

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

Saul Greenberg

41 BC

Head Goucho is tired of loosing to the Gauls



Saul Greenberg

Advisor intuitively finds a solution...



Saul Greenberg

Chariot Race, 40 B.C.

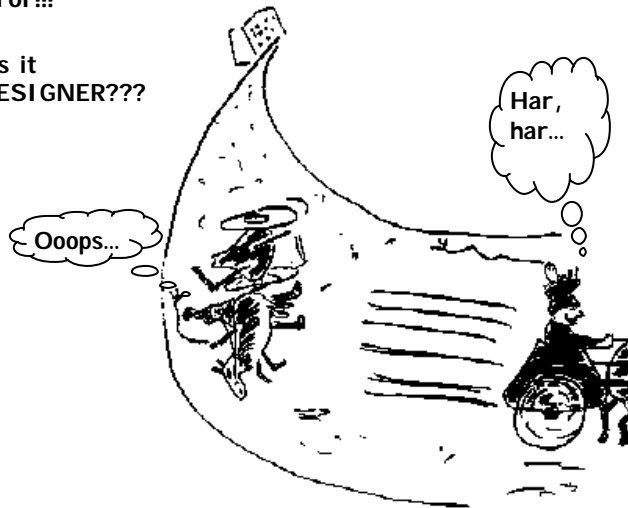
Notice the aerodynamic efficiency of the faster chariot



Saul Greenberg

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

Or was it the DESIGNER???



Saul Greenberg

Human Factors Engineered

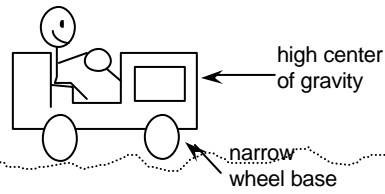
(Boadiceaised as well)



Saul Greenberg

Early tractors

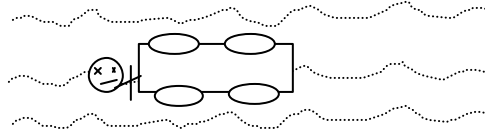
Original design



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

Saul Greenberg

Lesson 1

- Most failures of human-machine system are due to poor designs that don’t recognize peoples’ capabilities and fallibility's
- This leads to apparent machine misuse and “human error”

Lesson 2

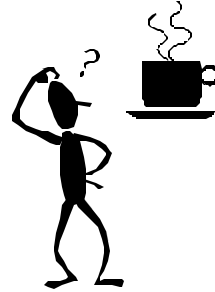
- Good design always accounts for human capabilities.

Saul Greenberg

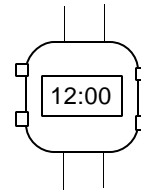
Psychopathology of everyday things

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 facets



Saul Greenberg

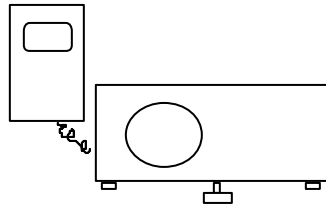


Saul Greenberg

Other pathological examples:

Remote control from Leitz slide projector

- How do you forward/reverse?



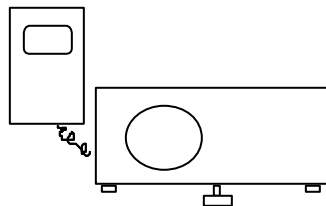
Saul Greenberg

Other pathological examples:

Remote control from Leitz slide projector

Instruction manual:

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

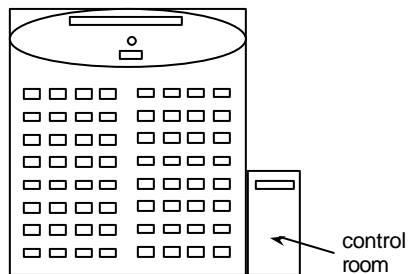


Saul Greenberg

Other pathological examples:

Amphitheater Louis-Laird in Sorbonne

- beautiful room with murals on ceiling
 - but murals are right side up only for lecturer!
- electric projection screen
 - controls in other room out of sight of screen!

