Design of Everyday Things

Characteristics of good UIs

The User Action Cycle

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Adapted by Caitlin Kelleher.

Mistakes

We often blame ***users***
when we should blame ***designers***.

Tractors

Early design

high center of gravity

narrow front wheel base

Terrain

- unsurfaced and rough
- hilly

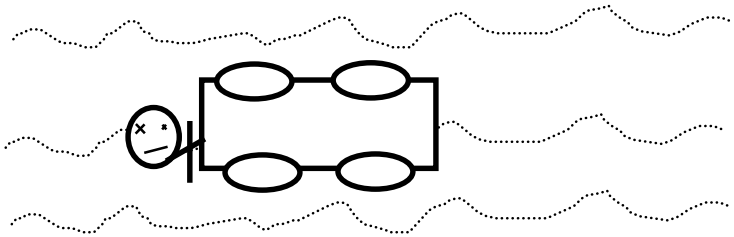
Farmer

- works long hours
- works quickly

Images from www.co.lawrence.tn.us and www.uni-magdeburg.de

Tractors

Result



Quotes from National AG Safety Database

- ***older tractors*** have narrow front ends that are easily upset
- tractor upsets cause more fatalities than other farm accidents
- injuries often include a broken or crushed pelvis.

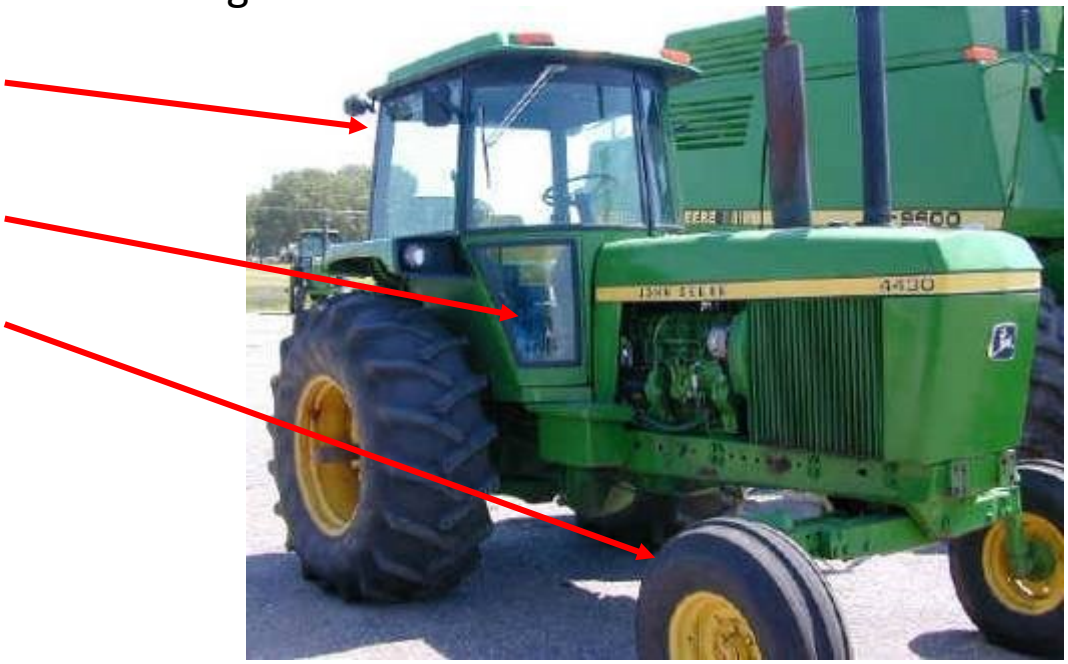
Accident image from //www.osh.dol.govt.nz/

