Psychology of Everyday Things

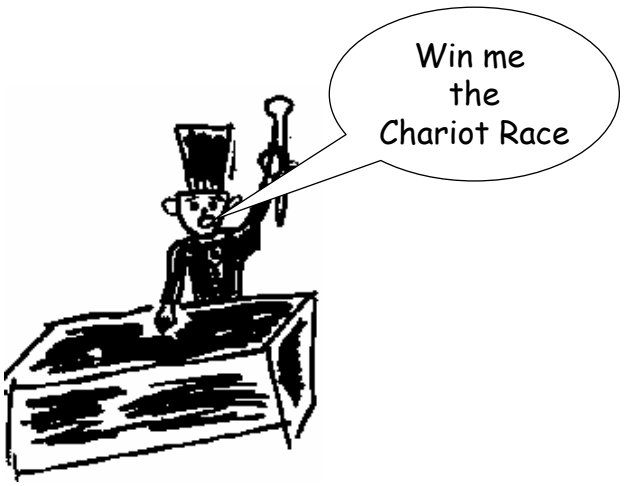
Pathological designs

Many human errors result from design errors

Human factors

Back In 41 B.C.

Head Goucho is tired of loosing to the Gauls

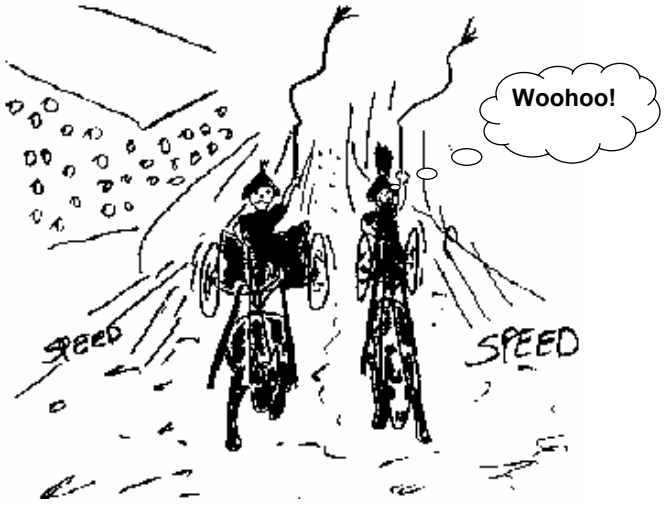


Advisor Determines The Problem… And Intuitively Finds A Solution

James Tam

Chariot Race, 40 B.C.

Notice the aerodynamic efficiency of the faster chariot

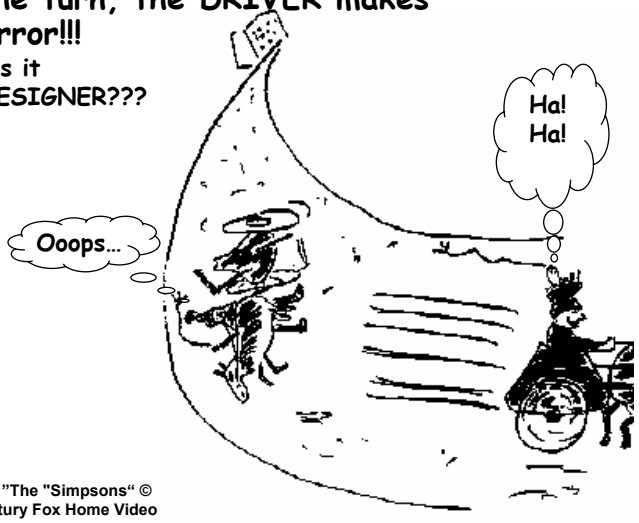


James Tam

Oops…Did I Forgot Something???

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

Or was it the DESIGNER???



Wav files from "The "Simpsons" © Twentieth Century Fox Home Video

James Tam

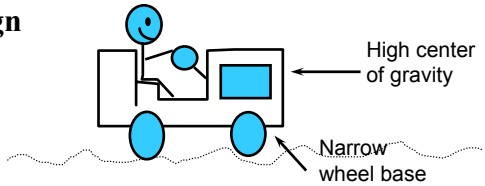
Human Factors Engineered Chariot

(Boadiceaised as well)

James Tam

Early Tractors

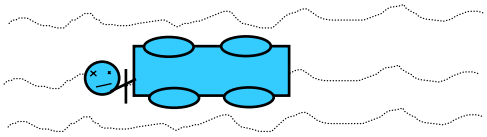
Original design



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

James Tam

Human Factors

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

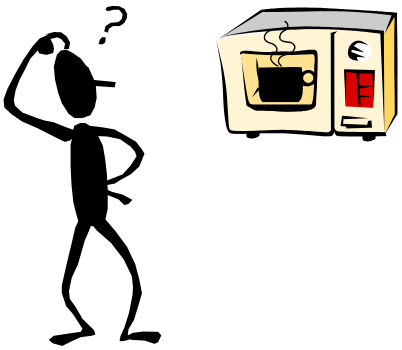
- Good design always accounts for human capabilities.

