beyond
design
thinking
a sad story
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 ____________
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
what’s wrong?
lack of automation?

It looks like you're writing a letter.

Would you like help?
- Get help with writing the letter
- Just type the letter without help
- Don't show me this tip again

Clippy
2003-2008
RIP
lack of style?

Dieter Rams, 1958
pocket transistor radio T3

Jony Ive, 2001
iPod
poor design process?

- incremental
- user-centered
- prototyping
- evaluation-driven
- brainstorming
flawed user interface?

- Aesthetics
- Anticipation
- Autonomy
- Color
- Consistency
- Defaults
- Discoverability
- Efficiency of the User
- Explorable Interfaces
- Fitts’s Law
- Human-Interface Objects
- Latency Reduction
- Learnability
- Metaphors
- Protect Users’ Work
- Readability
- Simplicity
- State: Track it
- Visible Interfaces

- Visibility
- Feedback
- Constraints
- Mapping
- Consistency
- Affordance

- Navigability
- Consistency
- Feedback
- Mental model

- Visibility of system status
- Match between system and the real world
- User control and freedom
- Consistency and standards
- Error prevention
- Recognition rather than recall
- Flexibility and efficiency of use
- Aesthetic and minimalist design
- Help users recognize, diagnose, and recover from errors
- Help and documentation

**Don Norman**

**Bill Moggridge**

**Bruce Tognazzini**

**Jakob Nielsen**
some claims

problem is deeper in underlying structure, not interface
process is not enough need a new design focus
user testing not informative tells you something’s wrong, not why
a theory of design

what’s it for?

systems, not components
have humans at boundaries
conceptual, not physical

what’s the goal?

making design more systematic
avoiding wasting effort when bound to fail
codifying expert knowledge
distilling what works
concepts & software
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 differentiate 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 is described here:

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
where do concepts come from?

domain concepts: exist in problem domain
- photo, movie, song
- account, balance
- social security number
- 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
- friend, follower
- relative reference
- selection, buffer
- permission, capability
pervasiveness of concepts

software design is primarily
the design of concepts

once concepts are chosen
game over (for the most part)

good concepts
usable, robust, maintainable

bad concepts
frustrating, fragile, inflexible
so what exactly is a concept?
a behavioral model

[Diagram showing a behavioral model with states and transitions labeled as:]
- ON
- OFF

Transitions:
- tick
- toggle(day)
- toggle(night)
on: bool
time: Slot
schedule: set Slot

inv on = (time ∈ schedule)
tick ≜ time := next(time)
toggle (s: Slot) ≜
  if s ∉ schedule then schedule := schedule ∪ {s}
  else schedule := schedule \ {s}
concepts as explanatory state

a concept is part of the internal state modifiable by user actions indirectly affecting the external world

examples

style (Word): affects formatting

tag (Facebook): affects view permission

selection (Finder): affects result of delete, move, etc
operational principle

if you modify the concept like this, the outcome will be...

“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”
concept sets and apps

for $c(a)$, set of concepts used in application $a$,

$$\langle x, y \rangle \in \text{depends} \iff \forall a \cdot x \in c(a) \implies y \in c(a)$$

note: if depends is cyclic, then cycle suggests a grouping of concepts
purposes
designing for a purpose

purpose

motivates

fulfills

contrivance

misfit
candidate contrivances

changeable print display on wall

fulfills?

corkboard

magnetic paint

adhesive
misfits

changeable print display on wall

fulfills?

damages prints

corkboard ✗
magnetic paint

adhesive
adding refinements

changeable print display on wall

... and no damage to prints

fulfills?

corkboard

magnetic paint

adhesive

✘

✘
never fully predictable

- changeable print display on wall
- ... and no damage to prints
- ... and allow wifi to pass

- corkboard
- magnetic paint (X)
- adhesive

fulfills?
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.
perturbing the context

purpose

fulfills

contrivance

... and change in user behavior
evaluating contextual demands

- magnetic paint
- 6 coats
- ... and neodymium magnets
- changeable print display on wall
- fulfills?
Every concept is motivated by a distinct subpurpose.
example: text formatting

