

## 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



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Advisor intuitively finds a solution...



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### Chariot Race, 40 B.C.

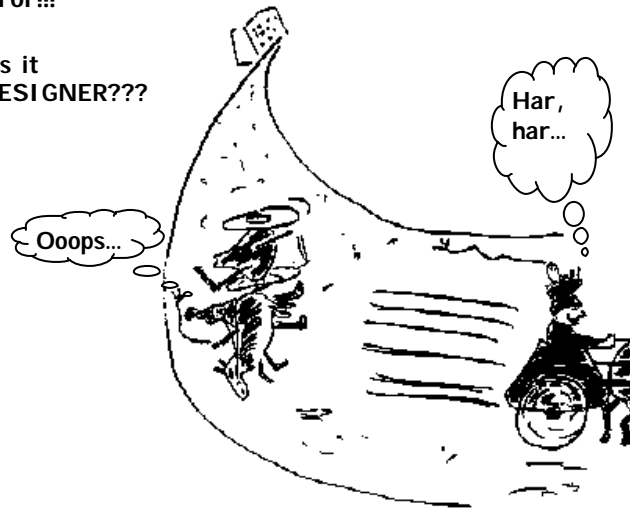
Notice the aerodynamic efficiency of the faster chariot



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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

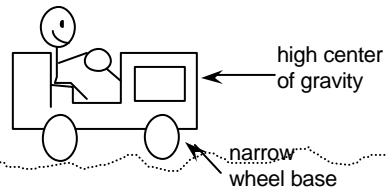
(Boadiceaised as well)



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## Early tractors

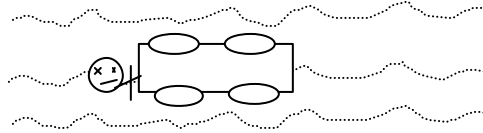
### Original design



### 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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### 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

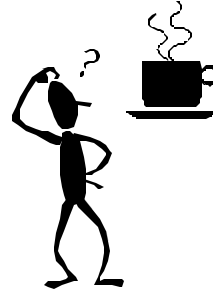
- Good design always accounts for human capabilities.

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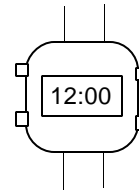
## Psychopathology of everyday things

### 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 facets



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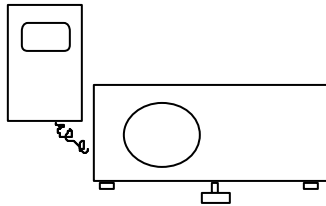


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## **Other pathological examples:**

### **Remote control from Leitz slide projector**

- How do you forward/reverse?



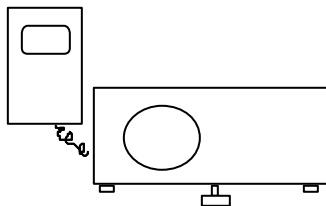
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## **Other pathological examples:**

### **Remote control from Leitz slide projector**

#### **Instruction manual:**

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

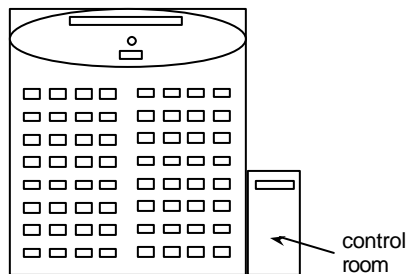


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## Other pathological examples:

### **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!

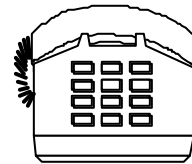


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## Still more pathological examples

### **Modern telephone systems**

- standard number pad
- two additional buttons \* and #



### **Problem**

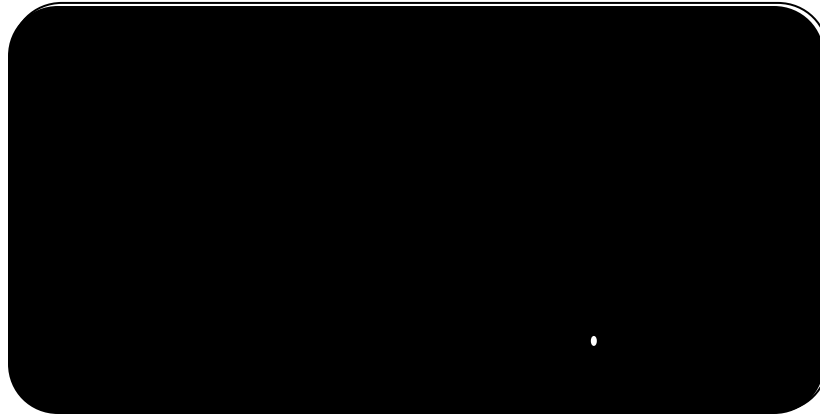
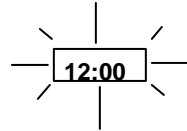
- many hidden functions
- operations and outcome completely invisible
  - \*72+number = call forward
    - can I remember that combination?
    - if I enter it, how do I know it caught?
    - how can I remember if my phone is still forwarded?
  - Ok, I'll read the manual
    - but what does "call park"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

