Building Systems with Ideas

Daniel Jackson, MIT

accenture

PROFESSIONAL EDUCATION

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sneak preview

what does a software designer do?
build idea structures

who designs software?
software designers
analysts and consultants
business process engineers

so what?
to get better software,
focus more on these idea structures

and it's not just software
policy, organizational systems

a story of apps, good and bad

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?

Create

2 / 3

300%

Parents:

Frizzle will again be taking her second grade
ting field trip. Please sign and return the pe
w.

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

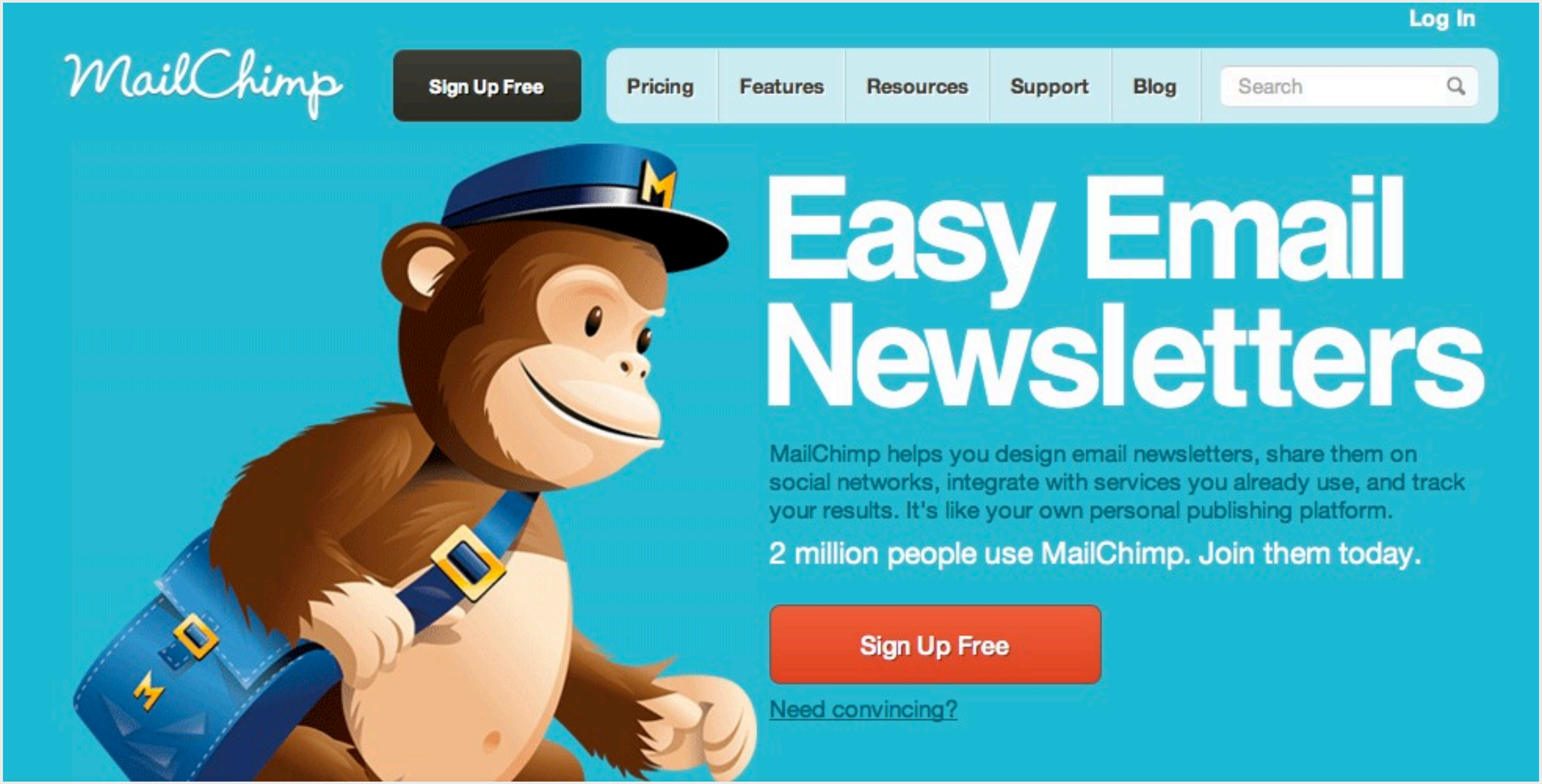
acrobat-sig-paste.txt

Last Saved: 8/27/09 5:20:28 PM
File Path ▾ : ~/Filestore/Advice/computers/acrobat-sig-paste.txt

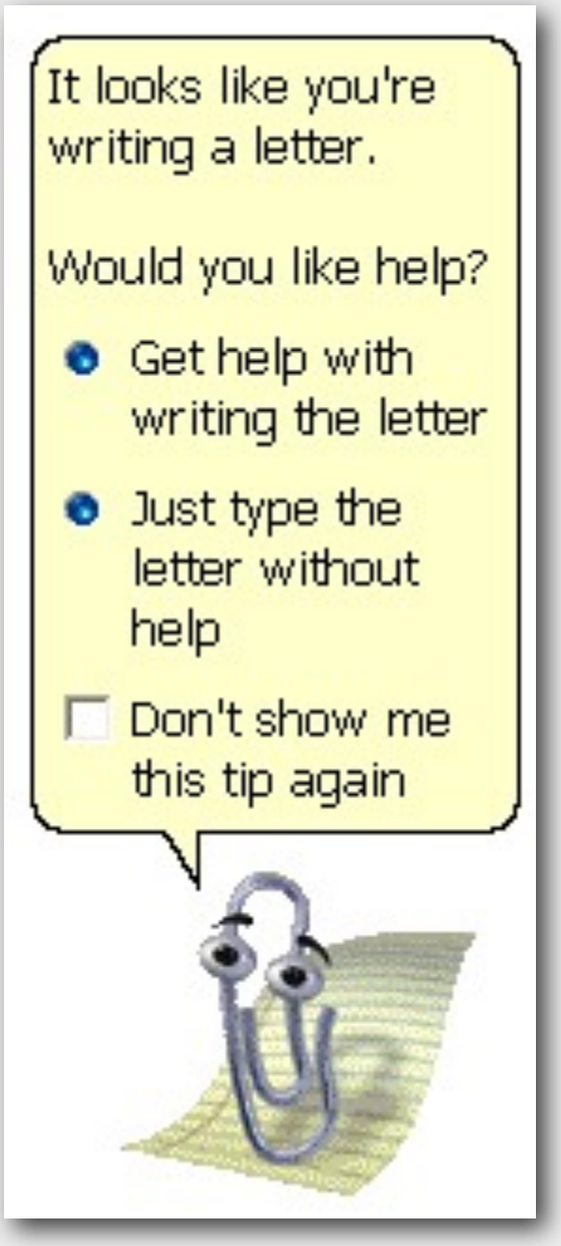
acrobat-sig-paste.txt

```
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
```

need a friendlier interface?



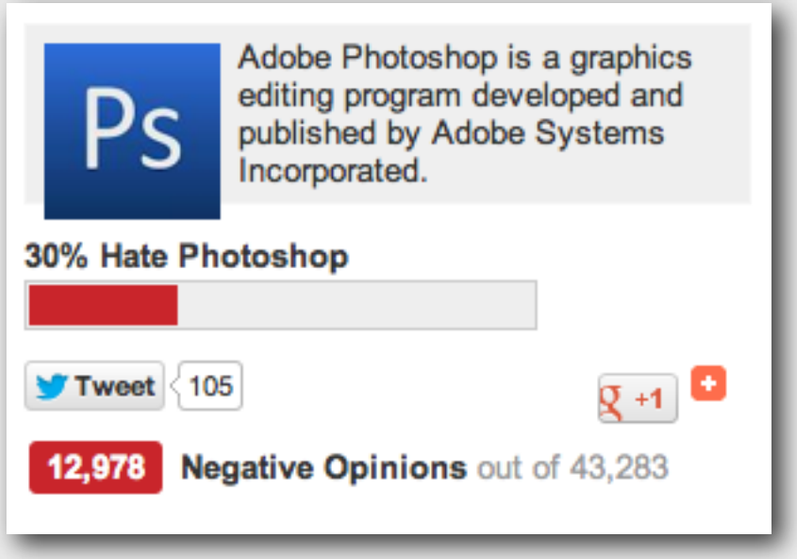
or a helping hand?



Clippy
2003-2008
RIP

no: can be complicated & usable

i'm not alone

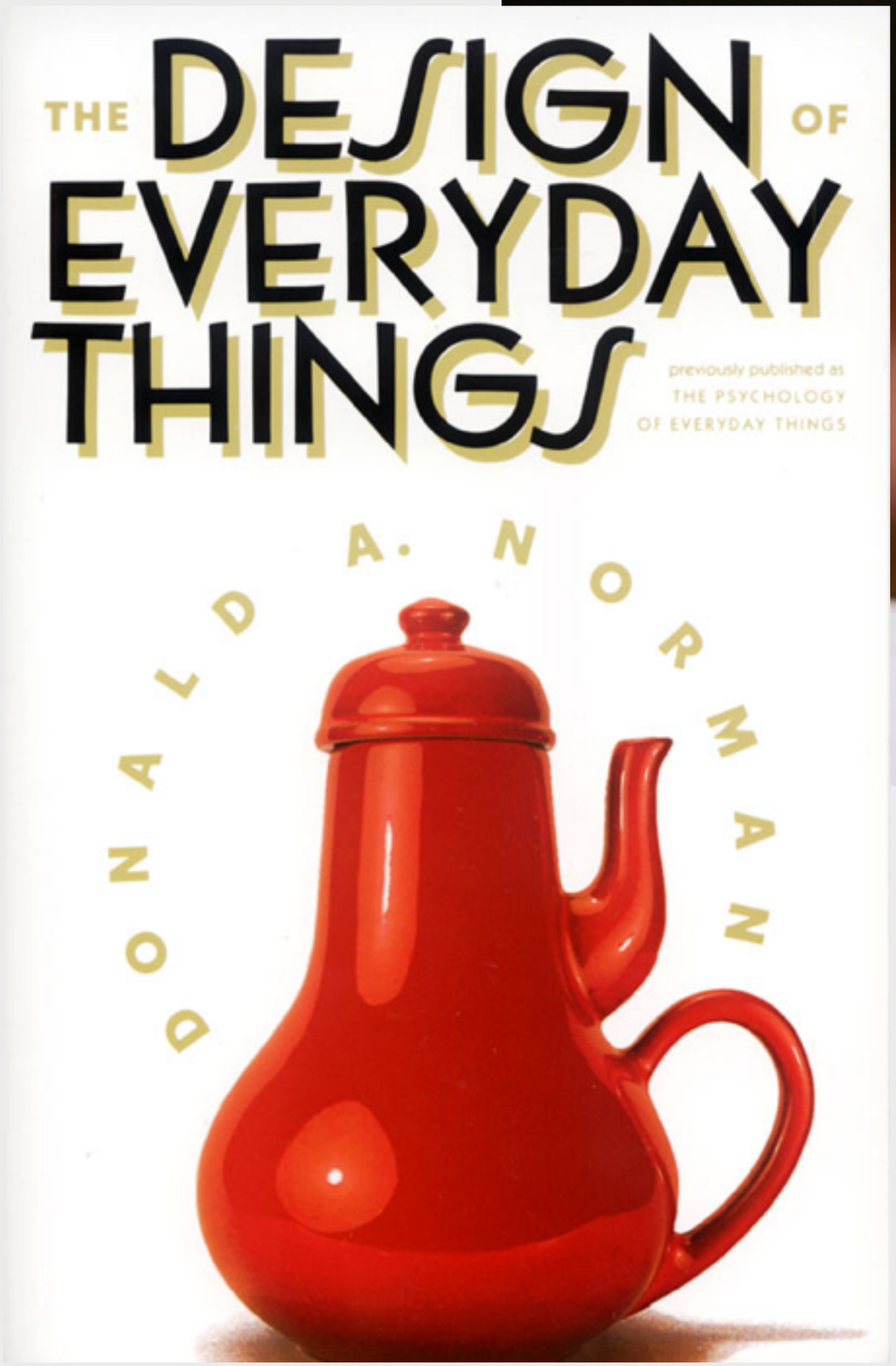


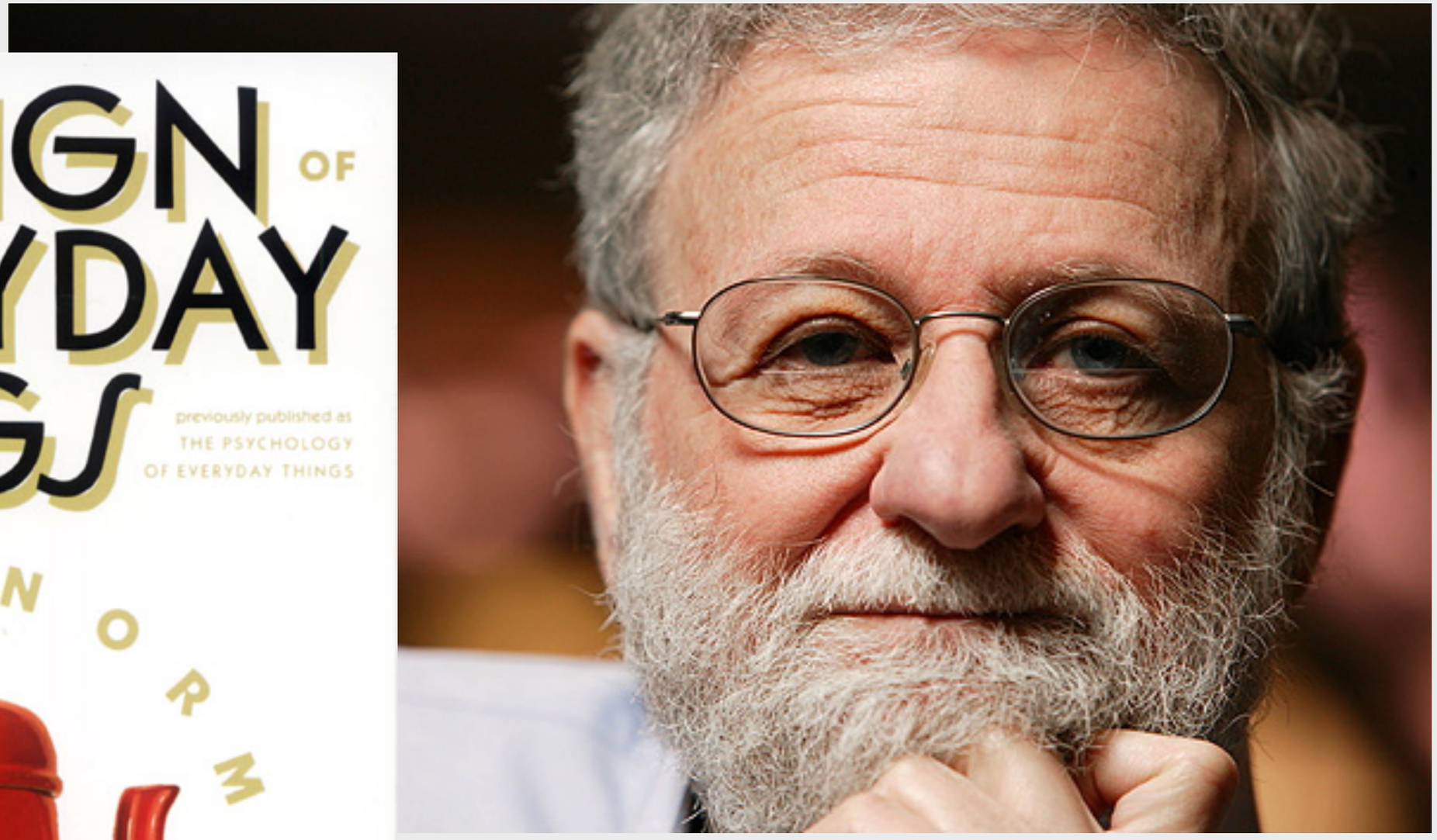
from http://amplicate.com

so what makes things easy to use?

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

Donald Norman (1988): action possibilities that are perceivable





Donald Norman

a door with good affordances

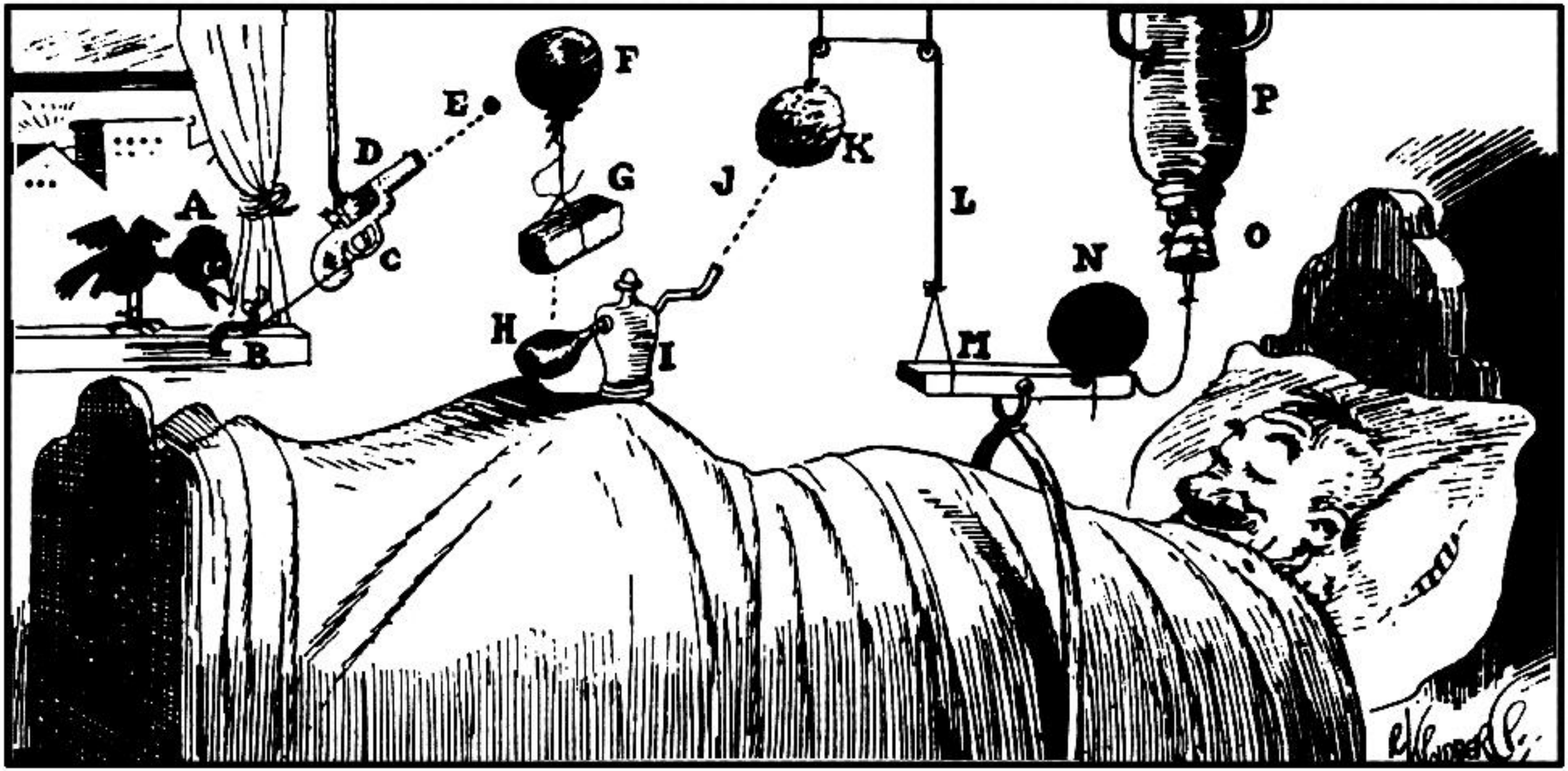
unhappy doors

push or pull?

door with user manual

using more complex things

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.