- maintain consistent format
- provide formatting unit

style fulfills

word processor

paragraph fulfills
concepts & purposes
fit for purpose

- purpose
- concept
- misfit

what is a misfit?
- a (set of) scenarios
  - often expands context
  - often surprising
misfit example

concept
Macintosh trash

purpose
allow files to be undeleted

scenario
user inserts USB key
attempts to copy files to it
finder says “not enough space”
user deletes all files on key
finder says “not enough space”
user realizes must empty trash
but this trashes all files on all disks...
concept

criteria
concept criteria

compelling: clear operational principle, one purpose
coherent: interaction with other concepts predictable
controllable: fulfills purpose without interference
complete: general and uniform over concept’s scope
consistent: represented consistently in the user interface
conventional: reuses existing concepts when applicable
compelling

simple operational principle & motivated by one purpose

trash (OS X)

principle: delete moves to special folder; emptying it removes contents for good
purpose: allow undo of deletions

layer (Photoshop)

principle: resulting pixel map is background map with composition of functions given by layers
purpose: non-destructive edits
refrigerator controls


controls

internal mechanism

controls
refrigerator mapping

concepts

control a

control b

purposes

set freezer temp

set fridge temp
rating stars
from Marc Hamburg, lead Lightroom engineer

purpose? not collection or even catalog specific
more uncompelling concepts

- no single clear purpose
  - Git’s staging area
  - JPEG quality and resolution
  - Gmail’s categories (vs labels)

- no simple operational principle
  - CSS’s dimensions (inches, pixels)
  - Tumblr’s answers vs comments

- serves someone else’s purpose
  - direct flight (legs share flight number)
coherent
realization and interaction with other features is predictable

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average: 261,351,109

relative reference

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average: 261,351,109

adding row: values unchanged
email conversations

Apple Mail: conversation consists of messages in multiple folders. Move, delete, etc apply only to the subset in this folder.
what’s a font?

so character style can only italicize some fonts
more incoherent concepts

Apple Mail’s contact names appear in sent messages!

Facebook’s shared album can move photos in but not out

Google form column hide hides in sheet, but not in published summary
controllable
fulfills purpose without interference from other concepts

skip slide
make parent
make parent and skip

skipping and hierarchy do not interfere in Apple Keynote
Eunsuk Kang <eskang@csail.mit.edu>
To: Daniel Jackson <dnj@MIT.EDU>, Santiago Perez De Rosso <sperezde@csail.mit.edu>
an example of bad coupling in gmail?

Hi Daniel, Santiago,

I am not sure whether this falls into one of the conceptual design issues that you have been analyzing, but here's a little annoyance that I just ran into using labels in Gmail.

This evening, I made two separate reservations with Enterprise (one in Phoenix and another one in Vegas), and the company sent me a confirmation e-mail for each one of them. Usually, I tag travel-related e-mails using a label (e.g. "Vegas Trip 2014") so that I can easily find all the relevant e-mails for a particular trip. Now, the problem is that GMail automatically grouped the two Enterprise emails into a single conversation. It turns out that in Gmail, a label applied to an e-mail in a conversation is applied to every other e-mail in the same conversation. This means I can't assign separate labels to the two car rentals! Ughh!

(By the way, is it possible to take an e-mail out of a conversation? Either this is impossible or the Gmail UI does not make this easy).

Eunsuk

conversations interfere with labels
aspect ratio fuji x100s
image quality setting
aspect ratio
"image size" setting
non-standard ratio + RAW?

image quality interferes with image size
consistent

represented consistently in the user interface

**interface elements**

- E1
- E2
- E3

**concepts**

- C1
- C2
- C3

**conflation**

- E1
- E2
- E3

**deviation**

- E1
- E2
- E3

**consistent**

- E1
- E2
- E3

- C1
- C2
- C3
deviation in OS X apps

OmniGraffle: control key

Apple apps: option key

copy style

⌥⌘C

^⌘C
conflation in unix
from the Unix Hater's Handbook

[chim:~] dnj% mv readme -README
[chim:~] dnj% mv -README readme
mv: illegal option -- R
usage: mv [-f | -i | -n] [-v] source target
       mv [-f | -i | -n] [-v] source ... directory
Someone accidentally deleted thousands of files in my company Dropbox: how can I quickly undelete them?
Reader Paul Cramblett has a problem with others who just don’t know how to share. He writes:

*I maintain a Dropbox folder that I use to share files with a select group of friends. I've tried to explain how Dropbox works to these people but someone invariably drags all the files out of the folder, which means they're no longer available to the rest of us. Is there some way to prevent files from being removed by someone who doesn't understand the difference between “copy” and “move”?*
alyssa & ben plan a party
Alyssa spoils everything.

