# towards a theory of conceptual design for software

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Onward, SPLASH · Pittsburgh · October 29, 2015

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# three software design problems

# 

# email categories

# gmail's categories

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公 🗆	Keith Muhammad at DeMont.	DeMontrond Auto Group - 141	01 North Freeway Housto	Aug 26
☆□	betterbatonrougejobs.com	Job Update 2015-08-26 - Loo	king For An Advantage W	Aug 26

# category tab settings

# Categories: ✓ Primary Learn more ✓ Social ✓ Promotions Updates □ 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



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.



ne,

# 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 (!)



### 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



# 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!





# what's a font?

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# 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

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	Keith Muhammad at DeMont.	DeMontrond Auto Group - 14101 No	orth Freeway Housto	Aug 26
	betterbatonrougejobs.com	Job Update 2015-08-26 - Looking F	or An Advantage W	Aug 26

#### categories: **a redundant concept**

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Light

#### subfamily: **a missing concept**

# what's an app about?

# what characterizes an app? concepts!

Apple Mail

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#### Microsoft Word



Paragraph Format Style

#### Twitter



Tweet Hashtag Following

#### Photoshop



PixelMap Layer/Mask Adjustment

# concepts define classes



#### 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



Microsoft Word, 1983

so what exactly is a concept?

## a timer



## a non-conceptual description



# 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



# NOTES ON THE SYNTHESIS OF FORM HRISTOPHER ALEXANDER Lass of the University

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

purpose: allow undo of deletions



**concept**: trash

**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



concepts





## 4 bad smells



# 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

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to working with you on coordinating your graduate student support process on Monday, about your plans and if you intend on supporting graduate students at CSAIL over the

onday. March 23rd with a link to your specific PI form which will include your

# unmotivated concepts



C2

**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

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# 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

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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

#### **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

#### correctly predicting behavior



# conclusions

# what else is in the paper?





## 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

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programming hard & technical about content

# a better view of software design



conceptual design: essential concepts & behavior

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representation design: organization & performance