Tractors

Used to be called ***driver's error***

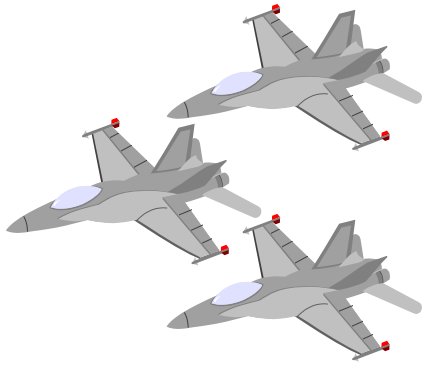
But

- accidents less frequent as modern designs have
  - roll cage
  - low center of gravity
  - wider wheel bases



Tractor from www.historylink101.com

Getting serious about design



World War II

- complex machines (airplanes, submarines...)
  - taxed people's sensorimotor abilities to control them
  - frequent (often fatal) errors occurred even after high training
- example airplane errors:
  - if booster pump fails, turn on fuel valve within 3 seconds
    - test shows it took ~five seconds to actually do
  - Spitfire: narrow wheel base
    - easy to do violent ground loops which breaks undercarriage
  - Altimeter gauges difficult to read
    - caused crashes when pilots believe they are at a certain altitude

Result

- human factors became critically important

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

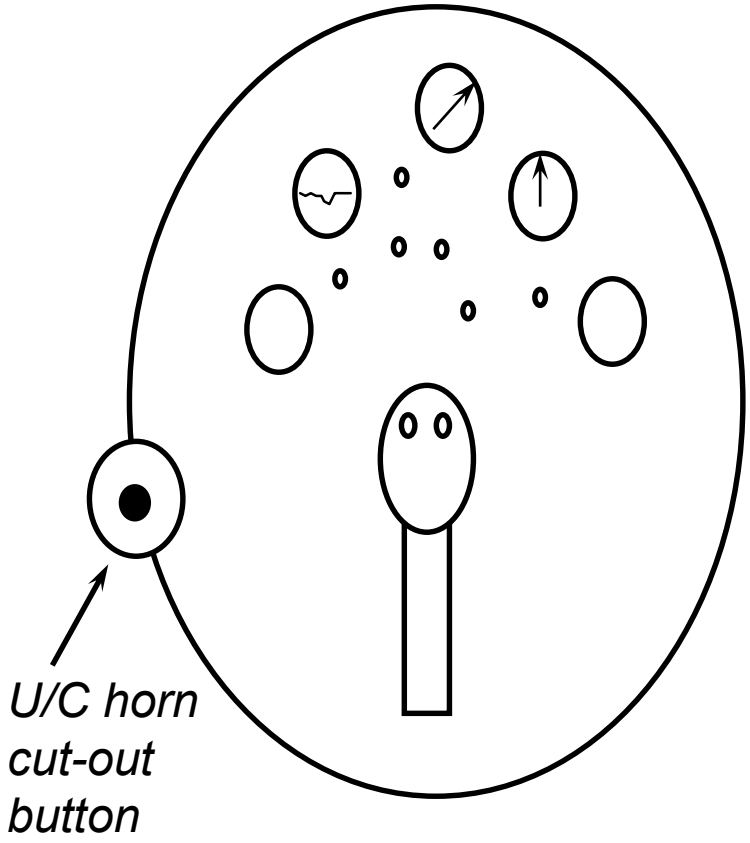
- plane airspeed drops too low to maintain lift
- if occurs just before landing, will crash