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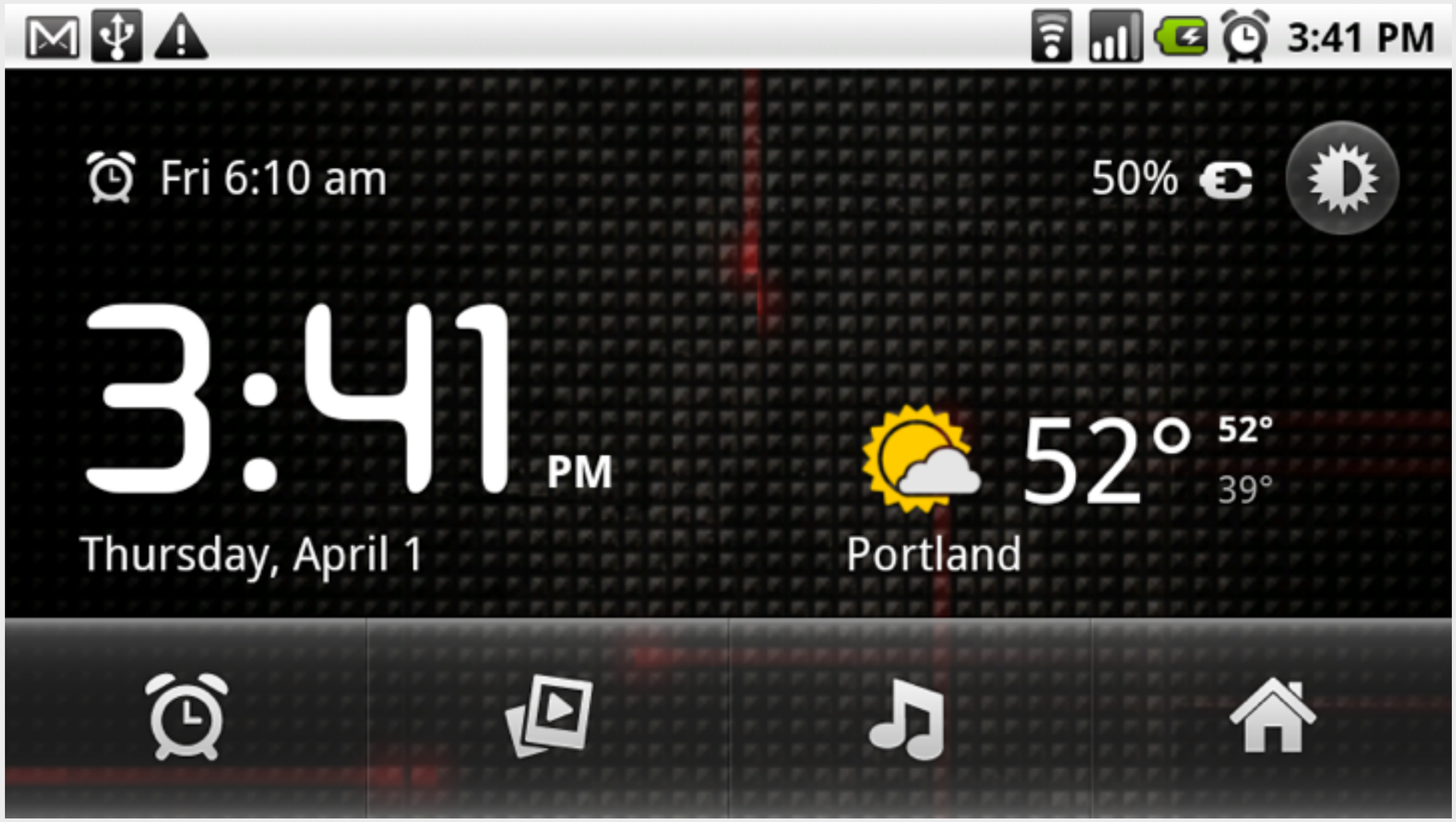
how to use this?

it's getting harder...

Dieter Rams

Braun Clock Radio (1978)

photo by Koichi Okuwaki



Android phone app

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...

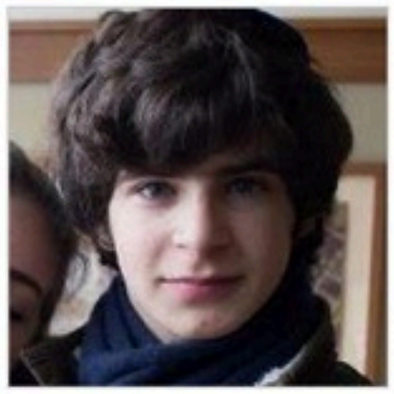
About Alarm Clock 2
Check for updates...
Preferences...

Quit

facebook 3 1 Search for people, places and things Daniel Jackson Home

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

About Create an Ad Create a Page Developers Careers Privacy Cookies Terms Help

Facebook © 2013 · English (US)

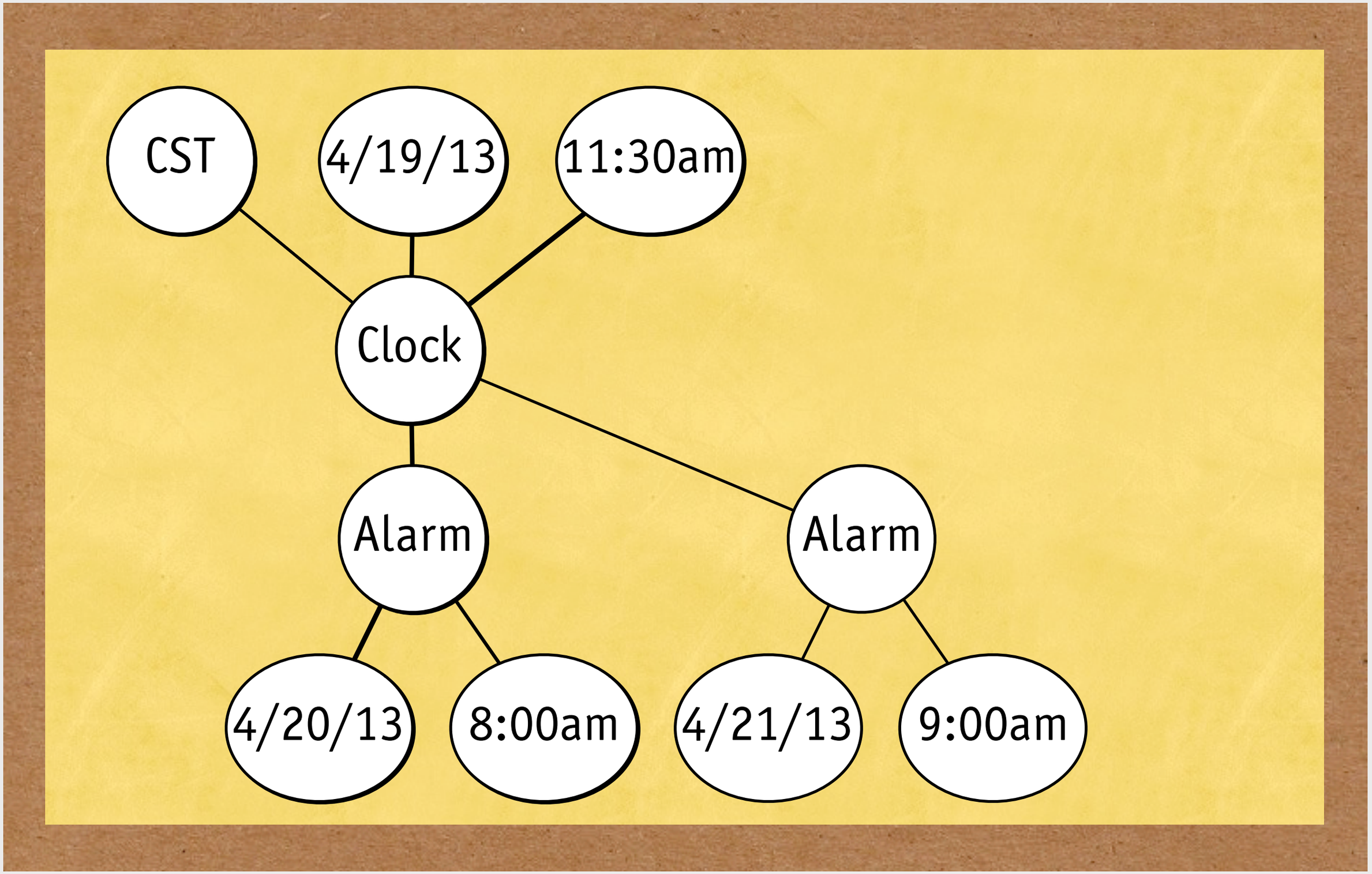
so how do we use these things?

conceptual models

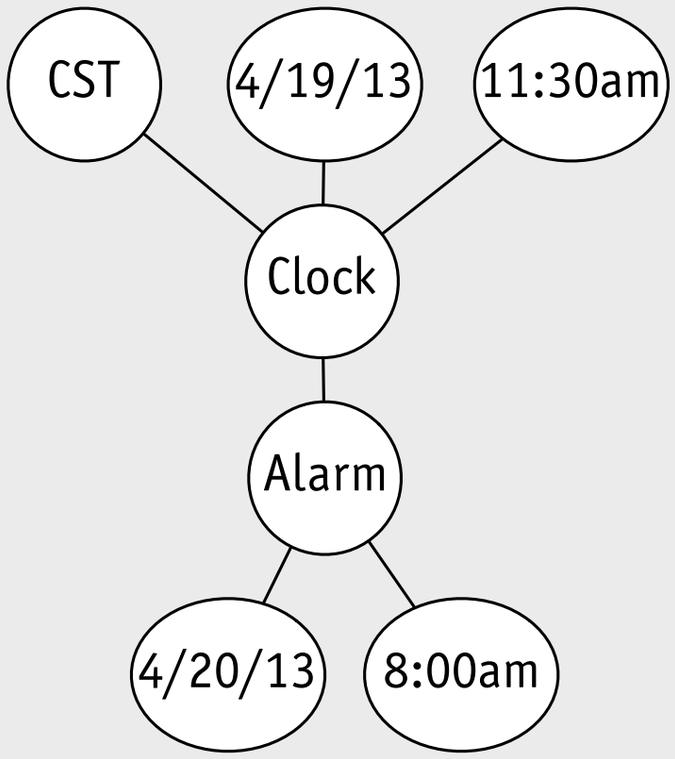
to use a complex application
we imagine what's inside
we form structures in our mind
we connect actions to structural changes

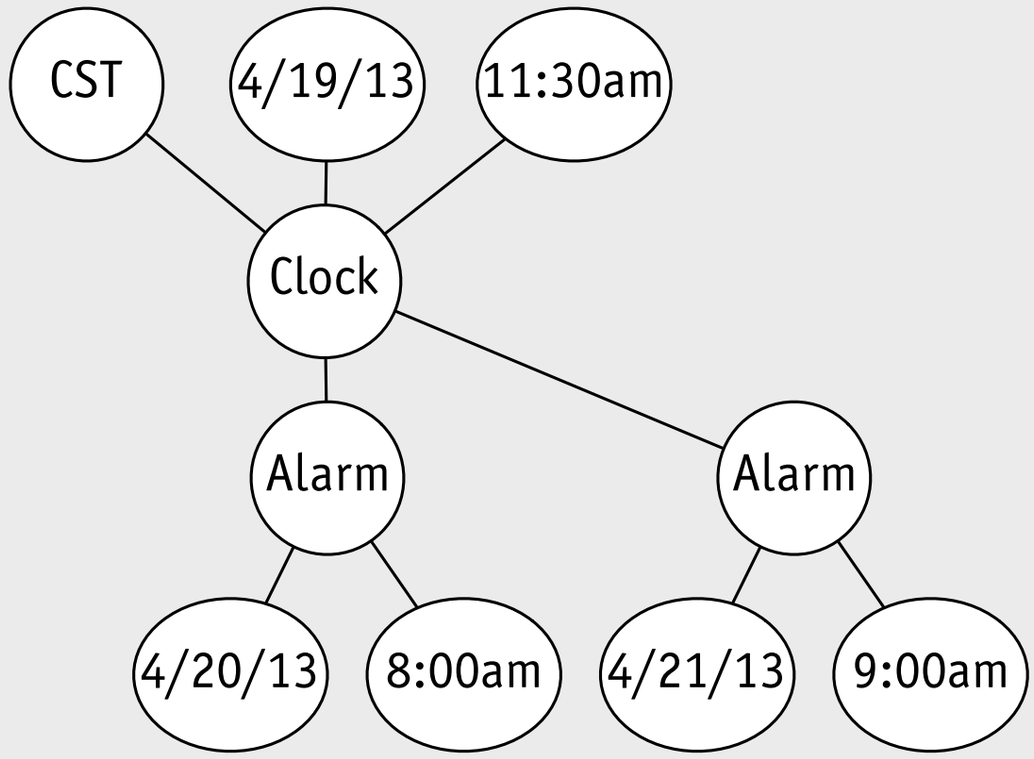
"abstract affordances"

