

(re)thinking software design

Daniel Jackson

joint work with Santiago Perez De Rosso
Tel Aviv University · December 18, 2013

good apps & bad apps

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

adobe acrobat to the rescue?

The image shows a screenshot of the Adobe Acrobat application interface. At the top, there is a toolbar with icons for 'Create', 'Save', 'Print', 'Email', 'Settings', 'Comments', 'Text', 'Redaction', 'Signatures', and 'Links'. Below the toolbar, a navigation pane shows page 2 of 3, with zoom level set to 300%. The main document area displays the text: "Parents: Frizzle will again be taking her second grade... ting field trip. Please sign and return the pe... W."

Overlaid on the bottom of the main window is a smaller window titled "acrobat-sig-paste.txt". This window contains a list of instructions:

- 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

On the right side of the main window, a sidebar is open, showing a list of page actions and design options:

- Pages
 - Rotate
 - Delete
 - Extract
 - Replace
 - Crop
 - Split Document
- Insert Pages
 - Insert from File
 - More Insert Options
- Edit Page Design
 - Header & Footer
 - Background
 - Watermark
 - Bates Numbering
- Content
- Forms
- Action Wizard
- Recognize Text
- Protection
- Sign & Certify

i'm not alone



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

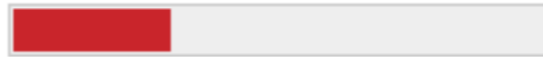


237 Negative Opinions out of 444



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

30% Hate Photoshop



Tweet 105

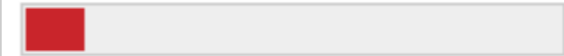


12,978 Negative Opinions out of 43,283



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

11% Hate Lightroom



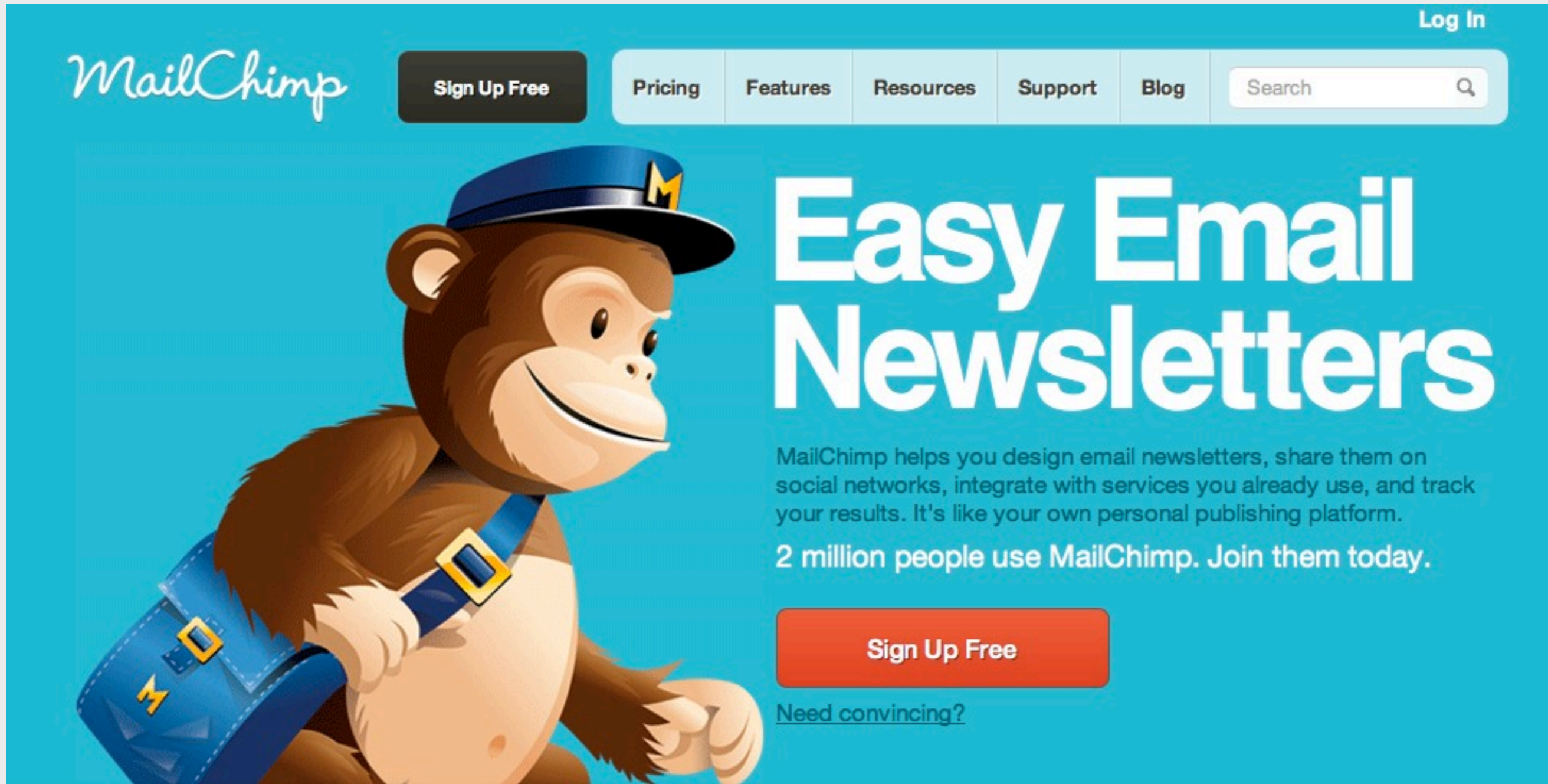
Tweet 5



297 Negative Opinions out of 2,632

**how to make
an app usable?**

simplify and humanize?



The image shows the top portion of the MailChimp website. On the left, the MailChimp logo is written in a white, cursive font. To its right is a dark blue button with the text "Sign Up Free" in white. Further right is a navigation menu with links for "Pricing", "Features", "Resources", "Support", and "Blog". A search bar with the placeholder text "Search" and a magnifying glass icon is located to the right of the navigation menu. In the top right corner, there is a "Log In" link. The main hero section features a large illustration of a brown monkey wearing a blue cap with a yellow "M" and a blue messenger bag with a yellow buckle. To the right of the monkey, the headline "Easy Email Newsletters" is displayed in large, white, sans-serif font. Below the headline, a paragraph of text describes the service: "MailChimp helps you design email newsletters, share them on social networks, integrate with services you already use, and track your results. It's like your own personal publishing platform." Below this paragraph is another line of text: "2 million people use MailChimp. Join them today." At the bottom of the hero section, there is a large orange button with the text "Sign Up Free" in white. Below the button is a link that says "Need convincing?" in a smaller, blue font.

MailChimp

Sign Up Free

Pricing Features Resources Support Blog

Search

Log In

Easy Email Newsletters

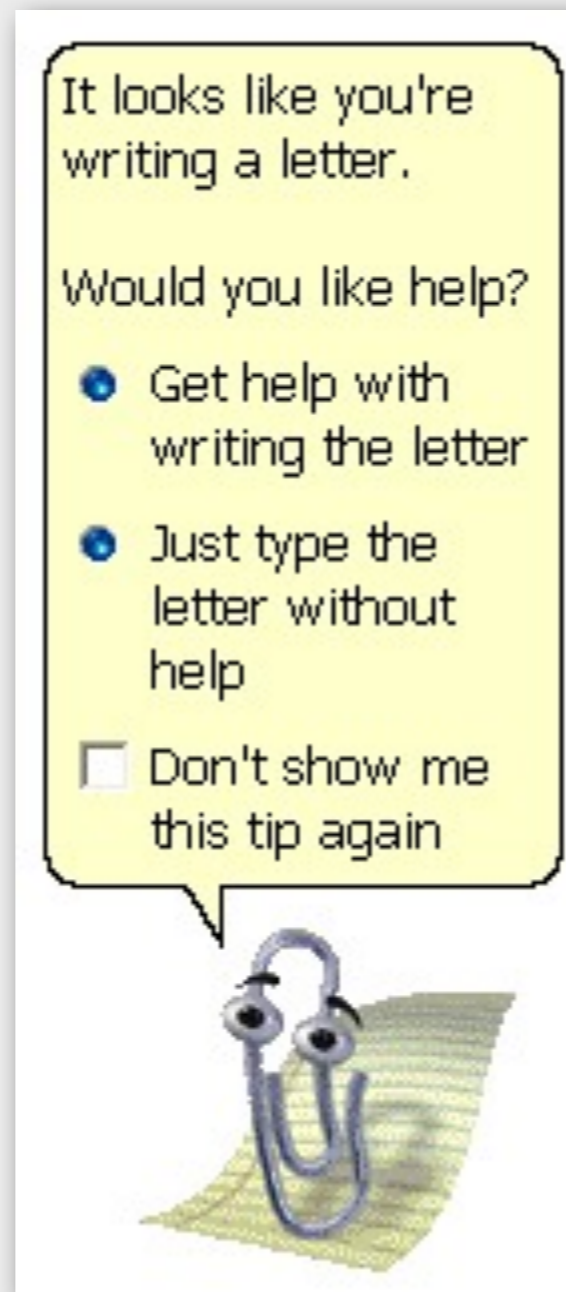
MailChimp helps you design email newsletters, share them on social networks, integrate with services you already use, and track your results. It's like your own personal publishing platform.

2 million people use MailChimp. Join them today.

Sign Up Free

[Need convincing?](#)

not always welcome



Clippy
2003-2008
RIP

affordances

James Gibson (1977): “action possibilities” latent in environment

Donald Norman (1988): action possibilities that are perceivable



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

a door with good affordances



unhappy doors



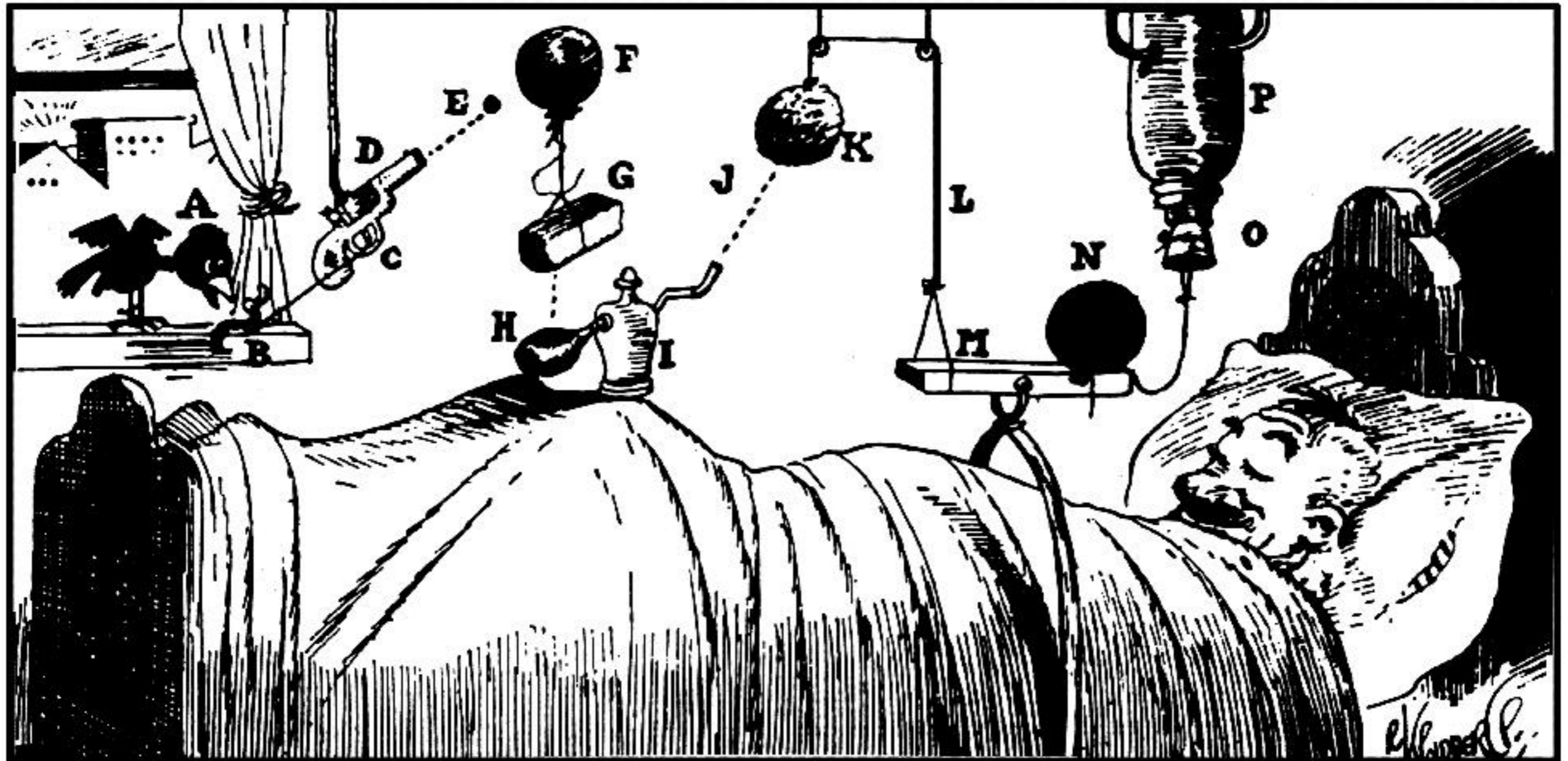
push or pull?



door with user manual



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

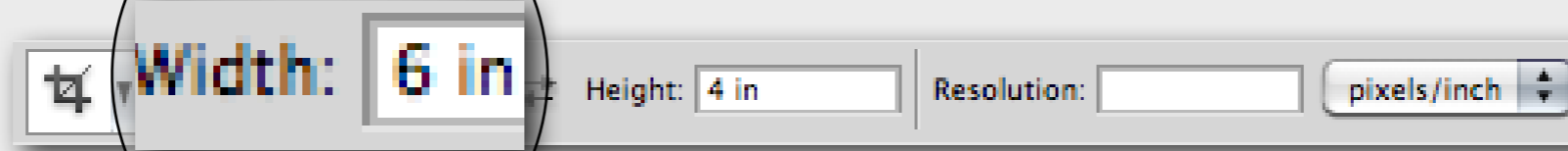
conceptual models

to use a complex application
we imagine what's inside
we form structures in our mind
we connect actions to structural changes

"abstract
affordances"

an example

cropping in adobe photoshop



(demo)

look at image size

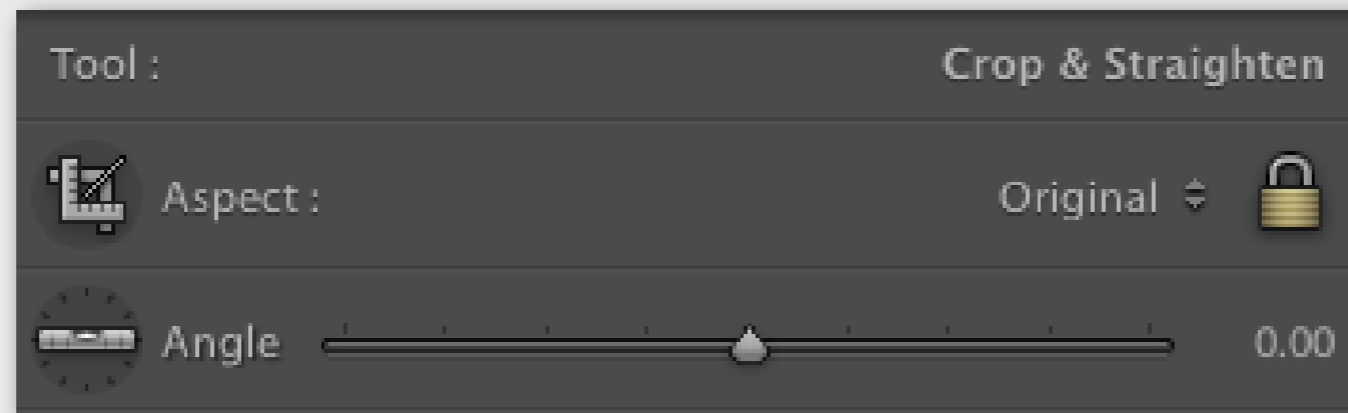
crop entire image without aspect ratio

note effect on image size

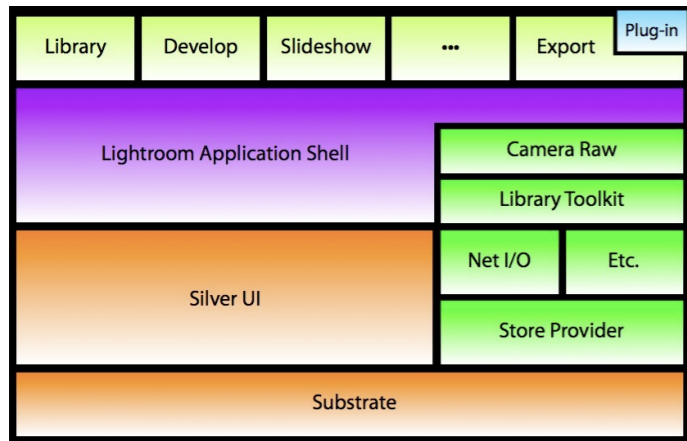
repeat with aspect ratio

now enter resolution

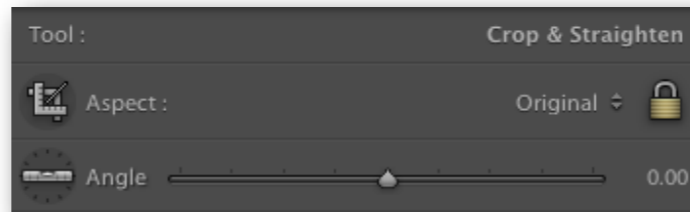
cropping in adobe lightroom



concepts



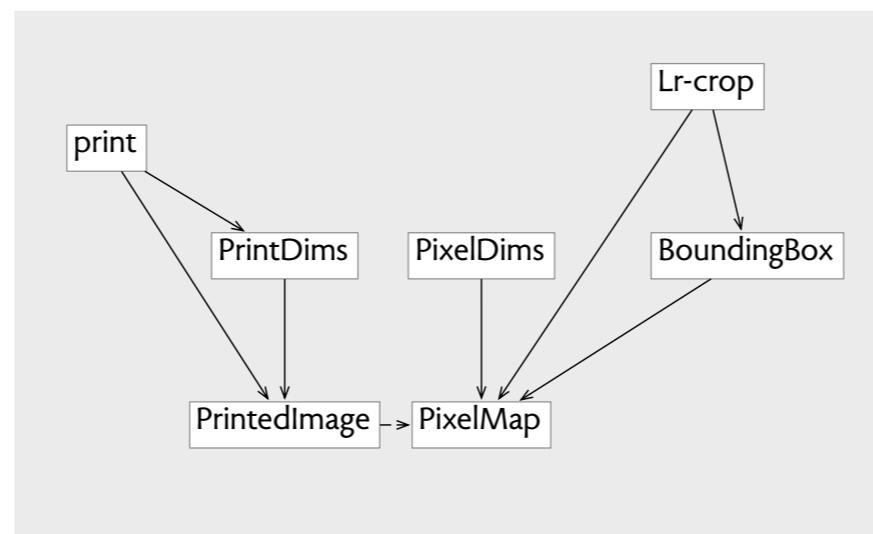
code



interface



user's model



conceptual model

hypothesis

the quality of the conceptual model
is the key factor that determines
how usable the app will be
how easy it is to build and maintain
how reliable it will be