Training

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

Slide ideas from David Hill

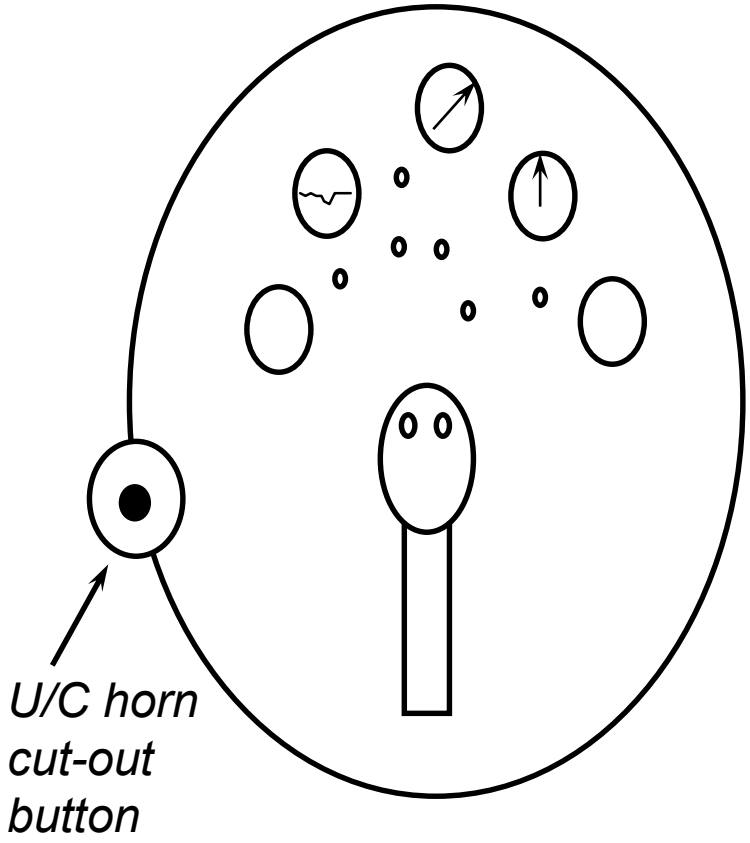
The Harvard Control Panel



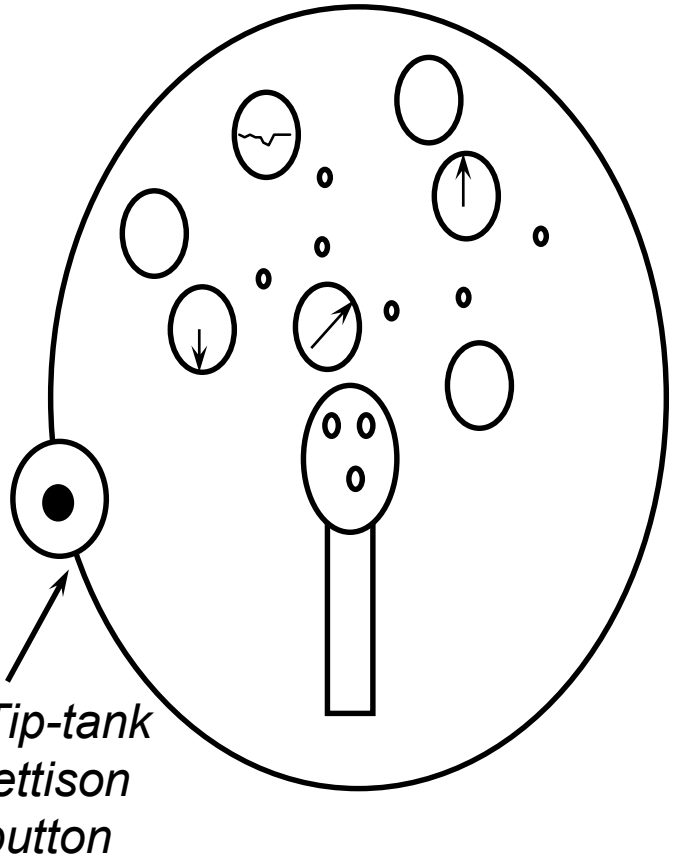
Problem #1: Conditioned response

stall -> push button; therefore stimulus nullified

The Harvard Control Panel



The T-33 Control Panel



Problem #2: Negative transfer

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

Slide ideas from David Hill

Don Norman – Design of Everyday Things

A good interface should have:

- Effective affordances
- Visibility
- Natural mappings
- Feedback to the user

Affordances

- Physical affordances:

  How do the following physical objects afford?

