software
studio

conceptual design

Daniel Jackson

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purposes

in this week’s lectures
what high-level software design is about

problem analysis
part of design, not a precursor

purposes
what they are & why they drive design
why inevitably incomplete

concepts
what they are & why they are design
how to express & evaluate
where do inventions come from?
slow progress

over many years...
many small improvements
add up to major change
one day...
a new technology becomes available
and makes an old problem solvable
teflon

cell phones

camera sensors
one day...

an inventor has a eureka moment
often inspired by something very different
**Velcro, 1941**

George de Mestral notices burdock burrs sticking to his dog’s fur
Microwave oven, 1955
Percy Spencer notices that candy bar melts when standing in front of radar
formulating the right problem

one day...
someone understands a problem
and formulates it in a crisp way
then others take up the challenge
The next question was the obvious one, “Can we produce a secure encrypted message, readable by the authorised recipient without any prior secret exchange of the key etc?” This question actually occurred to me in bed one night, and the proof of the theoretical possibility took only a few minutes. We had an existence theorem. The unthinkable was actually possible. The only remaining question was “Can it be made practicable?”. This took a while to answer.

James Ellis talking about ‘non-secret encryption’ (1970)
generalizing a problem

over time

a more general problem emerges
unifies problems across domains
Masoretic text (7th C) and RAID (1987)
examples of general problem of reliable transmission over unreliable channel
shrinking a problem

one day...
someone realizes problem is too hard
formulates a simpler problem
whose solution ends up subsuming the harder one
Tim Berners Lee’s browser (1991)

new problem: share documents; old problem: distributed computing
growing a problem

one day...
someone tries to solve a bigger problem
and realizes it’s easier than solving the smaller one
old problem: serve traffic data; new problem: obtain & serve traffic data
identify the real problem

one day...
someone sees that the problem is a larger one
Lytro light field camera (2012)
old problem: focus image on sensor; new problem: select a focused image
mpMan, first MP3 player (1998) iPod & iTunes (2001)
old problem: build an MP3 player; new problem: provide a music service
Mimio interactive whiteboard (2010)
old problem: make image of whiteboard;
new problem: use whiteboard to make image
Vehicle Identification Number (1954)
old problem: make car theft hard; new problem: reduce car theft
you might think
technology advances because of clever solutions

but (more?) often
technology advances because someone rethinks the problem
designing
on purpose
design is driven by purpose

- purpose
- motivates
- contrivance
- fulfills?
- misfit

✘
example: a photo wall

- changeable wall display of prints
  - motivates
    - adhesive corners
      - not strong enough
    - corkboard tiles
      - damages prints
    - magnetic paint
      - fulfills?

✔
as implemented
refining the purpose with misfits

- adhesive corners
- corkboard tiles
- magnetic paint
- blocks wifi

- changeable wall display of prints
- strong enough
- no damage

motivates

fulfills?

anticipated 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. This is because it is through misfit that the problem originally brings itself to our attention. We take just those relations between form and context which obtrude most strongly, which demand attention most clearly, which seem most likely to go wrong. We cannot do better than this.
designing the user too

purpose

fulfills?

contrivance

assuming a user behavior
example: magnetic paint

changeable wall display of prints

fulfills?

magnetic paint

six coats

neodymium magnets
example: aligning elements

purpose: help align objects

a contrivance: autoalign

a better contrivance: snap align
example: auto align

align diagram elements

motivates

fulfills

user applies operations
example: snap align

align diagram

elements

fulfills

motivates

user moves until guideline flashes

snap align
in conventional software terms

requirements

specification

purpose

contrivance

fulfills?

anticipated misfits

assuming a user behavior
conclusions

specifications
are precise designs descriptions
includes design of user too

requirements
can never be complete or precise
best we can do: purpose + known misfits
unity of purpose
Mitchell and Webb: “Unity of Purpose”
activity: identifying purposes
the purpose game

labels in Gmail

trashcan

color labels

friendship in FB
what's the purpose of dropbox?

Securely share, sync, and collaborate

Dropbox for Business is the secure file sharing and storage solution that employees love and IT admins trust.