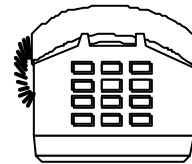


Saul Greenberg

Still more pathological examples

Modern telephone systems

- standard number pad
- two additional buttons * and #



Problem

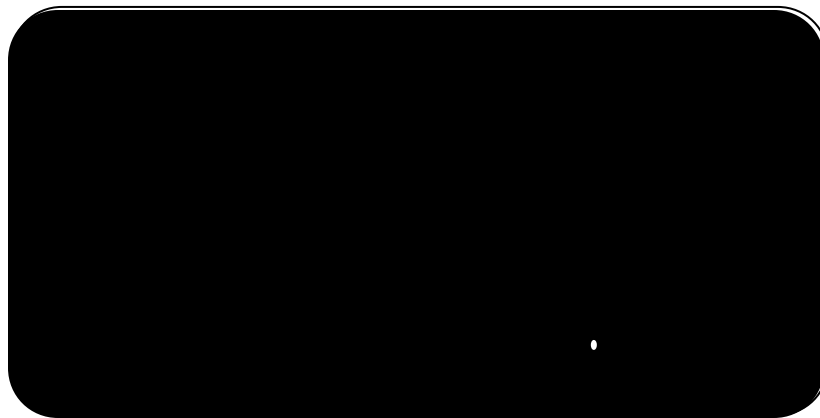
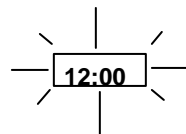
- many hidden functions
- operations and outcome completely invisible
 - *72+number = call forward
 - can I remember that combination?
 - if I enter it, how do I know it caught?
 - how can I remember if my phone is still forwarded?
 - Ok, I'll read the manual
 - but what does "call park" mean? what's a link?
 - where is that manual anyway?

Saul Greenberg

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



Saul Greenberg

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!
- Spitfire: narrow wheel base
 - easy to do violent uncontrolled ground loops which break undercarriage!
- Altimeter gauges difficult to read
 - caused crashes when pilots believe they are at a certain altitude

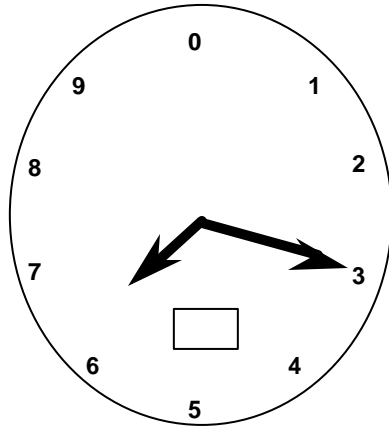


Result


- human factors became critically important


Saul Greenberg

What's the altitude?



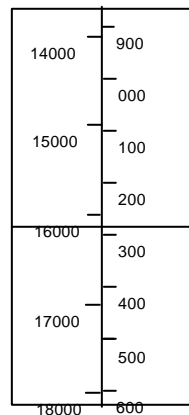
- Early days (< 1000'):
 - only one needle needed
- As ceilings increased over 1000'
 - small needle added
- As they increased beyond 10,000'
 - box indicated 10,000' increment through color change

 < 10,000'

 > 10,000'

Saul Greenberg

A kind of tape altimeter



Human factors test showed that this altimeter:

- eliminated reading errors
- was faster to read

But not in standard use! Why?

Reference line

Independent movement

Saul Greenberg

Harvard Airplane (World War II)

Undercarriage crashes

- pilots landed without dropping undercarriage!
- undercarriage warning horn
 - sounds if wheels up and power low (landing condition)

Stalls

- plane airspeed drops too low to maintain lift
- if occurs just before landing, will crash

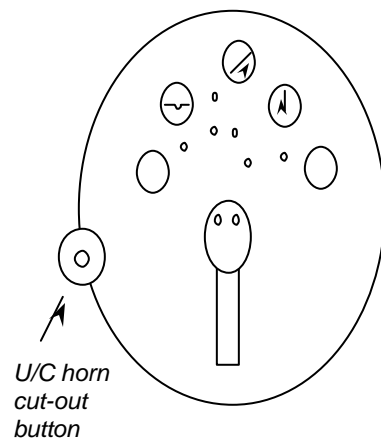
Training

- deliberately stall and recover
- but sometimes similar to landing with undercarriage up
 - horn sounds, annoyance
- installed “undercarriage horn cut-out button”



