

Psychology of Everyday Things

- Many so-called human errors and “machine misuse” are actually errors in design
- Designers help things work by providing a good conceptual model
- Designers decide on a range of users as the design audience
- But design is difficult for a variety of reasons that go beyond design

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41 BC

Head Goucho is tired of loosing to the Gauls

Win me
the
Chariot Race



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Advisor intuitively finds a solution...



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Chariot Race, 40 B.C.

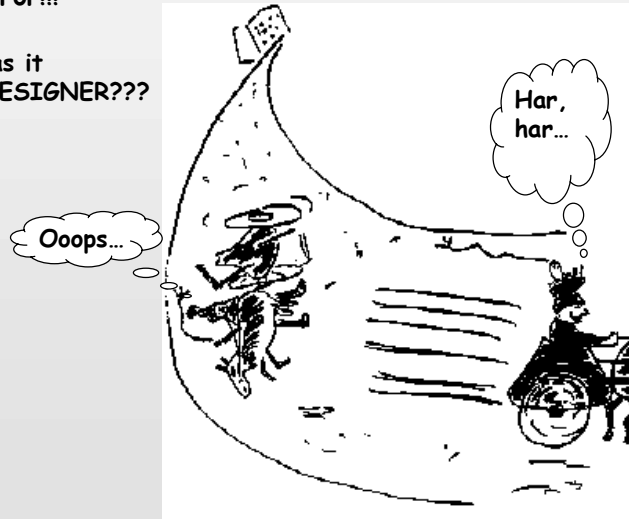
Notice the aerodynamic efficiency of the faster chariot



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But, in maneuvering for position on the turn, the DRIVER makes an error!!!

Or was it the DESIGNER???



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Human Factors Engineered

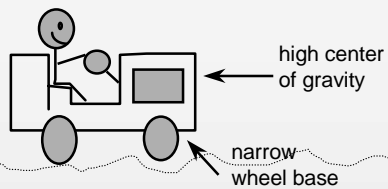
Trade-offs between performance and usability



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Early tractors

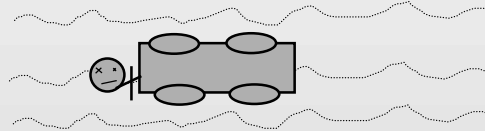
Original design



Terrain

- un-surfaced
- rough
- hilly

Result



Used to be called **“Driver’s Error”** but accidents now infrequent as designs now have low center of gravity, wider wheel bases

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Does this still happen today?

Yes - a new airplane about tens years ago! my second car!

In both cases, instruments that looked about the same had been redesigned so a negative transfer effect was created.

What did this mean for me as a driver?

- I had to get used to where the needle should be for 55.

What did this mean to pilots?

- Hours of training on the new systems!

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Lesson 1

- Most failures of human-machine system are due to poor designs that don't recognize peoples' capabilities and limitations
- This leads to apparent machine misuse and "human error"

Lesson 2

- Good design always accounts for human capabilities.

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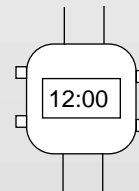
Psychopathology of everyday things

Typical frustrations

- The engineer who founded DEC confessed at the annual meeting that he can't figure out how to heat a cup of coffee in the company's microwave oven



- How many of you can program or use **all** aspects of your
 - digital watch?
 - VCR?
 - sewing machine?
 - washer and dryer?
 - stereo system (especially car ones)
 - unfamiliar water faucets



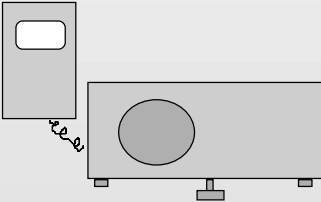
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Other pathological examples:

Remote control from Leitz slide projector

- How do you forward/reverse?

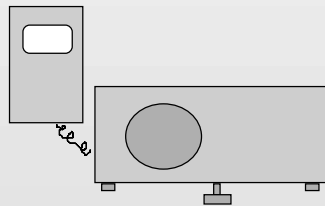


Other pathological examples:

Remote control from Leitz slide projector

Instruction manual:

- *short press*: slide change forward
- *long press*: slide change backward



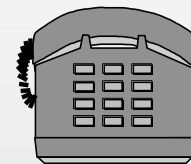
Do mouse buttons
seem similar?