opening the box



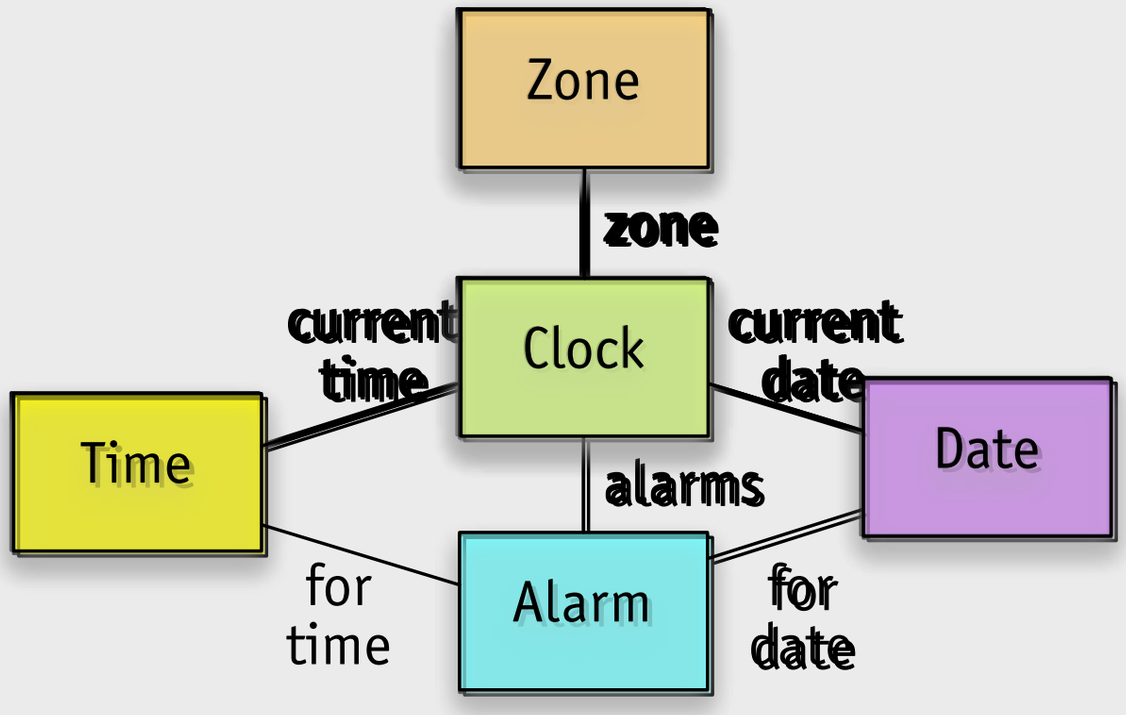
an infinity of abstract states

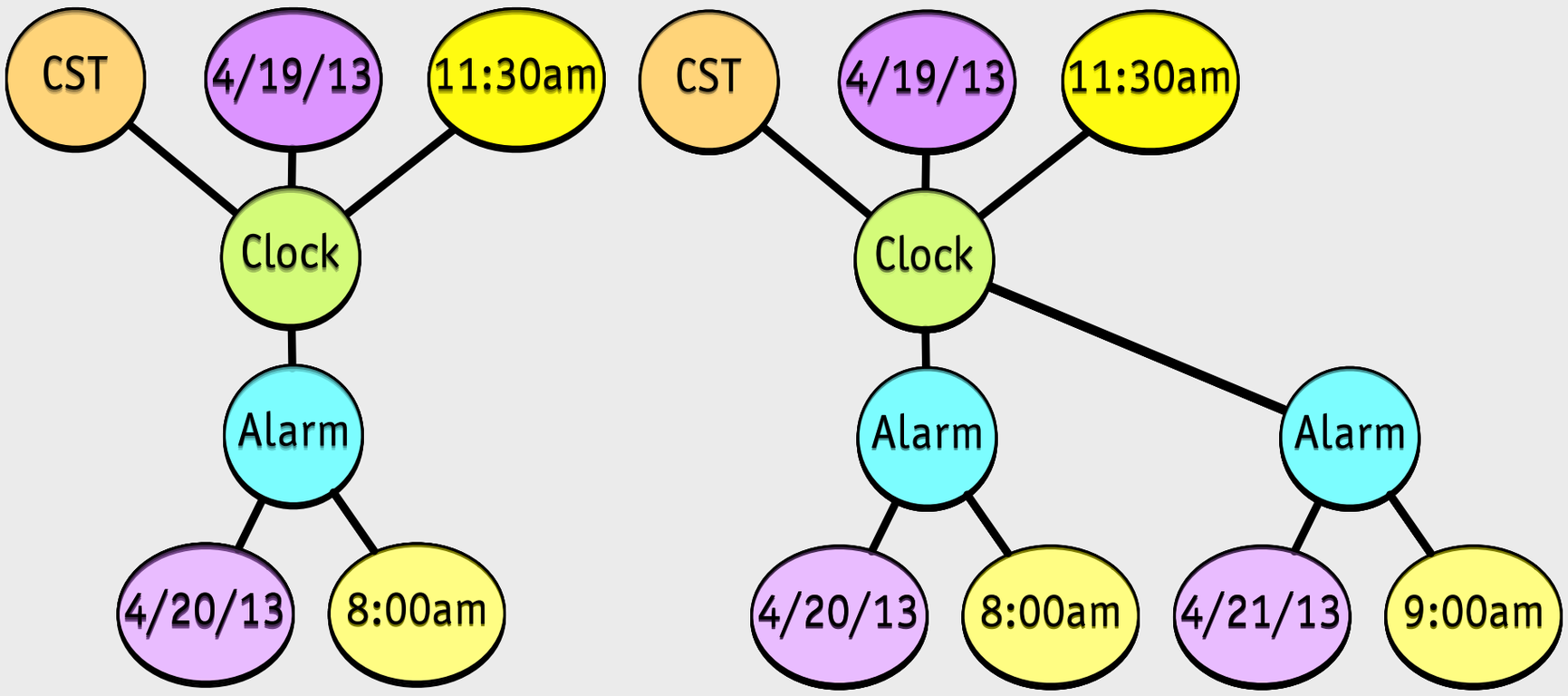


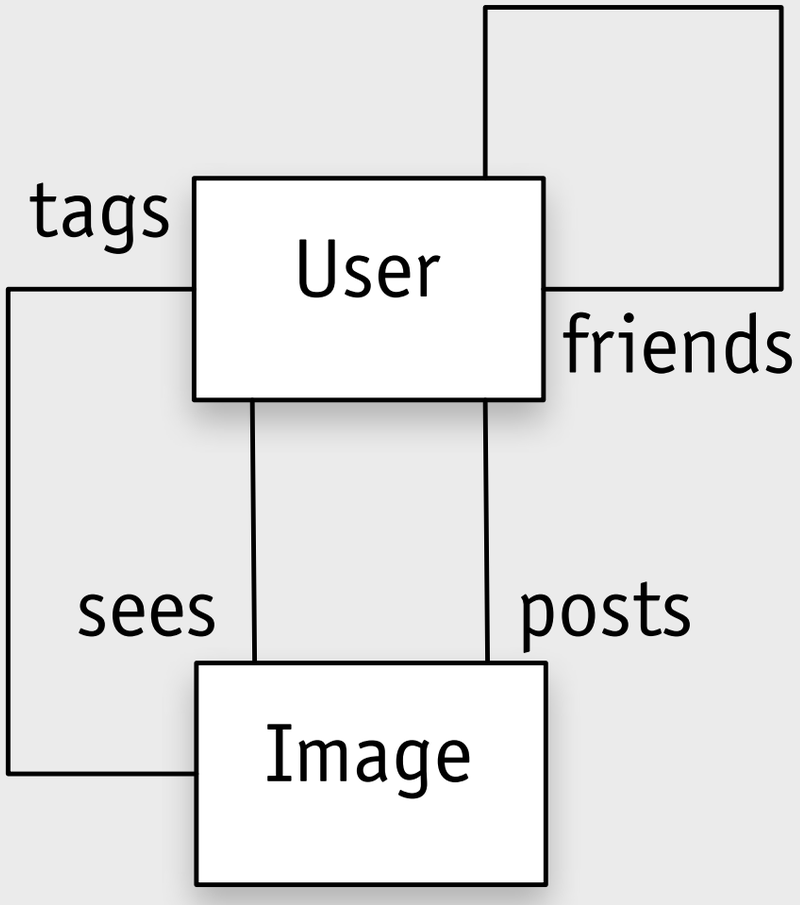


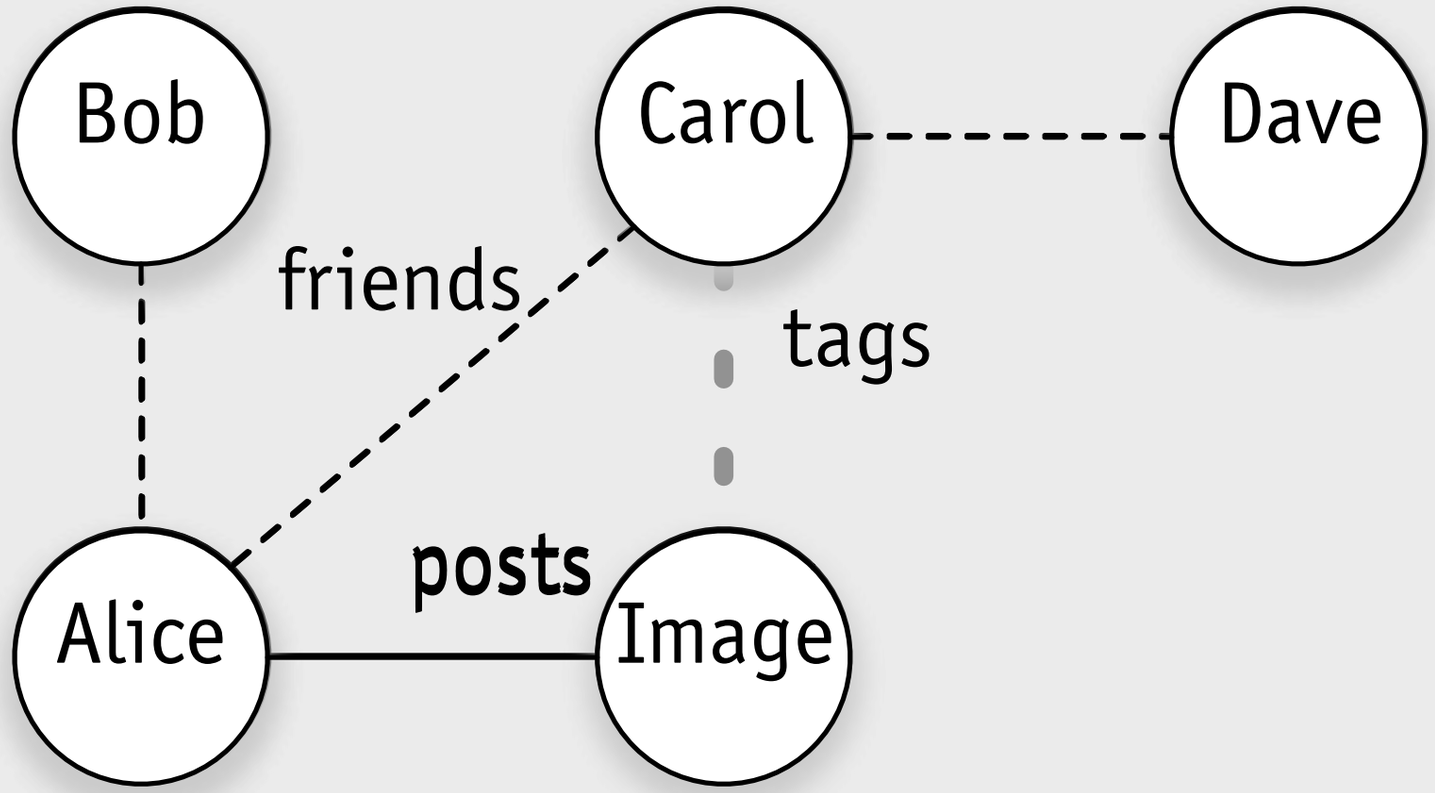
...

summarizing abstract states

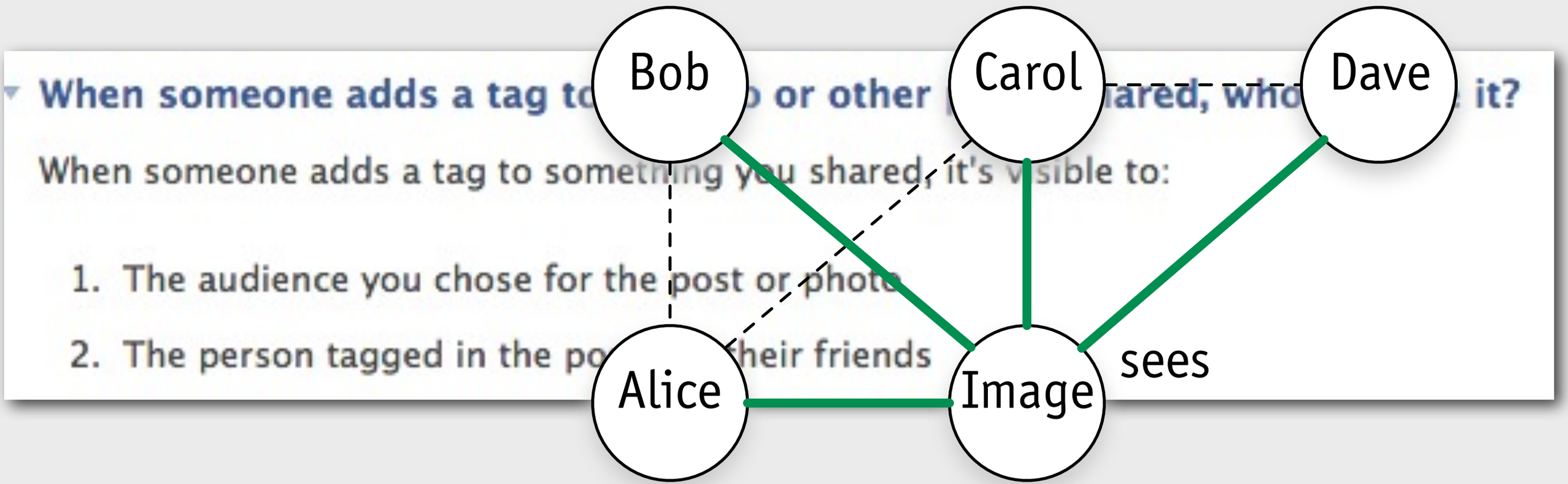








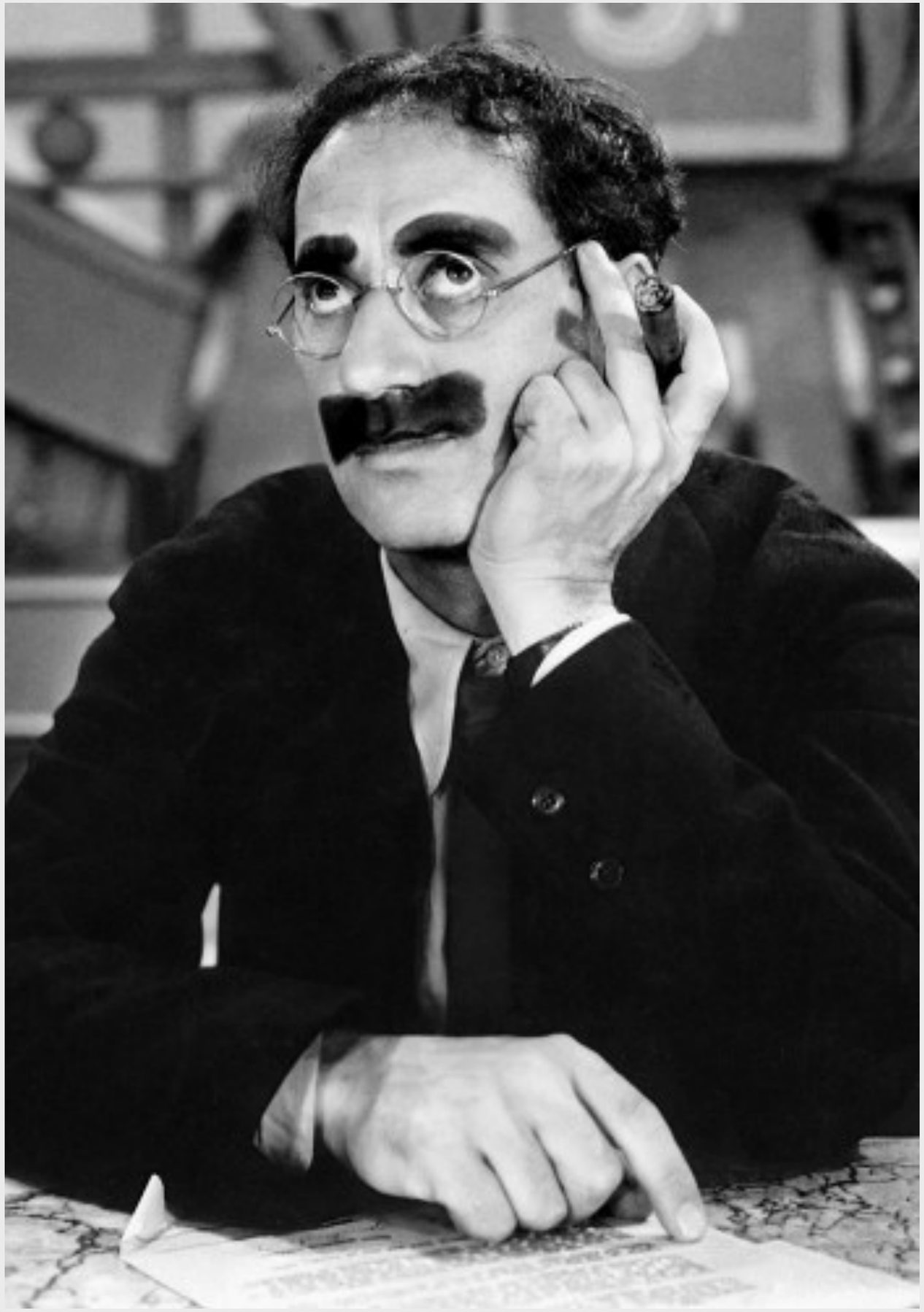
who can see the image?



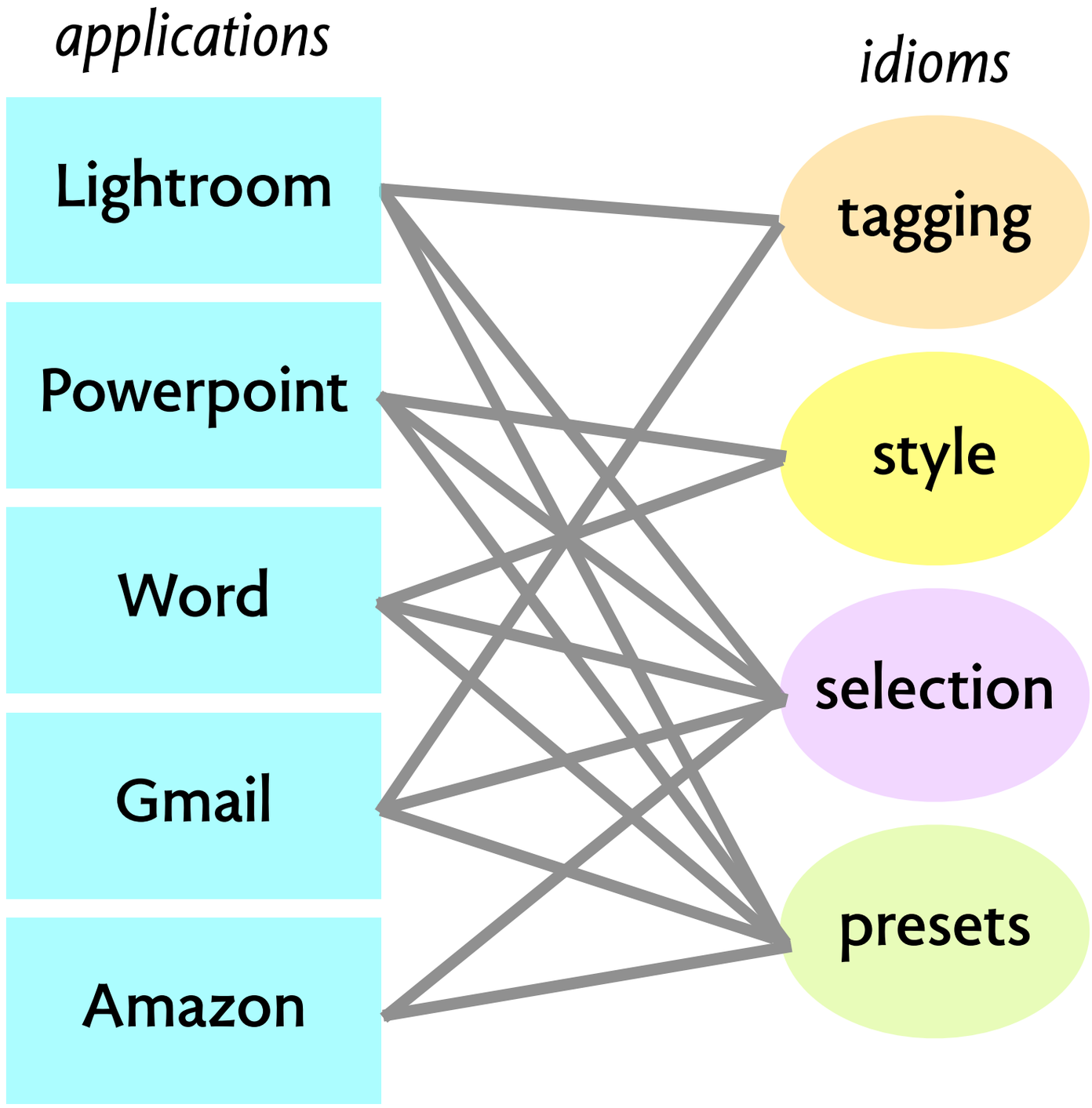
how do we learn so many conceptual models?

Why, a four-year-old child could understand this!

Run out and get me a four-year-old child! I can't make head or tail out of it.