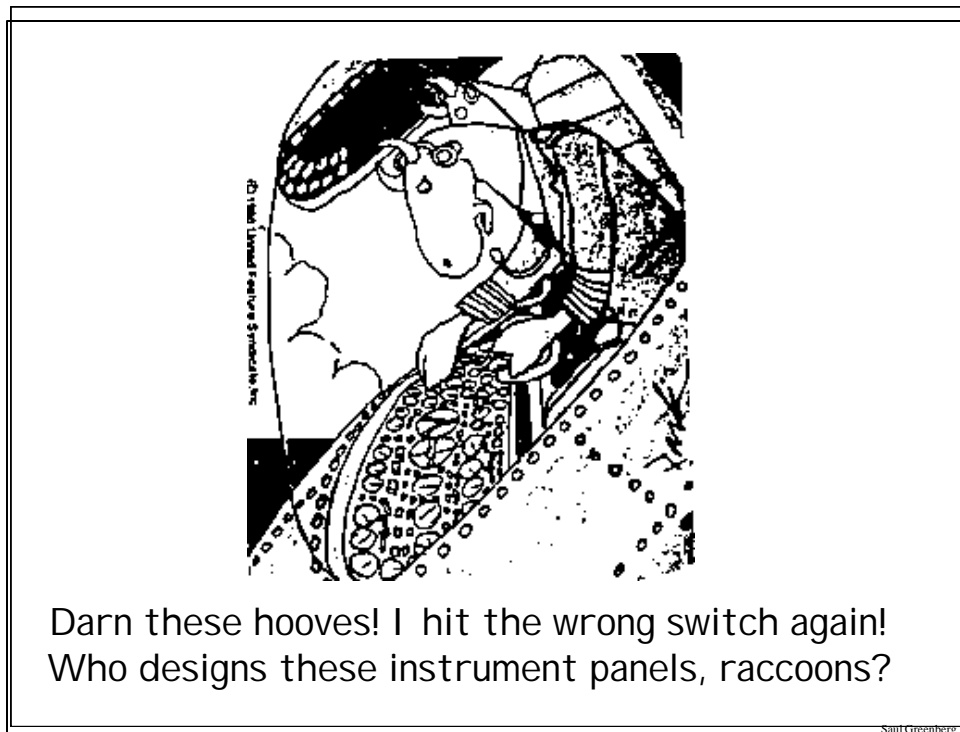
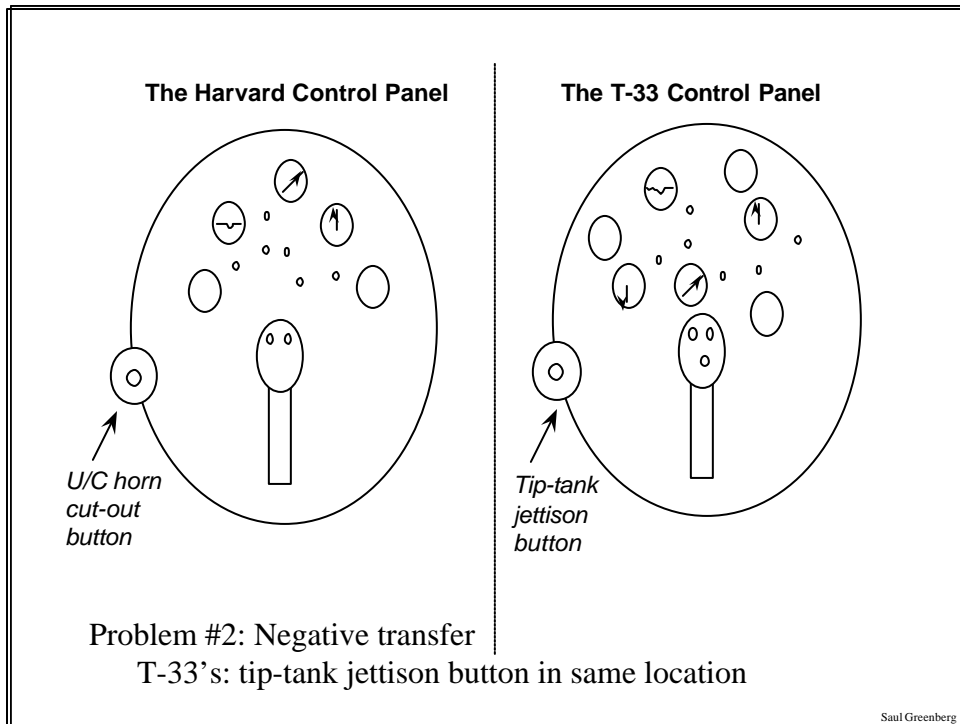
Saul Greenberg

The Harvard Control Panel



Problem #1: Conditioned response
stall -> push button; therefore stimulus nullified

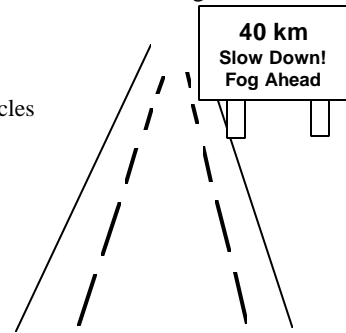
Saul Greenberg



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



Saul Greenberg

Some quotes

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"

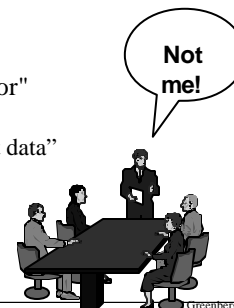
Designers of system

- 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?