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More pathological examples

Modern telephone systems

- standard number pad
- two additional buttons * and #



Problem

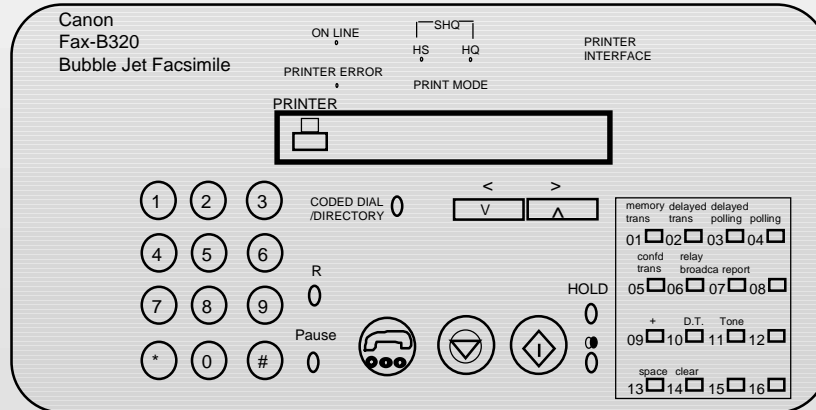
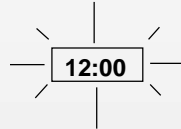
- many hidden functions
- operations and outcome completely invisible
 - *72+number = call forward
 - can I remember that combination?
 - if I enter it, how do I know it worked?
 - how can I remember if my phone is still forwarded?
 - Ok, I'll read the manual
 - but what does "call park" mean? what's a link?
 - where is that manual anyway?
- different phones act in different ways (cell phone #77 for example)

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Still more pathological examples

VCR's, camcorders, fax machines, ...

- most people learn only basic functions
- some people refuse to go near them (sounds familiar?)
- most functionality goes untouched



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Fundamental Design Goal

Ultimate goal: Use should be driven by the design, hopefully without any need for words or symbols, and definitely without any need for trial and error.

Can this be done for all users and all tasks?

An extreme positive case could be a machine with a single button. When you press the button, it does exactly what you had wanted it to do.

What about the “ed” text editor? The following has been said about this editor:

Even most hackers avoid this like the plague. It complains about errors with only a question mark; the manual says, *‘Experienced users will usually know what is wrong.’*

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Getting serious about design

World War II

- invention of machines (airplanes, submarines...) that taxed people's sensorimotor abilities to control them
- even after high degree of training, frequent errors (often fatal) occurred

Example airplane errors:

- if booster pump fails, turn on fuel valve within 3 seconds
 - test shows it took at least five seconds to actually do it!
- Altimeter gauges difficult to read
 - caused crashes when pilots believe they were at a certain altitude

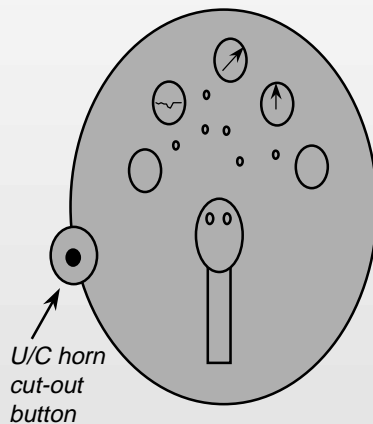


Result

- human factors became critically important

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The Harvard Airplane (WWII) Control Panel



Conditioned response

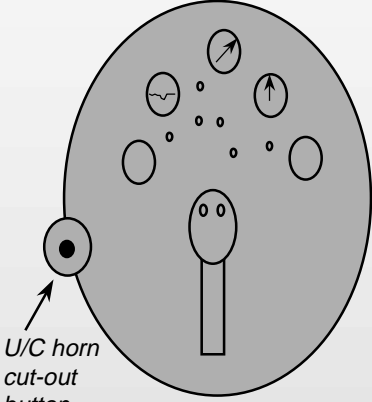
If the system thinks you are going to land with the wheels up, a horn goes off.