Are you sure you want to delete party from your Dropbox?

Are you sure you want to delete invitations from your Dropbox?
conflation in dropbox

How do I leave a shared folder?

“by changing the folder’s settings or by deleting it”

You can leave a shared folder at any time by changing the folder’s settings on the Dropbox website or deleting it. If you change your mind or leave a folder accidentally, you can rejoin it later.
small survey of MIT Dropbox users

correctly predicting behavior

study by Kelly Zhang
conventional

reuses existing concepts when applicable

concept idioms: across apps
style: separate formatting from element
selection: select objects to apply action to set

subtle issues & their solution
reapply in different context
eg, partial styles

some apps are just cliches
collection of idiomatic concepts
social app = {profile, post, friend, notify}
slides in Keynote
photos in Adobe Lightroom
messages in Apple Mail
objects in OS X Finder
thumbnails in Preview
notes in Evernote
subtlety selection scope

subset of selection in scope

subset of selection out of scope
subtlety active element

Adobe Lightroom: brightest thumbnail is the “active photo”
subtlety continuous selection

Photoshop: outline shown with “marching ants”

Photoshop: selection shown in Quick Mask mode
subtlety folder selection

Google Drive: selecting folder = selecting children

CrashPlan: selecting folder = selecting all future children
concept idiom selection

Purposes: apply action in aggregate to many items at once
### Idiom Catalog (So Far)

<table>
<thead>
<tr>
<th>instantiate</th>
<th>organize</th>
<th>relate</th>
<th>resource</th>
<th>save</th>
<th>communicate</th>
<th>personalize</th>
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<tbody>
<tr>
<td>stylesheet</td>
<td>selection</td>
<td>friend</td>
<td>access token</td>
<td>history</td>
<td>message</td>
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<td>notification</td>
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<td>karma</td>
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<td>invitation</td>
<td>reservation</td>
<td>cursor</td>
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a happy end to a sad story?
hard to discern any compelling concepts
Field Trip Permission Form

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Thank you!

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Parents signature       Date
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[Signature]

Parents signature August 15, 2014 Date
related work & inspirations
Aristotle: telos
Fred Brooks: conceptual integrity
Michael Jackson: problem frames
Nam Suh: independence axiom
David Parnas: uses relation
Martin Fowler: analysis patterns
Michael Polanyi: operational principle
Christopher Alexander: misfits
refrigerator controls


internal mechanism

controls
Don Norman’s analysis of the fridge system image is ‘incoherent or inappropriate’ so user’s mental model misaligned with designer’s model

my viewpoint
the design concepts are simply wrong
this is not a user interface problem
reflections
The choice of functional specifications — and of notation to write them down in — may be far from obvious, but their rôle is clear: it is to act as a logical firewall between two different concerns. The one is the “pleasantness problem”, i.e., the question of whether an engine meeting the specification is the engine we would like to have; the other one is the “correctness problem”, i.e., the question of how to design an engine meeting the specification.

Dijkstra, EWD952

A very large program is, by necessity, composed of a large number, say N, individual components and the fact that N is large implies that the individual program components must be produced with a very high confidence level. If for each individual component the probability of being right equals p, for the whole program the probability P of being right will satisfy

\[ P \leq p^N \]

and if we want P to differ appreciably from zero, p must be very close to one, because N is so large.

Dijkstra, EWD303

Fortunately, the problem of program correctness has turned out to be far less serious than predicted.

Hoare, 1996
sources of reliability

- interfaces
- concepts
- localization

bad concepts confuse user and developer and lead to unreliable code
limits of formalism

engineering science
mathematical models of behavior
engineering as application of science

but
physics cannot understand a clock
purposes cannot be formalized
essence of design is intent, not behavior
unused slides
Architects work in the medium of buildings, graphic designers work in paper and other print media, industrial designers on mass-produced manufactured goods, and software designers on software. The software designer should be the person with overall responsibility for the conception and realization of the program.

A Software Design Manifesto, 1996
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 metaphor

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