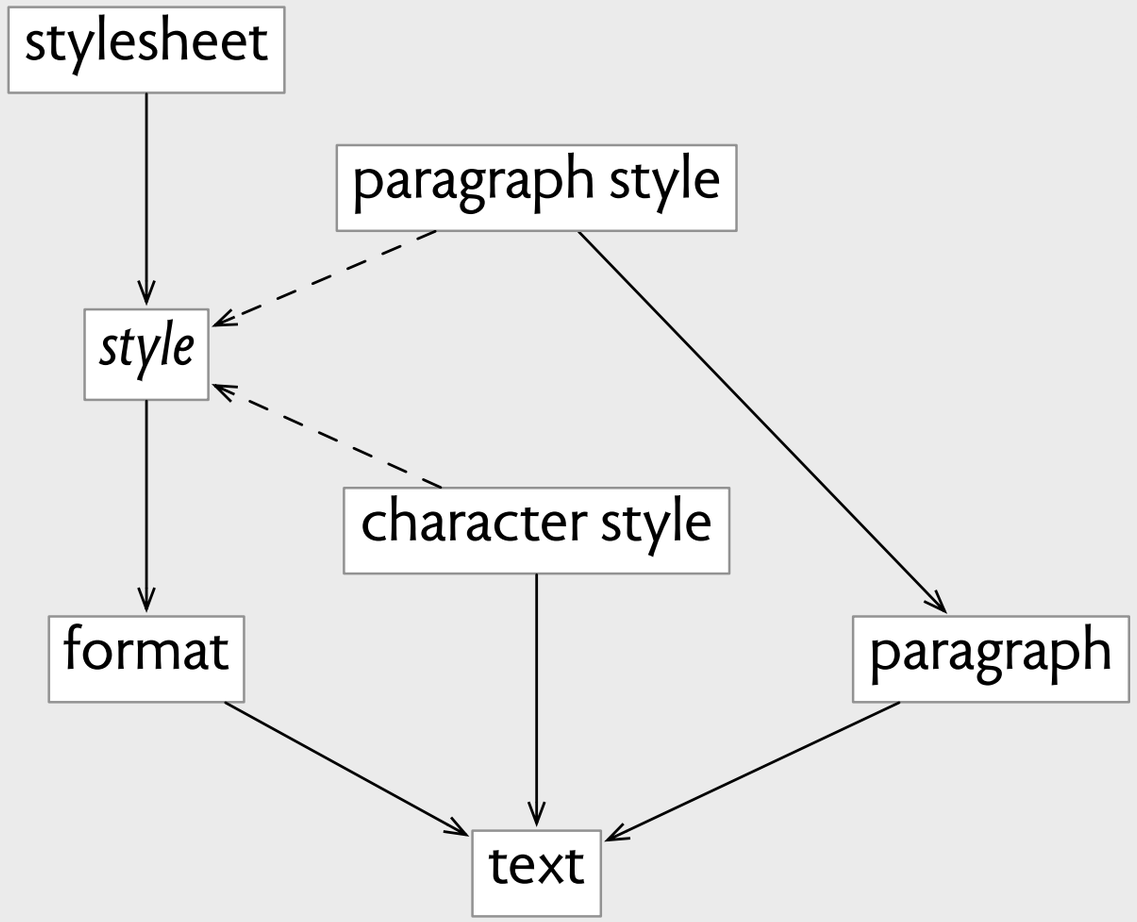
small survey of MIT dropbox users



Kelly Zhang

conclusions

what else is in the paper?



concept dependence graphs

concept idioms

concept	purpose
consistency	
style	achieve consistent formatting of a set of elements
master	achieve consistent structure and format of composite elements
stencil	use archetypal objects for consistency and time saving
style buffer	reformat another object like a previous one to save effort
preset	allow setting of many properties at once
organization	
folder	organize collection of items into a hierarchy
REST	organize collection of resources by simple path names
group	group items so they can be treated as a single item
layer	allow easy inclusion/exclusion of sets of items
stack	place items in stacking order for precedence
selection	apply action in aggregate to many items at once
label	add labels to items so they can be found later
alias	address one or more items with a shorthand name
filter	allow filtering of set of objects by their features
property	describe an object with properties that have values
metadata	sort and search for items using associated data
navigation	
	keep past actions for audit, undo, visibility
	provide temporary storage area for quick modificatio
	shortcut entry into traversable document

contributions

the idea of concepts
a new-old view of software design

talking about concepts
purpose, misfit, operational principle

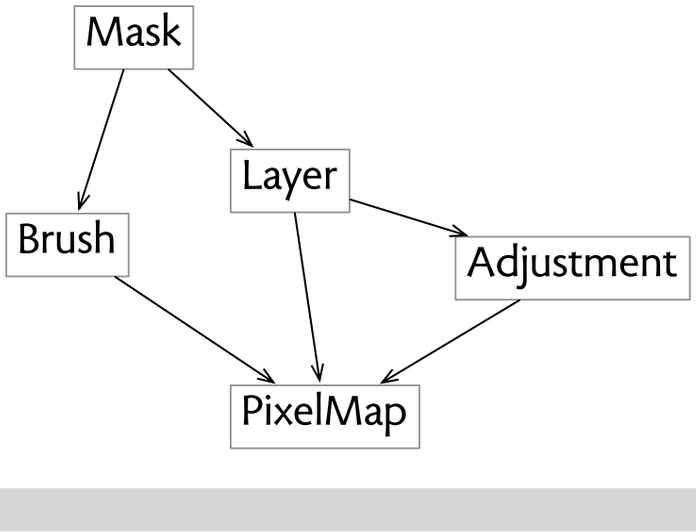
analyzing concepts
purpose-concept mapping, esp. overloading

a common view of software design

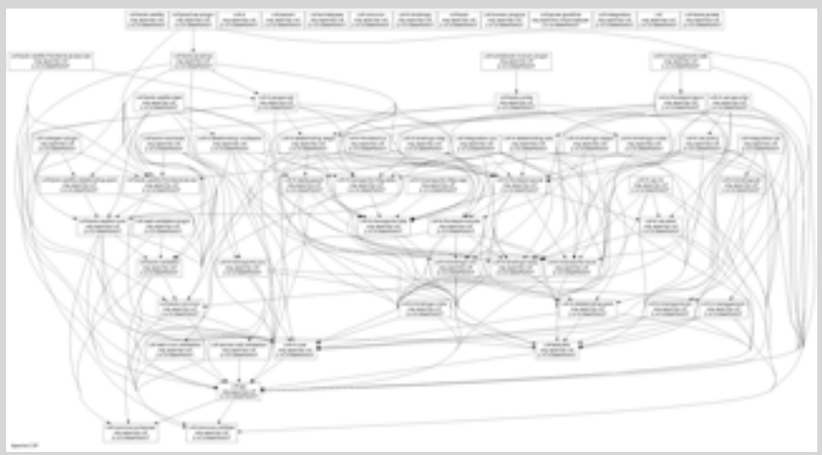
UI design
soft & human
about presentation

programming
hard & technical
about content

a better view of software design



conceptual design:
essential concepts
& behavior



representation design:
organization & performance