  Are they obvious?

Preece 2002

From Palmiter

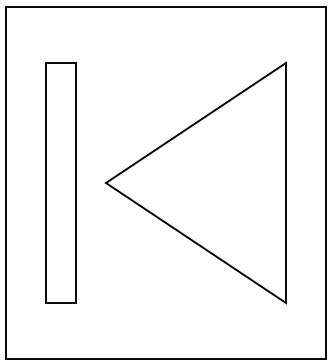
UI Affordance

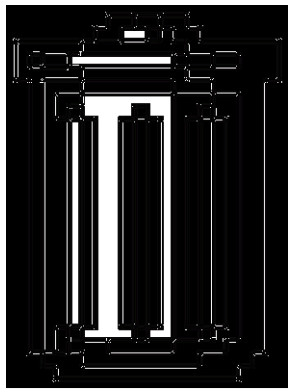
- It should be obvious how a control is used.
- Does the user perceive that clicking on that object is a meaningful, useful action?

From Palmiter

Affordances

- Virtual affordances
  - How do the following screen objects afford?
  - What if you were a novice user?
  - Would you know what to do with them?





Preece 2002

From Palmiter

Visibility

- This is a control panel for an elevator.
- How does it work?
- Push a button for the floor you want?

- Nothing happens. Push any other button? Still nothing. What do you need to do?

It is not visible as to what to do!

From:
www.baddesigns.com

Visibility

…you need to insert your room card in the slot by the buttons to get the elevator to work!

How would you make this action more visible?

- make relevant parts visible
- make what has to be done obvious

Visibility


AT&T
1720
DIGITAL ANSWERING SYSTEM
9-1-1
DELETE
REPEAT
STOP
MIC
PLAY

Affordance vs. Visibility

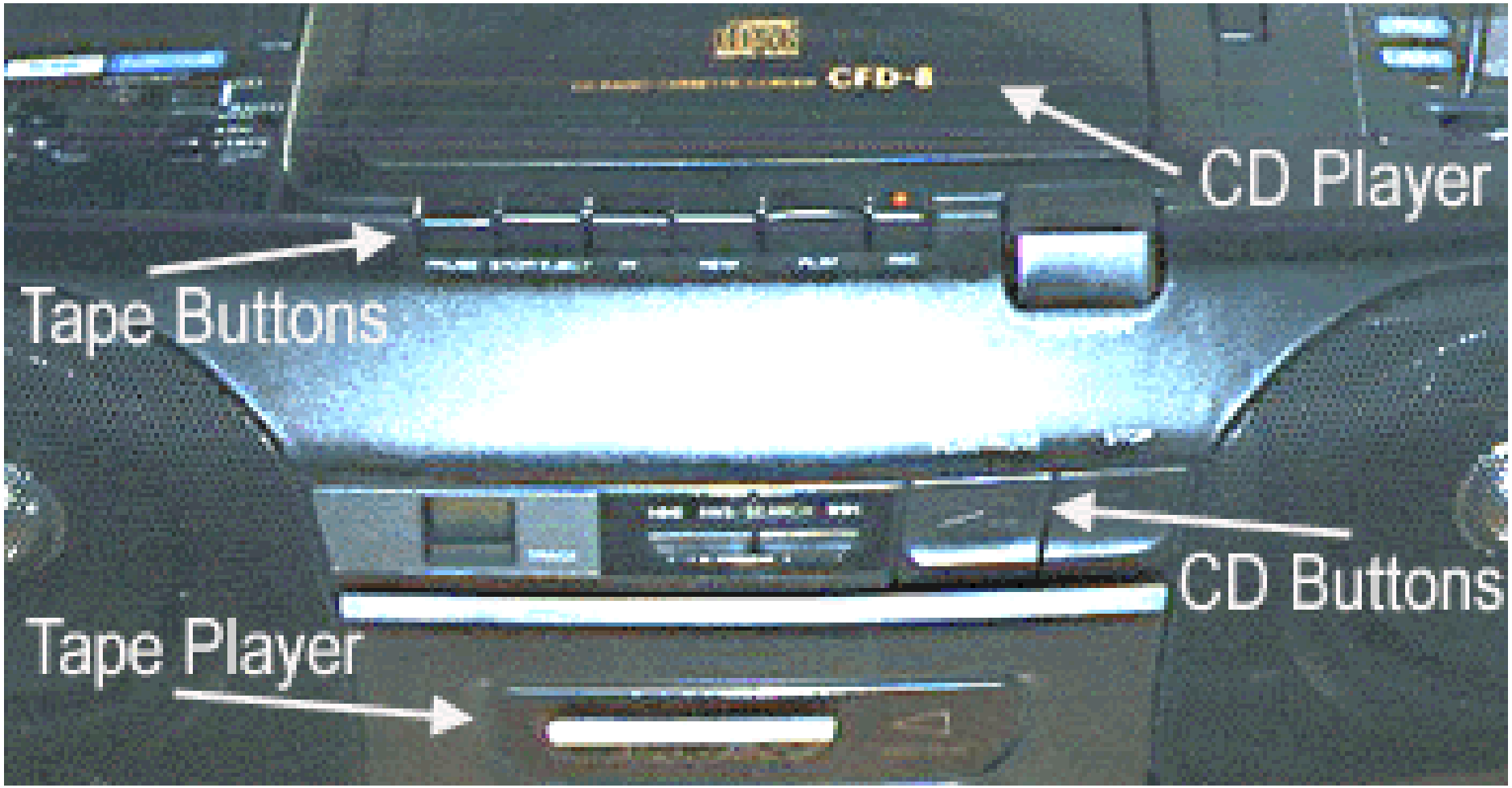
- Affordance: how do you interact with these?