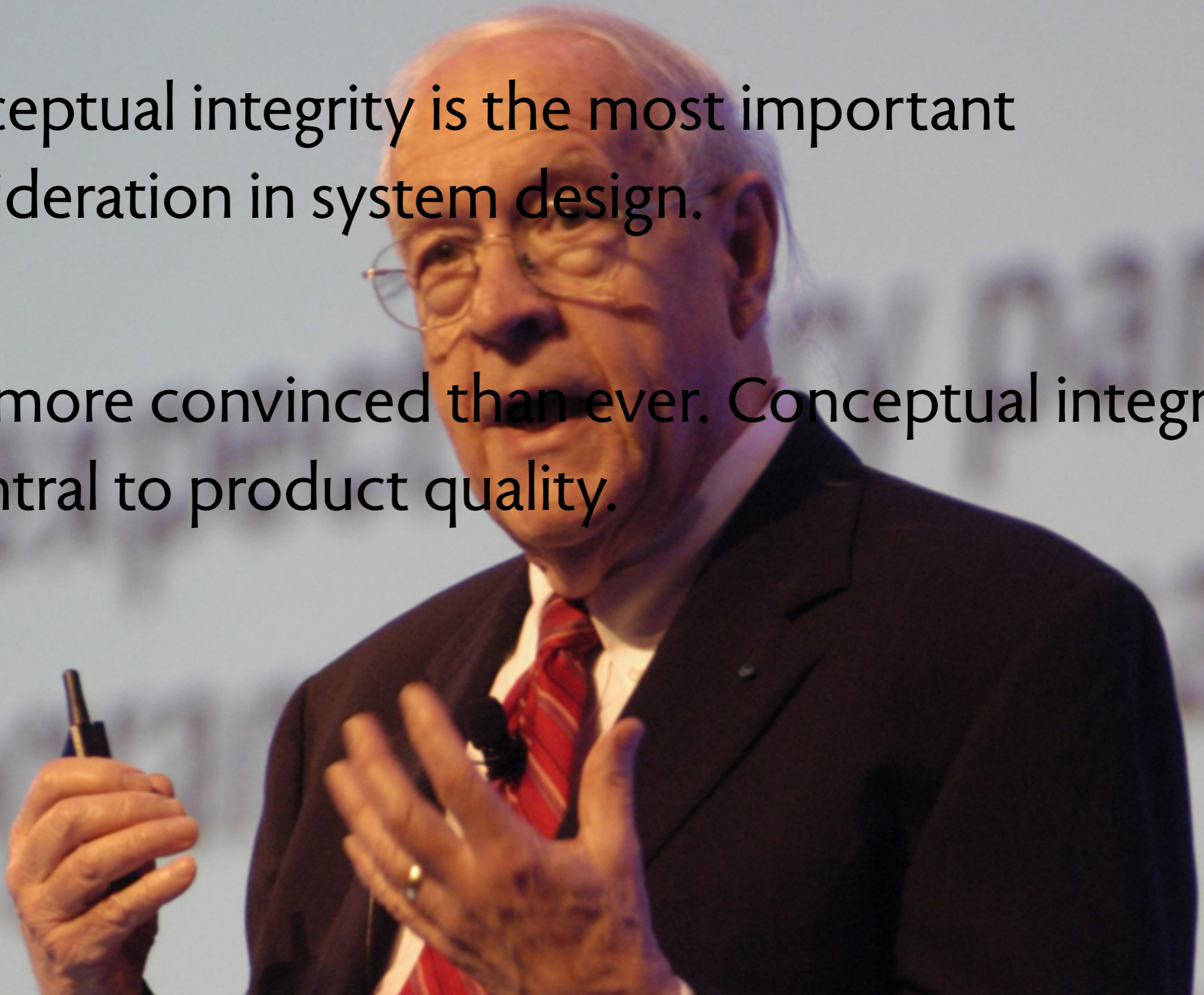
fred brooks

Conceptual integrity is the most important consideration in system design.

—1975

I am more convinced than ever. Conceptual integrity is central to product quality.

—1995



what's a concept?

a set or primitive representations

Char Date Keyword Tweet GPSCoord URL

names referring to real world objects

SSN ISBN CallNo Address

a set of structures

Book <BOOK, isbn: BOOK -> ISBN, callno: BOOK -> CallNo>

Member <MEMBER, ssn: MEMBER -> SSN, address: MEMBER -> Address>

Inventory <shelved: set BOOK, lent: MEMBER -> BOOK>

a set of events

join <JOIN, ssn: JOIN -> SSN, addr: JOIN -> Address>

lend <LEND, isbn: LEND -> ISBN, ssn: LEND -> SSN>

subconcepts

C' is a subconcept of C iff

$\text{fields}(C') \supseteq \text{fields}(C)$ and explanation of C' involves C

Book <BOOK, isbn: BOOK -> ISBN, callno: BOOK -> CallNo>

ShortLoanBook <..., SHORT: set BOOK, maxloan: SHORT -> Period>

Book ←----- **ShortLoanBook**

may have no extra fields

Book ←----- **NonCirculatingBook**

dependency

C' depends on C iff

C' cannot exist without C and explanation of C' involves C

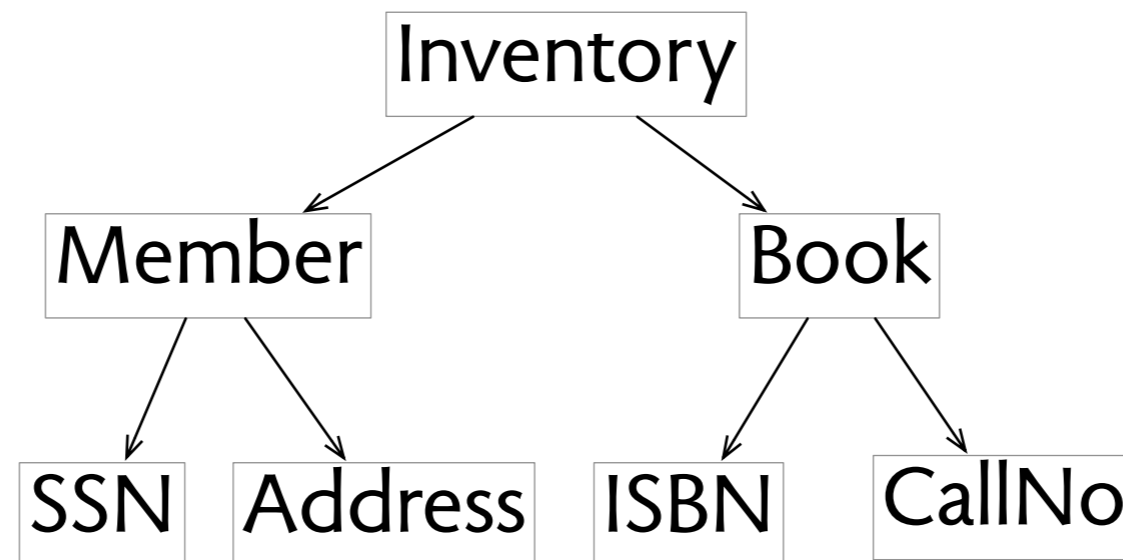
may arise because:

elements of C' refer to elements of C

Book <BOOK, isbn: BOOK -> ISBN, callno: BOOK -> CallNo>

Member <MEMBER, ssn: MEMBER -> SSN, address: MEMBER -> Address>

Inventory <shelved: set BOOK, lent: MEMBER -> BOOK>



dependency

C' depends on C iff

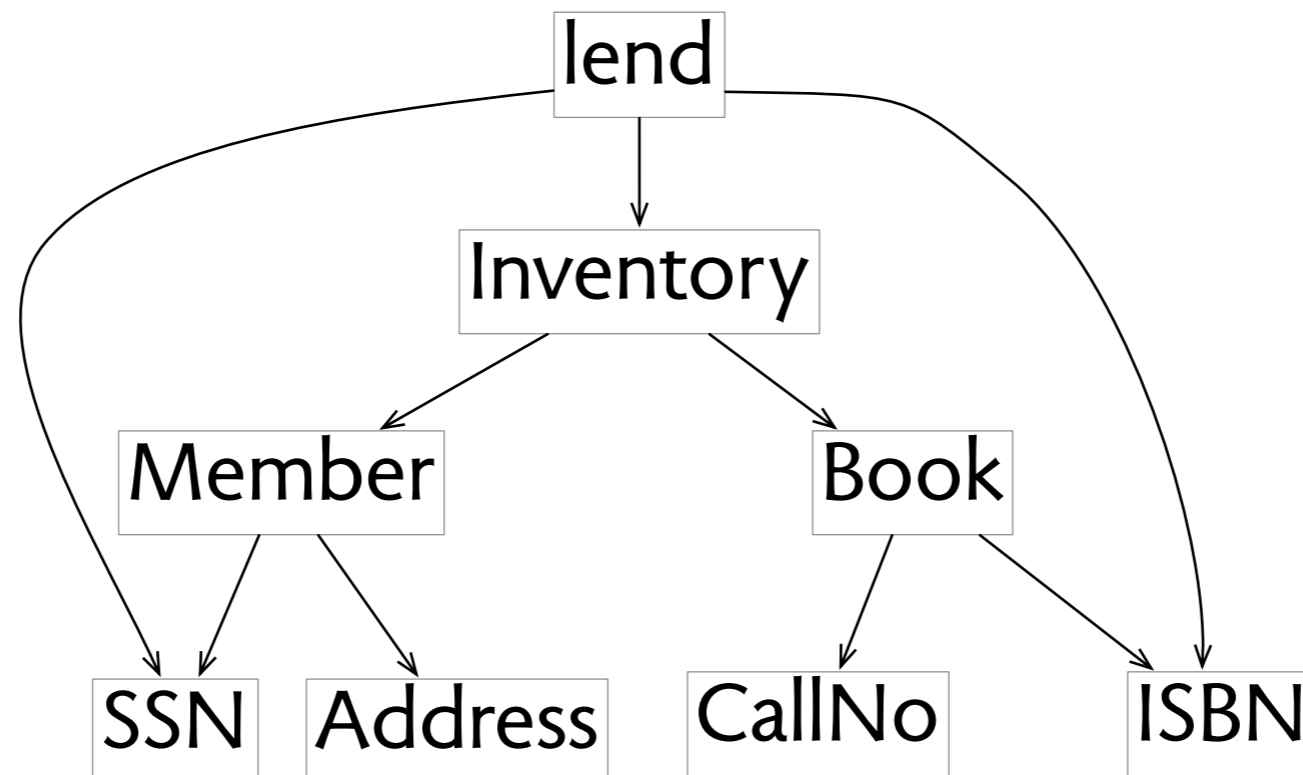
C' cannot exist without C and explanation of C' involves C

may arise because:

occurrence of event in C' affects or affected by state in C

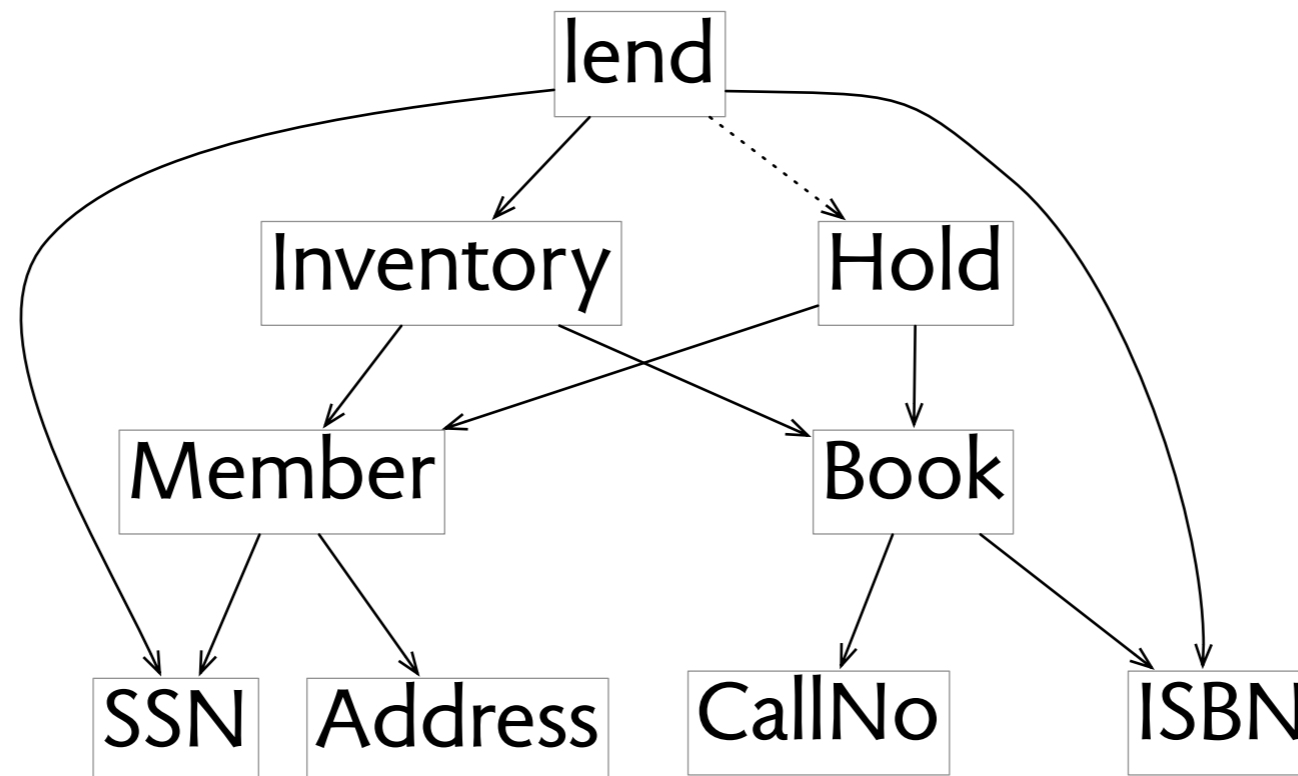
lend <LEND, isbn: LEND -> ISBN, ssn: LEND -> SSN>

Inventory <shelved: set BOOK, lent: MEMBER -> BOOK>



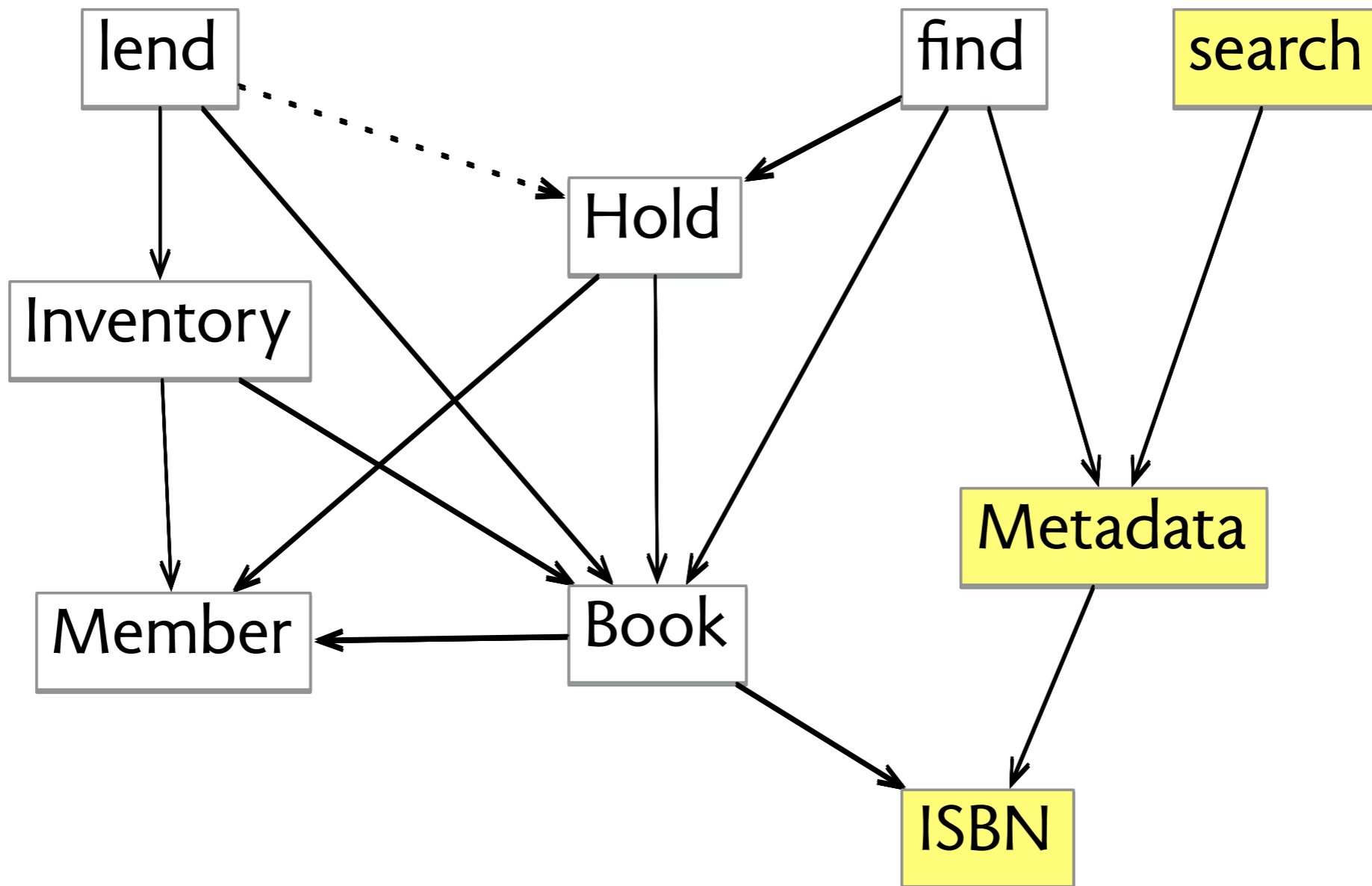
weak dependency

C' weakly depends on C iff
explanation of C' involves C but C' can exist without C



features

a *feature* is a set of concepts that
(a) has useful function
(b) is closed under dependence



where do concepts come from?