James Tam

Psychopathology Of Everyday Things

Typical frustrations

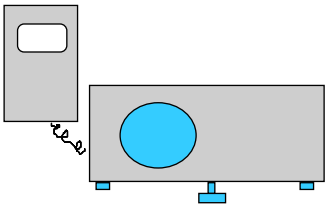
- The engineer who founded DEC (Digital Equipment Corporation) confessed at the annual meeting that he can't figure out how to heat a cup of coffee in the company's microwave oven



Other Pathological Examples:

Remote control from Leitz slide projector

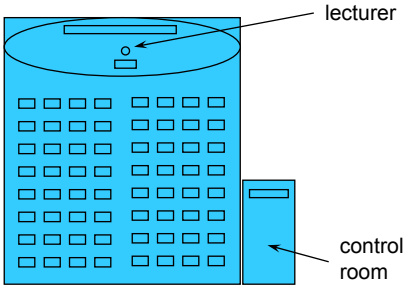
- How do you forward/reverse?



Other Pathological Examples:

Amphitheater Louis-Laird in Sorbonne

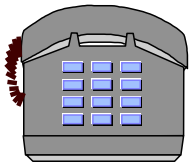
- Beautiful room with murals on ceiling
  - Murals are right side up only for lecturer!
- Electric projection screen
  - Controls in other room out of sight of screen!



Still More Pathological Examples

Modern telephone systems

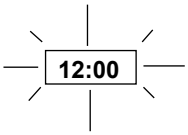
- Standard number pad
- Two additional buttons * and #



Problem

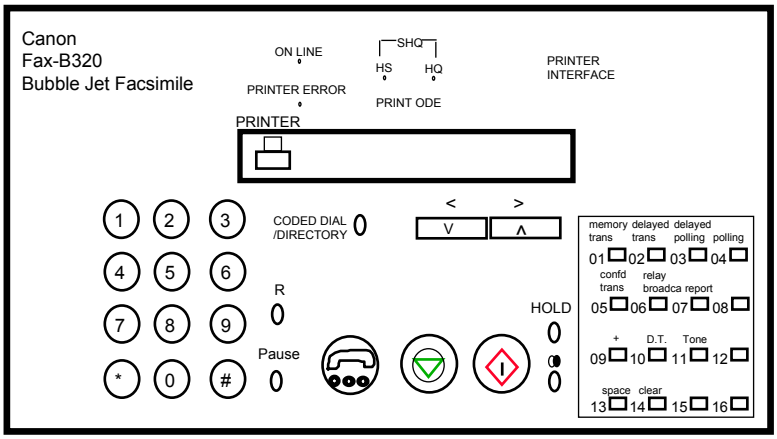
- Many hidden functions
- Operations and outcome completely invisible
  - *72+number = call forward
    Can I remember that combination?
    If I enter it, how do I know it caught?
    How can I remember if my phone is still forwarded?
  - Ok, I'll read the manual
    But what does "call park" mean?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

Still More Pathological Examples

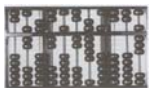


VCR's, camcorders, fax machines, ...

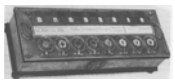
- Most people learn only basic functions
- Some people refuse to go near them (sounds familiar?)
- Most functionality goes untouched



However Design Has Always Been An Issue



Chinese Seun Poon



Pascal's calculating machine

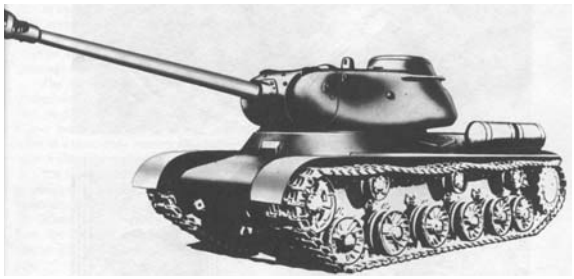
The ENIAC

The PDP-11

A modern super computer

Tank Designs From World War II

KV-II (from "Great Weapons of World War II")