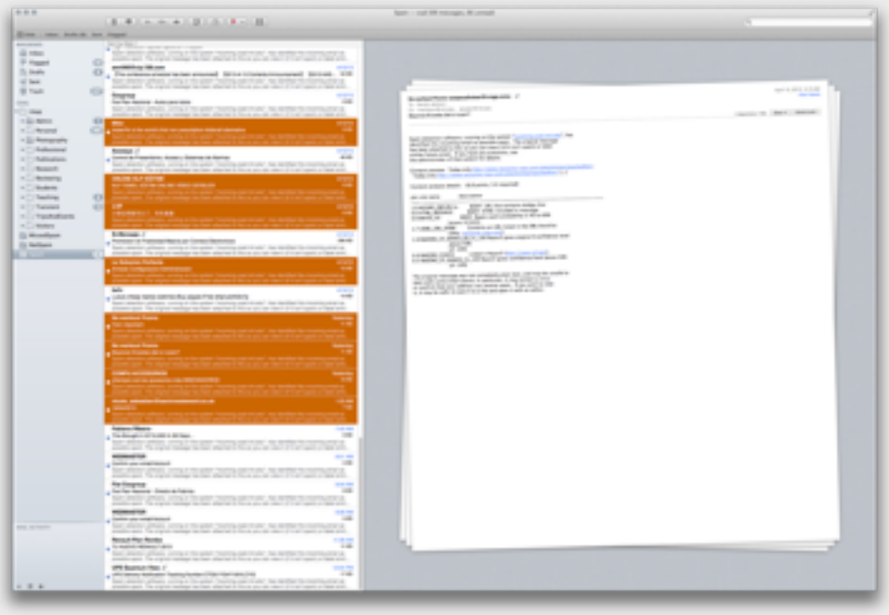
conceptual idioms



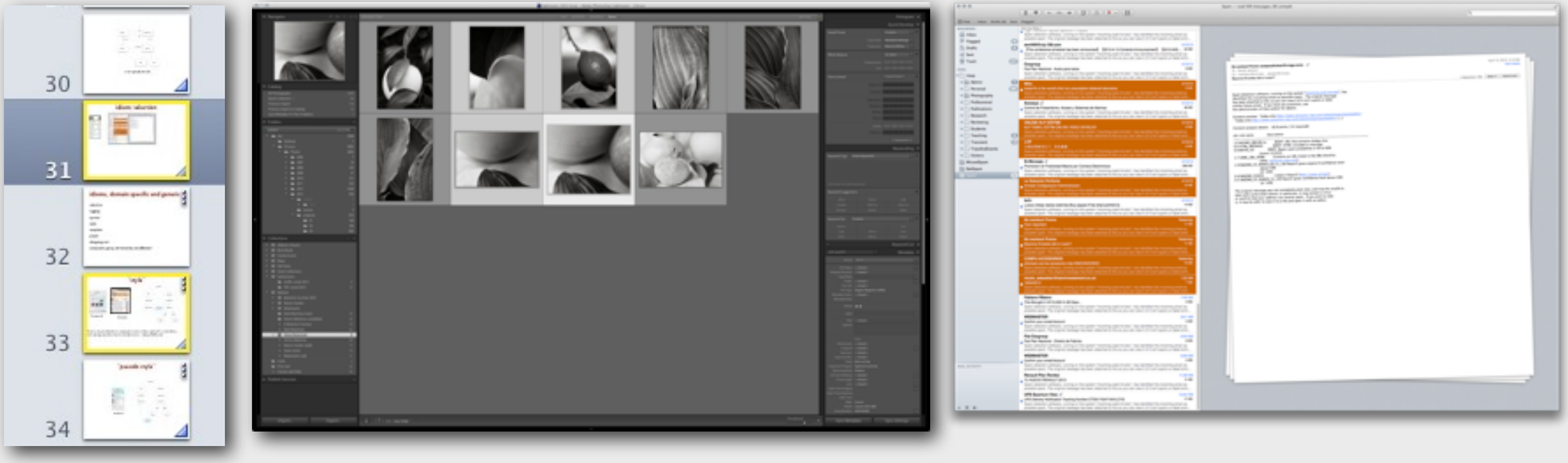
an idiom: selection

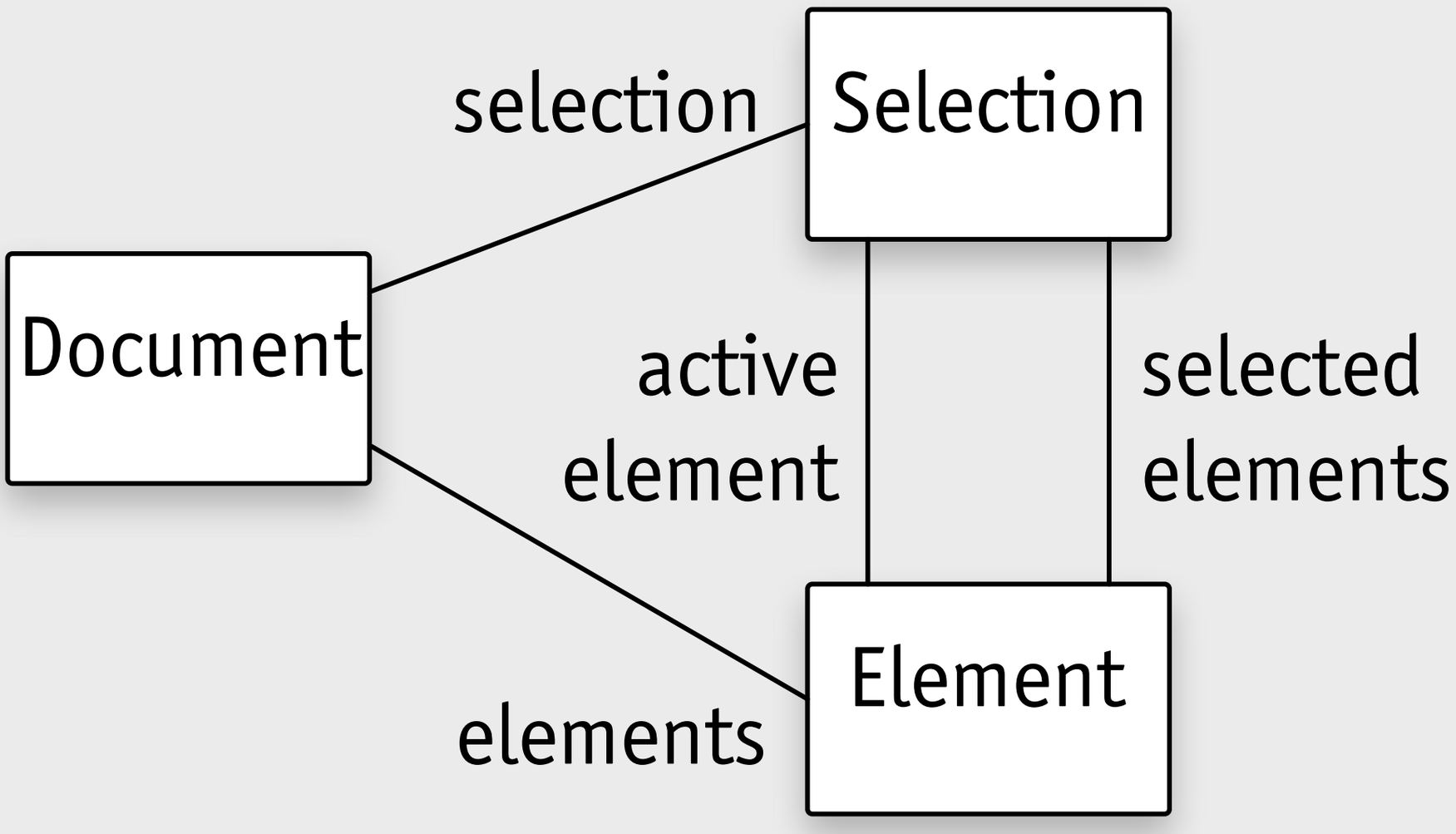
slides in Keynote

photos in Adobe Lightroom

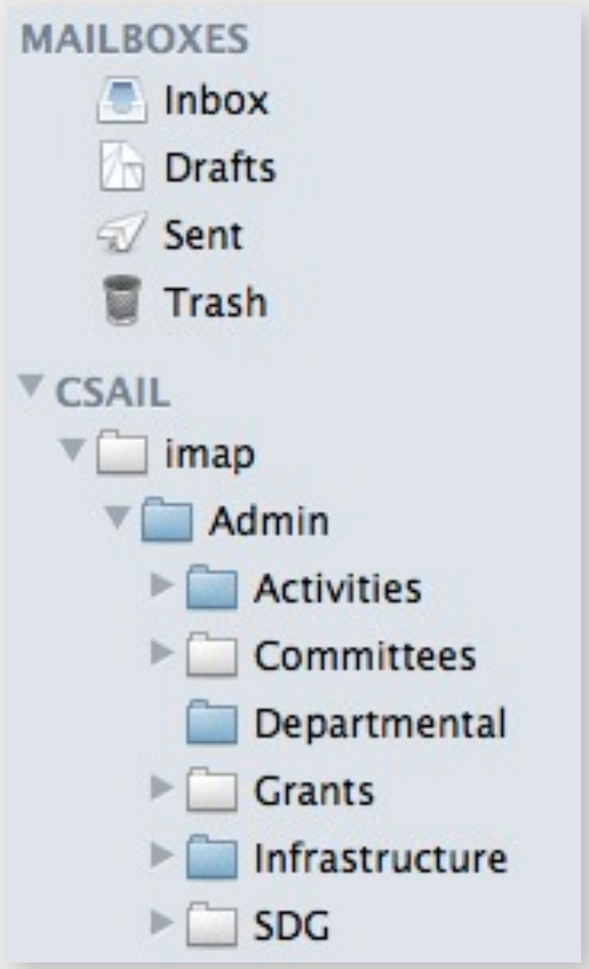


messages in Apple Mail

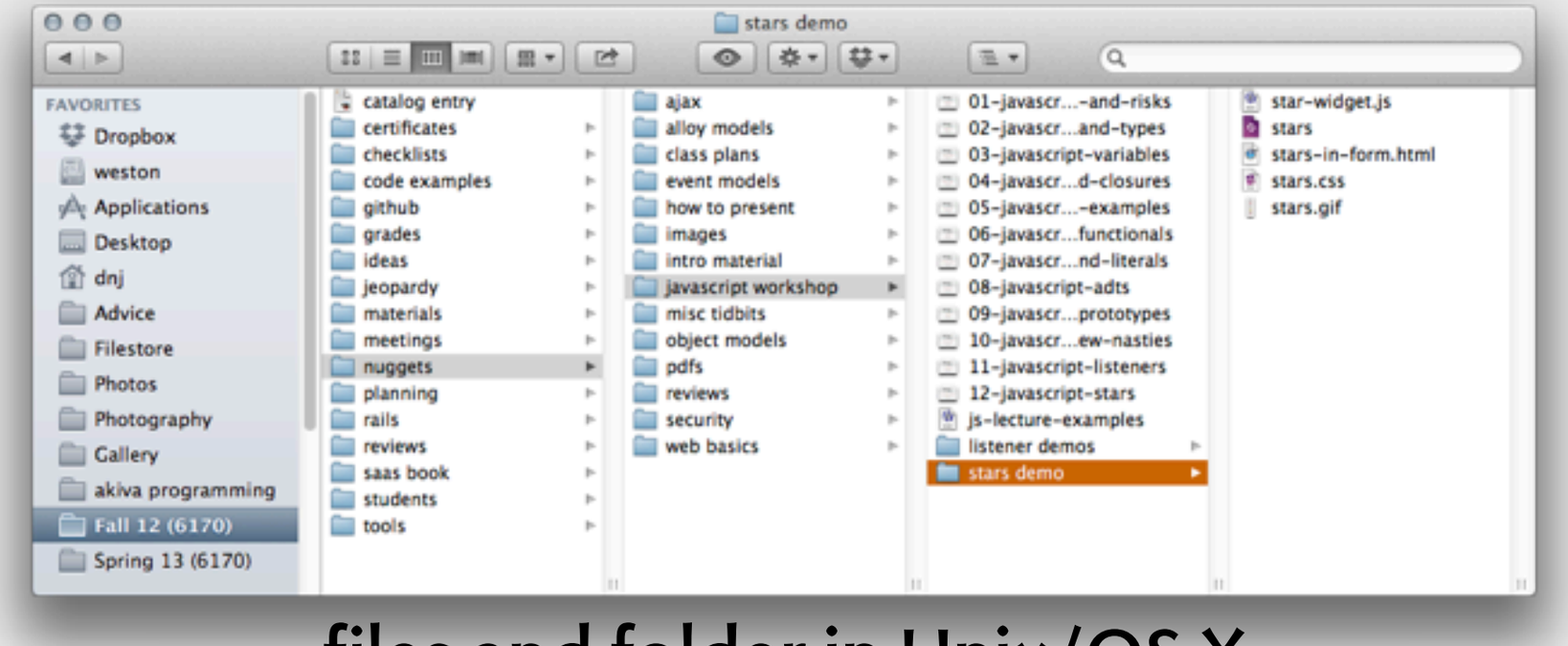



selection
Selection
Document
active
element
selected
elements
elements
Element

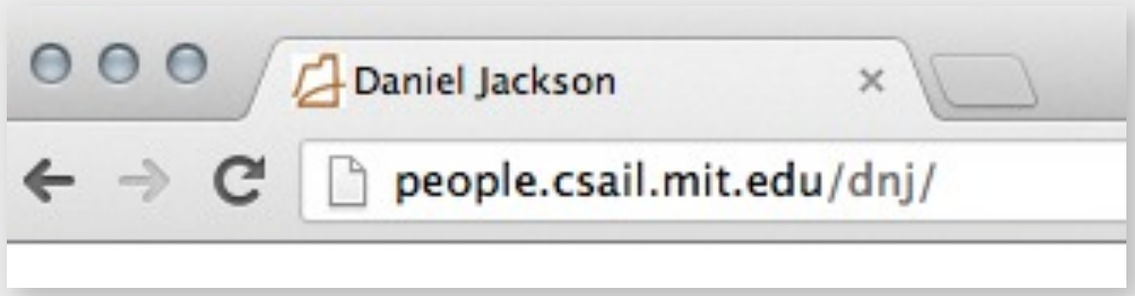
an idiom: directory



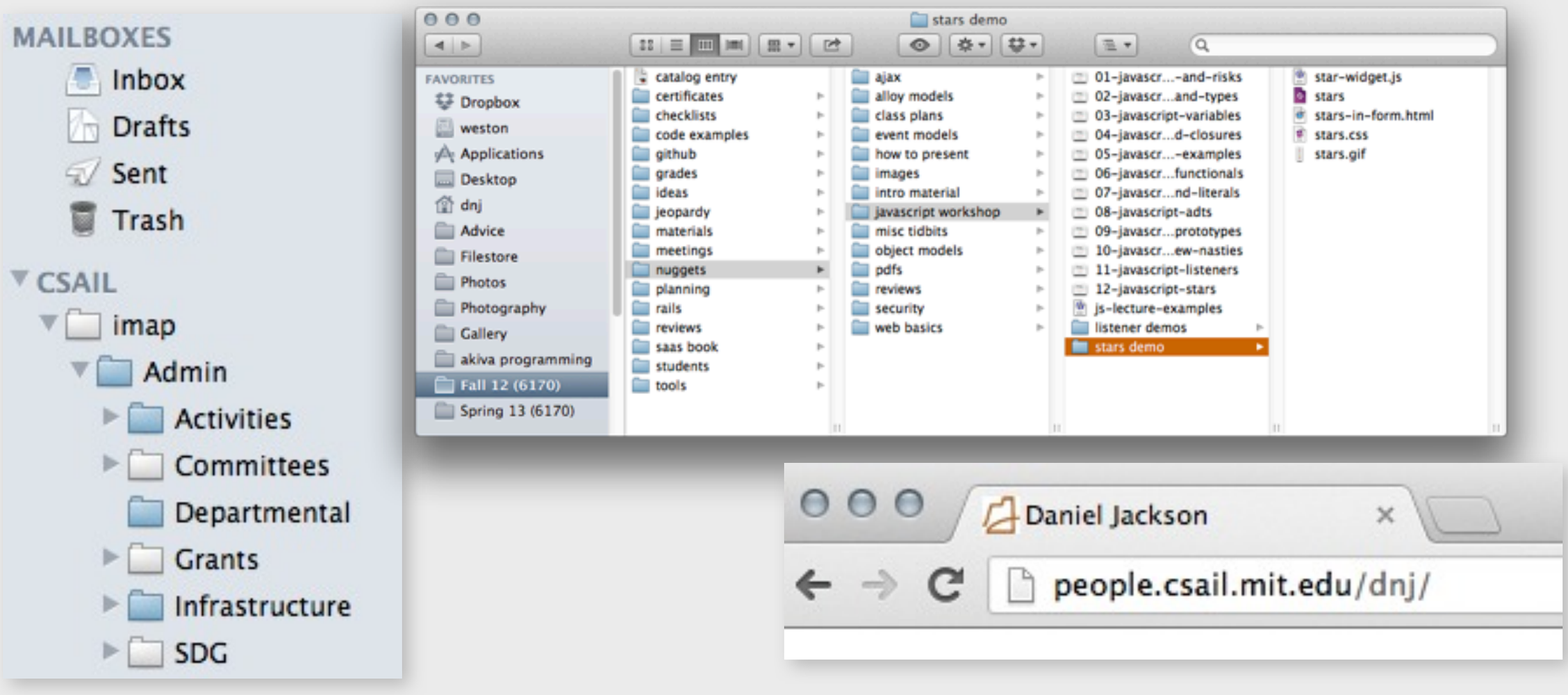
mailboxes
in Apple Mail



files and folder in Unix/OS X



domain names in DNS


MAILBOXES
Inbox
Drafts
Sent
Trash
CSAIL
imap
Admin
Activities
Committees
Departmental
Grants
Infrastructure
SDG
stars demo
FAVORITES
Dropbox
weston
Applications
Desktop
dnj
Advice
Filestore
Photos
Photography
Gallery
akiva programming
Fall 12 (6170)
Spring 13 (6170)
catalog entry
certificates
checklists
code examples
github
grades
ideas
jeopardy
materials
meetings
nuggets
planning
rails
reviews
saas book
students
tools
ajax
alloy models
class plans
event models
how to present
images
intro material
javascript workshop
misc tidbits
object models
pdfs
reviews
security
web basics
01-javascr...-and-risks
02-javascr...and-types
03-javascript-variables
04-javascr...d-closures
05-javascr...-examples
06-javascr...functionals
07-javascr...nd-literals
08-javascript-adts
09-javascr...prototypes
10-javascr...ew-nasties
11-javascript-listeners
12-javascript-stars
js-lecture-examples
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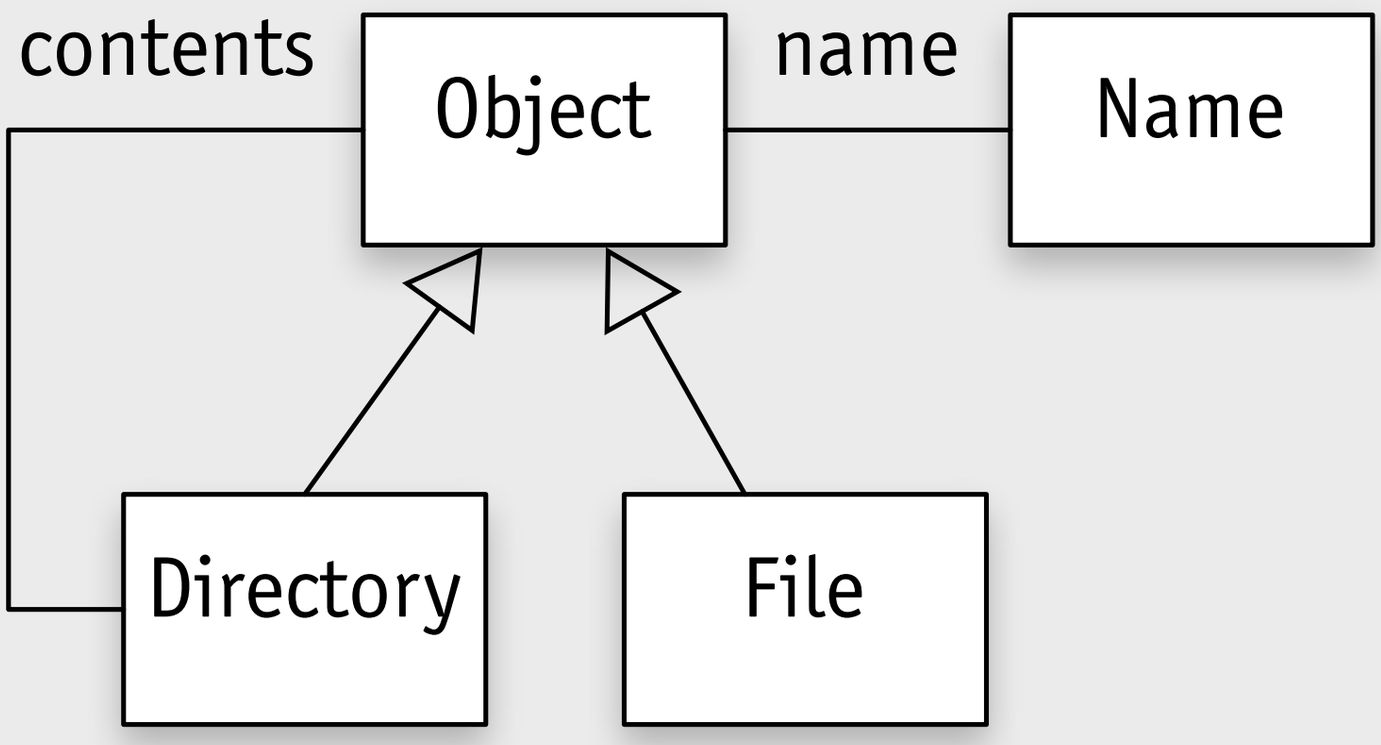
stars-in-form.html
stars.css
stars.gif
Daniel Jackson
people.csail.mit.edu/dnj/


contents
Object
name
Name
Directory
File

an idiom: tagging

twitter hashtags

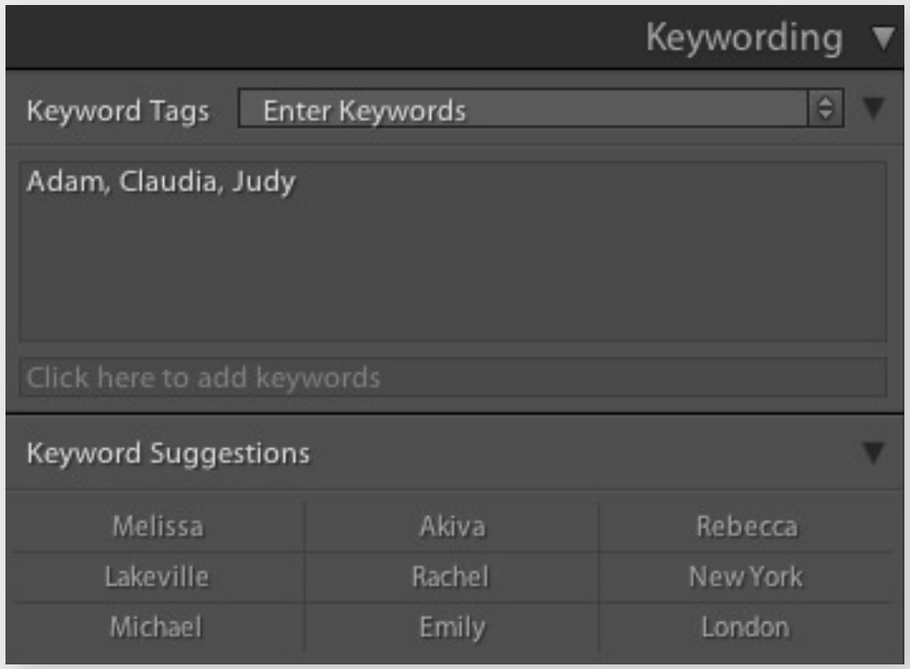
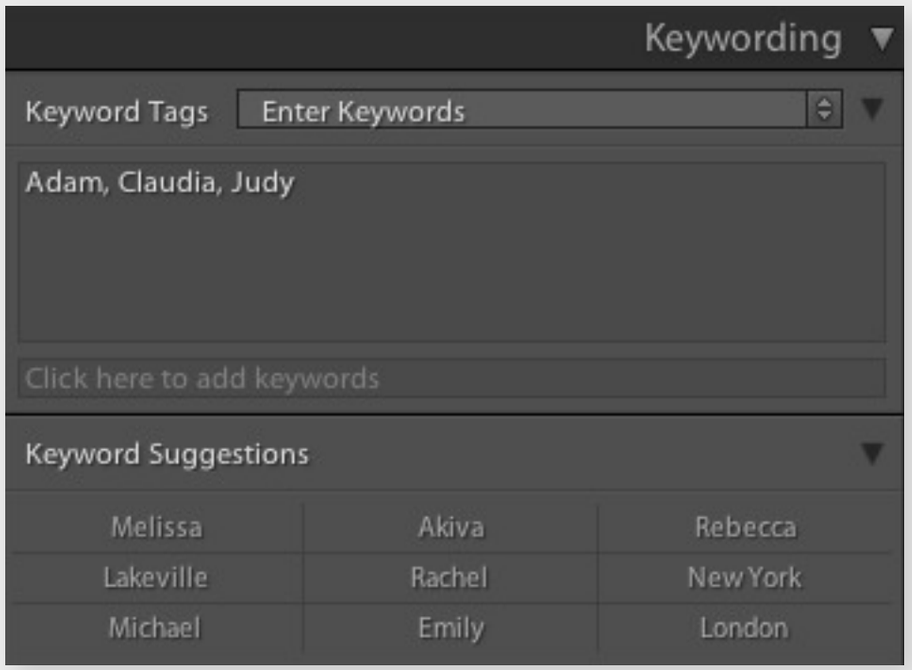


photo keywords

Gmail labels

Newsweek
#LASTPRINTISSUE


Keywording
Keyword Tags
Enter Keywords
Adam, Claudia, Judy
Click here to add keywords
Keyword Suggestions
Melissa
Akiva
Rebecca
Lakeville
Rachel
New York
Michael
Emily
London

