UNCOMMON   COMMON   SENSE

2.744 Product Design
human factors design

99,000-195,000 deaths per year due to human error in hospitals!

To Err is Human: Institute of Medicine, National Academy of Sciences November 1999. Zhan and Miller, JAMA, October 2003.
1999? that’s old!

what about 2013?
there have been a lot of changes since 1999

210,000-440,000

deads in US
per year due to human error

in hospitals!

A New, Evidence-based Estimate of Patient Harms Associated with Hospital Care: Journal of patient safety. September 2013.
that’s still not that new!

what about 2016?
there have been a lot of changes since 2013

more than 250,000

deads in US

per year due to human error

in hospitals!

https://www.hopkinsmedicine.org/news/media/releases/study_suggests_medical_errors_now_third_leading_cause_of_death_in_the_us
in-hospital leading causes of deaths
the intended experience

why so uncommon? what goes wrong?
the intended experience

why so uncommon?

no design!
pay attention!

little things make a big difference
pay attention!

look at the world with a sense of wonder
the intended experience

why so uncommon?

no design
the intended experience

why so uncommon?

no design
the intended experience

why so uncommon?

thoughtless design
play the movie!
the intended experience

why so uncommon?

sloppy design
the intended experience

why so uncommon?

selfish design
the intended experience

why so uncommon?

selfish design
the intended experience

why so uncommon?

inexplicable design
the intended experience

why so uncommon?

inexplicable design
the intended experience

why so uncommon?

inexplicable design
ya, but
the intended experience

why so uncommon?

difficult design
the intended experience

why so uncommon?

difficult design
the intended experience

why so uncommon?

difficult design
today’s goal?
improve our design
common sense

we can do better, right?
but before that

a short quiz!

i) list 3 actions that might lead to better user-centric design
ii) list 3 important aspects to consider when designing a symbol
iii) what does this symbol mean?
ASK OBSERVE EXPERIENCE

2.744 Product Design
semantics
syntax
usability
improve our design common sense

design guidelines

human factors:
a science devoted to the study of interaction between people and equipment
human engineering, usability engineering, ergonomics

prevent errors, avoid injury, increase productivity
improve our design common sense

design guidelines

avoid ambiguity

Boston

unclear grouping

Cambridge
improve our design common sense

design guidelines

avoid ambiguity
improve our design common sense

design guidelines

avoid ambiguity

reasonable limits?
### design guidelines

**avoid reliance on vigilance**

<table>
<thead>
<tr>
<th>Mechanical task</th>
<th>Error rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash one of two letters on display screen. Subject hits one of two keys in response. After correction.</td>
<td>0.6%</td>
</tr>
<tr>
<td>Medication in hospital. Per dose.</td>
<td>1.6%</td>
</tr>
<tr>
<td>UG students performing calculator tasks</td>
<td>2%</td>
</tr>
<tr>
<td>Errors in making aircraft flight management system entries. Per keystroke.</td>
<td>10%</td>
</tr>
<tr>
<td>Turning a control in wrong direction under extreme stress.</td>
<td>50%</td>
</tr>
</tbody>
</table>
BMD False Alarm

Amber Alert (CAE) - Kauai County Only

Amber Alert (CAE) Statewide

1. TEST Message

PACOM (CDW) - STATE ONLY

Tsunami Warning (CEM) - STATE ONLY

DRILL - PACOM (CDW) - STATE ONLY

Landslide - Hana Road Closure

Amber Alert DEMO TEST

High Surf Warning North Shores

Image courtesy: HIEMA
improve our design common sense

design guidelines

use direct metaphors
improve our design common sense

design guidelines

use direct metaphors
improve our design common sense

design guidelines

use direct metaphors
improve our design common sense

design guidelines

make actions/function visible
improve our design common sense

design guidelines

make things visible
improve our design common sense

design guidelines

make things visible
improve our design common sense

design guidelines

make things visible
improve our design common sense

design guidelines

understand user state of mind
improve our design common sense

design guidelines

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design guidelines

understand user state of mind
improve our design common sense

design guidelines

understand user habits/patterns
improve our design common sense

design guidelines

provide status: prompts, cues

www.baddesigns.com

open slowly
improve our design common sense

design guidelines

aesthetic minimalism
improve our design common sense

design guidelines

aesthetic minimalism

42 traffic lights. Beverly, East Yorkshire
improve our design common sense

design guidelines

aesthetic minimalism
improve our design common sense

design guidelines

use standards, consistency
improve our design common sense

design guidelines

anticipate misuse
improve our design common sense

design guidelines

anticipate misuse
improve our design common sense

design guidelines

design for error recognition

our error detection rate only approaches 90% for simple mechanical errors, such as mistyped numbers.