**domain concepts:
exist in problem domain**

photo, movie, song

direct flight, code share

401k, CDO, commission

typeface, ligature

**analogic concepts:
based on known notions**

blog post, email, tweet

desktop, folder, file

layer, mask, stacking

cart, order, item

**synthetic concepts:
invented for software**

relative reference

hypertext link

tag, keyword

select, cut buffer

confused concepts: a big problem!
direct flights, CSS pixel dimensions

some concepts are key enablers
relative references, paragraph styles

design criteria

orthogonality

- › concepts are independent
- › concepts are coupled in overlapping features

generality

- › concepts are rich enough to support distinct features
- › extra concepts added instead of generalizing existing ones

completeness

- › enough concepts to support *existing* features
- › crucial concepts are missing, features don't fully work

consistency

- › subconcepts are treated uniformly
- › subconcepts have unexpectedly different features

orthogonality apple keynote



skip slide

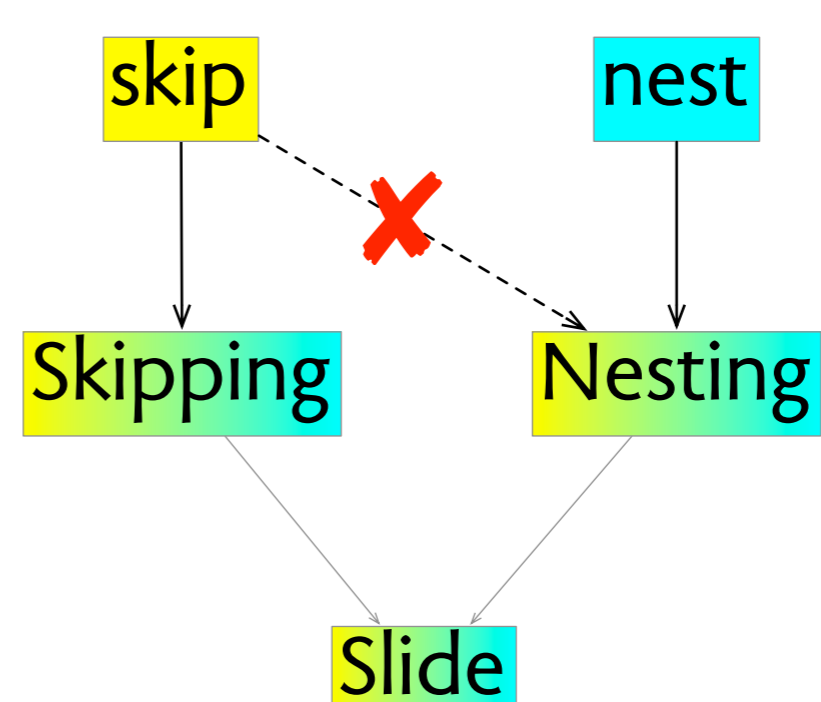
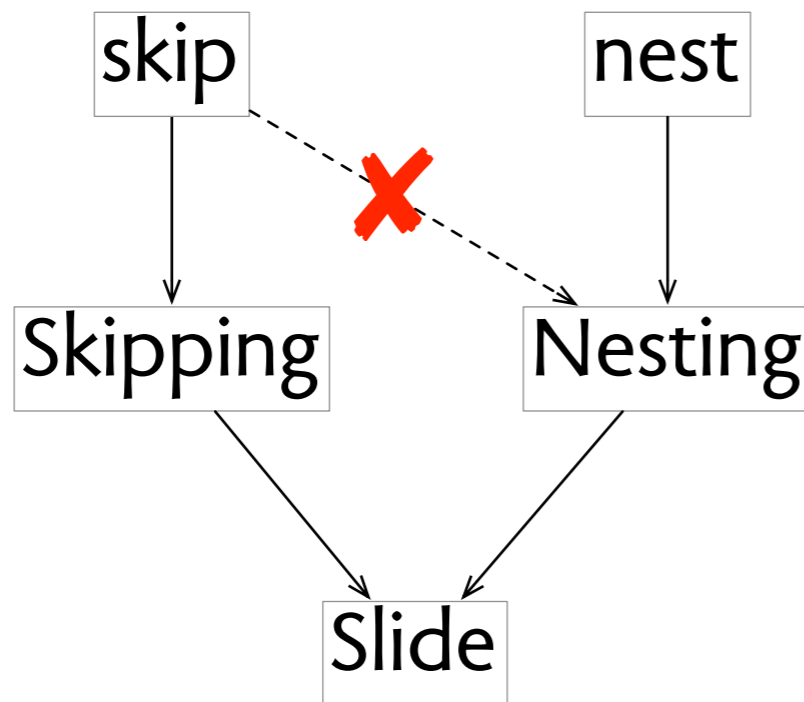
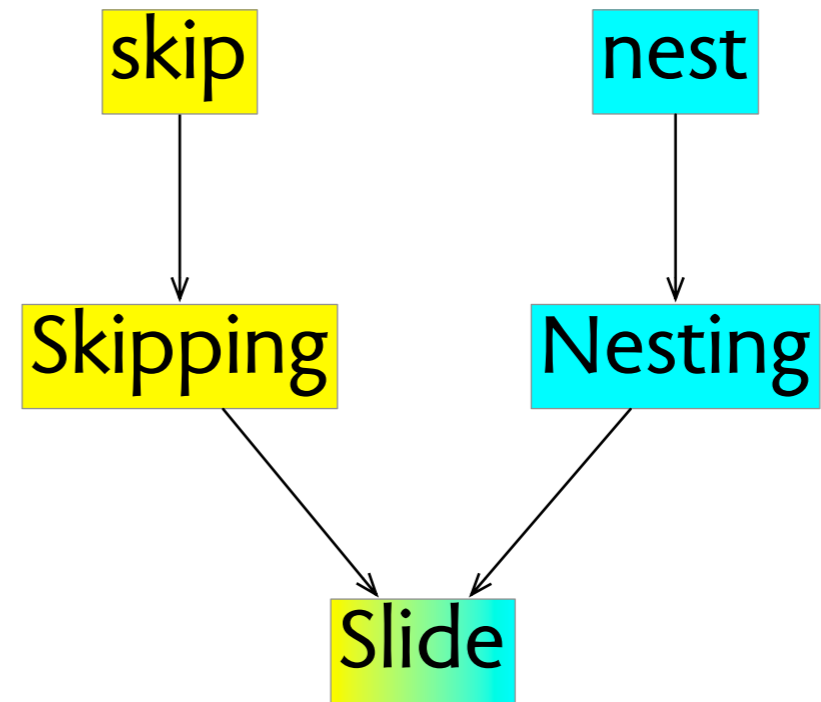
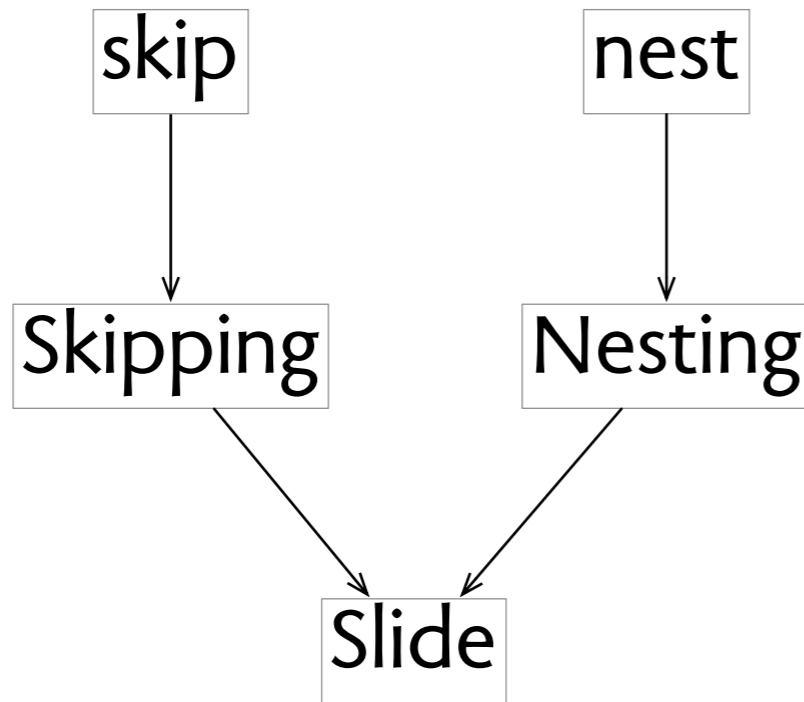


make parent



make parent
and skip

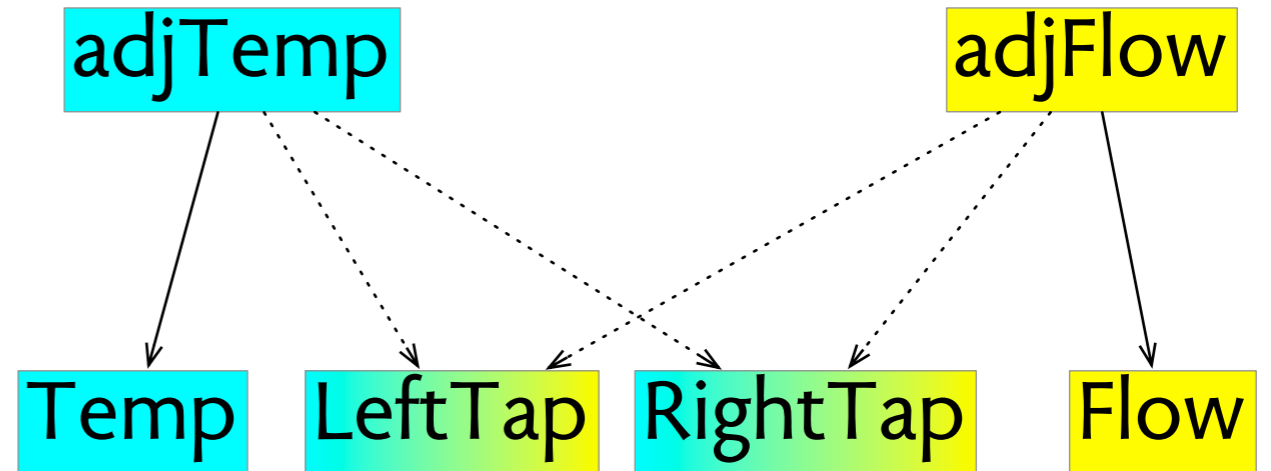
orthogonality apple keynote



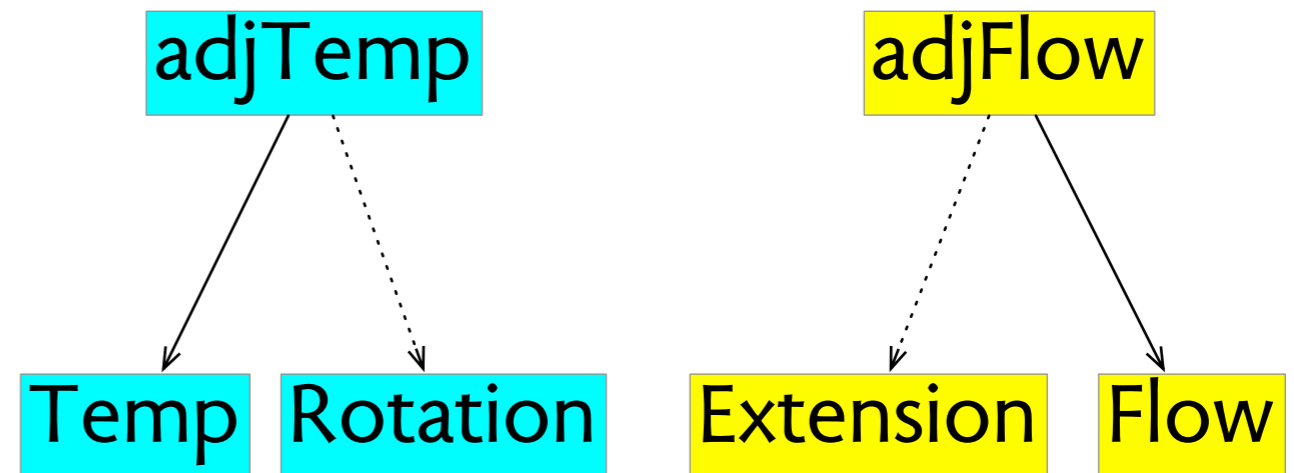
orthogonality faucets



coupled



uncoupled



orthogonality apple mail

Sort by Date ▾

↩ Santiago Perez De Rosso	12/11/13
designations and dependences	32 KB 2 ▶
↩ Santiago Perez De Rosso	10/31/13
Fwd: Software Carpentry and Git	7 KB 1 ▶
Jonathan Edwards	10/30/13
Fwd: Re: 500 lines or less	12 KB 1 ▶
↩ Michael Jackson	10/25/13
Conceptual Models	3 KB 1 ▶
Daniel Jackson	10/11/13
Analysing git with Alloy	46 KB 2 ▶
↩ Leonid Grinberg	10/11/13
some initial "bad design" examples	5 KB 1 ▶
↩ Kelly Zhang	10/10/13
Re: SuperUROP	13 KB 1 ▶
↩ Santiago Perez De Rosso	9/13/13
SuperUROP project - Re-designing Gmail	376 KB 1 ▶
William G. Griswold	9/9/13
memo on research agenda	197 KB 16 ▶
Daniel Jackson	8/18/13
Conceptual Design of Software: A Research Agenda	42 KB 2 ▶
Daniel Jackson	7/26/13
Shepherding Note 2	72 KB 3 ▶
↩ Santiago Perez De Rosso	7/12/13
Re: memo	17 KB 1 ▶
↩ Santiago Perez De Rosso	6/28/13
Re-thinking software design kickoff kit	255 KB
↩ Michael Jackson	6/26/13
Re: yippeel	10 KB 1 ▶
↩ Anthony Finkelstein	6/7/13
Re: requirements diagrams with influences	7 KB 1 ▶
↩ Santiago Perez De Rosso	5/16/13
Re-thinking software design kickoff kit	253 KB 1 ▶

William G. Griswold <wgg@cs.ucsd.edu> September 9, 2013 4:55 PM
To: Daniel Jackson <dnj@mit.edu> [Hide Details](#)
Cc: Kevin Sullivan <sullivan.kevinj@gmail.com>, Shriram Krishnamurthi <sk@cs.brown.edu>
Re: memo on research agenda

Just catching up here, sorry for the long silence.

Thanks for thinking so hard about my thoughts.

Your observation about CI reducing the design space is a superb one. The fact that this works at both the artifact and behavioral levels makes it especially attractive. I'll definitely use this idea when I next teach it!

--bill

On 9/1/13 3:10 PM, Daniel Jackson wrote:
Hi Bill,

On Aug 21, 2013, at 9:59 PM, William Griswold <wgg@cs.ucsd.edu <<mailto:wgg@cs.ucsd.edu>>> wrote:

If I might counter/expand on this a little here. In Daniel's manuscript, he critiqued my definition of conceptual integrity for being too code centric.

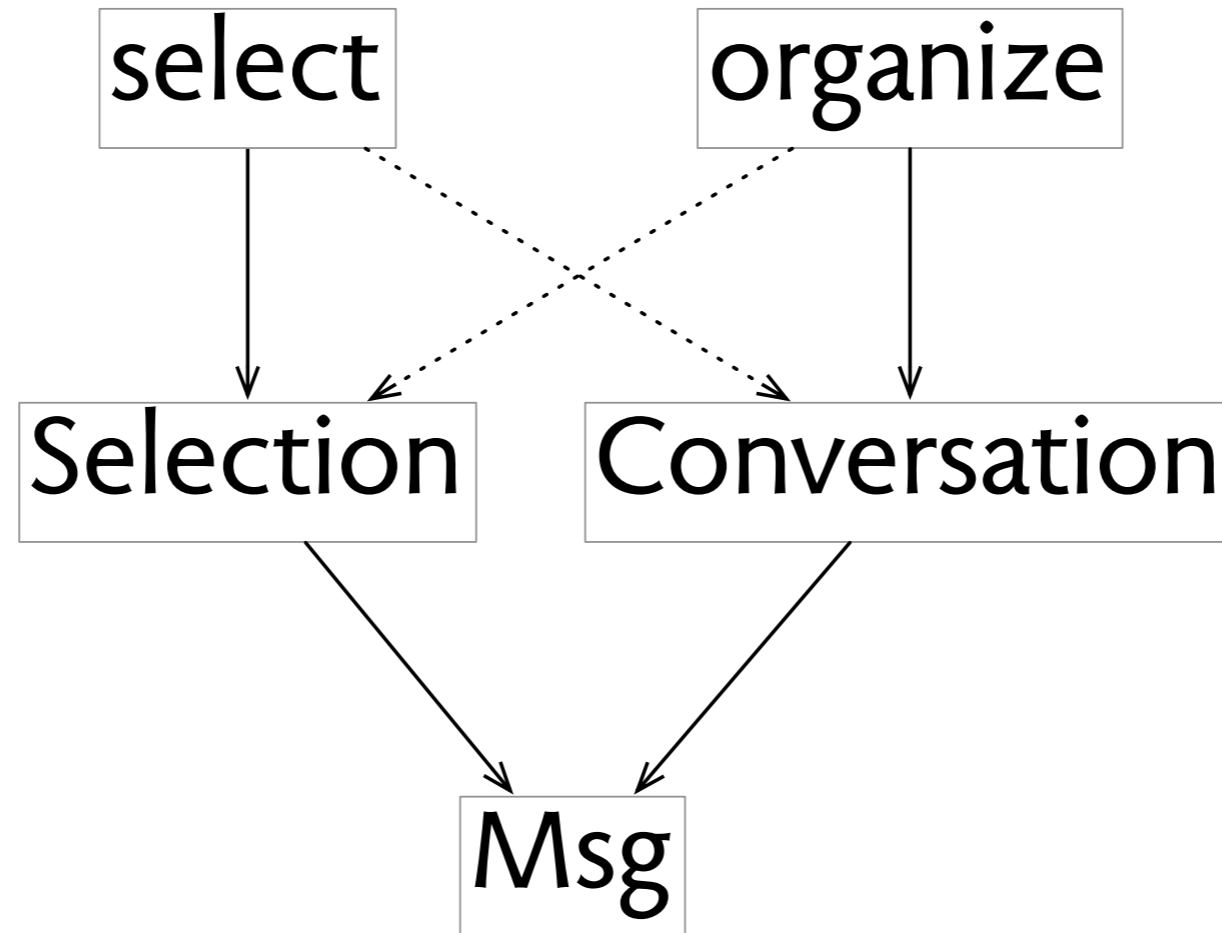
I didn't mean to imply that. I meant only to be observing that one definition of CI is what I called "stylistic uniformity", and I quoted your definition as (what seemed to me) a nice and clear articulation of that. I think CI likely involves that, but other properties too. I went on to say that my view of CI is that it's not so much about how the code is structured, but that wasn't intended to be a critique of your point of view. Code seems to be a very good arena in which to define the notion of stylistic uniformity.