hyperlink

- Visibility: what do they do?

Class Roster

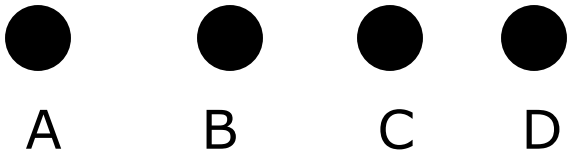
Natural Mappings



From Palmiter

Natural Mappings

- Which controls go with which burners?



Preece 2002

From Palmiter

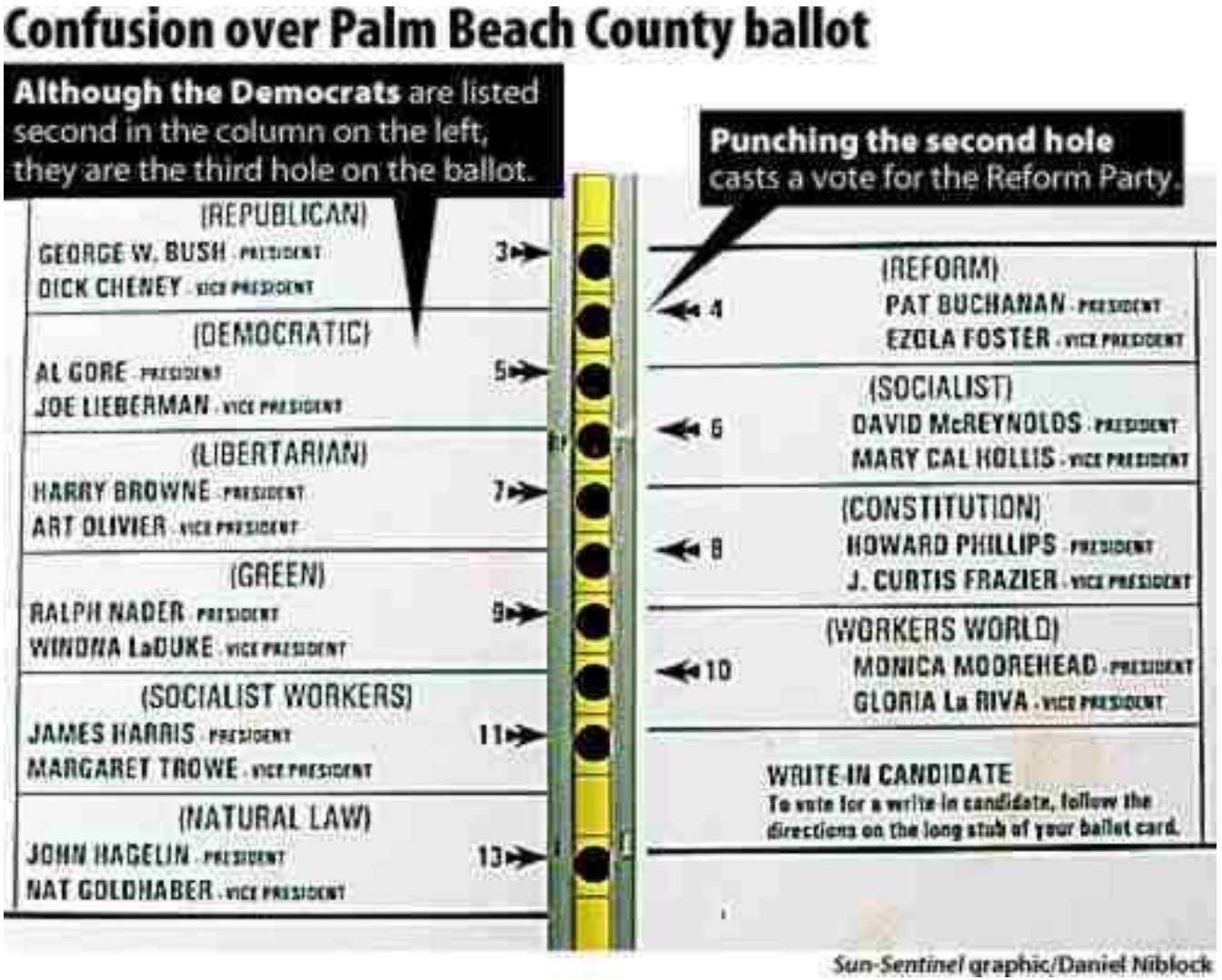
Why is this a better design?

Preece 2002

From Palmiter

Mapping

1.5 to 2 million votes were "lost" in the controversial 2000 Presidential election due to ballot design (CalTech/MIT Voting Technology Report, July, 2001).



From Palmiter

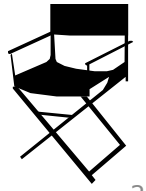
Feedback

- Is the action I just took, understood by the device or system?
- Did I do the right thing?
- Is the system ready for the next step?