for logic errors, error detection is far worse, often 50% or less

http://panko.shidler.hawaii.edu/HumanErr/
Is PEER REVIEW Broken?

redundancy
design for error recognition
improve our design common sense

design guidelines

recognition over recall

2 Choose a payment method

David, your cost could be $0.00 instead of $9.99! Get $50 off upon approval for the Amazon Rewards Visa Card

Your credit and debit cards

- Visa ending in 2773
- MasterCard ending in 6578
improve our design common sense

design guidelines

recognition over recall
improve our design common sense

design guidelines

instruct user (form follows function)
improve our design common sense

design guidelines

instruct user (form follows function)
improve our design common sense

design guidelines

instruct user (form follows function)
improve our design common sense

design guidelines

instruct user (form follows function)
improve our design common sense

design guidelines

design for use conditions
(readability)

Fitts law:
the time to acquire a target is a function of
the distance to, lighting, and size of the
target.
improve our design common sense

design guidelines

avoid ambiguity
avoid reliance on vigilance
make actions/functions visible
understand state-of-mind
understand user habits/patterns
provide status information, cues, prompts
use direct metaphors
strive for aesthetic minimalism
improve our design common sense

design guidelines

use standards and be consistent
design for error recognition
recognition over recall
instruct the user (form follows function)
design for use conditions

play the movie, do the experiment

test your concepts!
a quick experiment

vote now!
do not turn ballot over until instructed
10 seconds to vote (the line behind you is long!)
turn ballot back over when done voting

put on your age simulation glasses!

vote for the group “MECHANICAL”
Palm beach county (2000)

ballot design

supreme court 5-4, 493 vote margin
Palm beach county

ballot design

Layout of double pages with punch holes in between was novel & unfamiliar. The layout may have been disorienting to voters, particularly seniors.
Text in the left column was left-aligned, but text in the right column was right-aligned and the right column was positioned slightly lower than the left column, making the right column look like supplementary information. This changes the relationship to the punch holes.
Voting for the second candidate corresponds to the third hole.
The order of the holes corresponded to the candidate order for the first candidate only.
The word "Democratic" was more closely aligned with the punch hole for the Reform Party. Libertarian aligned with hole for Socialist.
There was no quick visual relationship between the boxes and the punch holes, exacerbated by interspersing punch holes relating to the left and right columns. The close vertical spacing of the punch holes was error prone.
Palm beach county

ballot design

The arrows were very small. Line between the arrows and punch holes creates a separation.

The numbers next to the arrows had no meaning and just added to the general confusion
Palm beach county

ballot design

All caps made blocks of text difficult to read, and the text was small.
Conclusion

All of these design factors, as well as dexterity requirements increased voter stress and hence voting errors for all candidates 2-10th on the ballot. Accidental voting for REFORM ~3,000
Emergency alert redesign

design a less error prone interface

sketch ideas on scrap paper
use laptop/software for your final version
email pdf to drwallace@mit.edu
refer to your human use design cheat-sheet
Hawaii Emergency Management Agency Alert System

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Amber Alert DEMO TEST

High Surf Warning North Shores
what’s next?

due Tuesday
what’s in a name?
read usability analysis example

due Thursday March 8
human-use analysis

Tuesday
project introduction, team networking

next Thursday
field trip: team building, project context
human use design guidelines

avoid ambiguity
avoid reliance on vigilance
make actions/functions visible
understand state-of-mind
understand user habits/patterns
provide status information, cues, prompts
use direct metaphors
strive for aesthetic minimalism
use standards and be consistent
design for error recognition
recognition over recall
instruct user. form follows function)
design for use conditions

play the movie, do the experiment!