While I agree, I think that my definition is appropriate for software engineers in contrast to interaction designers (or software engineers doing interaction design, which is dangerous -- just look at Google's interaction designs :).

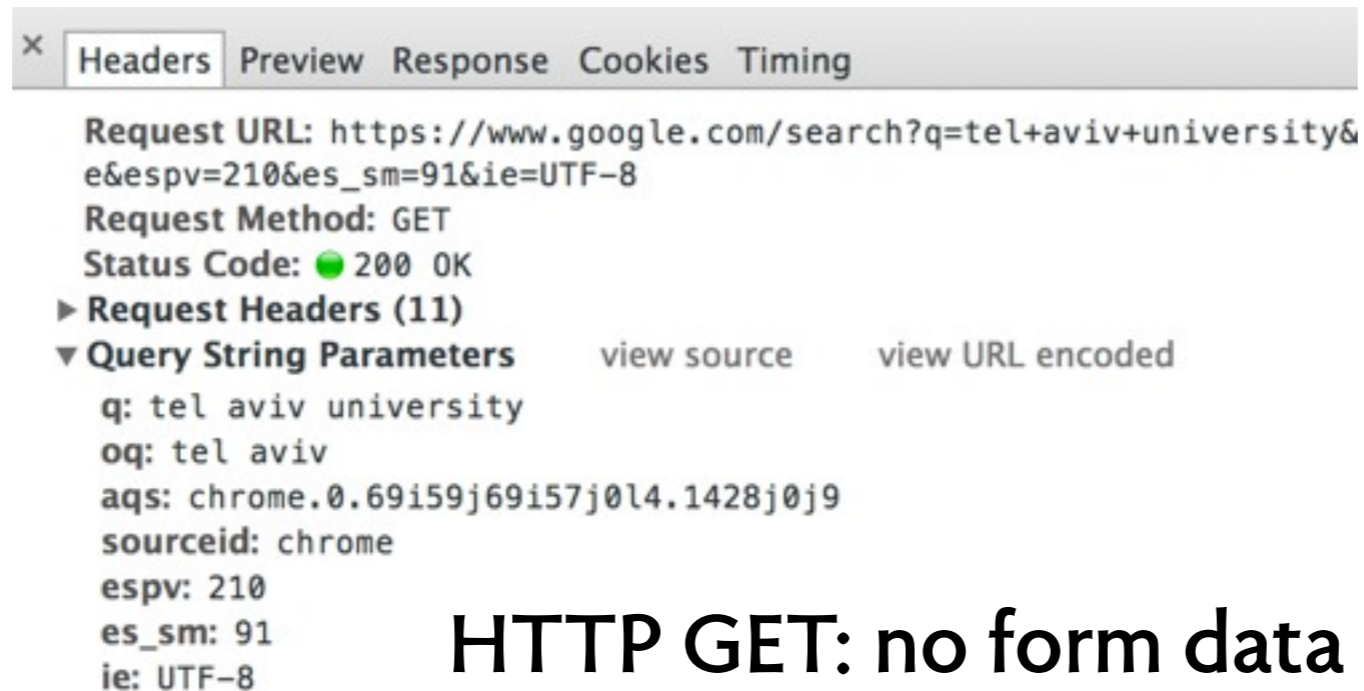
Your definition, it seems to me, would work for I/A design too: all it seems to require is the idea that you can perceive the hidden hand behind the artifact, and that seems equally true of an interface.

selecting a message outside the conversation
causes all messages in the conversation to be selected

orthogonality apple mail



orthogonality HTTP methods



× Headers Preview Response Cookies Timing

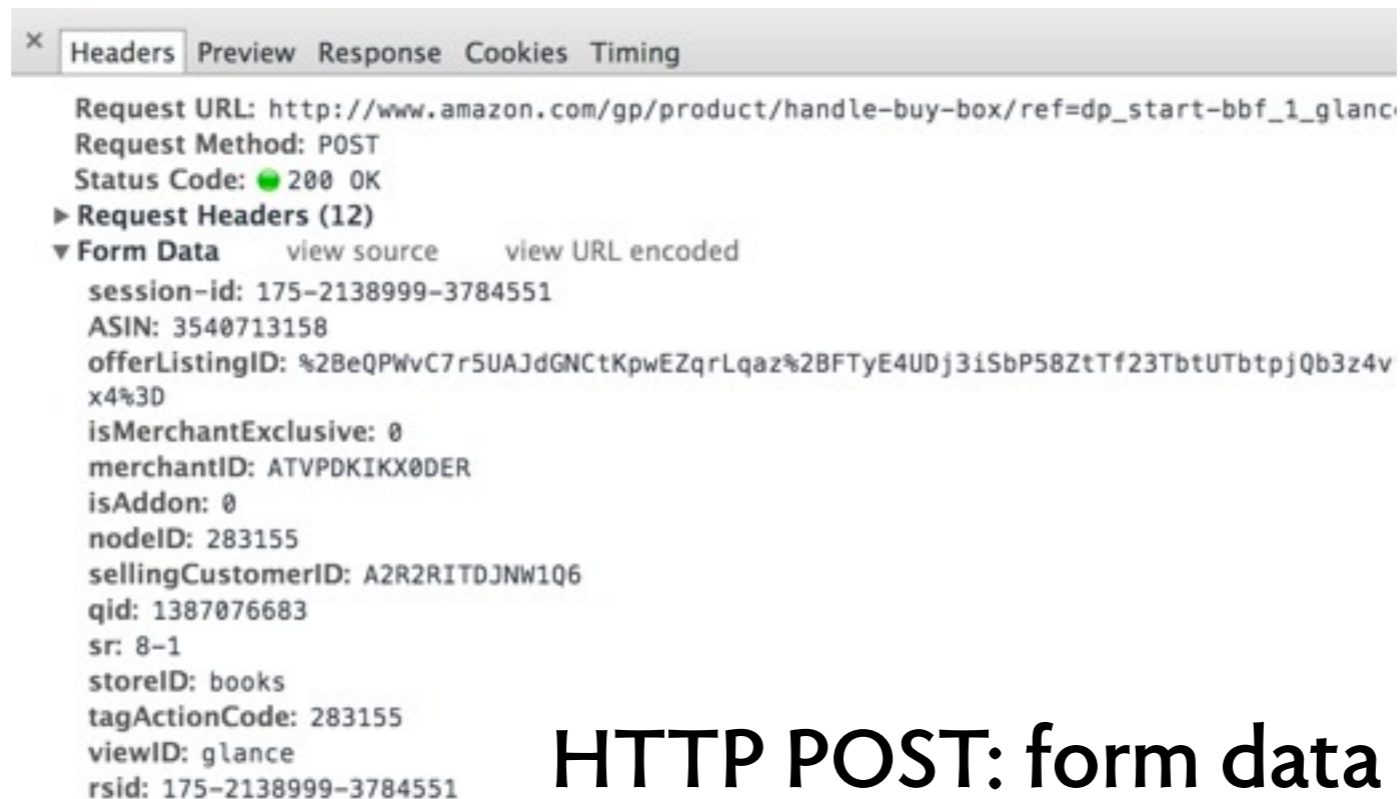
Request URL: https://www.google.com/search?q=tel+aviv+university&espv=210&es_sm=91&ie=UTF-8
Request Method: GET
Status Code: ● 200 OK

▶ Request Headers (11)

▼ Query String Parameters [view source](#) [view URL encoded](#)

q: tel aviv university
oq: tel aviv
aq: chrome.0.69i59j69i57j0l4.1428j0j9
sourceid: chrome
espv: 210
es_sm: 91
ie: UTF-8

HTTP GET: no form data



× Headers Preview Response Cookies Timing

Request URL: http://www.amazon.com/gp/product/handle-buy-box/ref=dp_start-bbf_1_glance
Request Method: POST
Status Code: ● 200 OK

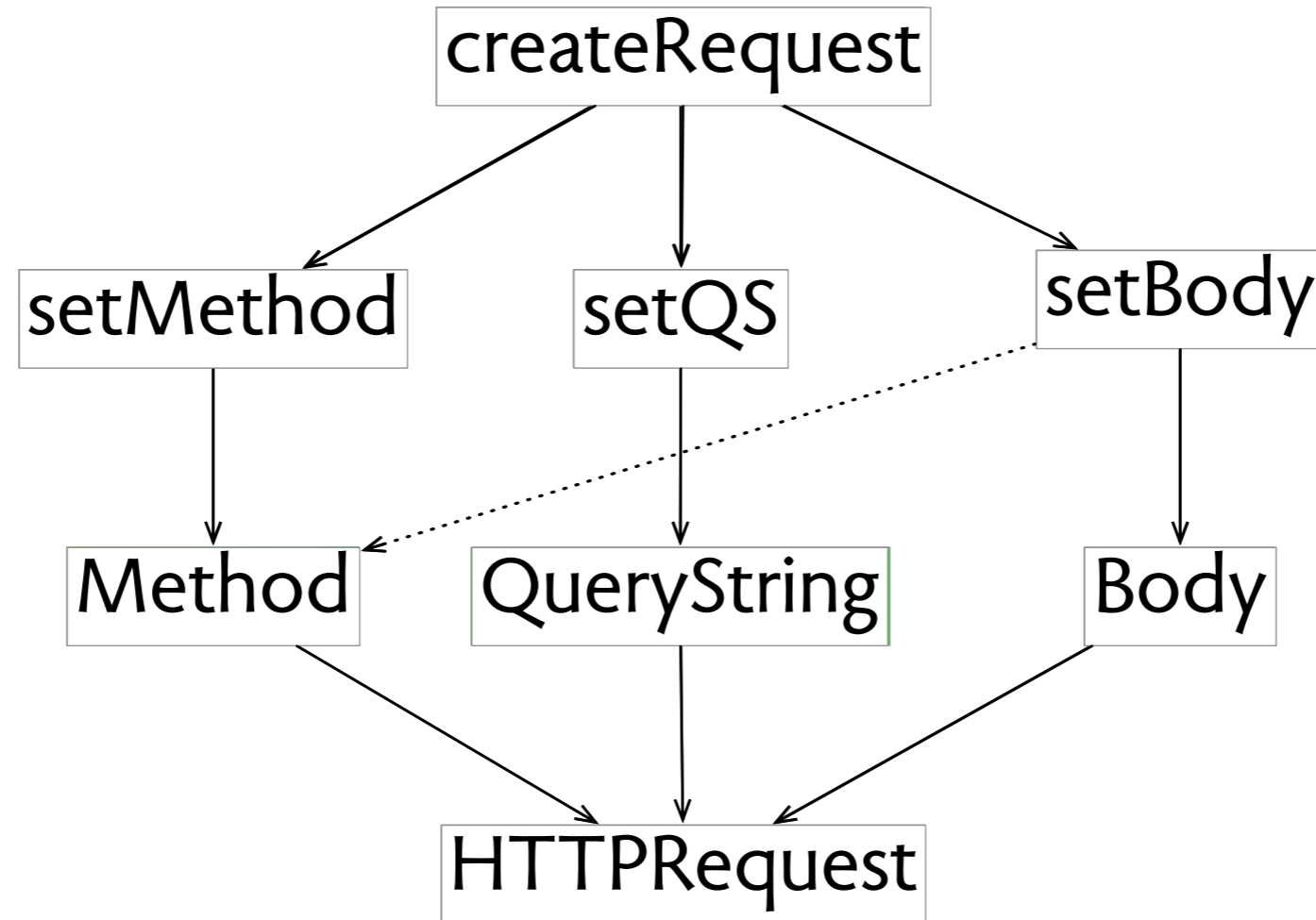
▶ Request Headers (12)

▼ Form Data [view source](#) [view URL encoded](#)

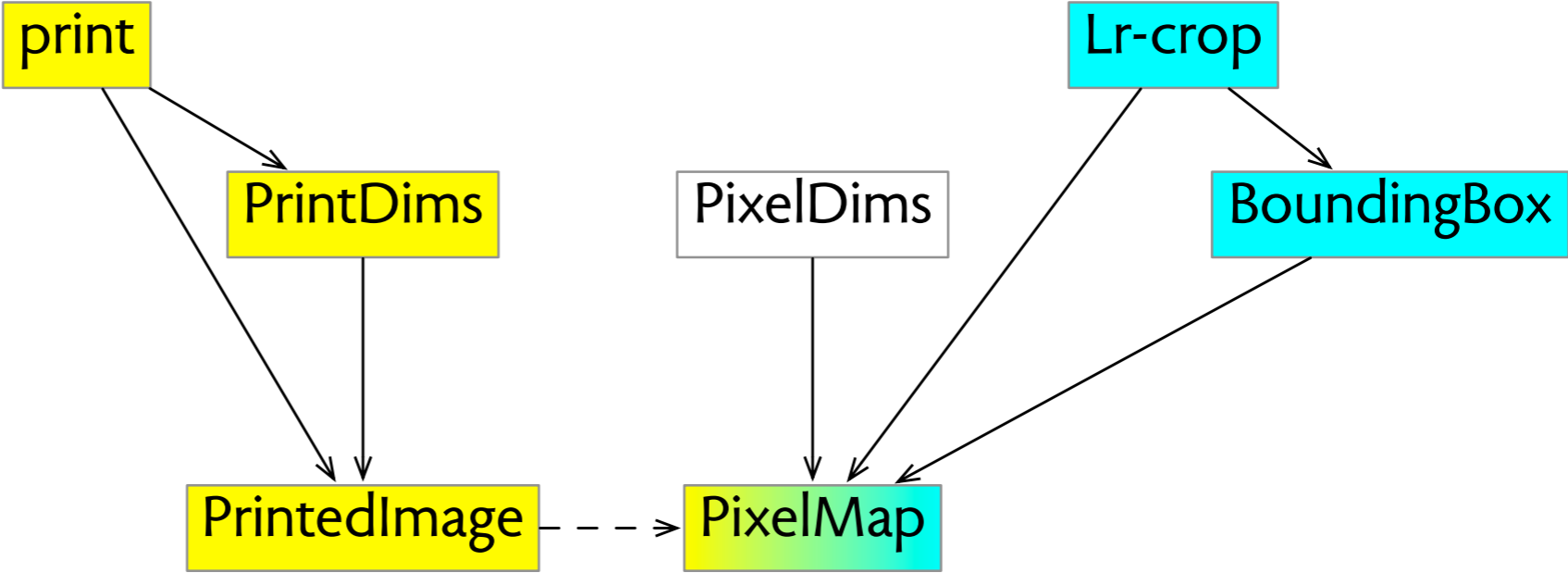
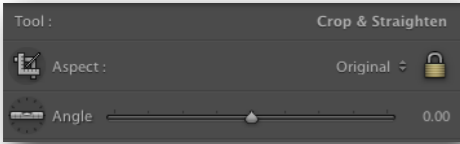
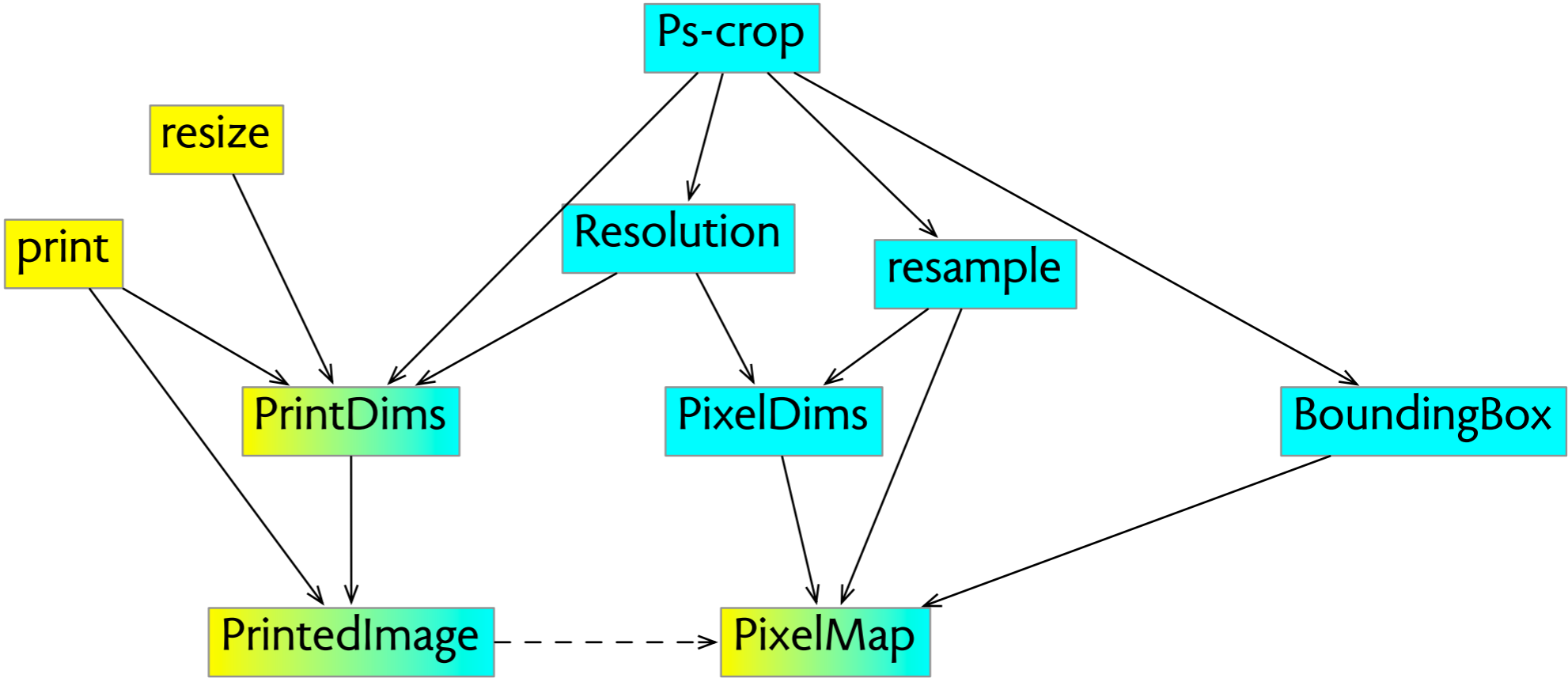
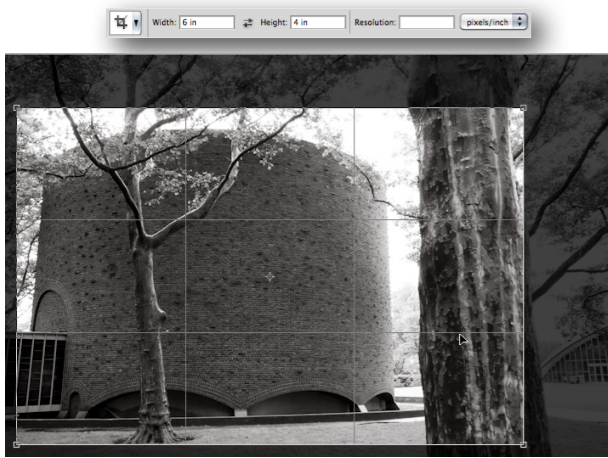
session-id: 175-2138999-3784551
ASIN: 3540713158
offerListingID: %2BeQPwvC7r5UAJdGNctKpwEZqrLqaz%2BFTyE4UDj3iSbP58ZtTf23TbtUTbtpjQb3z4vx4%3D
isMerchantExclusive: 0
merchantID: ATVPDKIKX0DER
isAddon: 0
nodeID: 283155
sellingCustomerID: A2R2RITDJNW1Q6
qid: 1387076683
sr: 8-1
storeID: books
tagActionCode: 283155
viewID: glance
rsid: 175-2138999-3784551

HTTP POST: form data

orthogonality HTTP methods



orthogonality cropping in Ps and Lr



generality apple keynote

text



Animation

TextAction

Action

AudioAction

Object

Text

Audio



generality gmail

[Home](#) › [Quick Tech Tip: Disabling Gmail's Category Tabs](#)

Quick Tech Tip: Disabling Gmail's Category Tabs

Mon, 07/29/2013 - 12:17 | [Chuck Gray](#)

in [LibraryPoint Blog](#) [Tech Tutorials](#) [Teen Blog](#) [Tech Answers](#) [Science and Technology](#) [Self-Help and Instructional](#)



Are you a Gmail user? Did you wake up a week or two ago to find that your new messages were now being automatically organized by Gmail into tabs of different, pre-determined categories? And, did you think, like me, that they were really ugly, stupid, and unnecessary? Here's a quick tip on how to rid yourself of them!