Google
Gmail
COMPOSE
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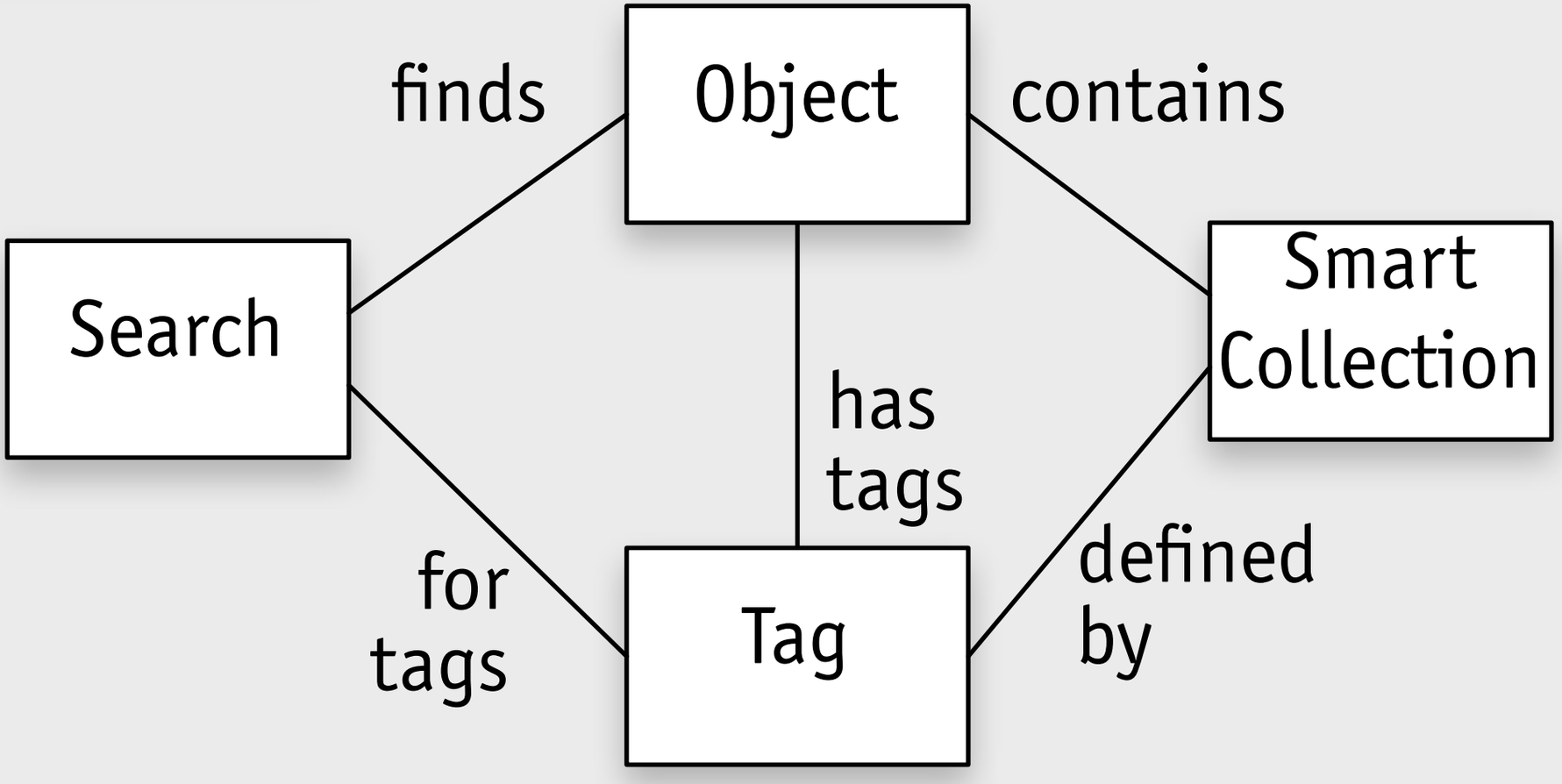
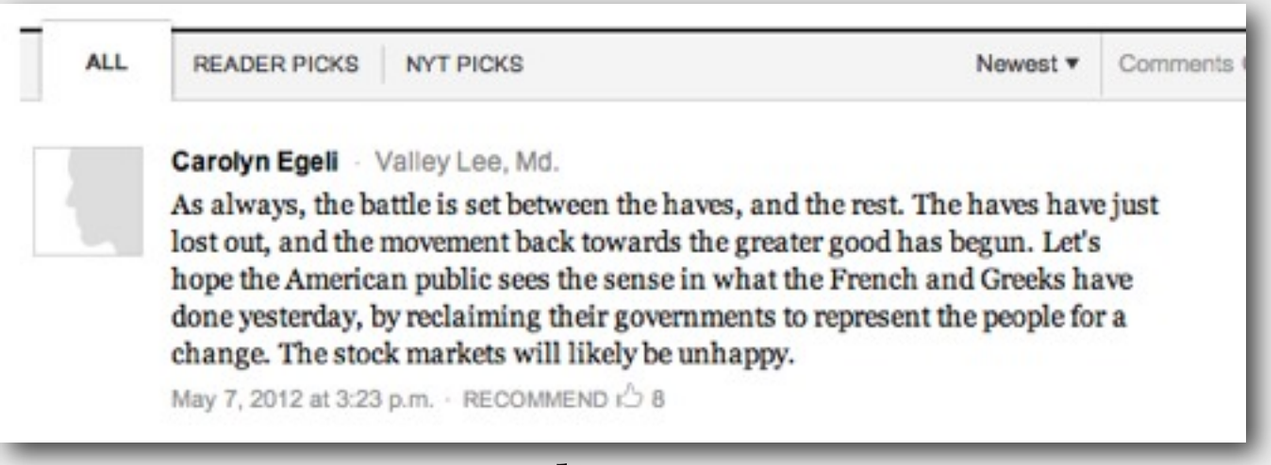
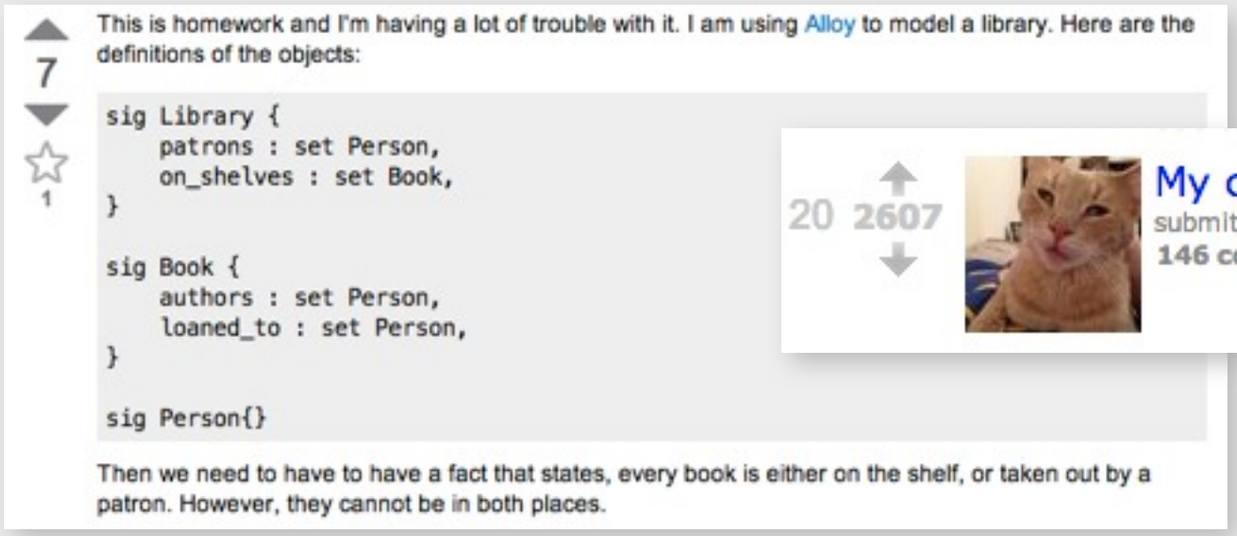
Important
Sent Mail
Drafts
Personal
Travel


finds
Object
contains
Search
Smart Collection
has tags
for tags
Tag
defined by

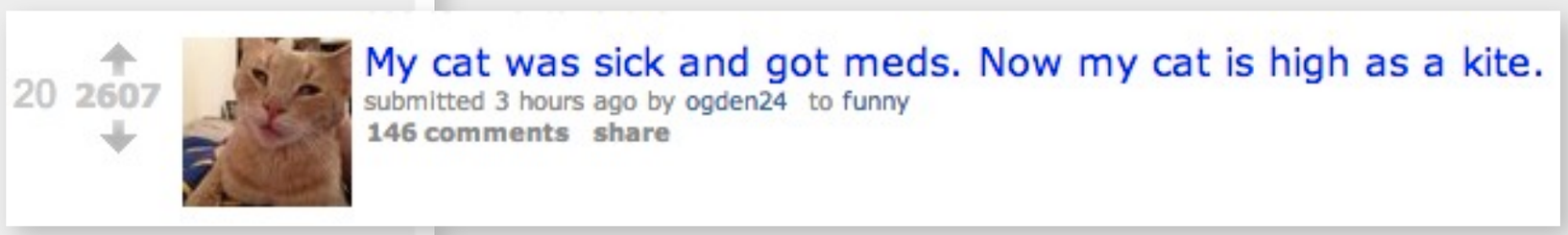
an idiom: upvoting



recommending comments on NY Times



questions on Stack Overflow



posts on reddit

ALL | READER PICKS | NYT PICKS | Newest ▾ | Comments

Carolyn Egeli · Valley Lee, Md.

As always, the battle is set between the haves, and the rest. The haves have just lost out, and the movement back towards the greater good has begun. Let's hope the American public sees the sense in what the French and Greeks have done yesterday, by reclaiming their governments to represent the people for a change. The stock markets will likely be unhappy.

May 7, 2012 at 3:23 p.m. · RECOMMEND 8

7

1

This is homework and I'm having a lot of trouble with it. I am using Alloy to model a library. Here are the definitions of the objects:

```
sig Library {
    patrons : set Person,
    on_shelves : set Book,
}

sig Book {
    authors : set Person,
    loaned_to : set Person,
}

sig Person{}
```

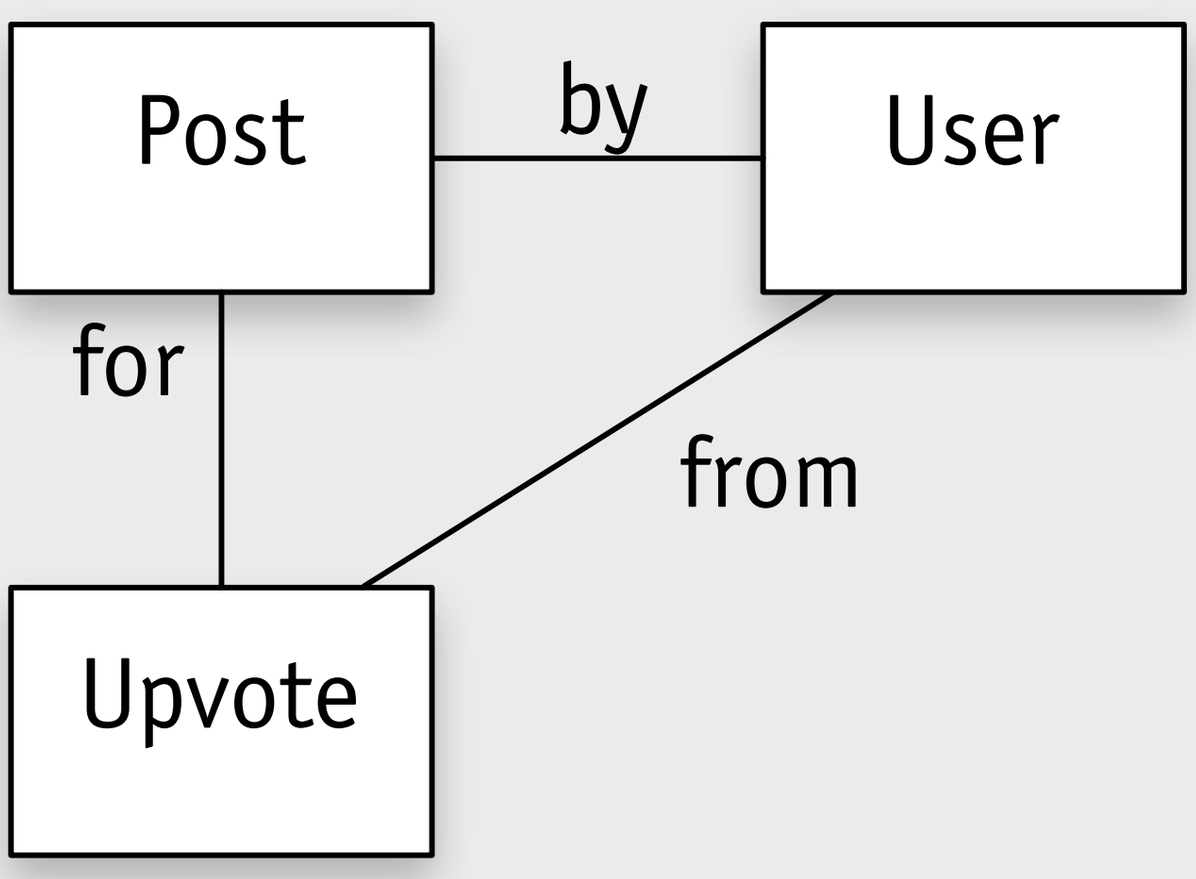
Then we need to have to have a fact that states, every book is either on the shelf, or taken out by a patron. However, they cannot be in both places.

20 2607

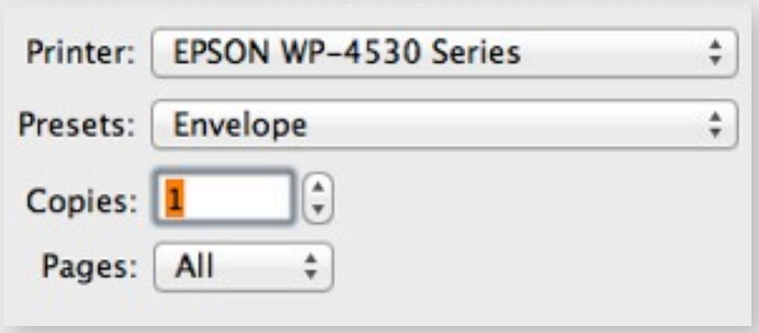
My cat was sick and got meds. Now my cat is high as a kite.