Joseph Stalin Tank "JS-1" (from "Great Weapons of World War II")

James Tam

Getting Serious About Designing For People

Started during the second World War

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

Spitfire photo from the Historical aircraft collection http://www.historicaircraftcollection.ltd.uk

James Tam

Getting Serious About Designing For People (2)

Spitfire cockpit from the Historical aircraft collection http://www.historicaircraftcollection.ltd.uk

Getting Serious About Designing For People (3)

Example airplane errors:

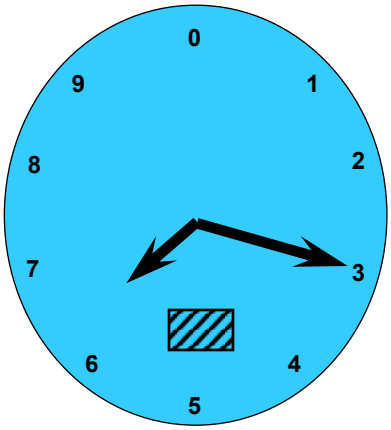
- If booster pump fails, turn on fuel valve within 3 seconds
- Tests showed it took at least five seconds to actually do it!

Result

- Human factors became critically important

Photos from "Great Weapons of World War II"

What Is The Altitude?



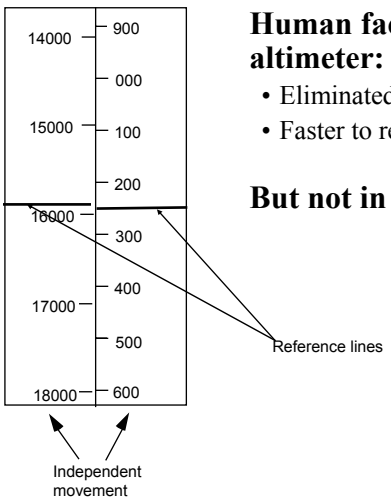
- Early days (< 1000'):
  - Only one needle needed
- As ceilings increased over 1000'
  - Small needle added
- As they increased beyond 10,000'
  - Box indicated 10,000' increment through color change

< 10,000'

> 10,000'

James Tam

An Alternative Altimeter (Tape)



Human factors test showed that this altimeter:

- Eliminated reading errors
- Faster to read

But not in standard use! Why?

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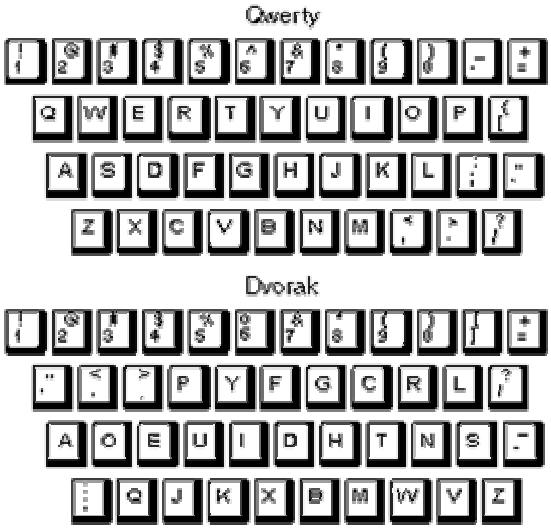
Computer Keyboards:
A Design That's Resistant To Change



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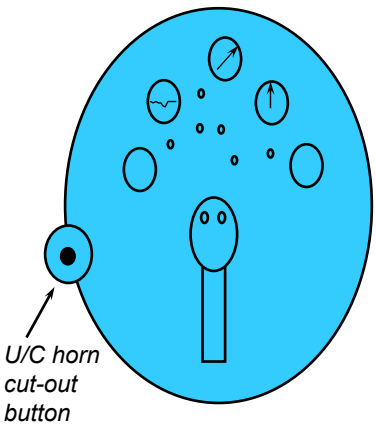
The Harvard Control Panel:
Problems During Training



Problem #1: Conditioned response

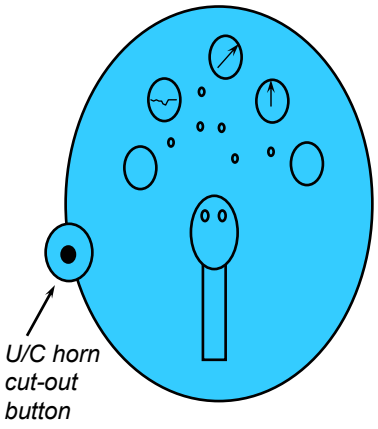
Stall -> push button; therefore stimulus nullified