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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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## 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



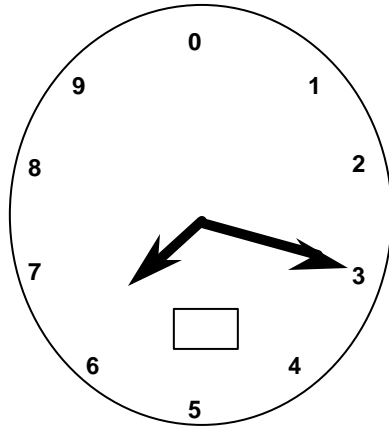
**Result**

- human factors became critically important


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


## What's the altitude?



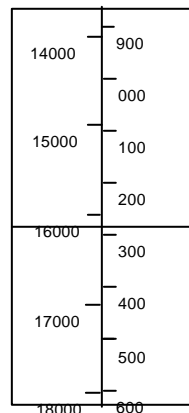
- Early days (< 1000'):
  - only one needle needed
- As ceilings increased over 1000'
  - small needle added
- As they increased beyond 10,000'
  - box indicated 10,000' increment through color change

 < 10,000'

 > 10,000'

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## 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

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## 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

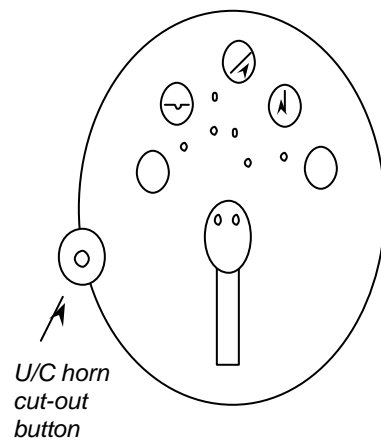
### **Training**

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



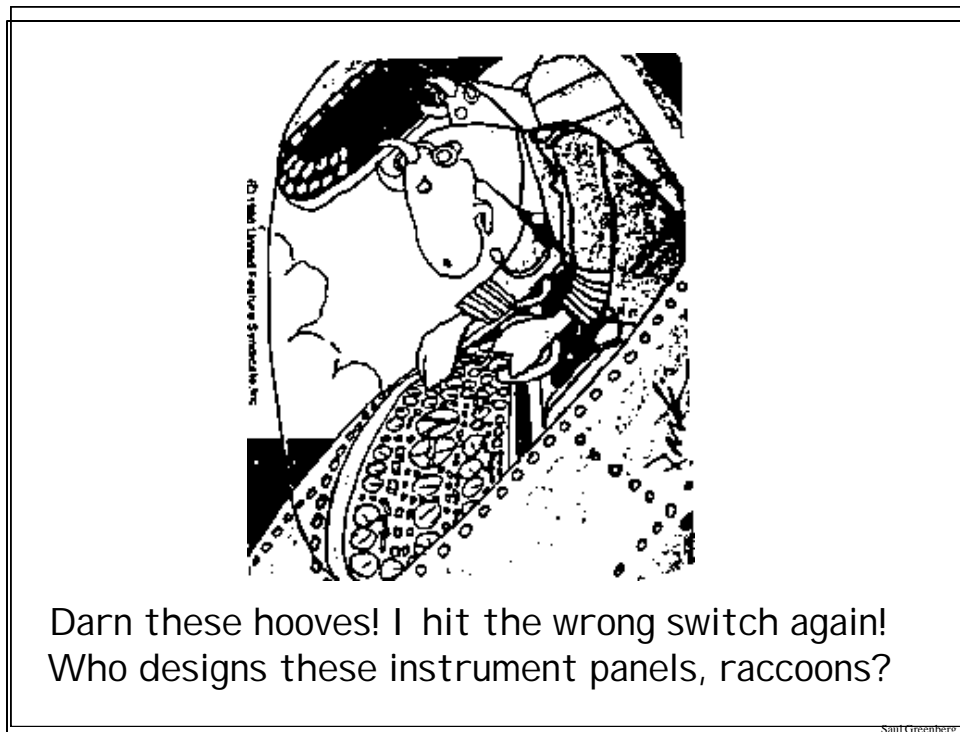
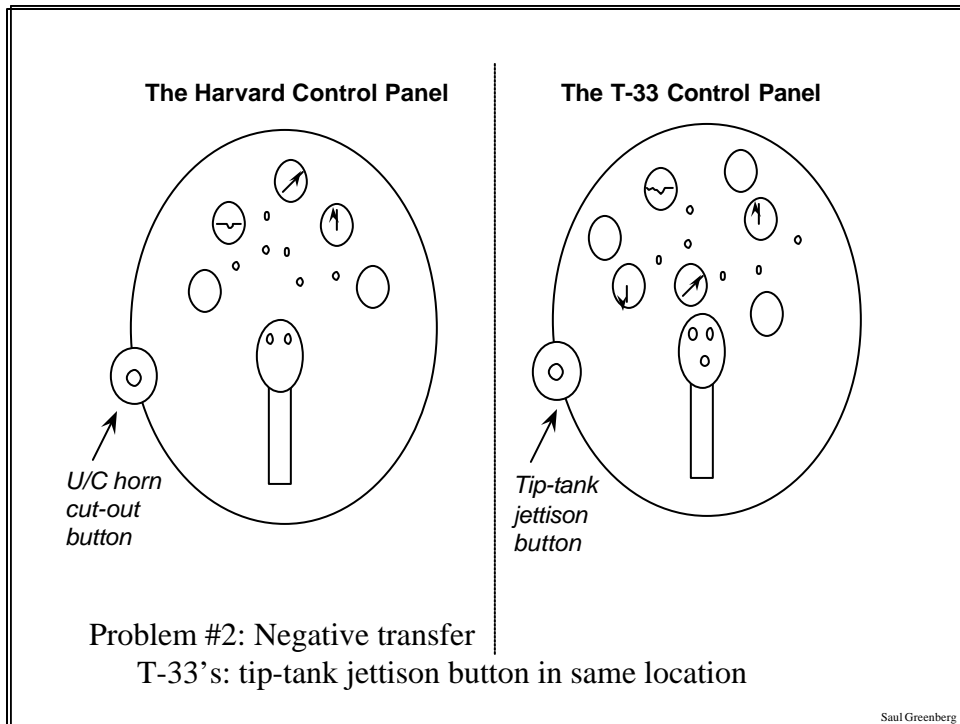
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## The Harvard Control Panel