Greenberg

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

Saul Greenberg

Other computer psychopathologies

from InfoWorld, Dec '86

- “London—

An inexperienced computer operator pressed the wrong key on a terminal in early December, causing chaos at the London Stock Exchange. The error at [the stockbrokers office] led to systems staff working through the night in an attempt to cure the problem”

Saul Greenberg

Other computer psychopathologies

from *Science* magazine

- In 1988, the Soviet Union's Phobos 1 satellite was lost on its way to Mars, when it went into a tumble from which it never recovered.

“not long after the launch, a ground controller omitted a single letter in a series of digital commands sent to the spacecraft. And *by malignant bad luck*, that omission caused the code to be mistranslated in such a way as to trigger the [ROM] test sequence [that was intended to be used only during checkout of the spacecraft on the ground]”

Saul Greenberg

The PC Cup Holder

A True (?) Story from a Novell NetWire SysOp

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."

At this point the Tech Rep had to mute the caller, because he couldn't stand it. The caller had been using the load drawer of the CD-ROM drive as a cup holder, and snapped it off the drive.

Saul Greenberg

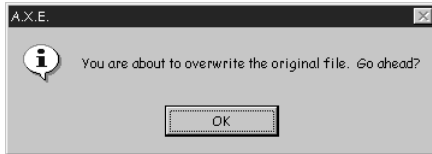
Inane Dialog Boxes - What would you do?



Umm, thanks for the warning, but what should I do?



What happens when you cancel a cancelled operation?



Do I have any choice in this?

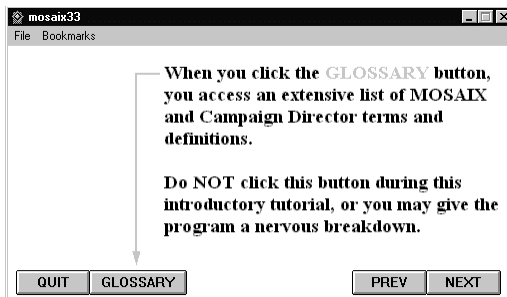
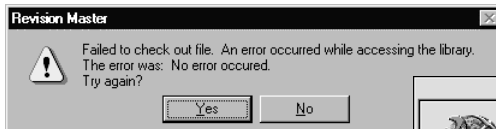


Uhhh... I give up on this one

Saul Greenberg

Inane Dialog Boxes

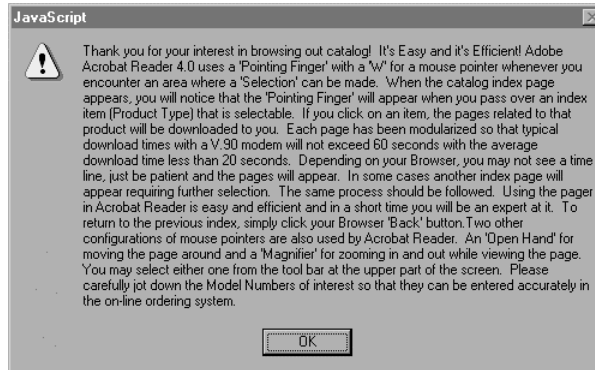
These are too good not to show



Saul Greenberg

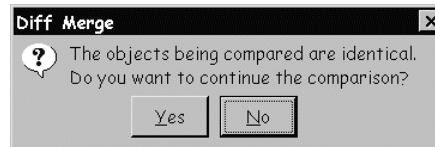
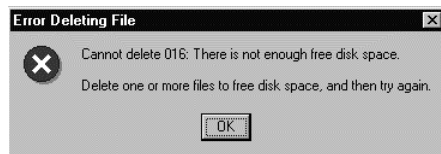
Silly Help

Midwest Microwave's online catalog

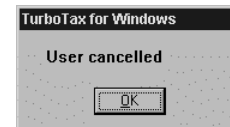


Saul Greenberg

A few more I couldn't resist...



ClearCase, a source-code control system from Rational Software



Saul Greenberg



“HIT ANY KEY TO CONTINUE”

Saul Greenberg