submitted 3 hours ago by ogden24 to funny

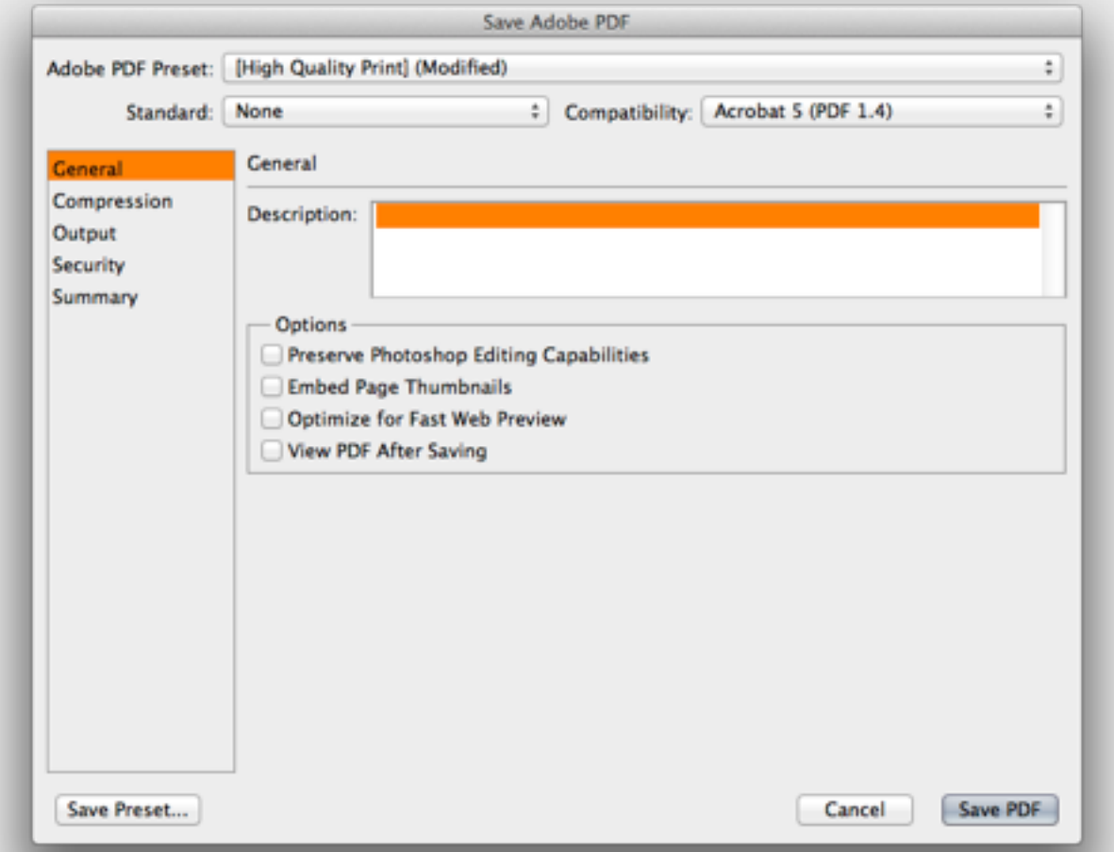
146 comments **share**



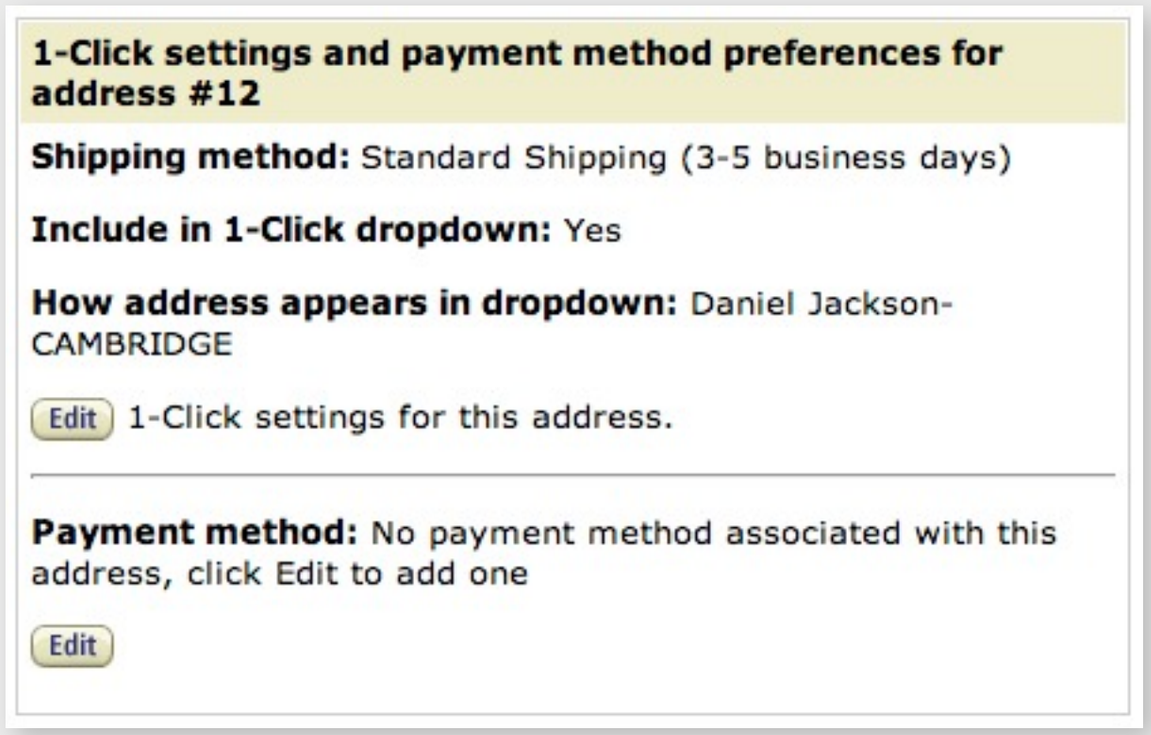
an idiom: presets



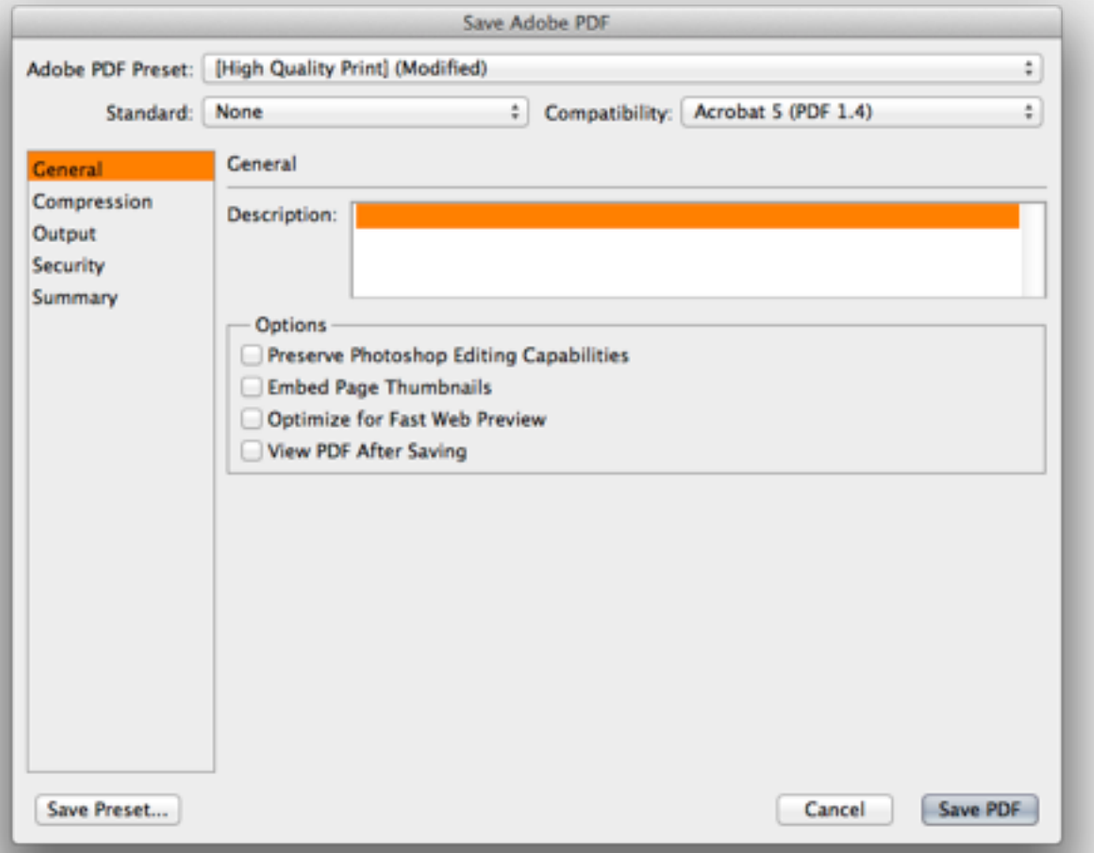
printer settings

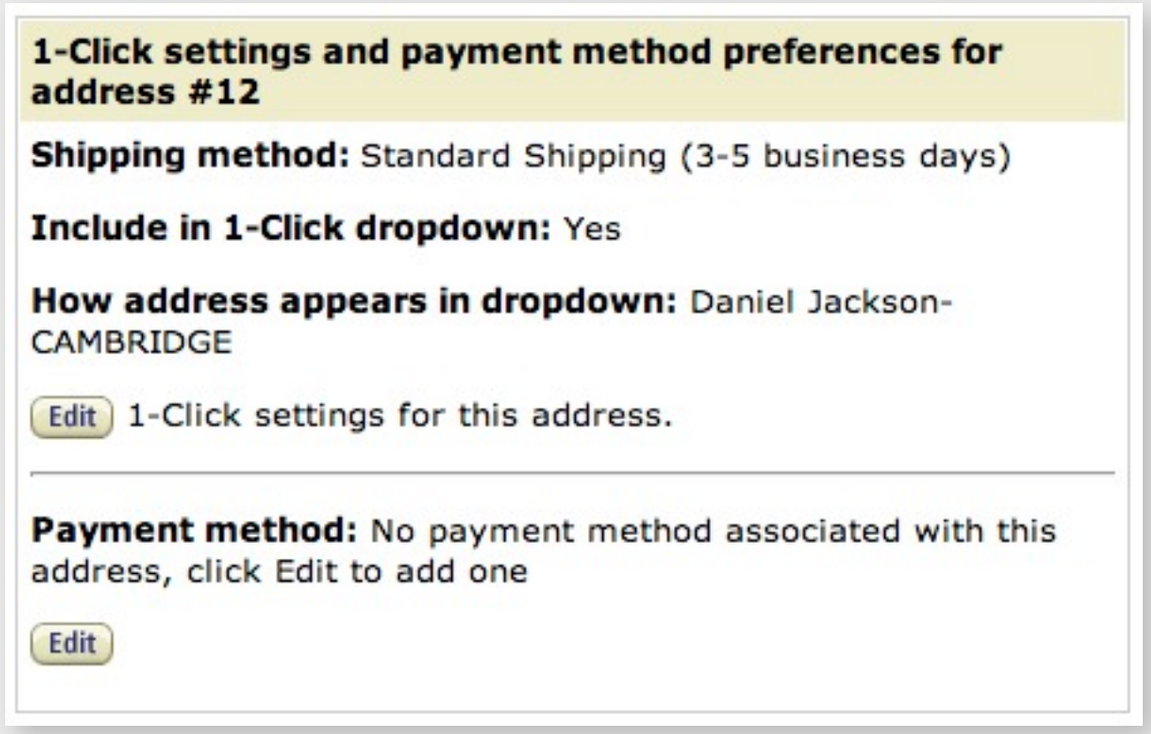


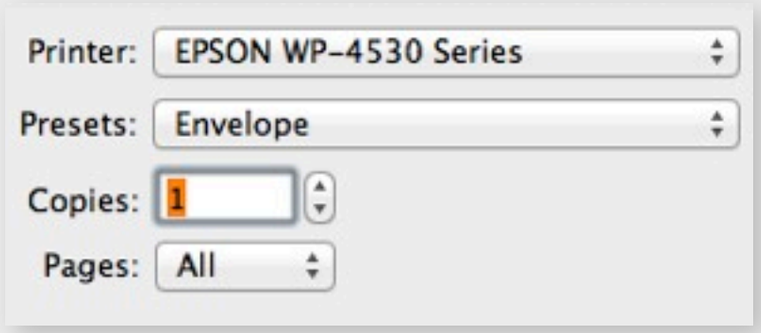
exporting PDF

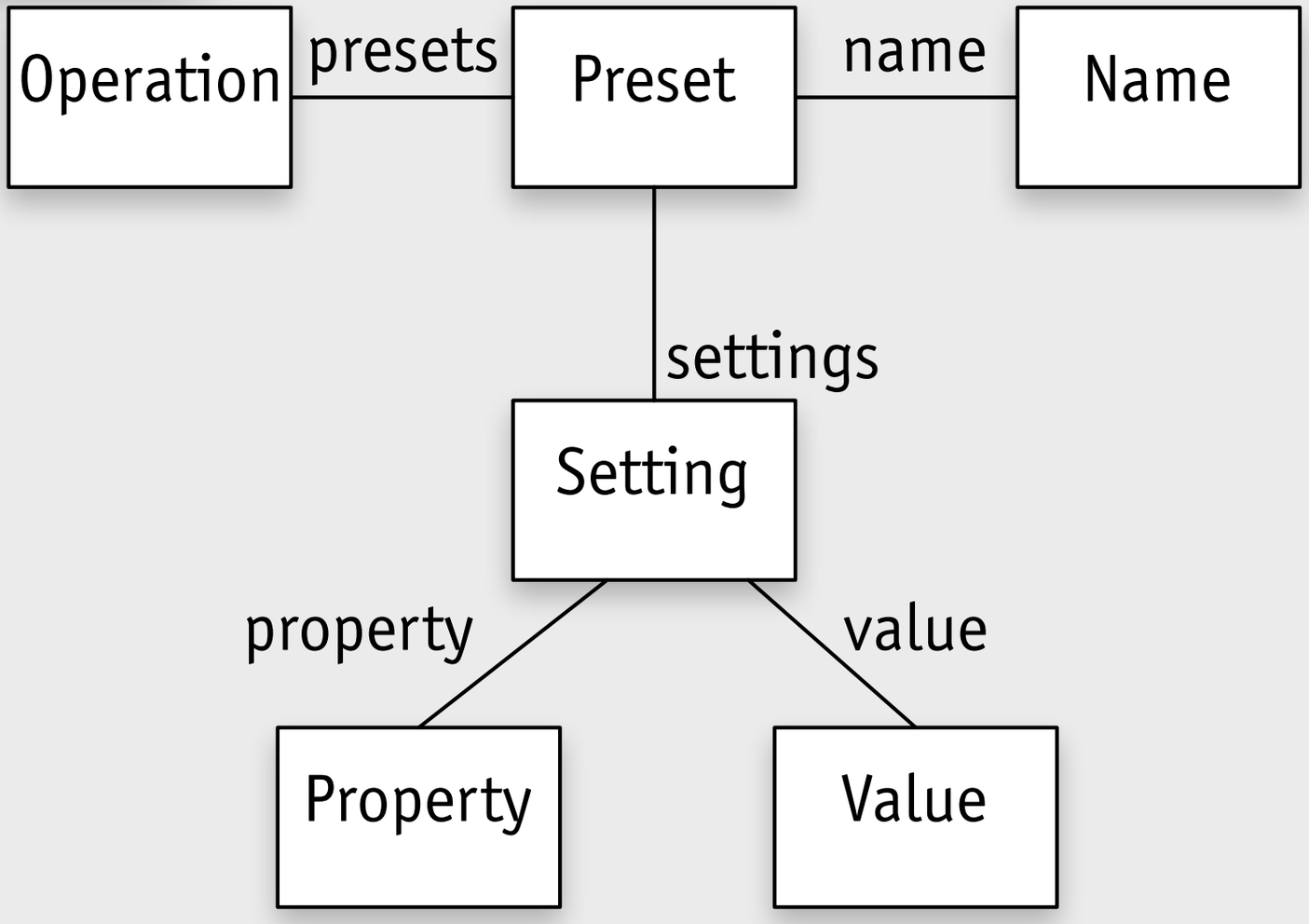


Amazon's one-click settings


Save Adobe PDF
Adobe PDF Preset: [High Quality Print] (Modified)
Standard: None
Compatibility: Acrobat 5 (PDF 1.4)
General
Compression
Output
Security
Summary
General
Description:
Options
Preserve Photoshop Editing Capabilities
Embed Page Thumbnails
Optimize for Fast Web Preview
View PDF After Saving
Save Preset...
Cancel
Save PDF


1-Click settings and payment method preferences for address #12
Shipping method: Standard Shipping (3-5 business days)
Include in 1-Click dropdown: Yes
How address appears in dropdown: Daniel Jackson-CAMBRIDGE
Edit 1-Click settings for this address.
Payment method: No payment method associated with this address, click Edit to add one
Edit


Printer: EPSON WP-4530 Series
Presets: Envelope
Copies: 1
Pages: All


Operation
presets
Preset
name
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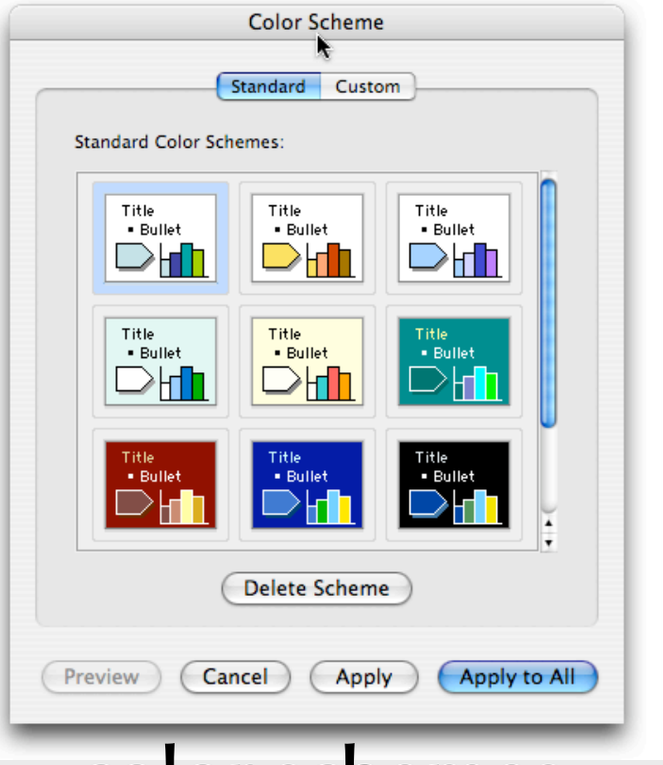
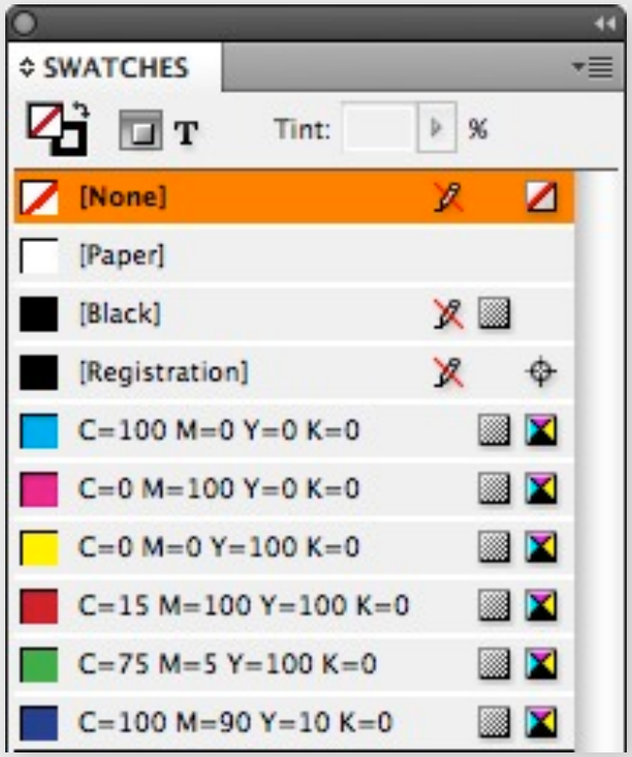
settings
Setting
property
value
Property
Value