Wav from Star Trek © Paramount Pictures

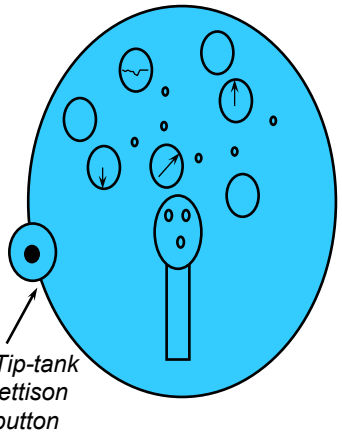
James Tam

The Harvard Control Panel: Problems During Actual Practice

The Harvard Control Panel



The T-33 Control Panel



Problem #2: Negative transfer

T-33's: tip-tank jettison button in same location

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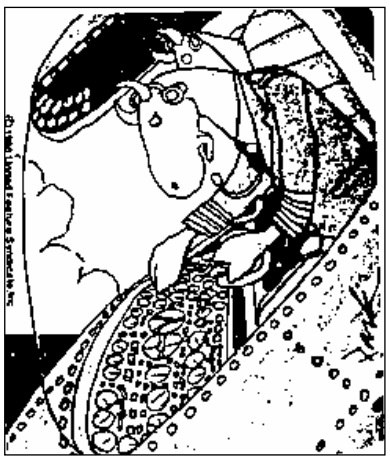
Differences Between The Designer And Operator



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

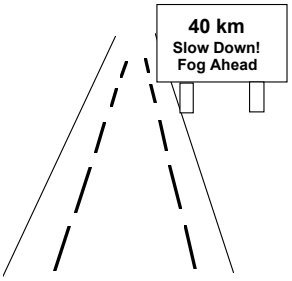
James Tam

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



Some Quotes From The Investigation

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"

Example Problems With The System And Recommendations

Cryptic input codes, 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

Cryptic error messages

- "Error code 7"

Teletype machine was old, text illegible

- No feedback
  - People could not see what they entered into system, or system's reply

Operator overloaded with other chores

- Also handled radio and telephone traffic

Another Computer Psychopathology

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]"

When An Obsolete Design Proved To Be Best

Photos from "Great Weapons of World War II"

James Tam

When An Obsolete Design Proved To Be Best

Photos from "Great Weapons of World War II"

James Tam

Design: The Right Design For The Right Situation

A Very Old Joke: 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?"

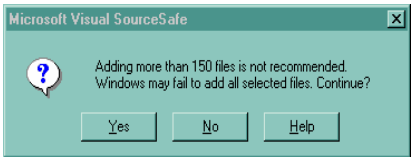
Caller: "Yes, it's attached to the front of my computer."

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?"

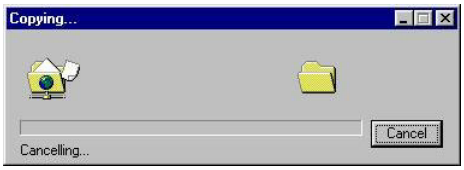
Caller: "It came with my computer, I don't know anything about a promotional. It just has '4X' on it."

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.

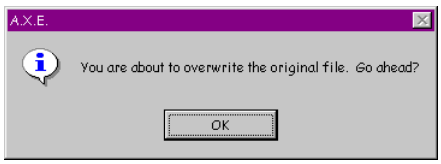
Inane Dialog Boxes



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



What happens when you cancel a cancelled operation?