**share**: control who can read your files

**sync**: keep files on multiple machines consistent

**collaborate**: support multi-user editing of documents

**store**: expand space available by storing files in the cloud
spot the purpose!

**a purpose is**
not a specification (how it’s achieved)
not an anticipated misfit (what might do wrong)
not a qualification (how well it fits)

**which is a true purpose for a file synchronizer?**
low latency for file transfers
ultra-high availability
enable access to files on multiple machines
backup in case of hardware failure
support for OS X, Windows and Linux
design thinking
a search for design methods...

popular approaches
  design thinking
  agile development
user-centered design
optimize organization & task structure
Taylor (1880s), Toyota JIT (1980s), CMM (1990s), agile (2000s)
“new” activities

brainstorming

user studies

prototypes
Dieter Rams, 1958
pocket transistor radio T3

Henry Hobson Richardson, 1877
Trinity Church, Boston

Alfonso Bialetti, 1933
La Moka coffee maker

Leica, 1953
M3 rangefinder camera
broadening

anthropology

psychology

art

economics
design thinking
an exciting popular movement
advocates a design ‘way of thinking’

elements of design thinking
incremental process
user involvement
early & frequent prototyping
engaging other fields

but not a design method
doesn’t address design per se
what is software design?
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.
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
To see what rate of progress one can expect in software technology, let us examine the difficulties of that technology. Following Aristotle, I divide them into essence, the difficulties inherent in the nature of software, and accidents, those difficulties that today attend its production but are not inherent.

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

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

software design: smoothing rough & sharp edges big picture by attention to small details

“That’s quite obsessive, isn’t it?”
Jonathan Ive
https://www.youtube.com/watch?v=zaLMOSWAwdw
three
snafus
my camera fuji x100s
image quality setting

The image shows a menu with options for image quality settings. The options available are:

- Fine
- Normal
- Fine+Raw
- Normal+Raw
- Raw
aspect ratio
“image size” setting
non-standard ratio + RAW?
“image size”, revisited

“image size” is a very strange concept
what’s the snag?

**coupling**
aspect ratio & quality settings
can’t change independently

**confusion**
image size is image quality & ratio
#2 email categories
gmail's categories

Your messages are automatically categorized into the following optional tabs:

<table>
<thead>
<tr>
<th>Tabs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Messages from friends and family, as well as any other messages that don't appear in other tabs.</td>
</tr>
<tr>
<td>Promotions</td>
<td>Your deals, offers, and other promotional emails.</td>
</tr>
<tr>
<td>Social</td>
<td>Messages from social networks, media-sharing sites, online dating services, gaming platforms, and other social websites.</td>
</tr>
<tr>
<td>Updates</td>
<td>Notifications such as confirmations, receipts, bills, and statements.</td>
</tr>
<tr>
<td>Forums</td>
<td>Messages from online groups, discussion boards, and mailing lists.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary</th>
<th>Social</th>
<th>Promotions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keith Muhammad at DeMont.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T High Speed Internet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keith Muhammad at DeMont.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>betterbatonrougejobs.com</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

New sign-in from Chrome on Mac - New sign-in from Chrome on Mac - 12:30 pm
DeMontrond Auto Group - 14101 North Freeway Housto - 12:19 pm
AT&T High Speed Internet Service Activation - Your A1 - 10:37 am
DeMontrond Auto Group - 14101 North Freeway Housto - Aug 26
Job Update -- 2015-08-26 - Looking For An Advantage W - Aug 26
Choose which message categories to show as inbox tabs. Other messages will appear in the Primary tab.
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.
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 tabs are based on these new categories. When you create a filter, in addition to being able to label a message, you can now categorize it as: Personal, Social, Updates, Promotions, or Forums from a drop-down box. These, as you see, match the tabs.

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.
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's the snag?

what are categories?
look like labels, smell like labels...
but not quite labels

non-uniformity

can't use labels as tabs
tabs only apply to the inbox
#3 fonts & styles
what’s a font?
what’s the snag?

styles are broken

  can’t define a style that italicizes all fonts:
  Arno Regular to Arno Italic
  Futura Book to Futura Book Oblique
  Magma Light to Magma Light Italic
what kind of problems are these?

coding errors?
does the code meet the spec? are there bugs?

user interface design?
is the user interface not learnable, efficient or safe?