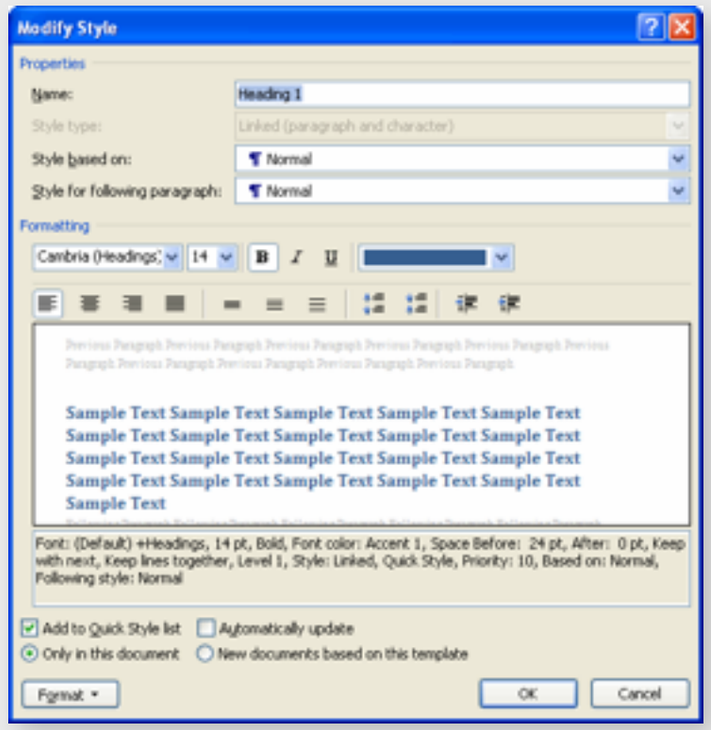
an idiom: styles



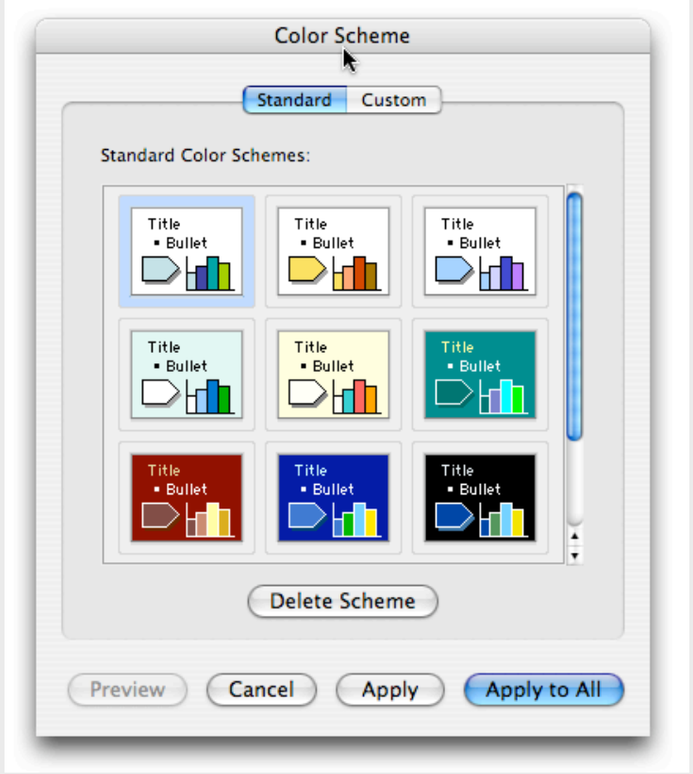
color schemes
in Powerpoint

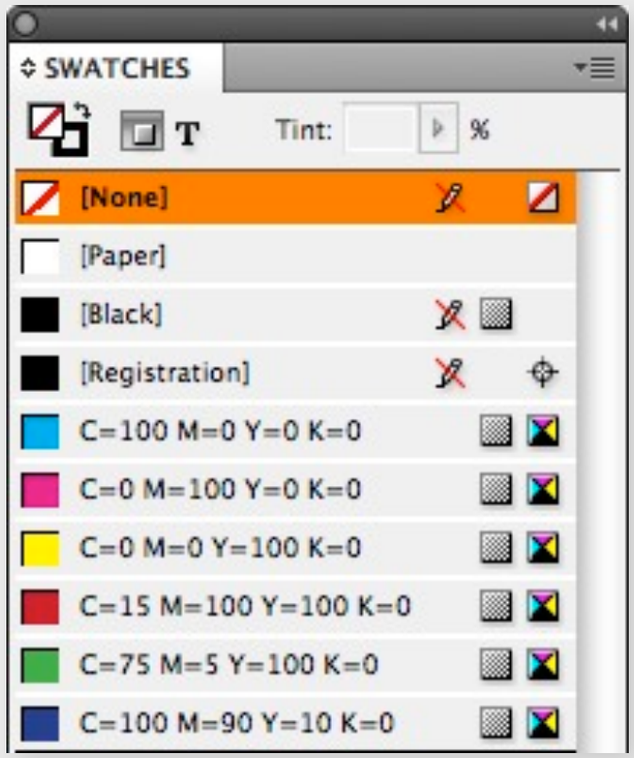


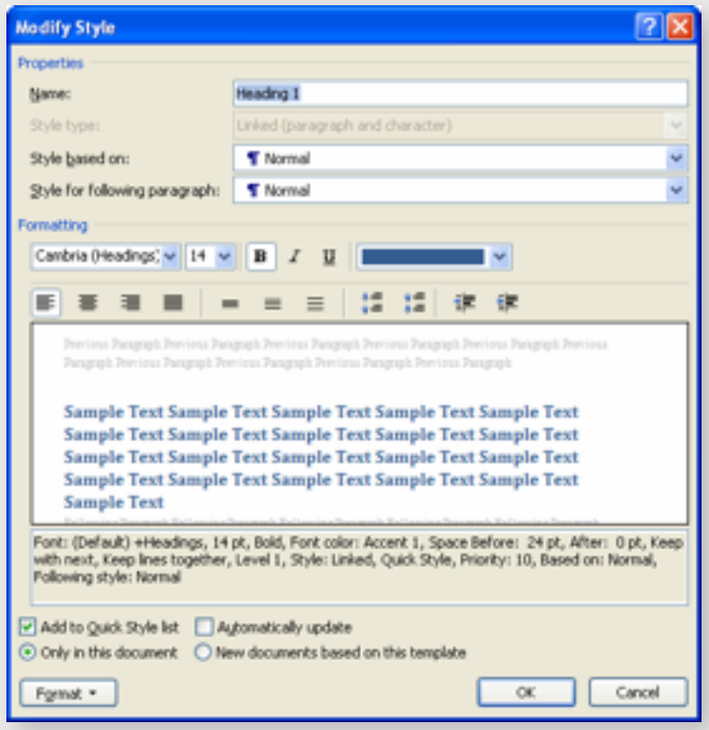
swatches
in Indesign

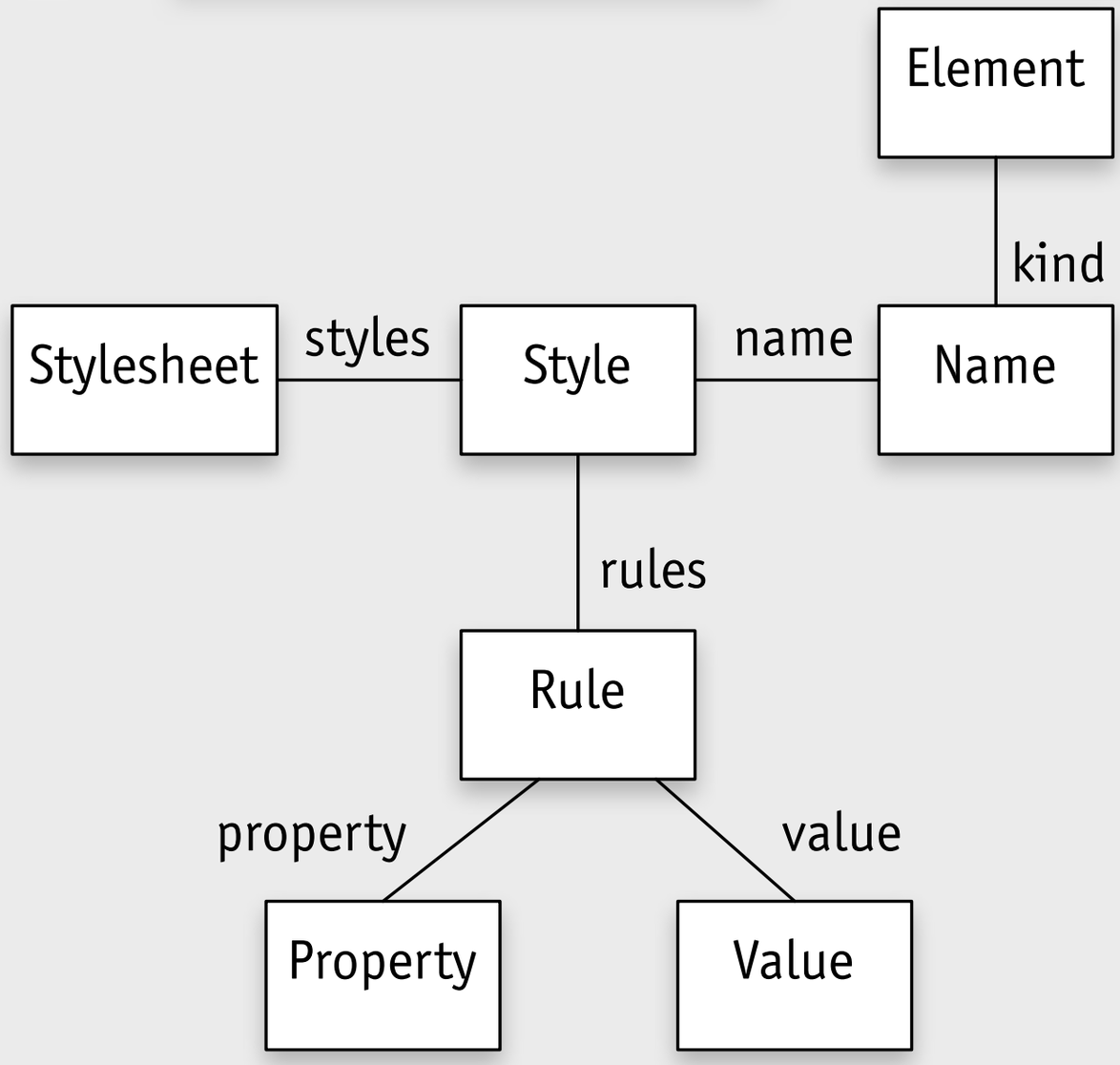


paragraph styles
in Word









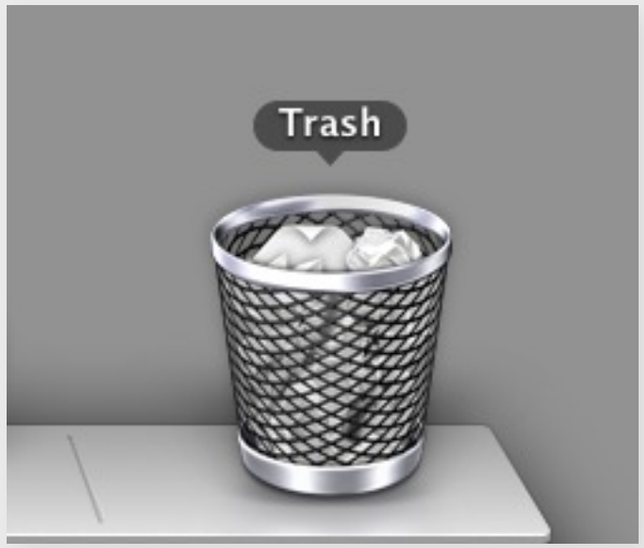
There is no problem in computer science that cannot be solved by introducing another level of indirection.
--David Wheeler

so is it a *good* conceptual model?

conceptual criteria

✗	are the concepts rich enough?
✗	are the concepts simple enough?
✗	are the concepts consistent?
	are idioms & conventions leveraged?
	are suitable generalizations introduced?
	are concepts decoupled?

example: macintosh 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	--

deleting from external drive (eg USB)

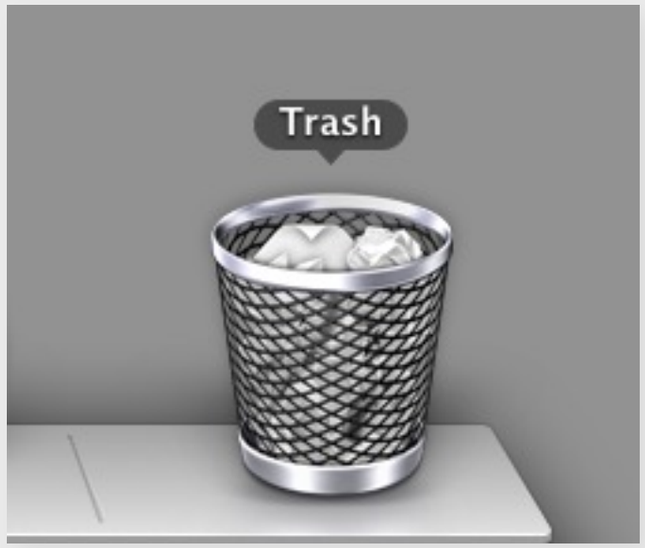
› can't reuse space until trash emptied

retrieving accidentally deleted files

› no date of deletion

partial emptying

› not possible



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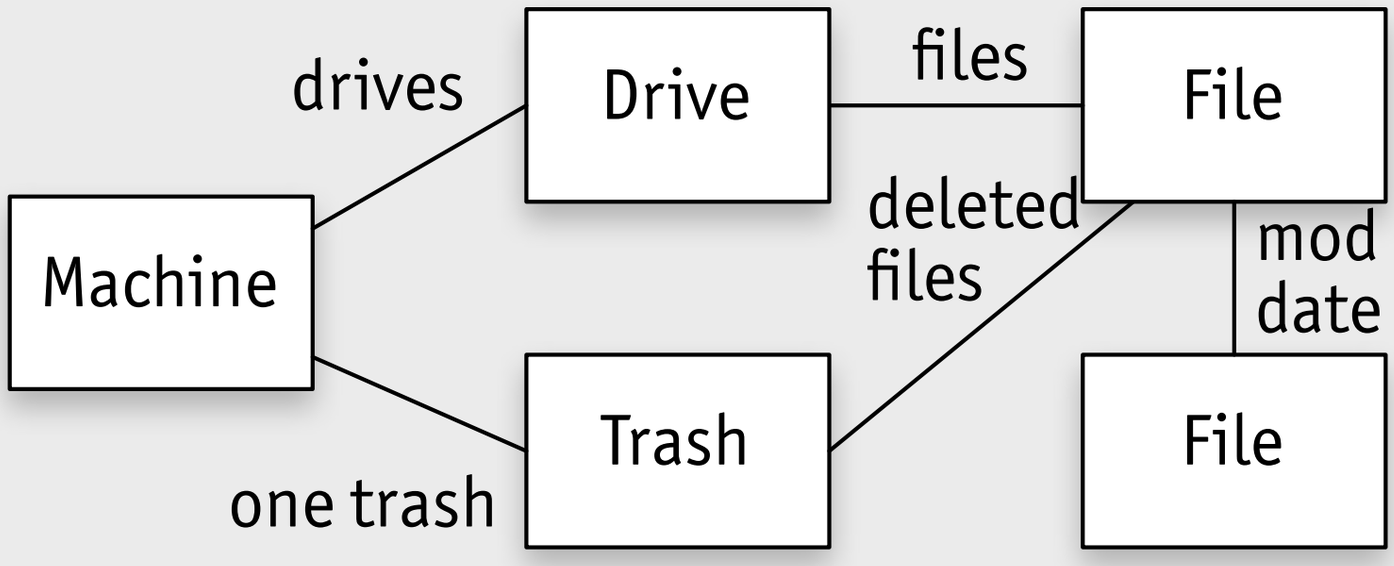
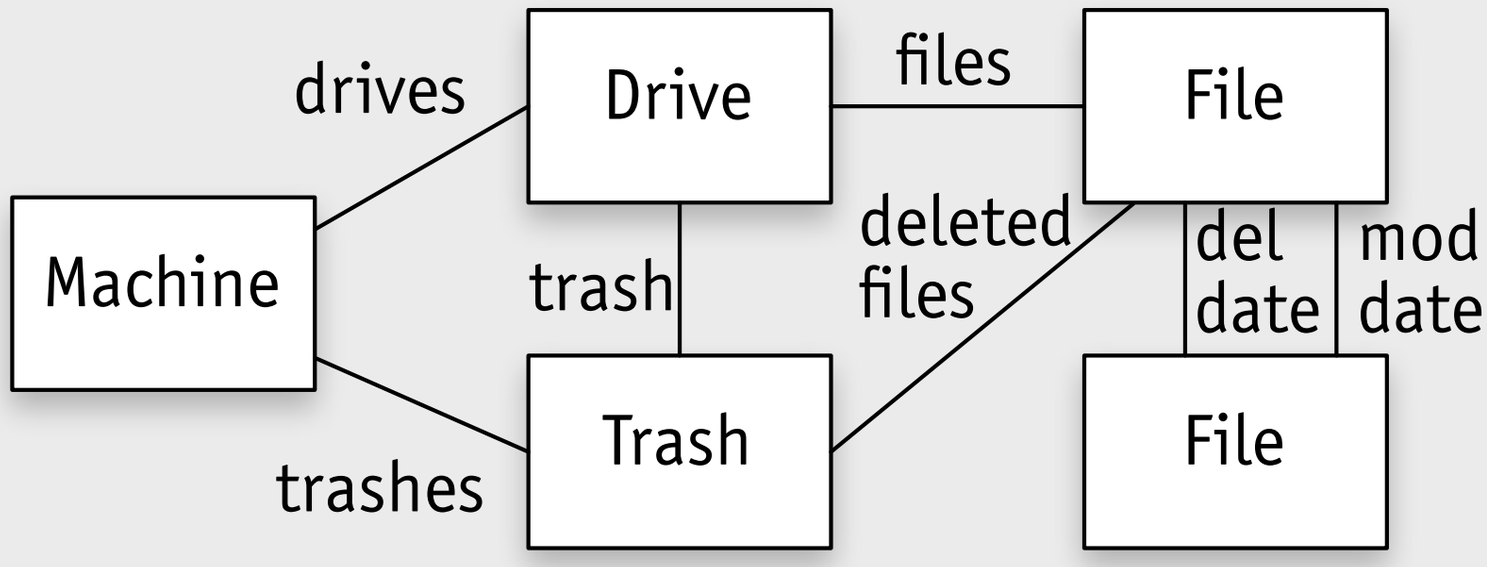
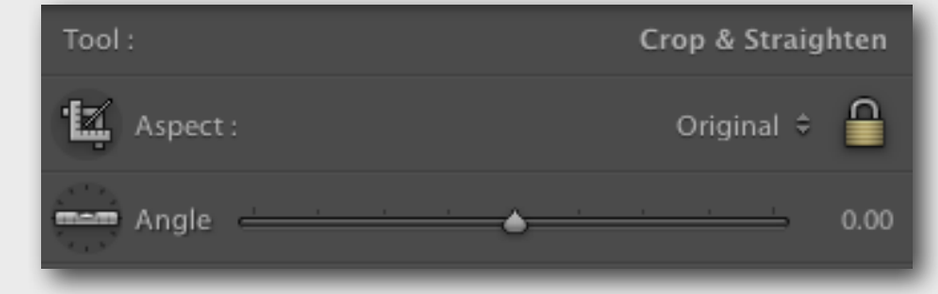