MELANIE PINOLA on LIFEHACKER - GMAIL - 6/07/13 8:00am

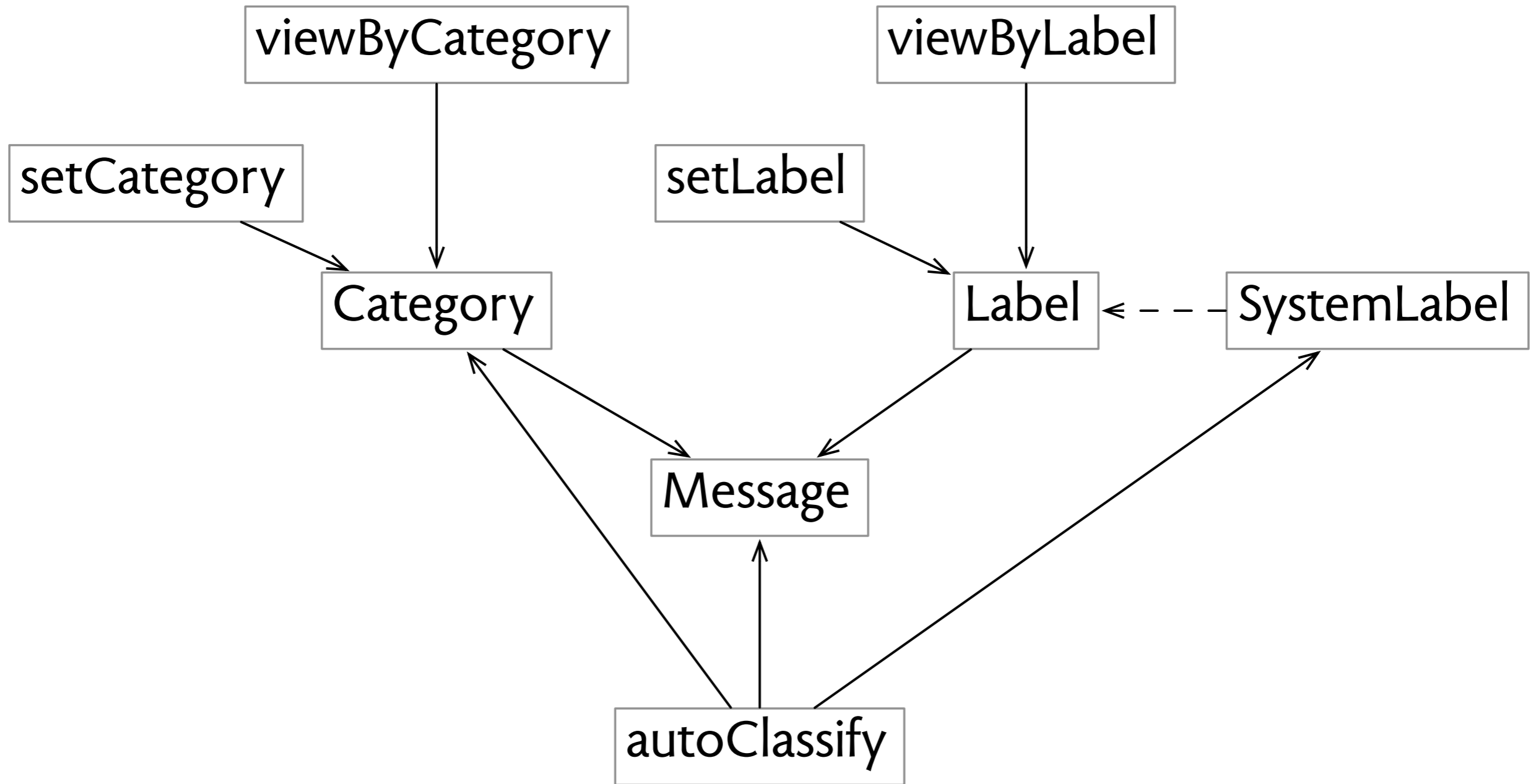
204,173 🔥 181 💬

Everything You Need to Know About Gmail's New, Super-Confusing Layout

🔍 EXPAND



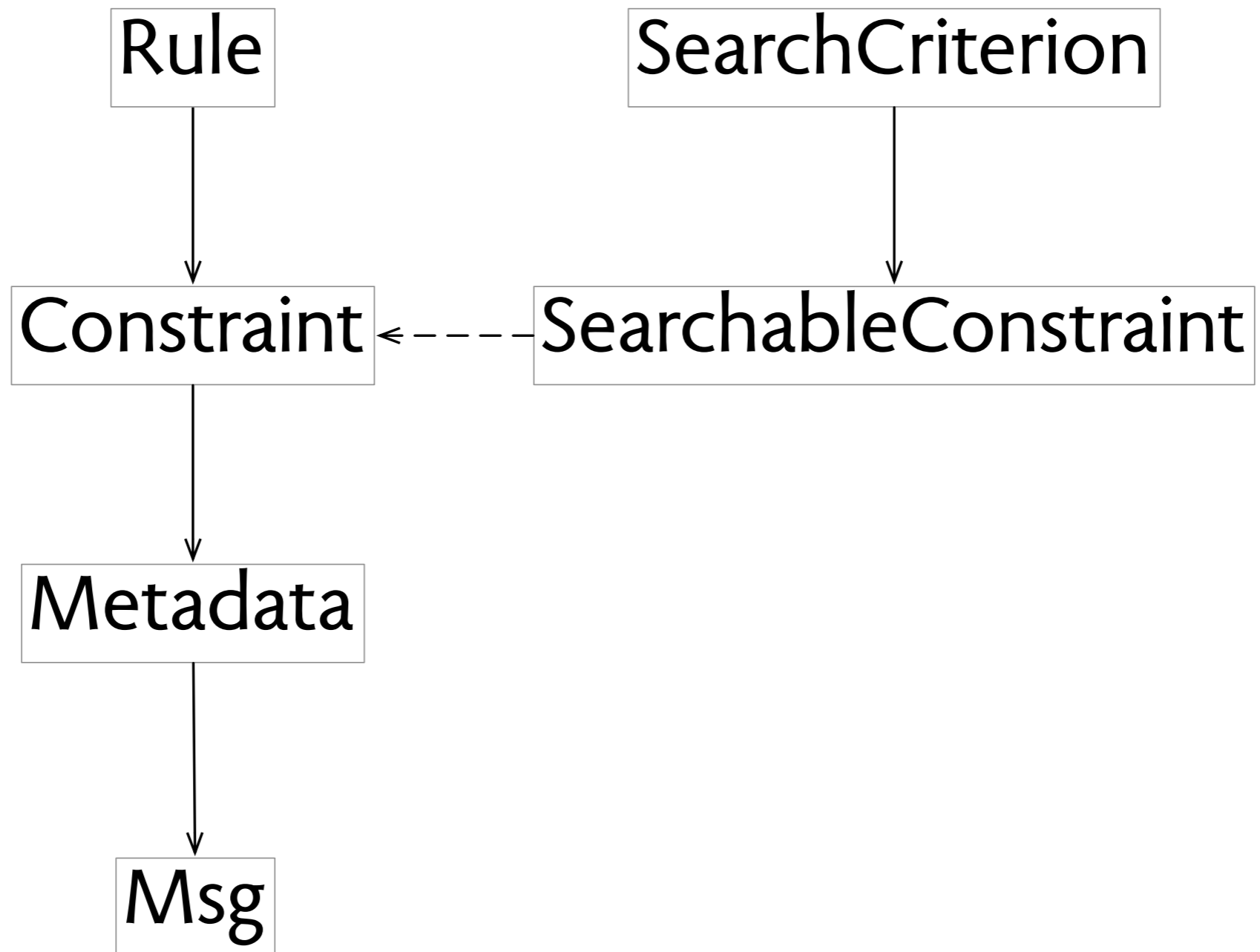
generality gmail



generality apple mail



generality apple mail



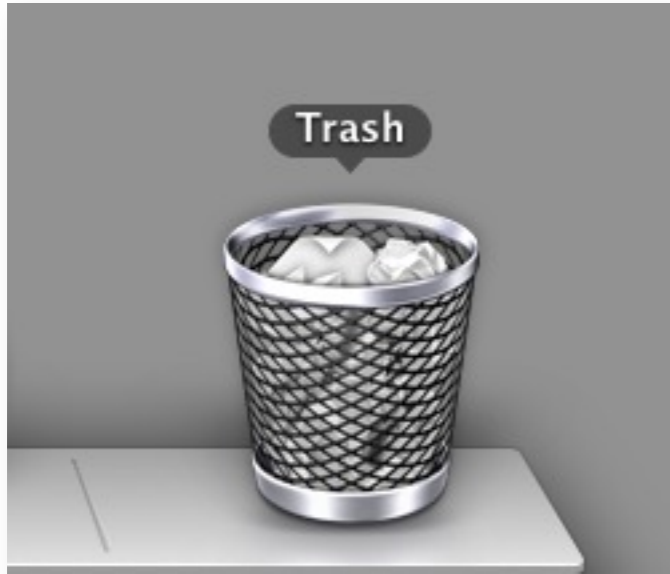
generality programming languages

JavaScript holes
undefined, null and ReferenceError

Java
primitive & boxed types

Ruby closures
lambda, proc and block

completeness apple OS X trash



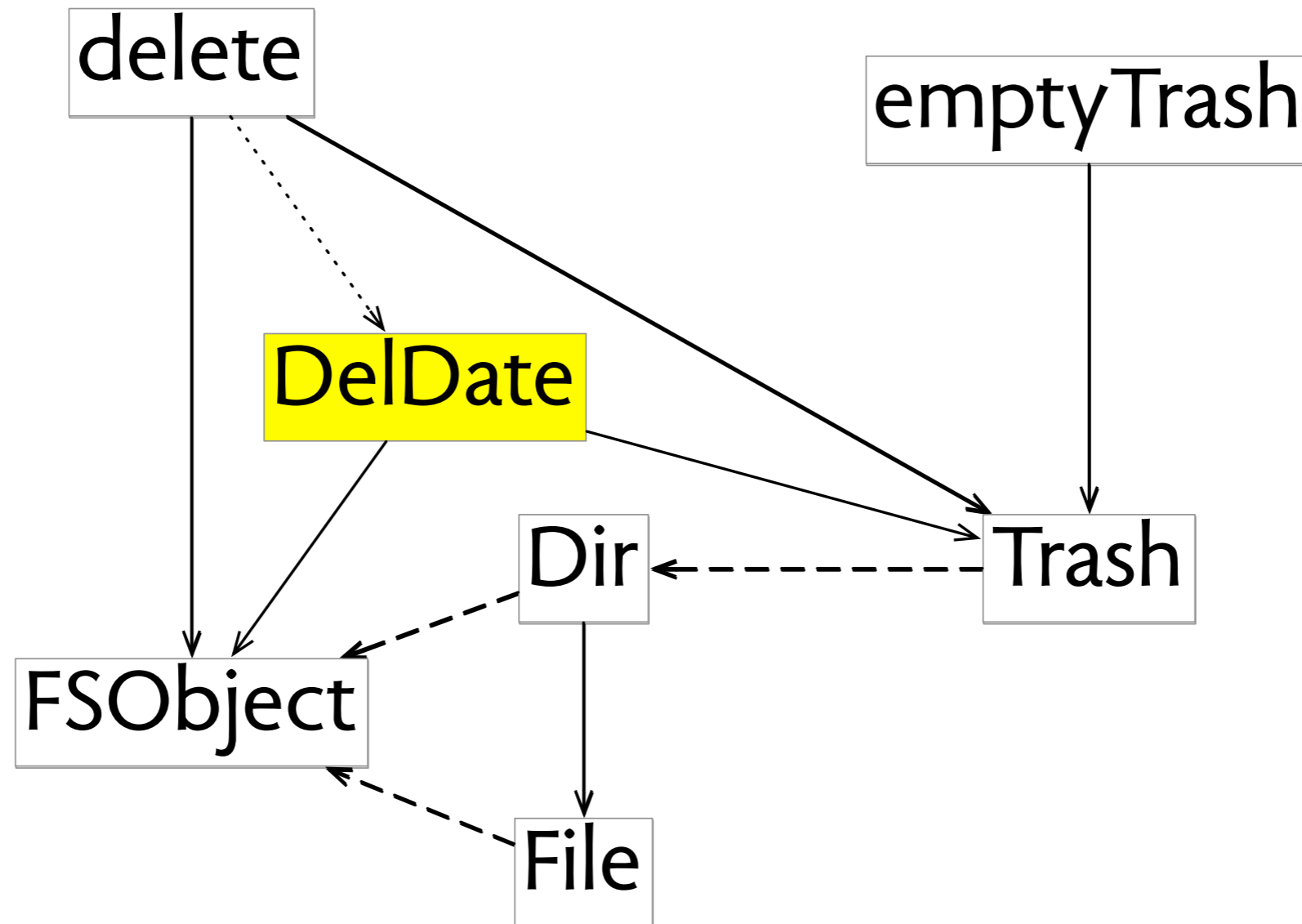
Trash		
Name	Date Modified	Size
Screen Shot 2013-02-25 at 11.46.27 AM	Today 11:46 AM	58 KB
Screen Shot 2013-02-25 at 11.45.46 AM	Today 11:45 AM	39 KB
bits.key	Yesterday 7:09 PM	326 KB
▶ 2013 2.16.58 PM	Feb 22, 2013 2:16 PM	--
▶ 2013-02-18	Feb 22, 2013 2:12 PM	--
▶ 2013-02-17	Feb 22, 2013 2:12 PM	--
▶ 2013-02-15	Feb 22, 2013 2:12 PM	--

trash is just like any other folder...