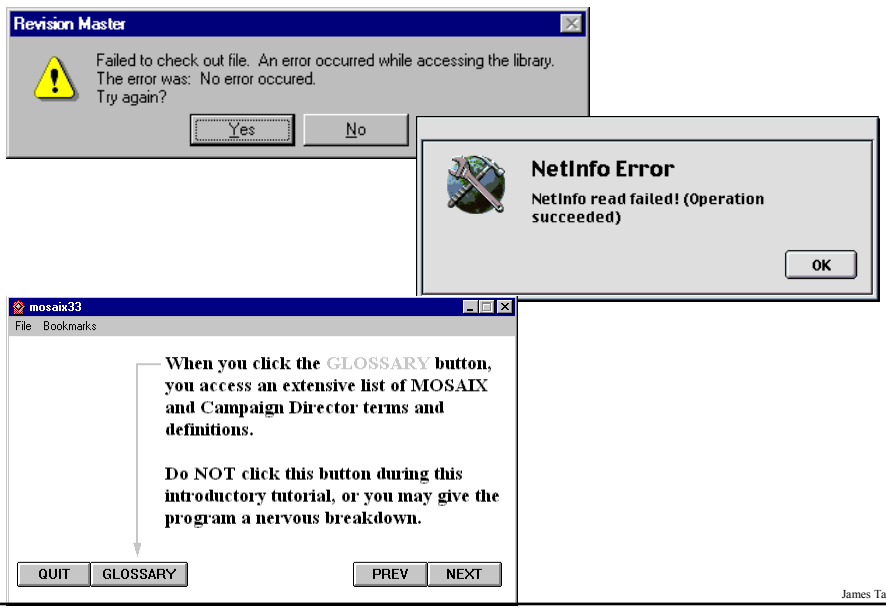


Do I have any choice in this?

Uhhh… I give up on this one

James Tam

Inane Dialog Boxes (2)



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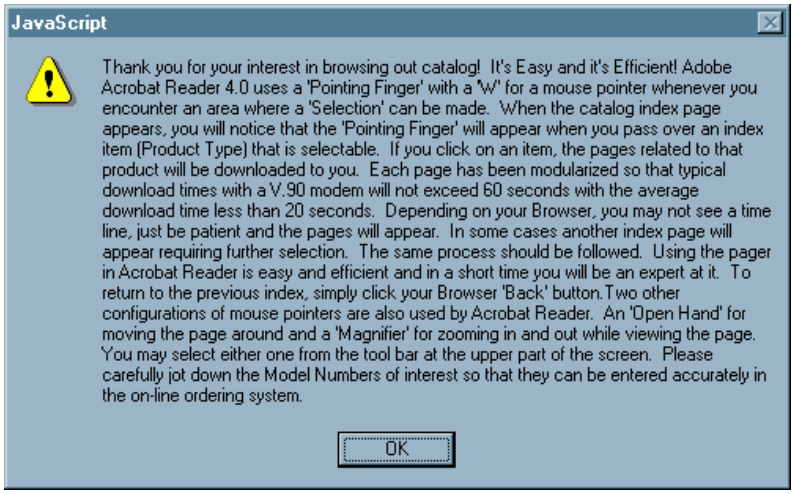
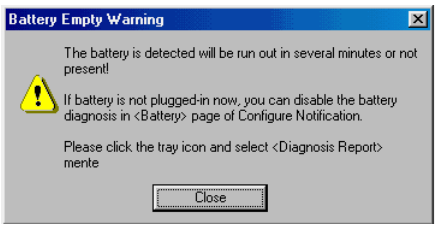
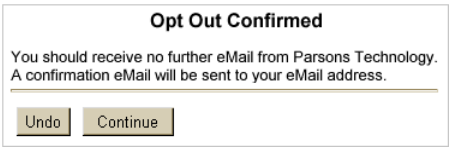
Silly Help

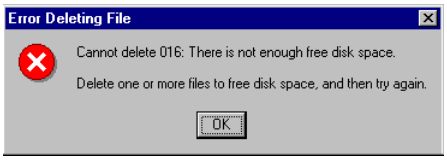
Midwest Microwave's online catalog

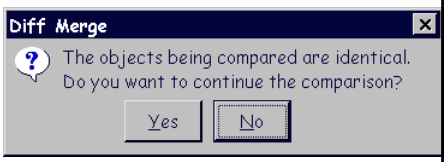


A Few More…I Couldn't Resist.

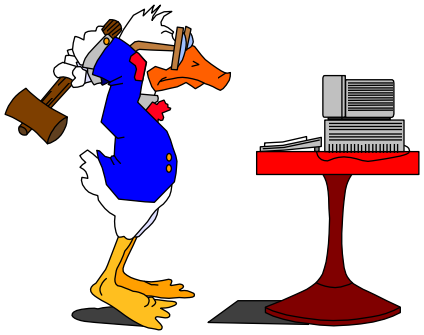








ClearCase, a source-code control system from Rational Software



“HIT ANY KEY TO CONTINUE”

You Should Now Know

- **How and when did the need for the study of Human Factors arise**
- **How good designs consider the operator's capabilities and weaknesses**
- **Why some designs are regarded as being pathological**
- **How designs should be situation specific**