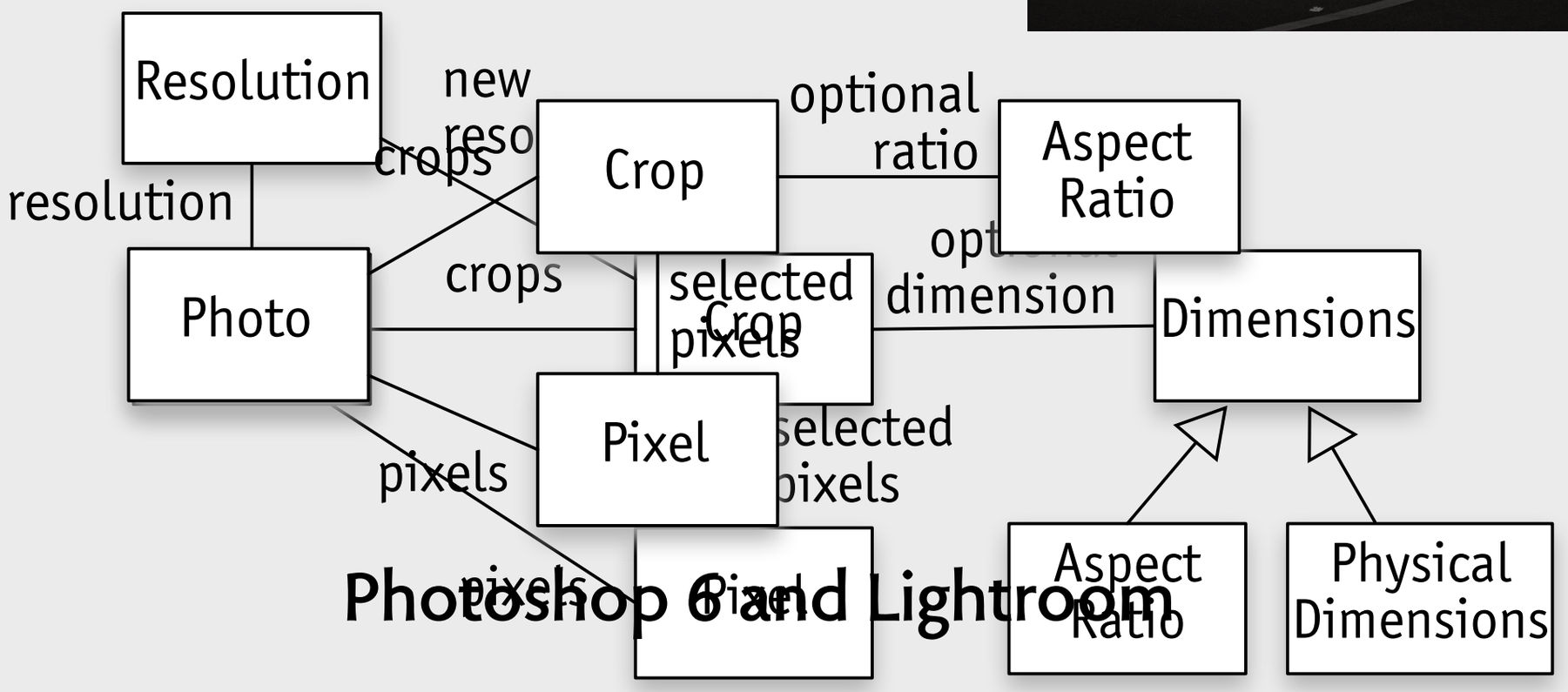
what exists

what we need



example: photoshop cropping

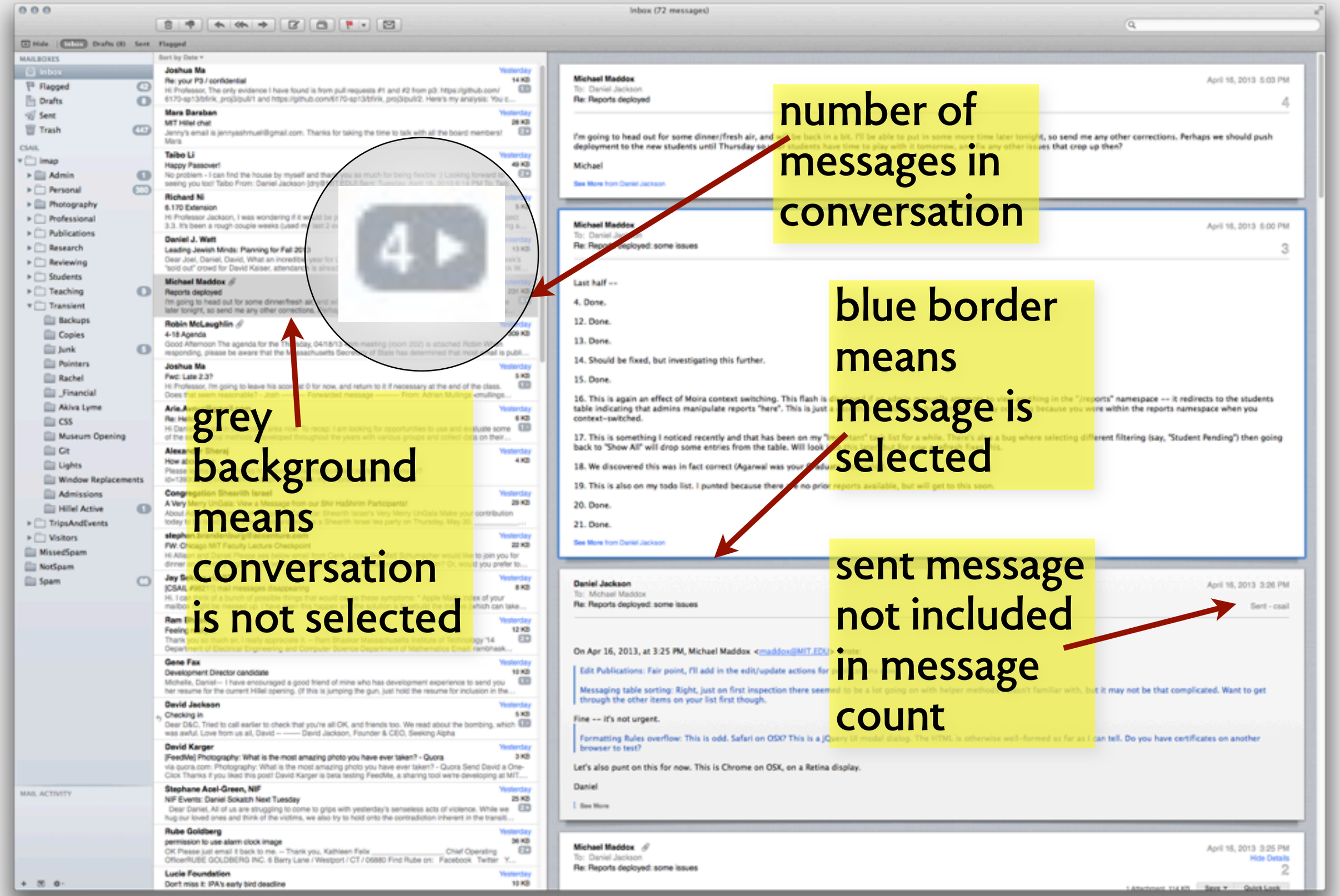


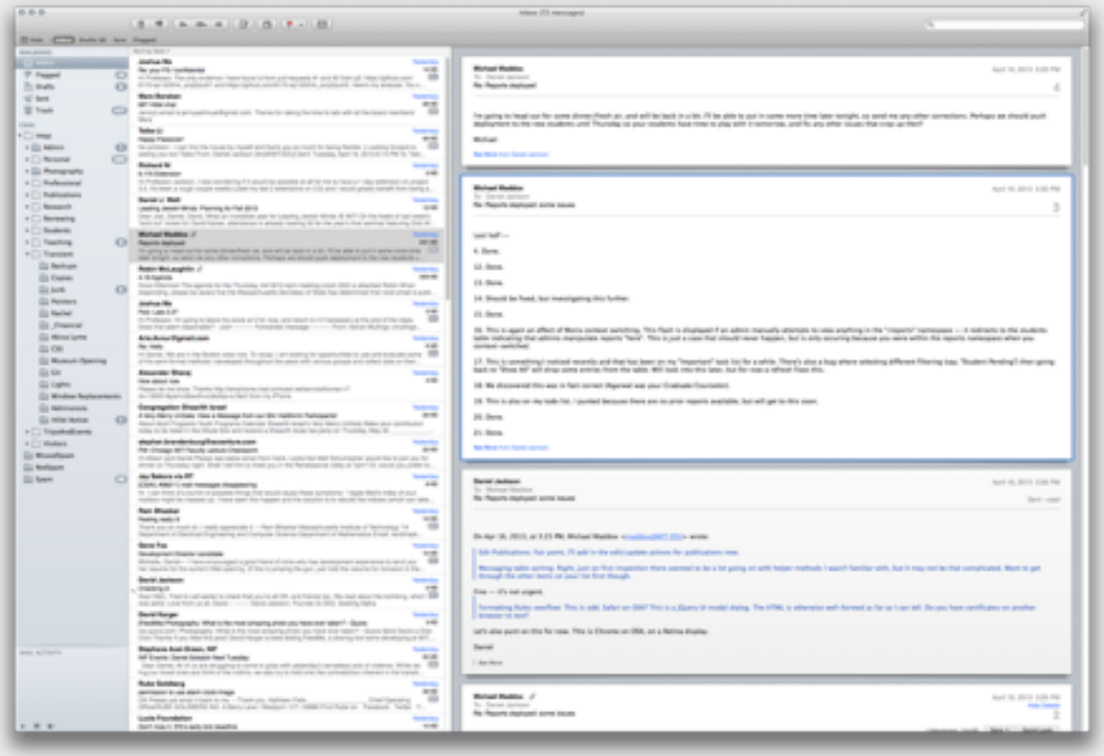


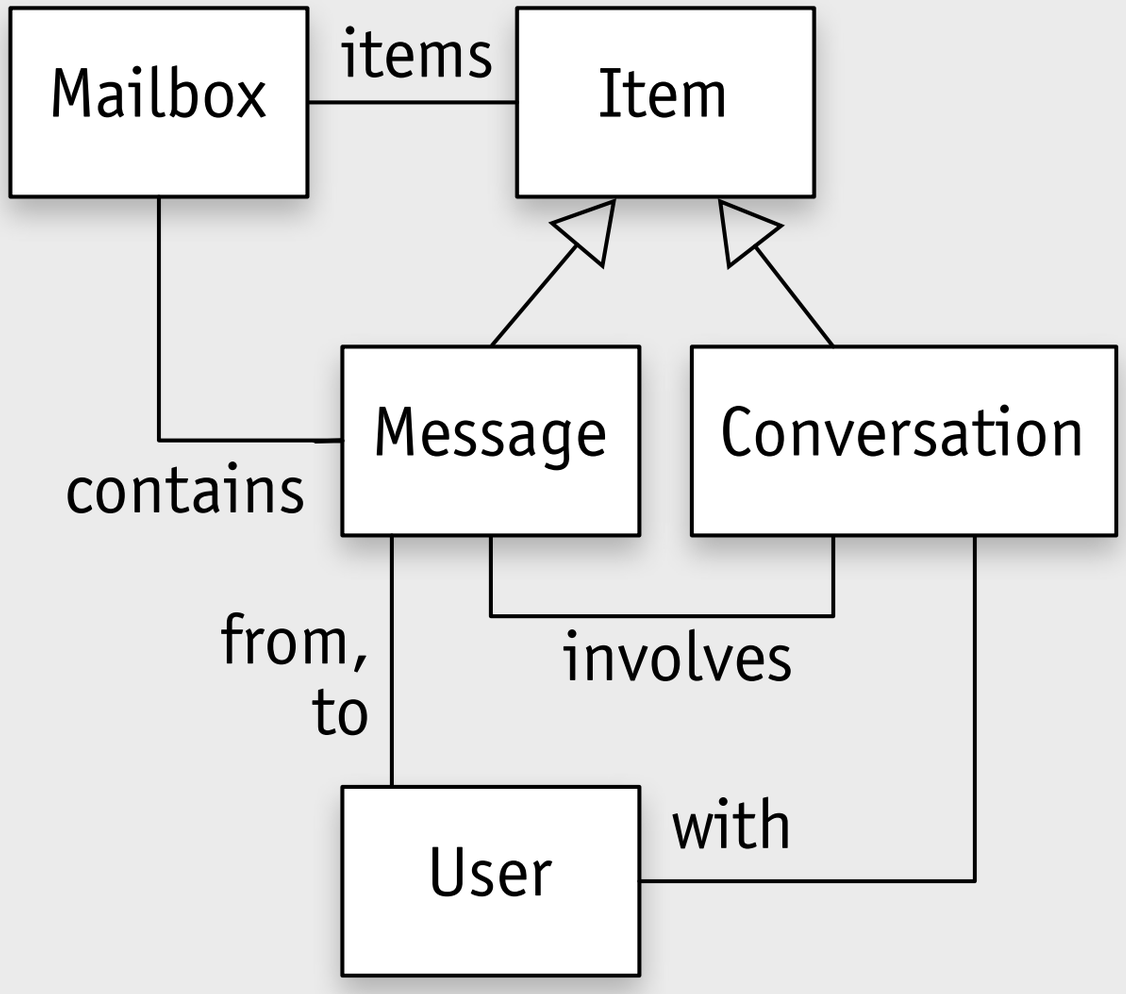
Photoshop 6 and Lightroom

Photoshop 5 and before

example: Apple Mail conversations







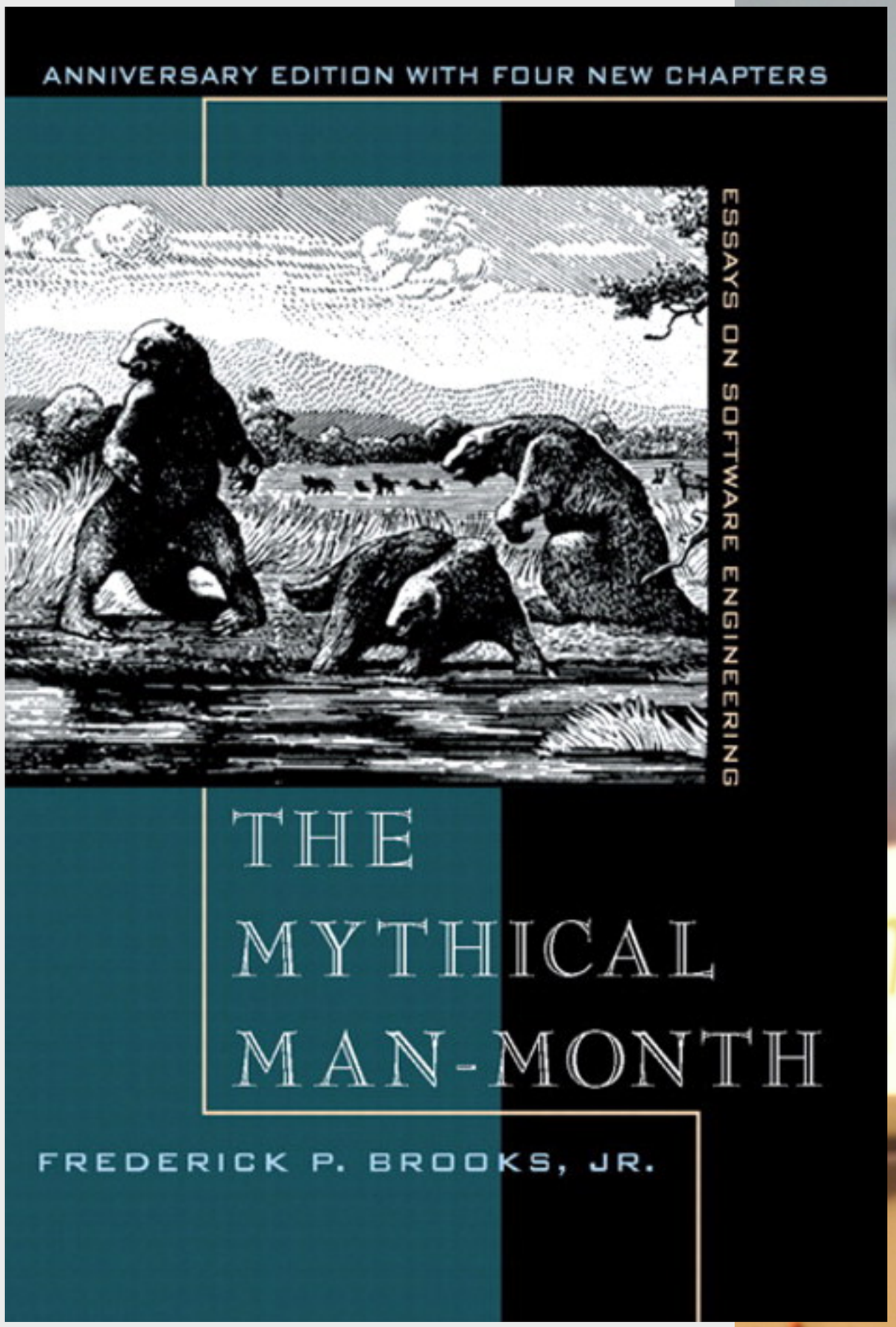
some questions

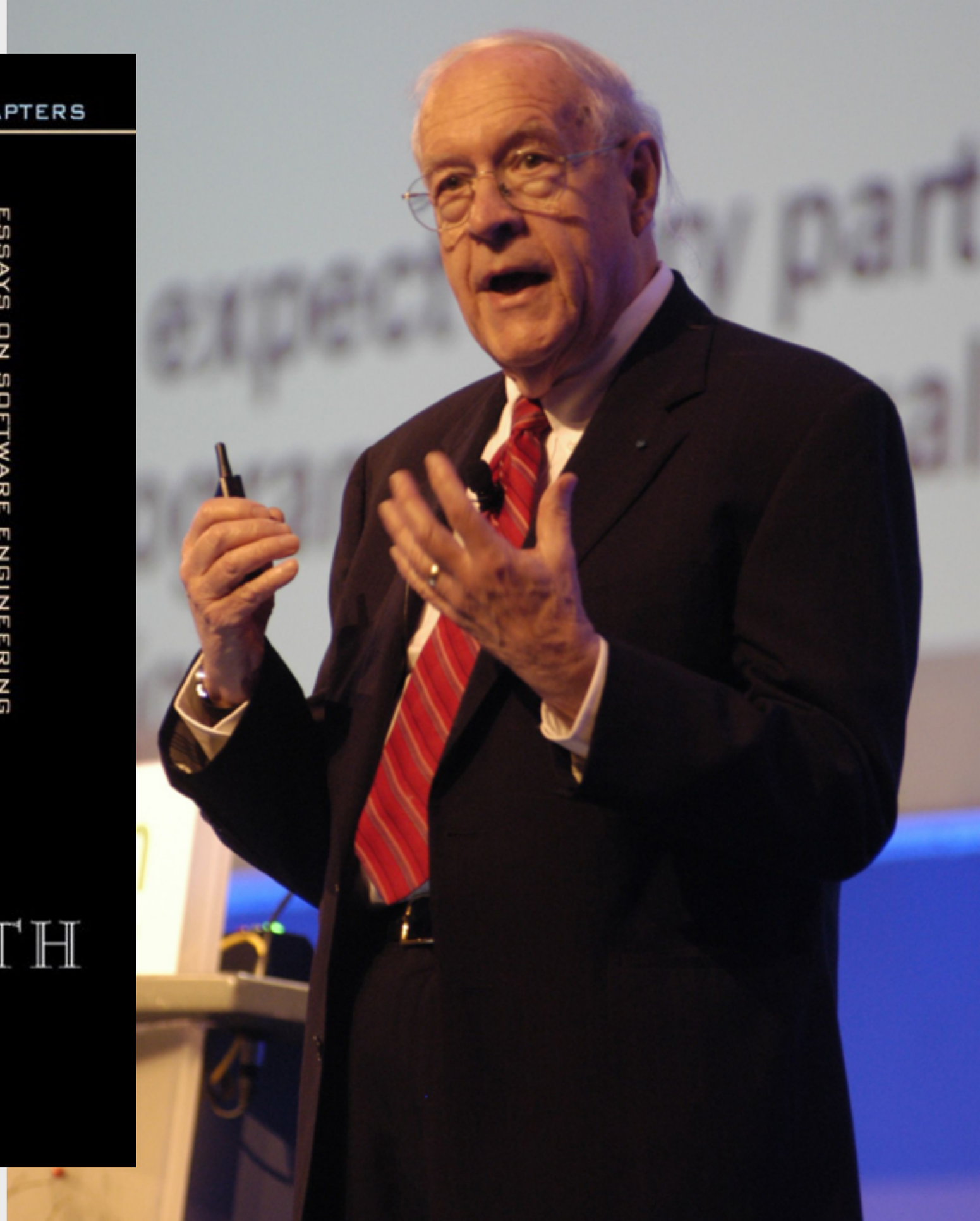
- does a mailbox contain all the messages its conversations involve? *no*.
- do move, delete, etc apply to conversations? *yes*.
- when you move a conversation to another mailbox, do all messages move with it? *no*.

closing thoughts

it's not just about usability

weak concepts	strong concepts
hard to use	intuitive, predictable
a mess to maintain	decoupling & localization
unreliable & buggy	more dependable


ANNIVERSARY EDITION WITH FOUR NEW CHAPTERS
ESSAYS ON SOFTWARE ENGINEERING
THE MYTHICAL MAN-MONTH
FREDERICK P. BROOKS, JR.



Conceptual integrity is the most important consideration in system design.

—Fred Brooks, 1975

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

—Fred Brooks, 1995

Because ease of use is the purpose, this ratio of function to conceptual complexity is the ultimate test of system design. Neither function alone nor simplicity alone defines a good design.

building a method of conceptual design

analysis tools

design criteria

modeling notations

idioms & patterns

underlying theory

case studies

alloy.mit.edu

alloy: a language & tool for relational models

about alloy

Alloy is a language for describing structures and a tool for exploring them. It has been used in a wide range of applications from finding holes in security mechanisms to designing telephone switching networks.

An Alloy model is a collection of constraints that describes (implicitly) a set of structures, for example: all the possible security configurations of a web application, or all the possible topologies of a switching network. Alloy's tool, the Alloy Analyzer, is a solver that takes the constraints of a model and finds structures that satisfy them. It can be used both to explore the model by generating sample structures, and to check properties of the model by generating counterexamples. Structures are displayed graphically, and their appearance can be customized for the domain at hand.

At its core, the Alloy language is a simple but expressive logic based on the notion of relations, and was inspired by the Z specification language and Tarski's relational calculus. Alloy's syntax is designed to make it easy to build models incrementally, and was influenced by modeling languages (such as the object models of OMT and UML). Novel features of Alloy include a rich subtype facility for factoring out common features and a uniform and powerful syntax for navigation expressions.

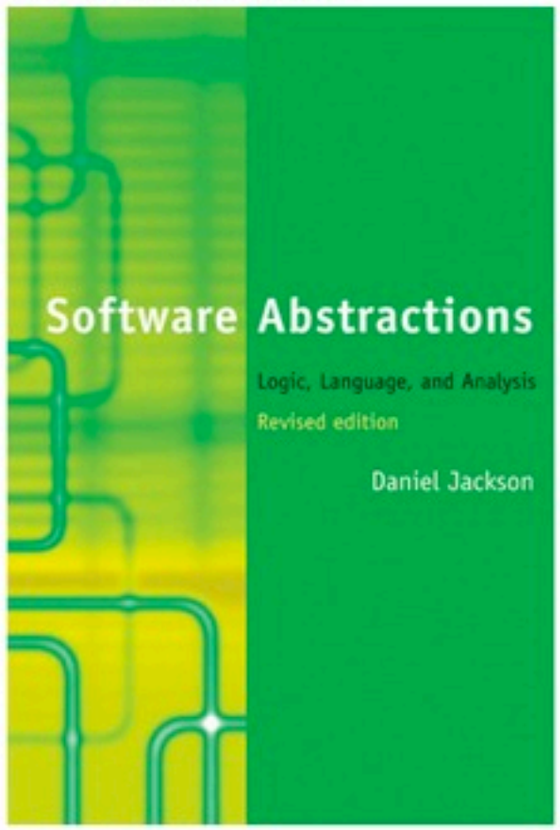
The Alloy Analyzer works by reduction to SAT. Version 4 was a complete rewrite that included Kodkod, a new model finding engine that optimizes the reduction, and a new front end.

news

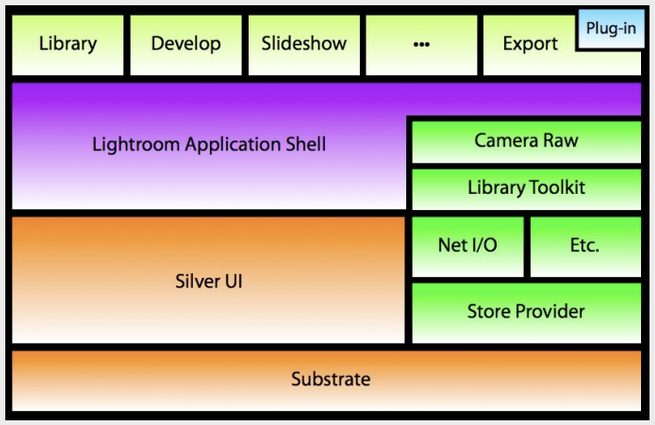
ASM, Alloy, B and Z Conference: 6 new publications on Alloy.

A Japanese translation of book published!

Revised edition of book now out!
Available from MIT Press.



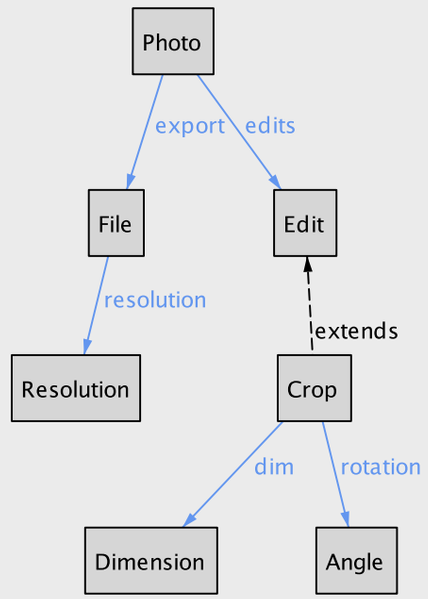
the heart of software



code

interface

user's model



conceptual model

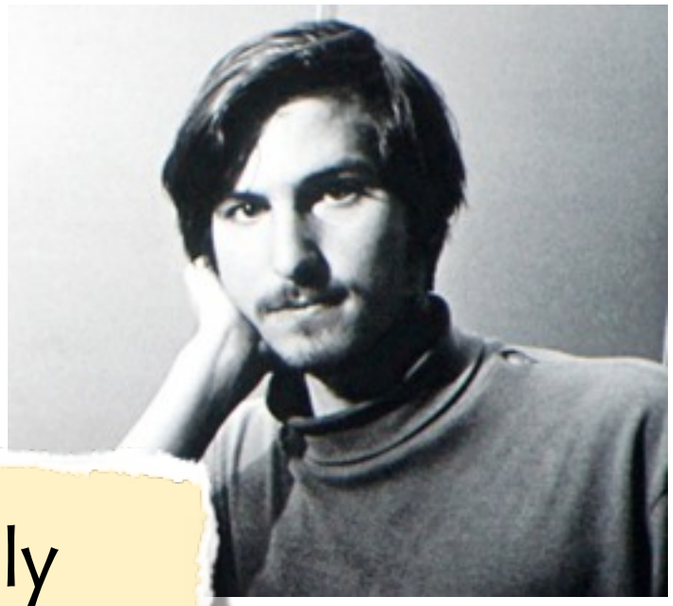
Lightroom architecture diagram from
http://www.troygaul.com/LrExposedC4.html

takeaway

conceptual design is
at the heart of the design of software
and many other complex systems

it's what you do
if you're an analysis, consultant, programmer...

focusing on concept structure
low cost, potentially high gain



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