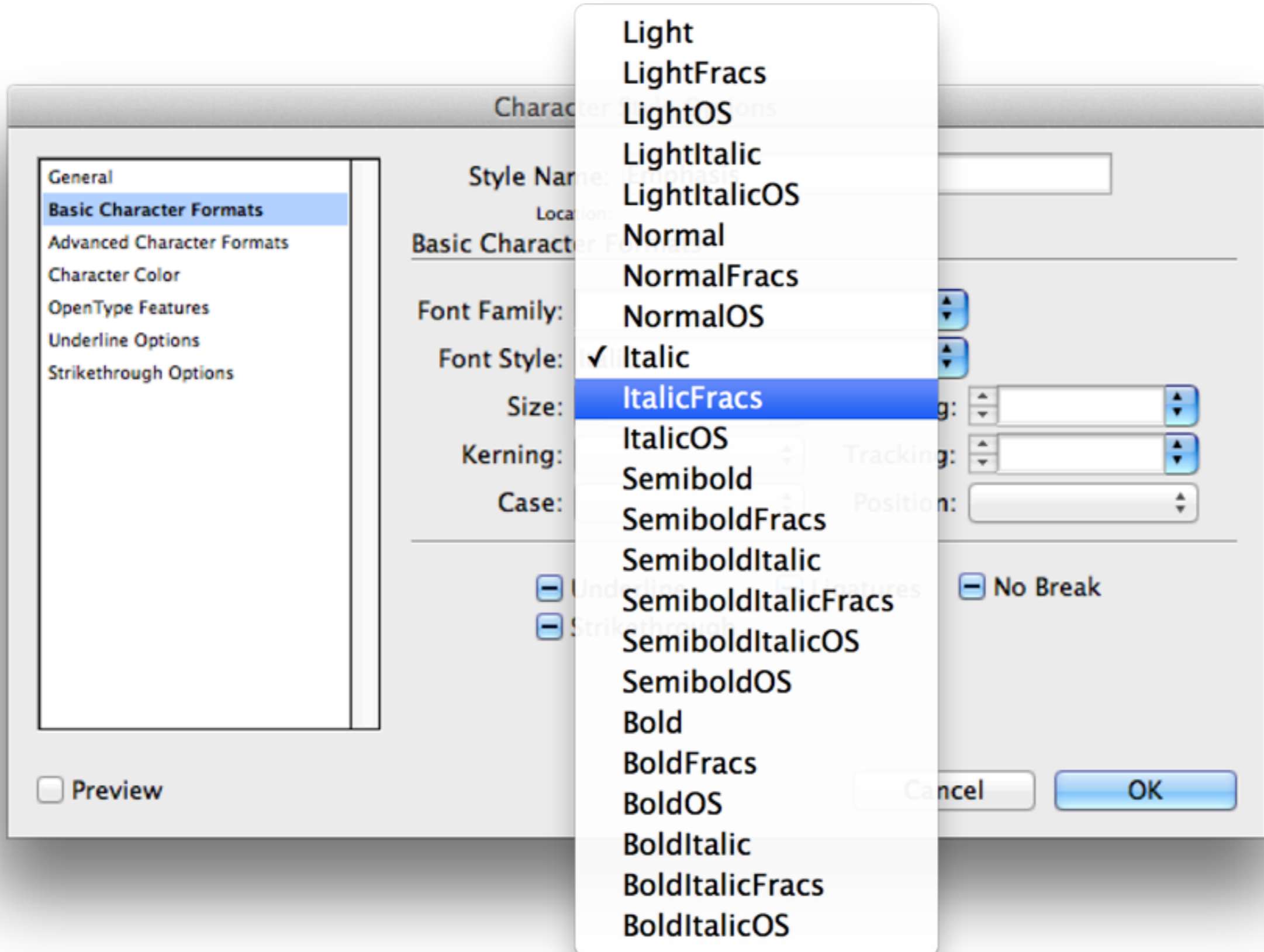
if you delete an old file by mistake,
how do you find it?

can't search by deletion date

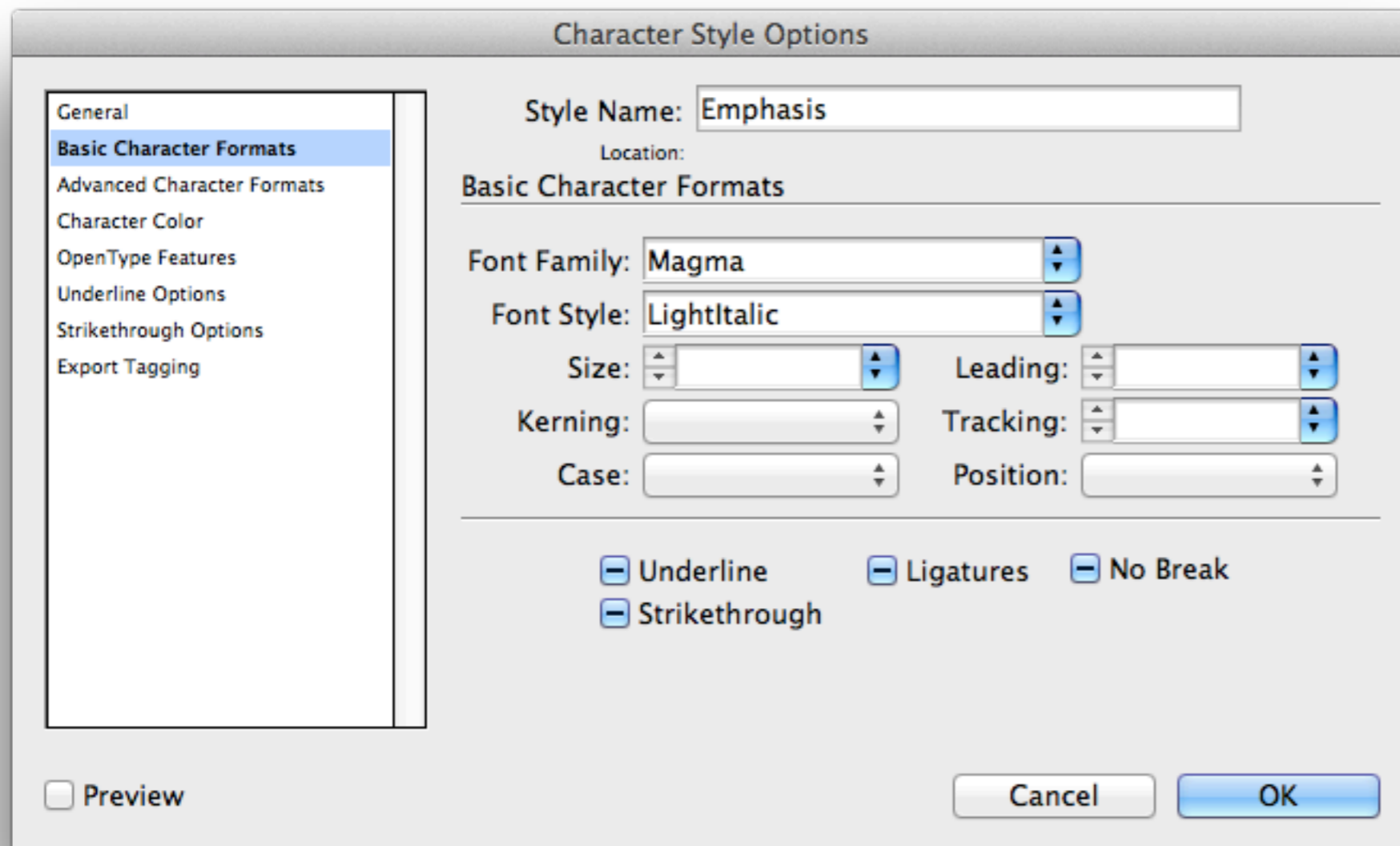
completeness apple OS X trash



completeness adobe indesign

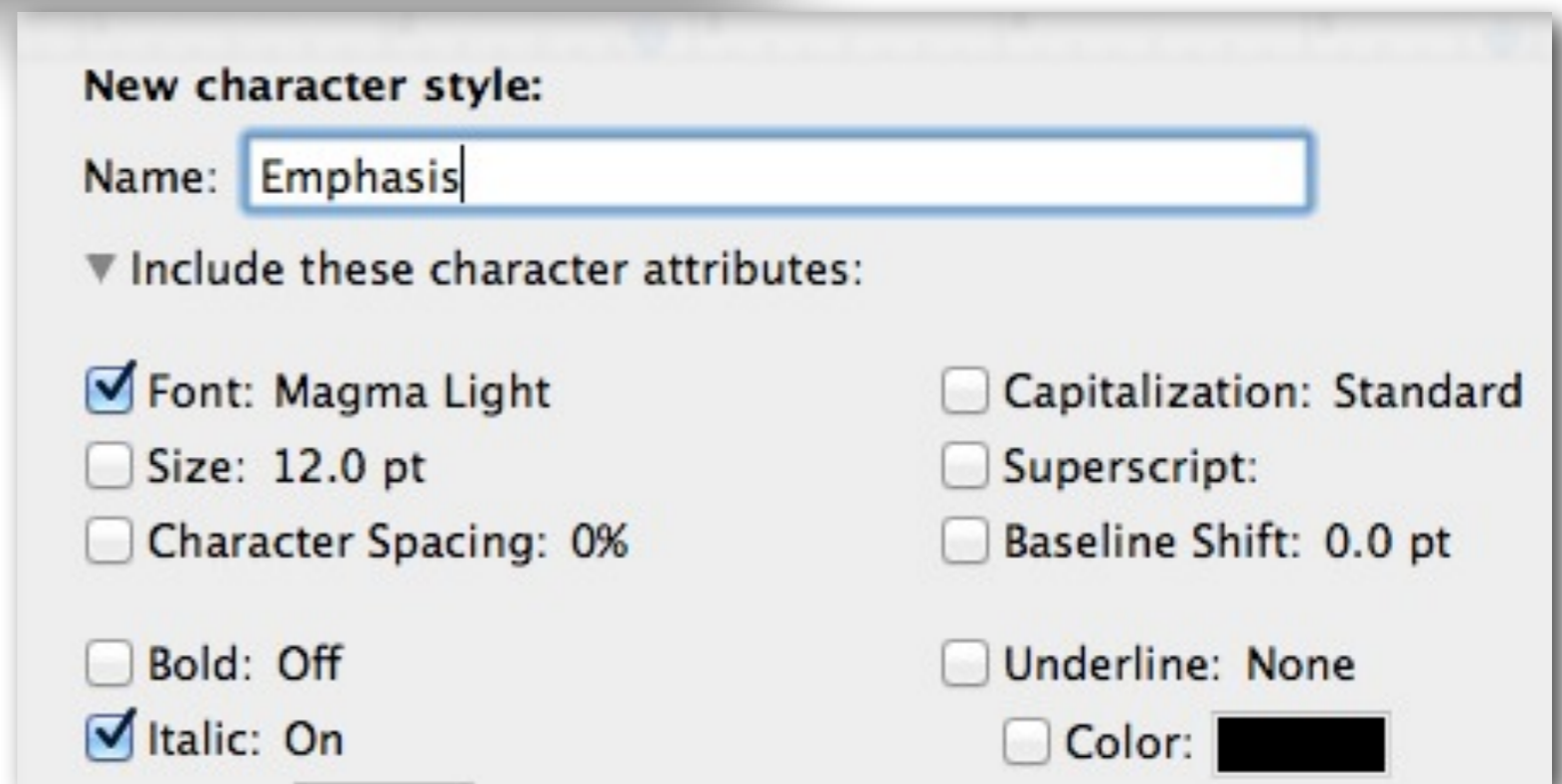


so character style can only italicize some typefaces

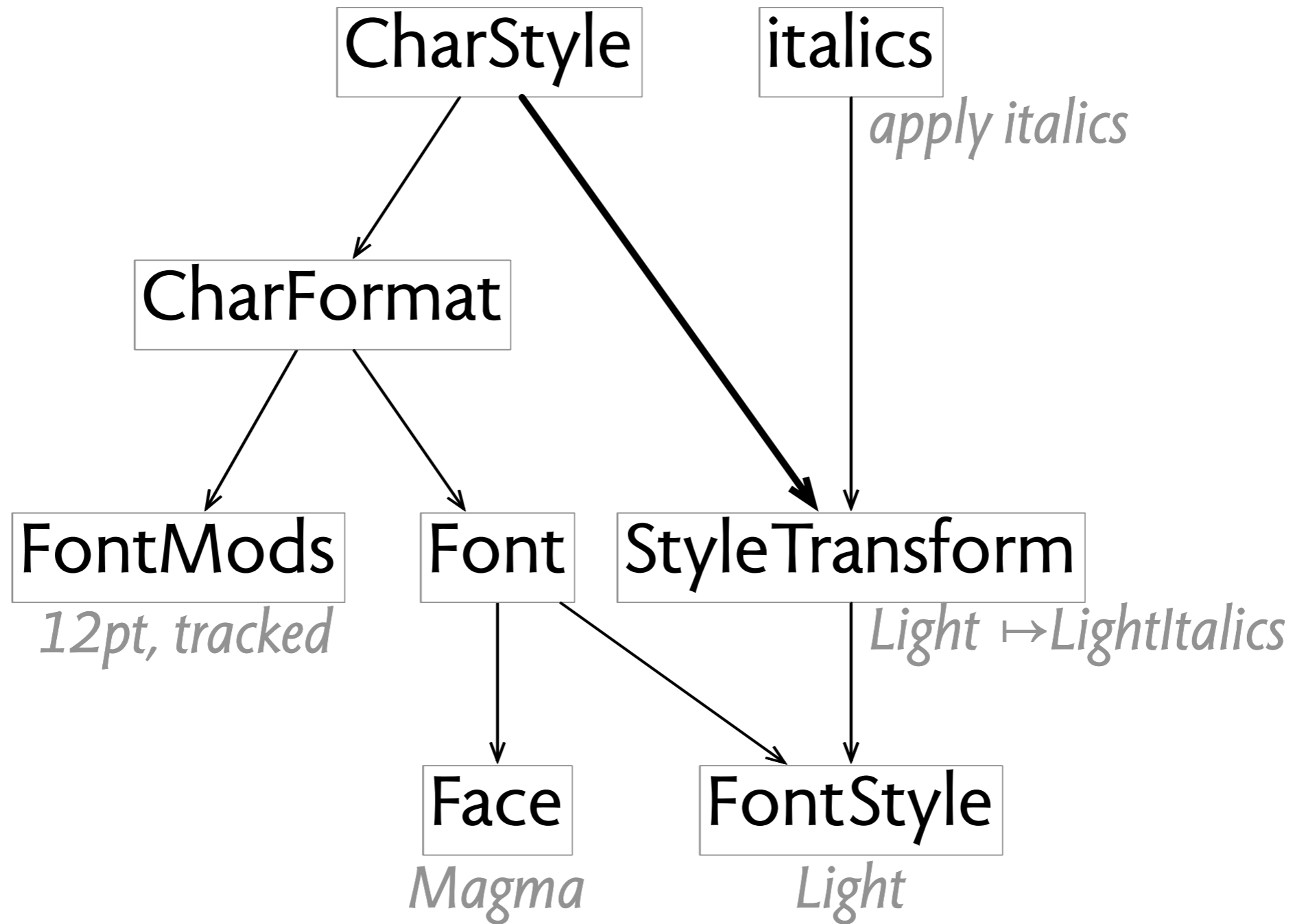


adobe indesign:
face & style

apple pages:
font & transform



completeness adobe indesign



completeness (a note)

completeness means
existing features must have enough concepts

completeness does not mean
enough concepts for additional features

examples

Git has no concept of directory
Keynote and Powerpoint have no styles

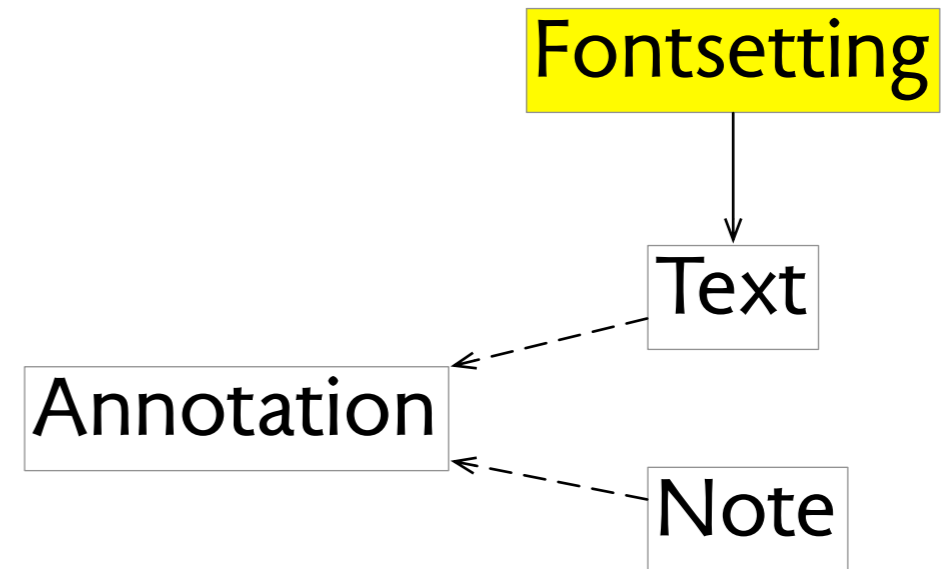
consistency apple preview

The Washington Post

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Private consultants warned of risks before HealthCare.gov's Oct. 1 launch

By [Juliet Eilperin](#) and [Sandhya Somashekhar](#), Published: November 18

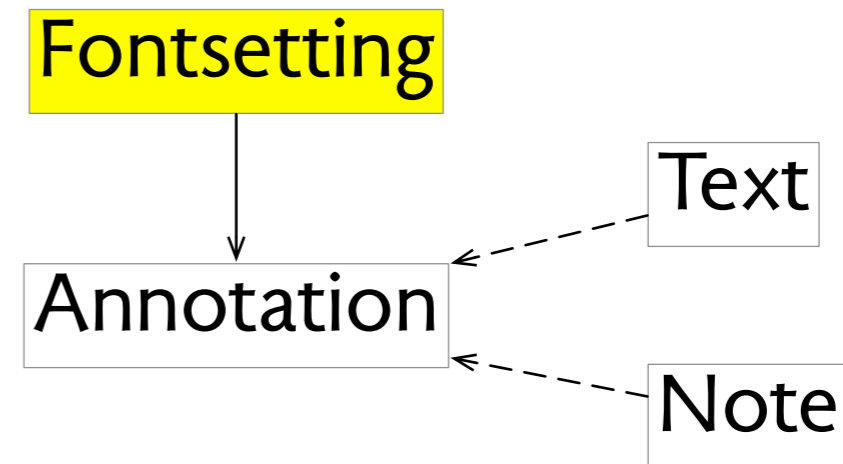


The Washington Post

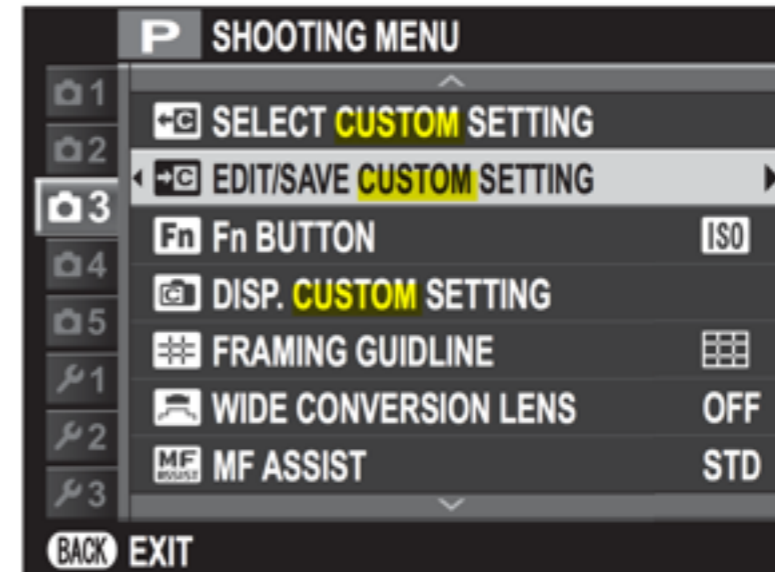
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Private consultants warned of risks before HealthCare.gov's Oct. 1 launch

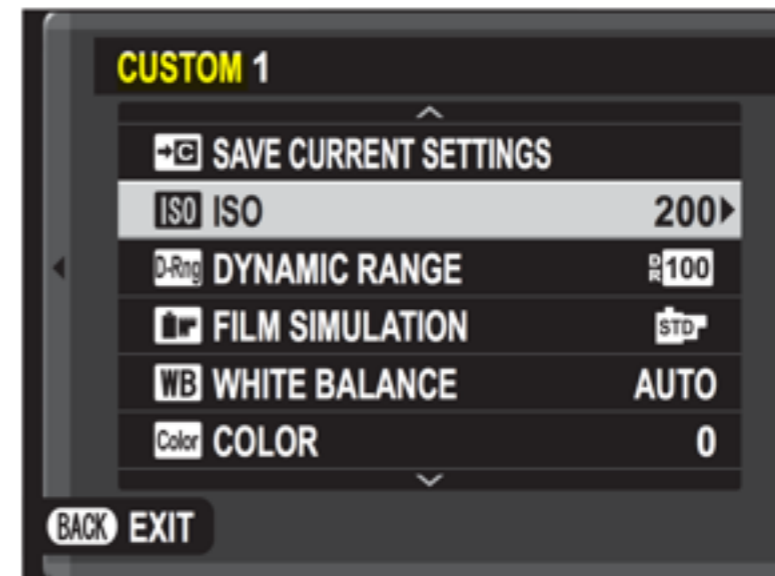
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consistency fuji x100s