3 kinds of concept snag
confused concept: image size
redundant concept: category
missing concept: font subfamily
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, character set

word processor
paragraph, format, style

desktop publishing app
text flow, link, 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?
– Jamon
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

Microsoft Word, 1983

Bravo, 1974
kinds of concept

<table>
<thead>
<tr>
<th>domain concepts</th>
<th>instrumental concepts</th>
<th>enabling concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>electoral vote</td>
<td>hashtag</td>
<td>relative reference</td>
</tr>
<tr>
<td>reservation</td>
<td>label</td>
<td>public key</td>
</tr>
<tr>
<td>social security number</td>
<td>friend</td>
<td>layer mask</td>
</tr>
<tr>
<td>calendar event</td>
<td>follower</td>
<td>conference call</td>
</tr>
</tbody>
</table>
activity: identifying concepts
spot the concept!

what are the concepts of a browser?
abstract affordances
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.
The Design of Everyday Things

Donald A. Norman

Donald Norman
James Gibson (1977): “action possibilities” latent in environment
Donald Norman (1988): action possibilities that are perceivable
a door with good affordances

“affords pushing”

“affords pulling”
"norman doors"

push or pull?

door with user manual

conflicting instructions
Who Is in These Photos?

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

Who is this? Who is this?

Skip Tagging Friends

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

When someone adds a tag to something you shared, it's visible to:
- The audience you chose for the post or photo
- The person tagged in the post and their friends

as a textual constraint in Alloy:
all i: Image | sees.i = (posts.i).friends + (i.tags).friends
what facebook should say

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

When someone adds a tag to something you didn’t share, it's visible to:
- All of their friends and fellow psychopaths
- All of your future employers, boyfriends, girlfriends and in-laws
for physical designs
effects are clear, if hard to predict
affordances connect actions to effects

for software designs
effects are often not clear
affordances become ‘abstract’

so we need to
convey to users effects of actions
challenge: effects are indirect
understanding mechanisms with concepts
a timer
a non-conceptual description

\[
\begin{align*}
\text{tick} & \quad \text{toggle(day)} \\
\text{toggle(night)} & \quad \text{ON} \\
\end{align*}
\]
a conceptual explanation

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

**data model**
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
data model

- Device
  - Activated
  - schedule
- Schedule
- Slot
  - Now
  - slots
a concept is...

an increment of functionality
that fulfills a purpose
contributing to the system’s overall purpose
with its own state
visible to the user
with its own actions
performed by the user
affecting the external world
but often only indirectly
the operational principle
a better 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

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

Michael Polanyi
“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 a file and it belongs to a folder with keyboard focus, then pressing delete will move the file to the trash”
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)
concept
purposes
design is driven by purpose

- purpose
- motivates
- fulfills?
- contrivance
- misfit
concept design driven by purpose

application purpose

purpose

motivates

fulfills?

purpose

motivates

fulfills?

purpose

motivates

fulfills?

application

concept

concept

concept
the fundamental principle

in a well-designed system
each concept is motivated by one purpose
create & format documents

- consistency within docs
- formatting unit
- consistency across docs

motivates

- style
- paragraph
- stylesheet

Microsoft Word
concept
distinctions
given vs instrumental concepts

Instrumental:
invented for app
- banking app
  - overdraft protection loan
  - automatic bill payment
  - available funds balance
  - account balance

Given:
preexisted in domain
- social networking app
  - friendship
  - tag
  - post
  - photo
  - URL

- travel app
  - itinerary
  - agony factor
  - passenger profile
  - flight number
  - reservation

Note that all concepts, even given concepts are a means to an end.
these are not concepts...

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

search     authentication

<table>
<thead>
<tr>
<th>purposes</th>
<th>concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>search string</td>
<td>certificate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DOM element</th>
<th>HTTP request</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>implementation details</th>
</tr>
</thead>
<tbody>
<tr>
<td>concepts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>web page</th>
<th>link</th>
</tr>
</thead>
</table>
analyzing concepts
the ideal mapping

purposes

P1  --  C1

P2  --  C2

concepts
4 bad smells

- Unfulfilled purpose
  - P1
  - C1
  - P2

- Unmotivated concept
  - P1
  - C1
  - C2

- Overloaded concept
  - P1
  - C1

- Redundant concepts
  - P1
  - C1
  - C2
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

Search results for "shafi" in Apple Mail.
unmotivated concepts

buffer (emacs)
no reason not to save to file

stash (Git)
addresses branching misfits

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]
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