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

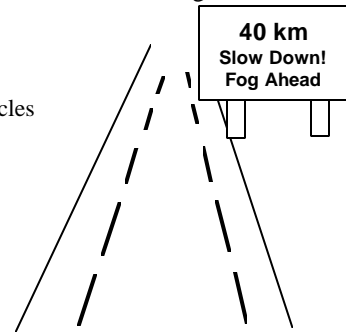
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## The Psychopathology of computers

**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

### **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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## **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”

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## 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]”

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## 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.

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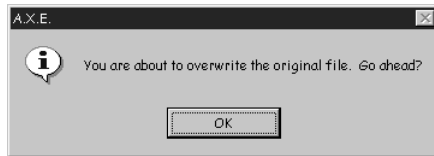
## Inane Dialog Boxes - What would you do?



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?

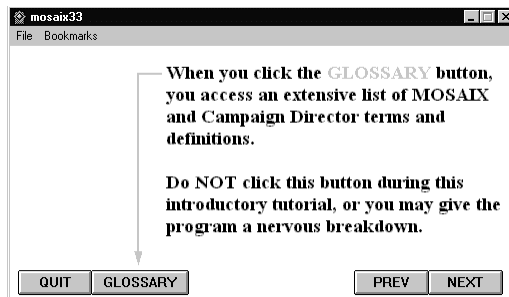
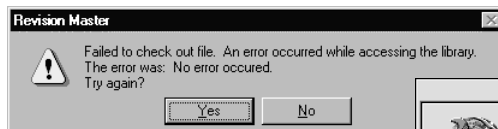


Uhhh... I give up on this one

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## Inane Dialog Boxes

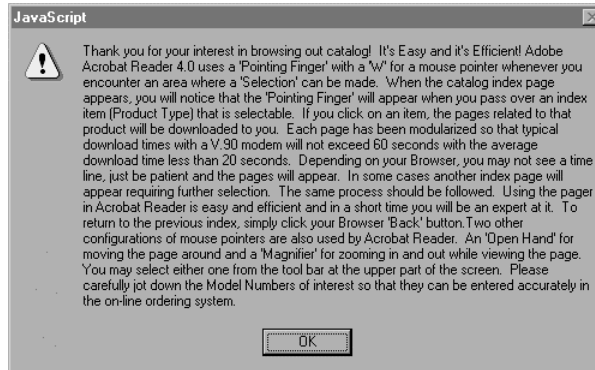
These are too good not to show



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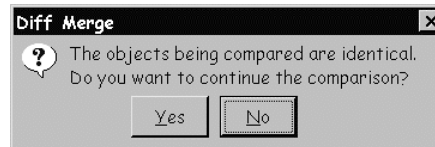
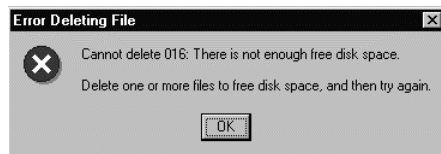
## Silly Help

### *Midwest Microwave's online catalog*

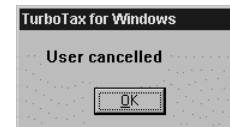


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## A few more I couldn't resist...



*ClearCase*, a source-code control system from Rational Software



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**“HIT ANY KEY TO CONTINUE”**

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