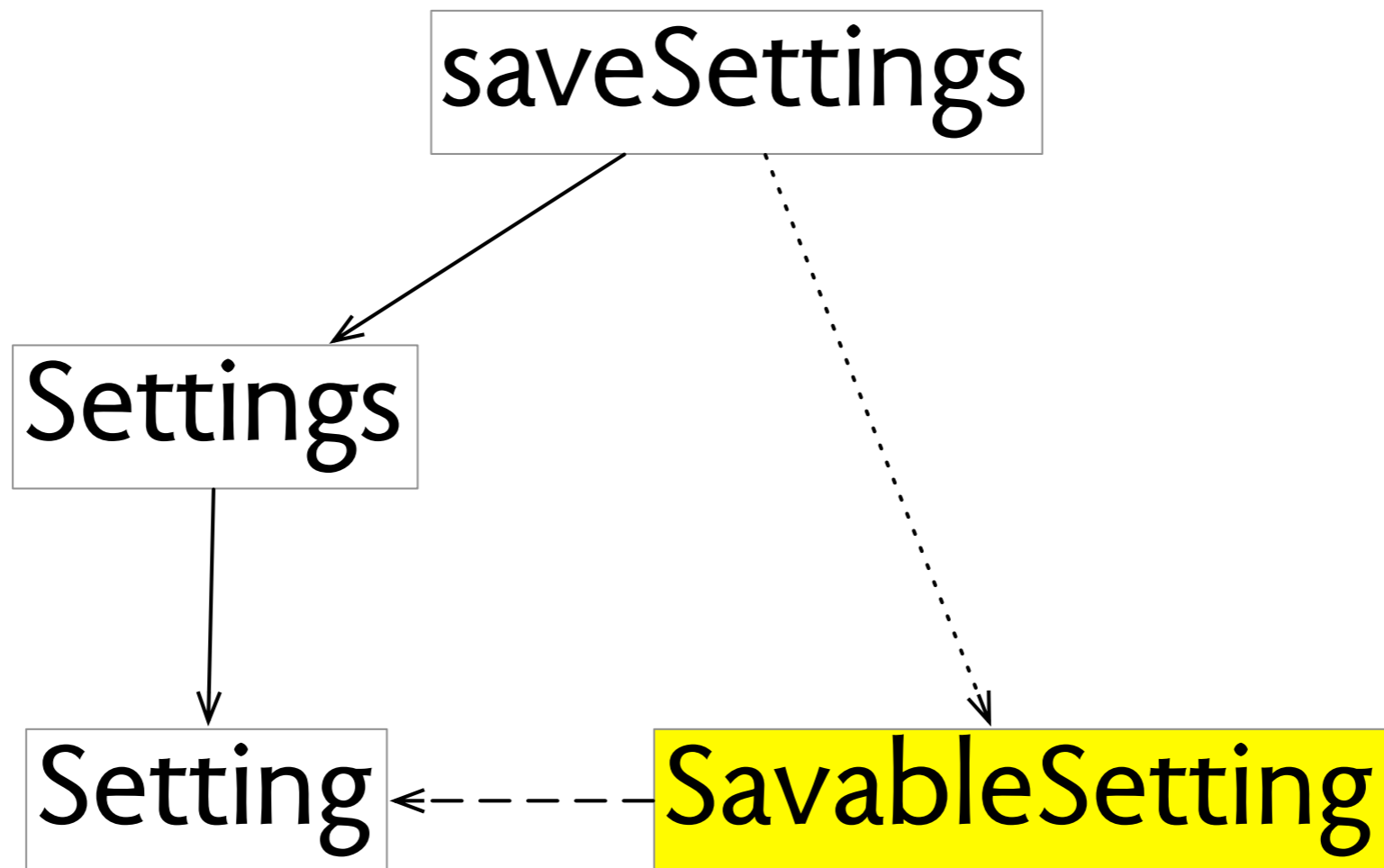


2 Highlight a custom settings bank and press **MENU/OK** to select. Adjust the following as desired and press **DISP/BACK** when adjustments are complete: **ISO** ISO, **D-Rng** DYNAMIC RANGE, **Film Simulation** FILM SIMULATION, **WB** WHITE BALANCE, **Color** COLOR, **Sharp** SHARPNESS, **Highlight Tone** HIGHLIGHT TONE, **Shadow Tone** SHADOW TONE, **NR** NOISE REDUCTION, and **Reset** RESET.



1.) The X100's Custom Settings memories are useless. Unlike [Canon's brilliant C1, C2 and C3 Total Recall modes](#), the X100's EDIT/SAVE CUSTOM SETTINGS function only stores and recalls a few of the image parameters like sharpness and white balance, but not Auto ISO, image size, AF mode, flash or anything else. For these to be useful, they need to save *everything*, as Canon does. Even the LCD brightness needs to be saved and recalled, for instance, on my Canons, I use different presets for shooting outdoors or indoors.

consistency fuji x100s

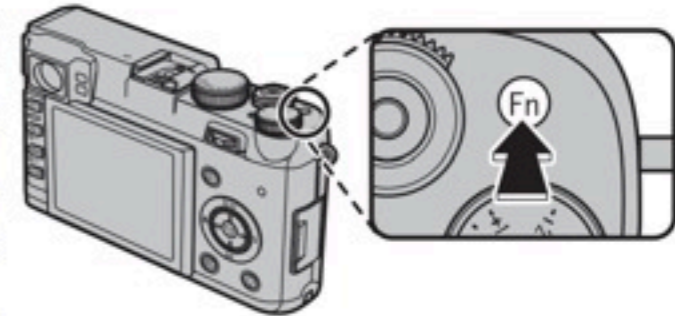


completeness fuji x100s



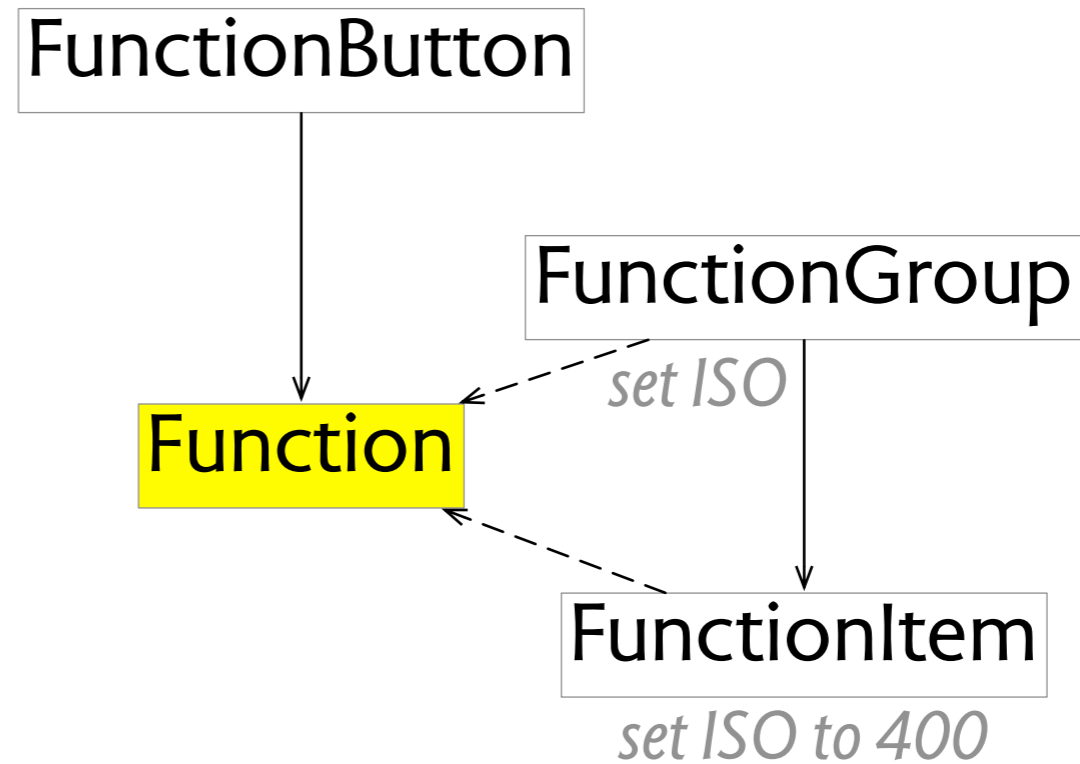
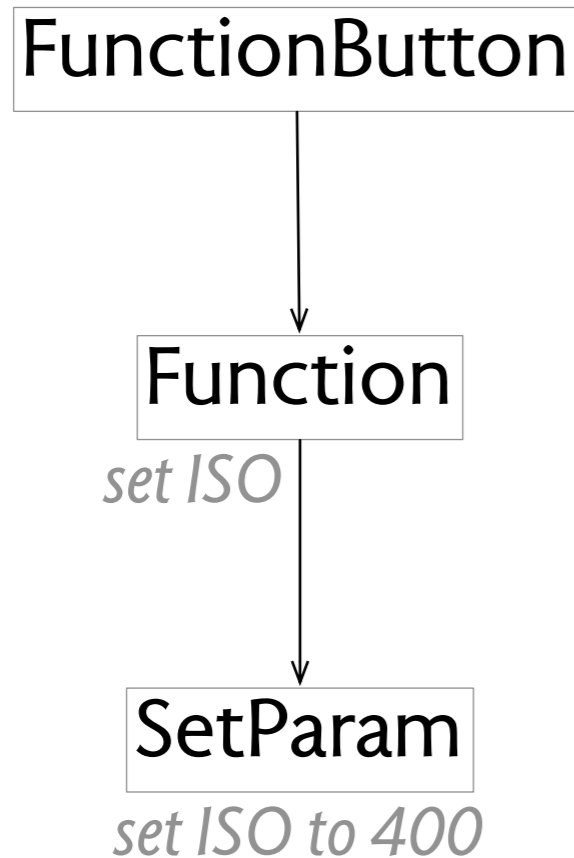
The Fn Button

The role played by the **Fn** button can be selected using the **Fn Fn BUTTON** option in the shooting menu (📖 74). The options available include multiple exposure (📖 57), depth-of-field preview (📖 38), sensitivity (📖 44), the self-timer (📖 53), image size (📖 72), image quality (📖 73), dynamic range (📖 73), film simulation (📖 55), ND filter (📖 65), AF mode (📖 77), custom settings (📖 70), movie recording (📖 32), advanced filter (📖 77), RAW/JPEG toggle (📖 63), and wide conversion lens (📖 108).



◆ The **Fn Fn BUTTON** menu can also be displayed by pressing and holding the **Fn** button.

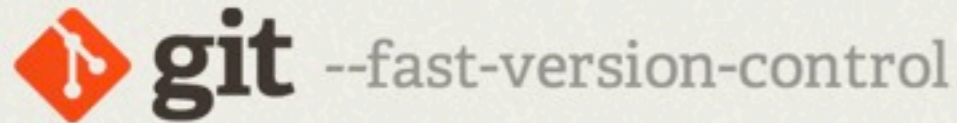
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analyzing git

with Santiago Perez De Rosso

git, distributed version control




Search entire site...

Git is a **free and open source** distributed version control system designed to handle everything from small to very large projects with speed and efficiency.

Git is **easy to learn** and has a **tiny footprint with lightning fast performance**. It outclasses SCM tools like Subversion, CVS, Perforce, and ClearCase with features like **cheap local branching**, convenient **staging areas**, and **multiple workflows**.



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GitHub Bootcamp If you are still new to things, we've provided a few walkthroughs to get you started.



tracking & untracking

2.2.2 Tracking New Files

In order to begin tracking a new file, you use the command `git add`. To begin tracking the README file, you can run this:

```
$ git add README
```

If you run your status command again, you can see that your README file is now tracked and staged:

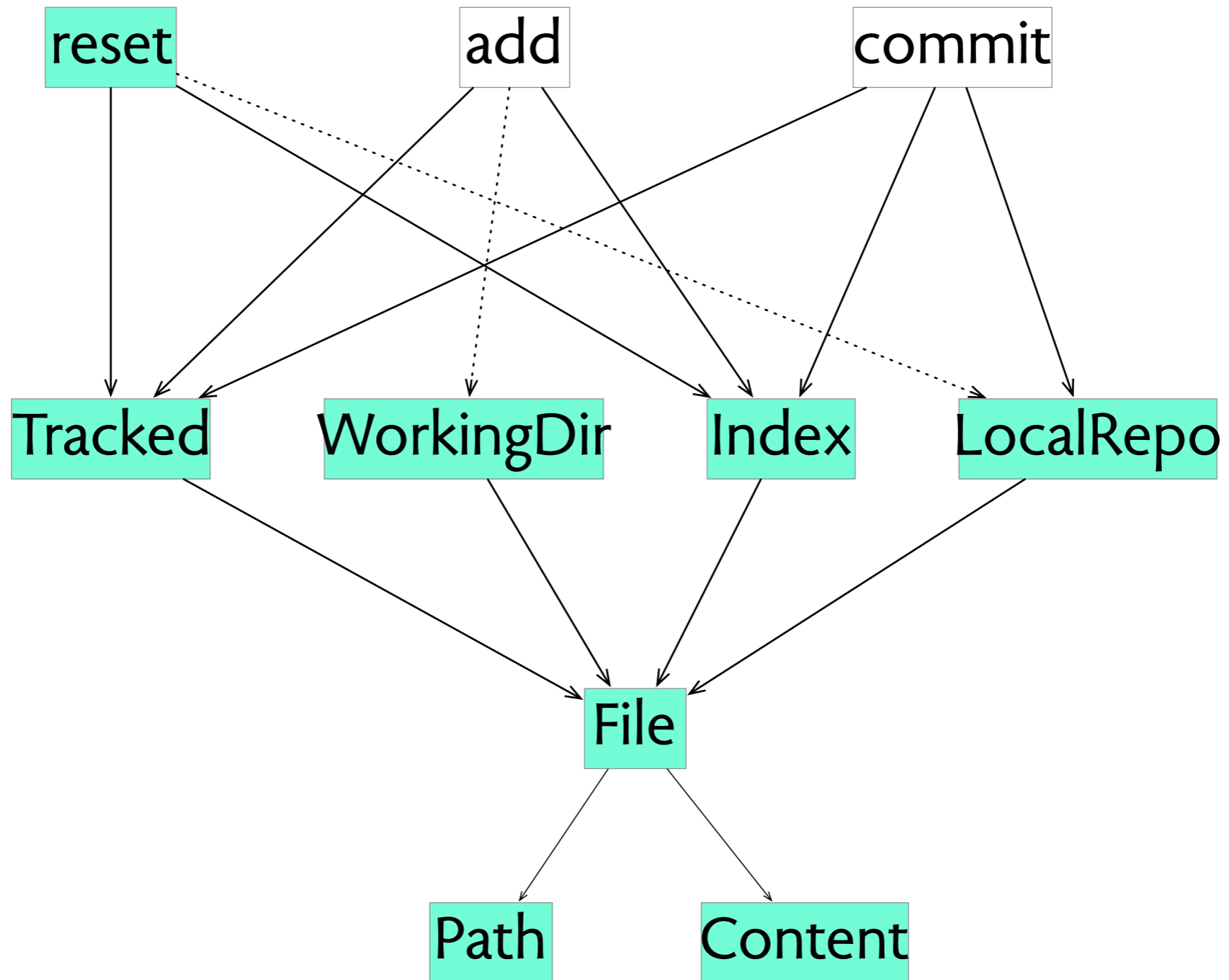
```
$ git status
# On branch master
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
# new file:   README
#
```

but if file is committed,
reset will NOT untrack it

to untrack in that case,
update-index to make it
"assumed unchanged"

after that, reset will
TRACK the file

untracking in git



gitless: our reworking of git

[about & download](#)

[documentation](#)

[community](#)

[code](#)

Gitless: a version control system

About Gitless

Gitless is an experimental version control system built on top of Git. We are exploring what conceptual integrity means with the goal of building a rigorous foundation for concept design. We encourage you to try out the current version of Gitless and [send feedback](#). Keep in mind that Gitless might change in non-retrocompatible ways (so don't script around it just yet) as we seek to answer the fundamental question that drives this software project: if we were to challenge the very core concepts in version control systems, what would version control look like?

In its current state, Gitless is a distributed version control system that supports all of the most commonly used Git features. We are missing some things like submodules and cherry-picking but these are coming soon (maybe; only if we don't find a superior, more robust way of achieving the same goal). Either way, since Gitless is implemented on top of Git (could be considered what Git pros call a 'porcelain' of Git) you can always fallback to the 'git' command to finish a task.