Pamela Zave: Secrets of CF
overloaded concepts epson driver

result: can’t create custom size for front loading
overloaded concepts epson driver

select paper dimensions

select paper source in printer

paper size
Orthogonality is violated when one concept's fitness for purpose is undermined by another concept.
non-orthogonal concepts

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

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

listserv & bcc (SMTP)
modified subject reveals target

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

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

group & connector (Keynote 5.3)
can’t select box if connected
set ratio

image size

set image quality

image quality

an orthogonality violation

set ratio

image size

set image quality

image quality

overloaded concept too
uniformity is violated when a concept has different versions or instantiations that behave differently for no good reason
non-uniform concepts

- deposits by check (banking)
  funds arrive before clearing

- primitive type (Java)
  not like a class type

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

- alerts (Apple iCal)
  can’t select email alerts for default

- custom settings (Fuji x100s)
  only some settings selectable
activity: reverse
engineering concepts
reverse engineering concepts

figure out the
concept purpose
operational principle

for these concepts
grouping in drawing apps
shopping cart in online store
contact (on phone, eg)
symbolic link in file system
call forwarding in telephone switching
return merchandise authorization
pixel measurements in CSS
activity: analyzing misfits
analyzing misfits

for each misfit
identify the concepts
pinpoint what the problem is

trimming conversations in Gmail
can only delete conversation, not message

losing renames in backup and version control
when file is renamed, looks like deletion+creation
conceptual acrobatics
Field Trip Permission Form

Dear Parents:

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

Thank you!

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

[Signature]

February 11, 2013

Parents signature ___________________________ Date ____________
acrobat to the rescue

how to add a signature in acrobat
-- open document in acrobat
-- Tools—>Advanced Editing—>Touchup Object Tool
-- right click at desired point | Place Image...
then select jpg

how to add date
-- Tools—>Typewriter
what we hate ... & love

from http://amplicate.com
cropping in adobe lightroom
cropping photoshop

Width: 6 in
Height: 4 in
Resolution: pixels/inch
cropping the whole image
it’s all about the concepts

Acrobat
- text box
- object
- document text

Photoshop
- channel
- layer
- mask

Lightroom
- action
- treatment
- effect

incoherent concepts, no clear purpose

powerful concepts with low level purposes

simple concepts with purposes aligned to common tasks
all’s well that ends well

**acrobat 9**
deployed troubled

**acrobat 10**
user interface tweaks

**acrobat 11**
conceptual reworking
hard to discern any compelling concepts
Field Trip Permission Form

Dear Parents:

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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.

Parents signature  Date
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

Parents signature  August 15, 2014

Date

conceptual reworking: now just text
case studies
small survey of MIT Dropbox users

correctly predicting behavior

- Good knowledge: delete shared folder results in leaving
- Average knowledge: delete shared subfolder removes it
- Poor knowledge: delete shared subfolder removes it

Kelly Zhang
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).
sample misfit
you’re working in a branch and want to switch to another
but there are uncommitted changes
you can’t switch without overwriting work in the new branch
you don’t want to commit unfinished work
best option is to stash, but even that doesn’t work if conflicts

diagnosis
staging area, working directory and branch are coupled
and stash is an unmotivated concept

gitless: new concept of branch
when you switch branches, the working directory changes with it
and all uncommitted changes in the old branch are saved
results of a user study

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Somewhat</th>
<th>Neutral</th>
<th>Agree Somewhat</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
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<td>9%</td>
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</tr>
</tbody>
</table>

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

Task completion time (minutes)

Git Gitless
4 6 8 10 12 14
5 10 15 20
4 6 8 10 12 14
why is css so damn hard?

- control layout
  - set visibility
  - set position
    - set dims & offsets
    - set overlap
      - container-dependent positioning
      - scrolling-independent positioning
    - set width & height
      - exclusion
        - dimension
          - width
          - height
        - offset space
          - viewport space
          - element space

hypothesis: driving design by use cases: gets hopelessly coupled a lesson for agile development?
code analysis opportunities

are defects clustered around fragile concepts?
predict where next defect will be?
focus refactoring efforts?

can concept coupling be inferred?
map modules to concepts & look for interactions

find needless dependences?
compare code & concept dependences
identify dependences due to implementation
conclusions
conclusions

essence of design
is conceptual, not representational

concepts
provide leverage in design at all stages
help you refine design ideas & understand snags

key ideas
purposes & misfits
the operational principle
concepts as abstract affordances