In training they would deliberately decrease speed and even stall the plane in-flight. The system thought they were about to land with the wheels up and the horn would go off. They installed a button to allow to pilot to turn it off. Also, if the plane did stall in-flight, they could turn off the annoying horn as they were trying to correct the situation.

stall → push button
stimulus nullified

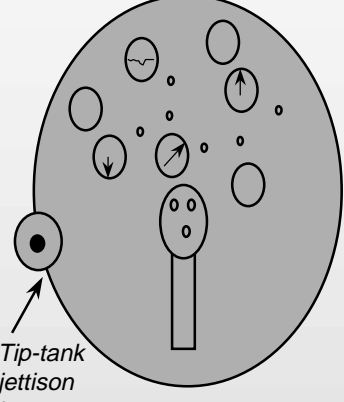
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The Harvard Control Panel



U/C horn
cut-out
button


The T-33 Control Panel



Tip-tank
jettison
button

Negative transfer
 T-33's: tip-tank jettison button was in the same location!
 Out of reflex, if you stalled you would quickly **jettison fuel**...

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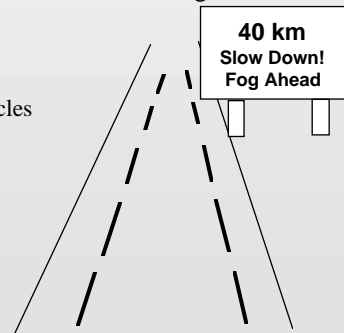
Darn these hooves! I hit the wrong switch again!
 Who designs these instrument panels, raccoons?

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The Psychopathology of computers

Britain has (had) a Motorway Communications System operating 40% of it's highways

- The system receives control information from Police
 - changes lane signs, direction signs, speed limits, etc
 - occurs on the motorway itself in real time
- On December 10th 1976, police, using the system, failed to change the speed limit signs when fog descended
 - 34 vehicles crashed
 - 3 people were killed
 - 11 people were injured and trapped in their vehicles for several hours
 - motorway closed for 6.5 hours



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Some quotes after the crash...

Police (at inquest)

- "The system did not accept the instruction"

Dept of Transport (after examining computer activity logs)

- "There is no evidence of technical failure"

Designers of system

- after emphasizing that they have no responsibility for the system:
 - "We supplied it over 5 years ago and we have never been called to look at that problem"

The Coroner's Court

- after examining the evidence, claimed it was "operator error"
 - the police operator:
 - "failed to follow written instructions for entering the relevant data"

Where have we heard this before?



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Example system problems and recommendations

Input codes cryptic, error-prone

- Example: XR300/1
 - “change (X) sign 300 on highway M5 (R) to code 1”
 - i.e. change particular sign to indicate fog condition

No feedback

- operator entered command, no visible effect of what was actually done

Cryptic error messages

- “Error code 7”

Teletype machine was old, text illegible

- people could not see what they entered into system, or system’s reply

Operator overloaded with other chores

- also handled radio and telephone traffic

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The PC Cup Holder

Urban Legend - probably based on true stories:

Caller: "Hello, is this Tech Support?"

Tech Rep: "Yes, it is. How may I help you?"

Caller: "The cup holder on my PC is broken and I am within my warranty period. How do I go about getting that fixed?"

Tech Rep: "I'm sorry, but did you say a cup holder?"

Caller: "Yes, it's attached to the front of my computer."

Tech Rep: "Please excuse me if I seem a bit stumped, it's because I am. Did you receive this as part of a promotional, at a trade show? How did you get this cup holder? Does it have any trademark on it?"

Caller: "It came with my computer, I don't know anything about a promotional. It just has '4X' on it."

The caller had been using the load drawer of the CD-ROM drive as a cup holder, and snapped it off the drive.

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“HIT ANY KEY TO CONTINUE”

(1) I don't have an “**any**” key on my keyboard, do you?

(2) This instruction is not correct - I tried

shift

caps lock

control

print screen

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