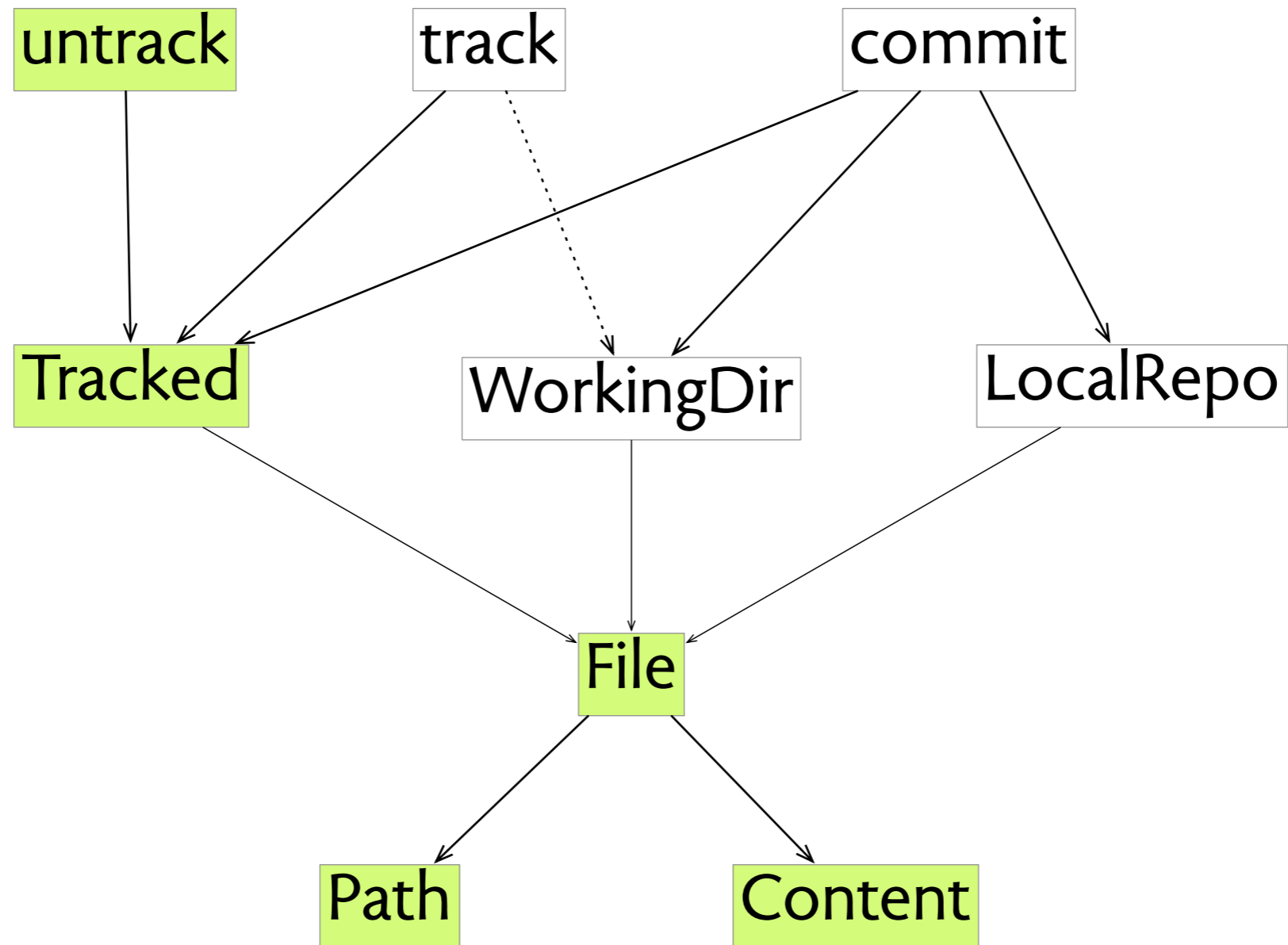
Install

You need to have Python 2.7 and Git 1.7.12+. The easiest way to install Gitless is through the Python Package Index (pip):

```
pip install gitless
```

For more detailed instructions see the [README file](#).

untracking in gitless



postscript: acrobat


orthogonality acrobat

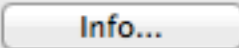



Certify

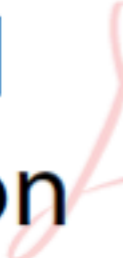

-  With Visible Signature
-  Without Visible Signature


Sign Document


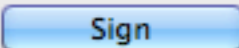
Sign As: Daniel Jackson <dnj@CSAIL.MIT.EDU> 

Certificate Issuer: Client CA 


Appearance: Standard Text 

Daniel Jackson  Digitally signed by Daniel Jackson
DN: c=US, st=Massachusetts, l=Cambridge, o=MIT Computer Science & Artificial Intelligence Laboratory, ou=Users, cn=Daniel Jackson, email=dnj@CSAIL.MIT.EDU
Date: 2013.12.18 09:57:07 +02'00' 

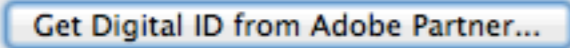
Lock Document After Signing 

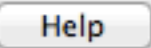
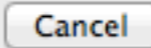
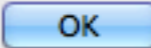
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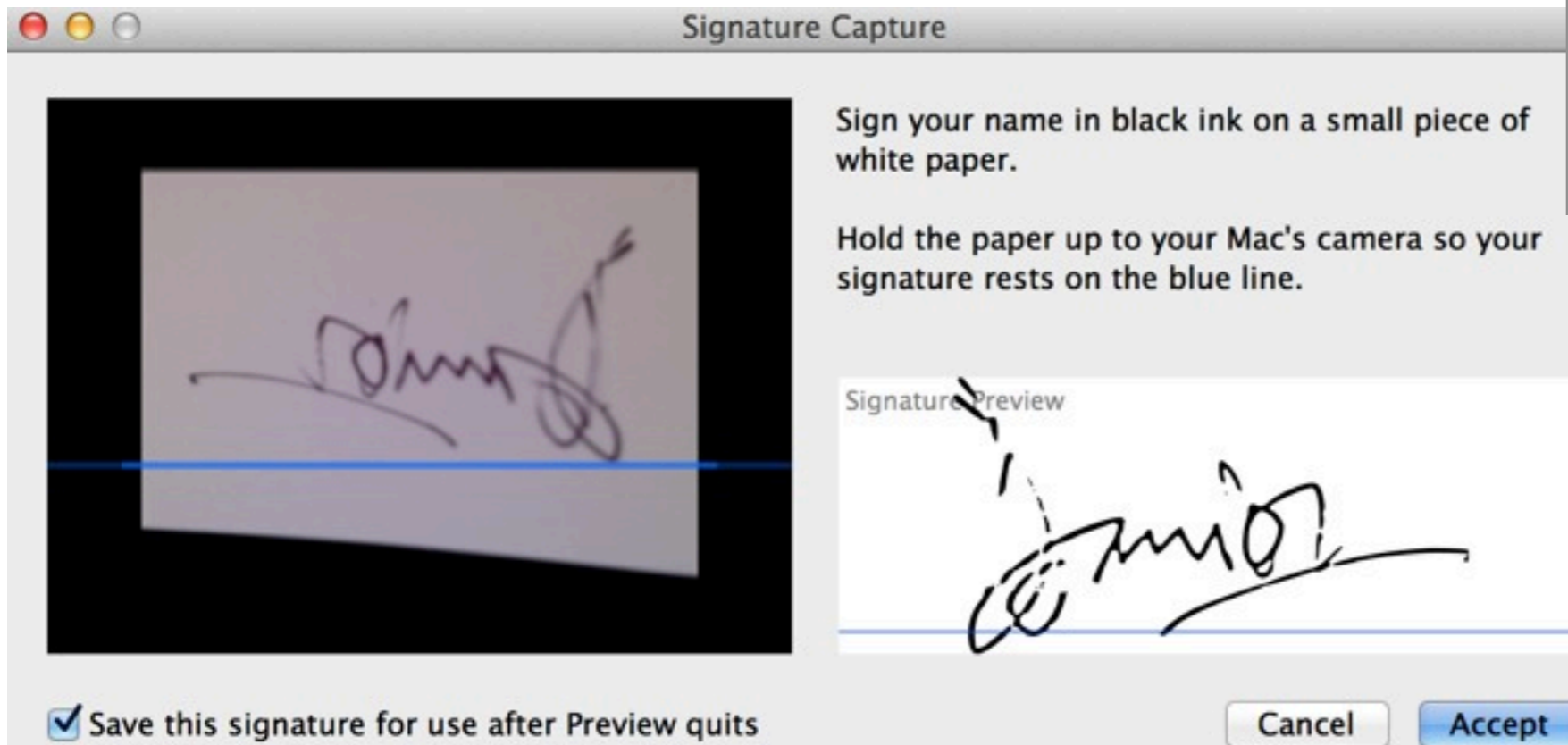
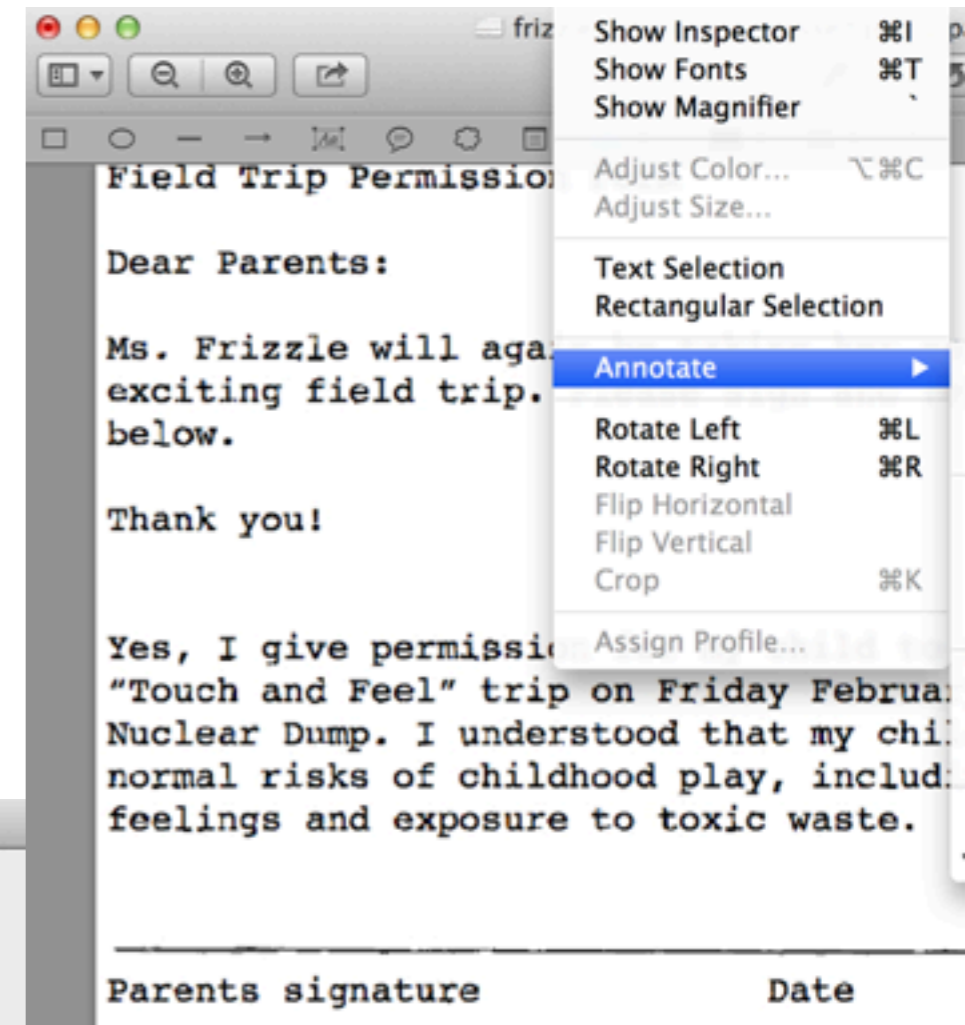
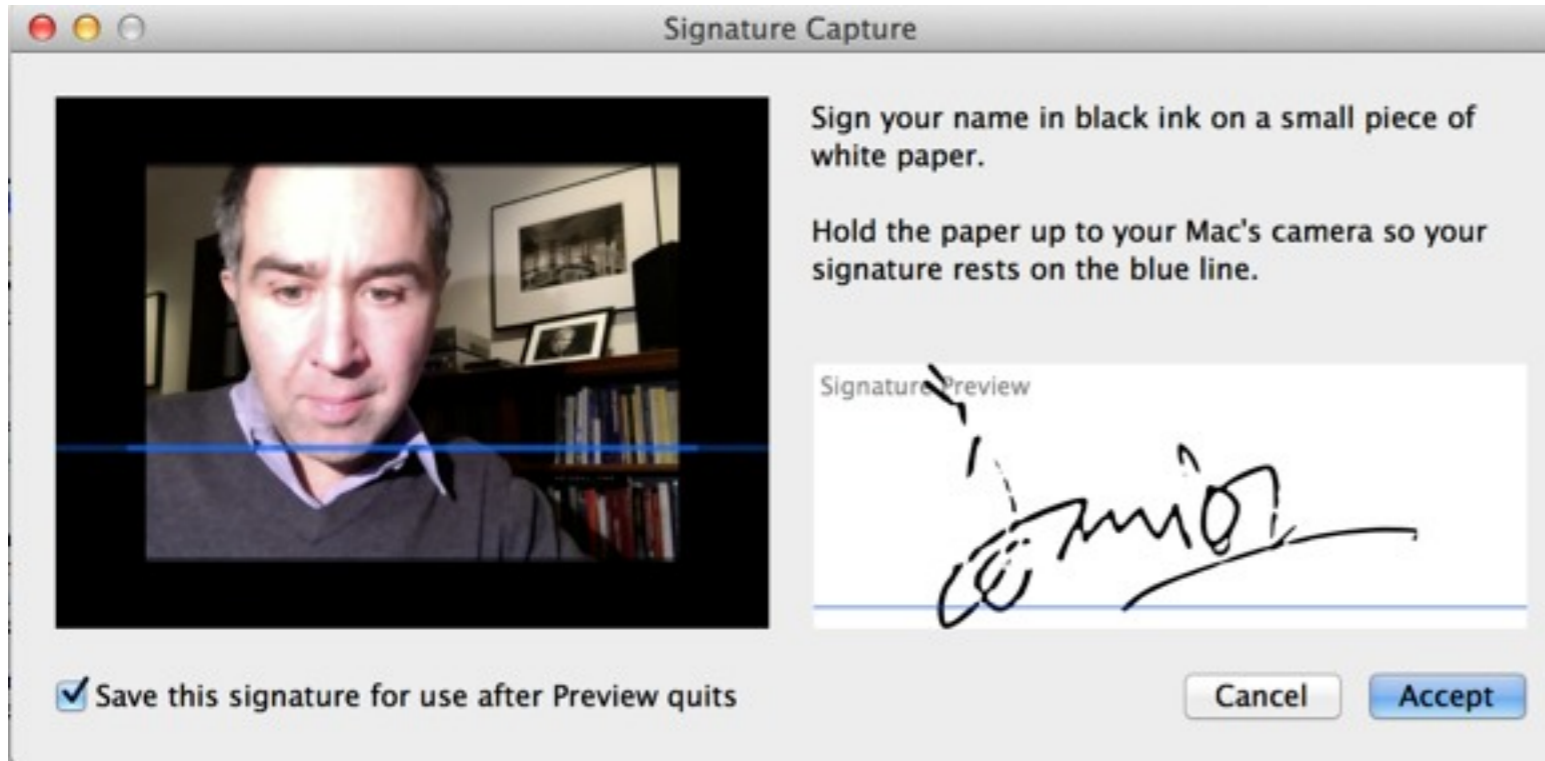
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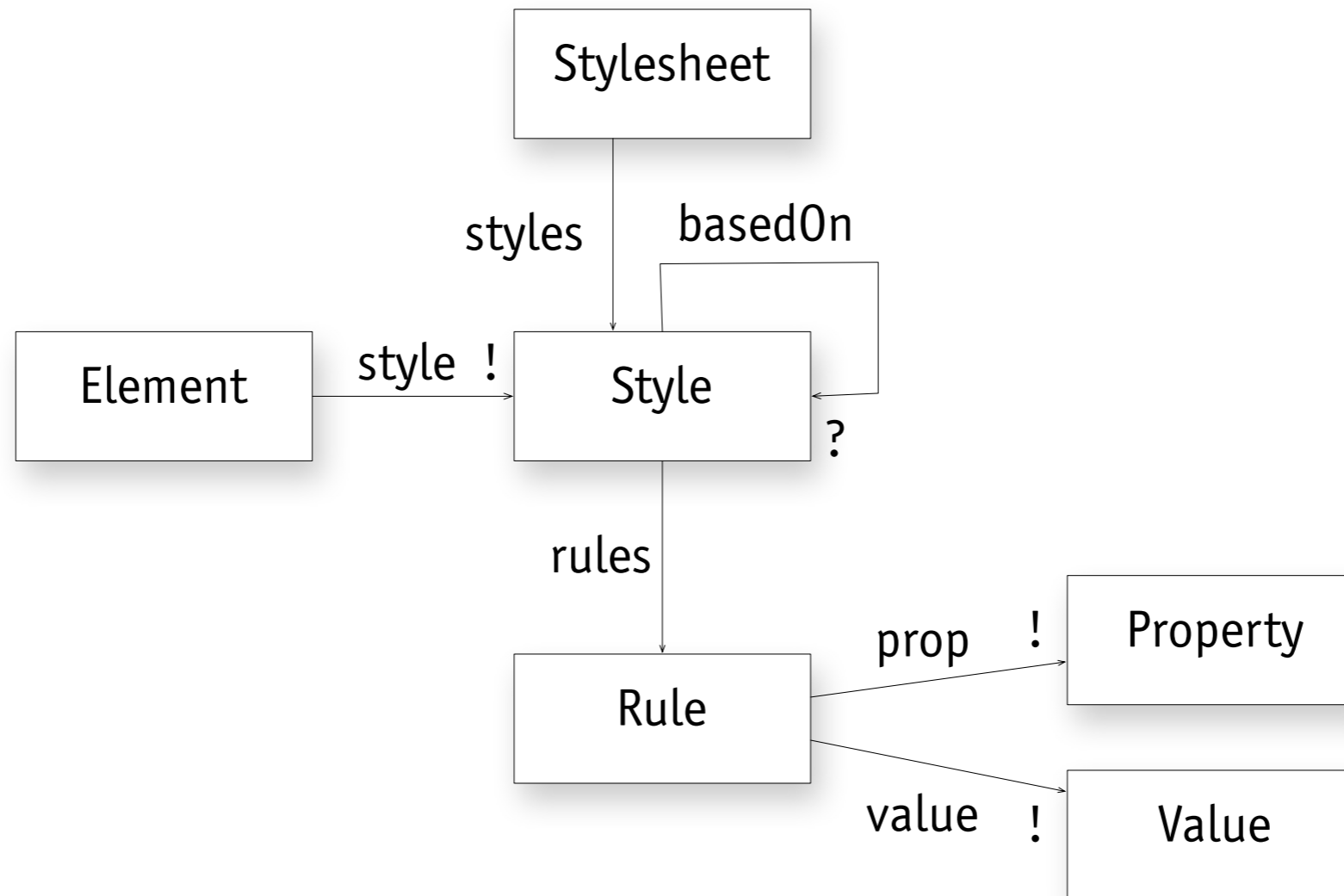
completeness apple preview



conclusion

idioms concept state structure

idea: classify idioms; invariants expose tricky design problems



all s: Style, p: Property | some s.rules | r.prop = p

next steps

analyzing diagrams

- › do graph properties (eg cycles) have design implications?

new case studies

- › Gmail, CSS and DropBox underway

evaluation

- › is Gitless easy to use?

concept to code dependences

- › does a concept dependence imply a code dependence?

related work

on concept description

- › *Analysis Patterns* (Fowler, 1997)
- › *Data Model Patterns* (Hay, 2011)
- › *Conceptual Models* (Henderson & Johnson, 2011)

on conceptual integrity

- › “orthogonality, propriety & generality” (Brooks, 1997)

on dependences

- › the uses relation (Parnas, 1978)
- › Design Rules (Baldwin & Clark, 2000)