From Palmiter

Feedback

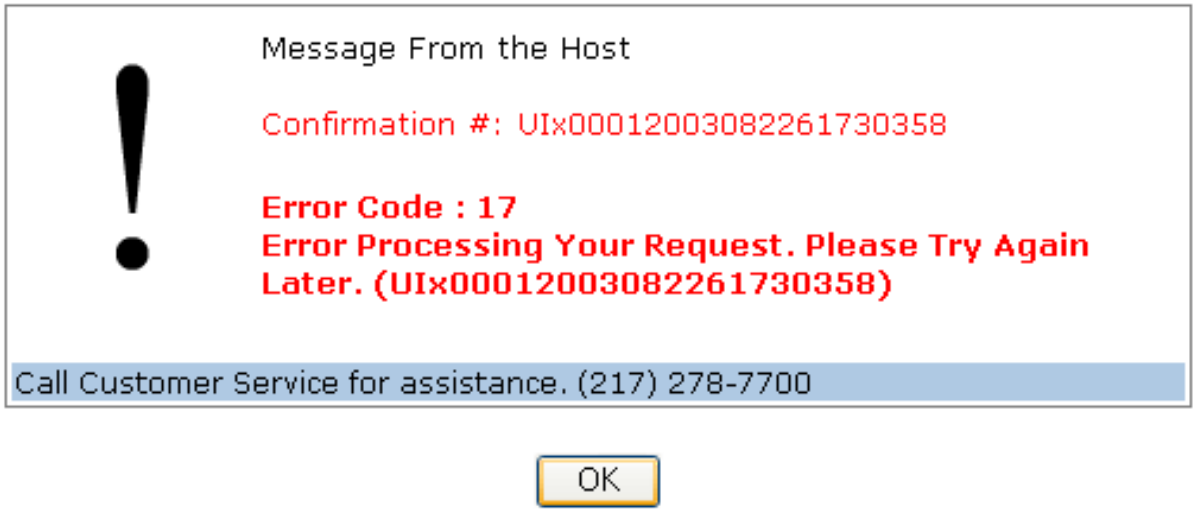
- Let the user always know where they are in the process
- Feedback about where you can go and where you are (feedback and feed forward)
- Tell them what's happening
- Tell the user how to recover
- Make error messages clear with alternatives for action



From Palmiter

What does *bunny.move(forward, 10)* do?

Unhelpful feedback



From Bailey

Feedback

- What did my action do?
  - User susieQ has been added to the class roster.

Design a Terrible Email Client

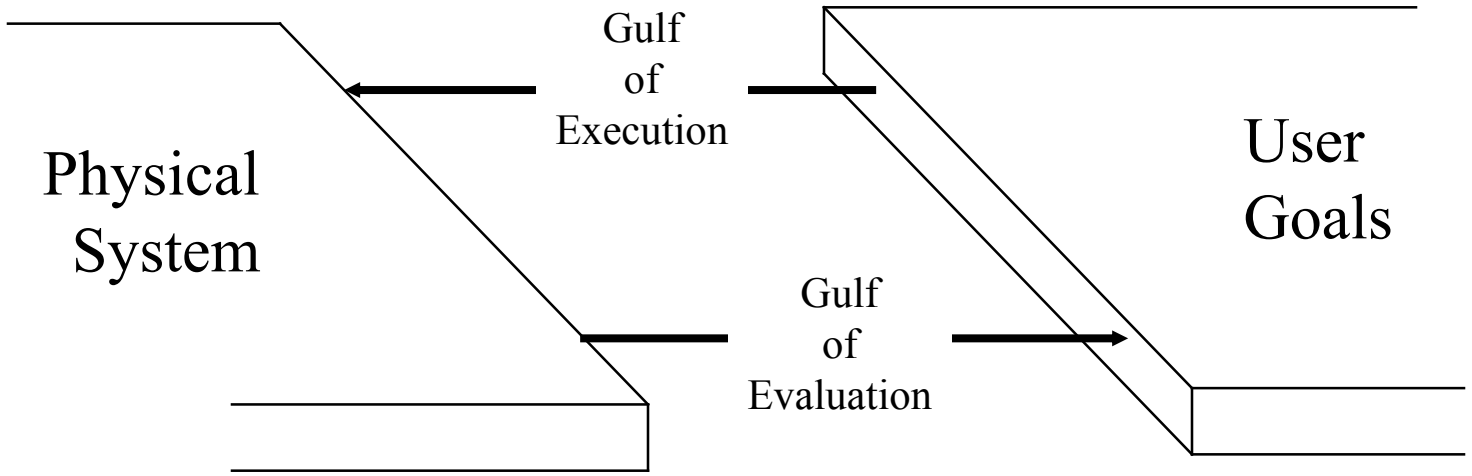
- You should incorporate example violations of:
  - Effective affordances
  - Visibility
  - Natural mappings
  - Feedback to the user

The Action Cycle

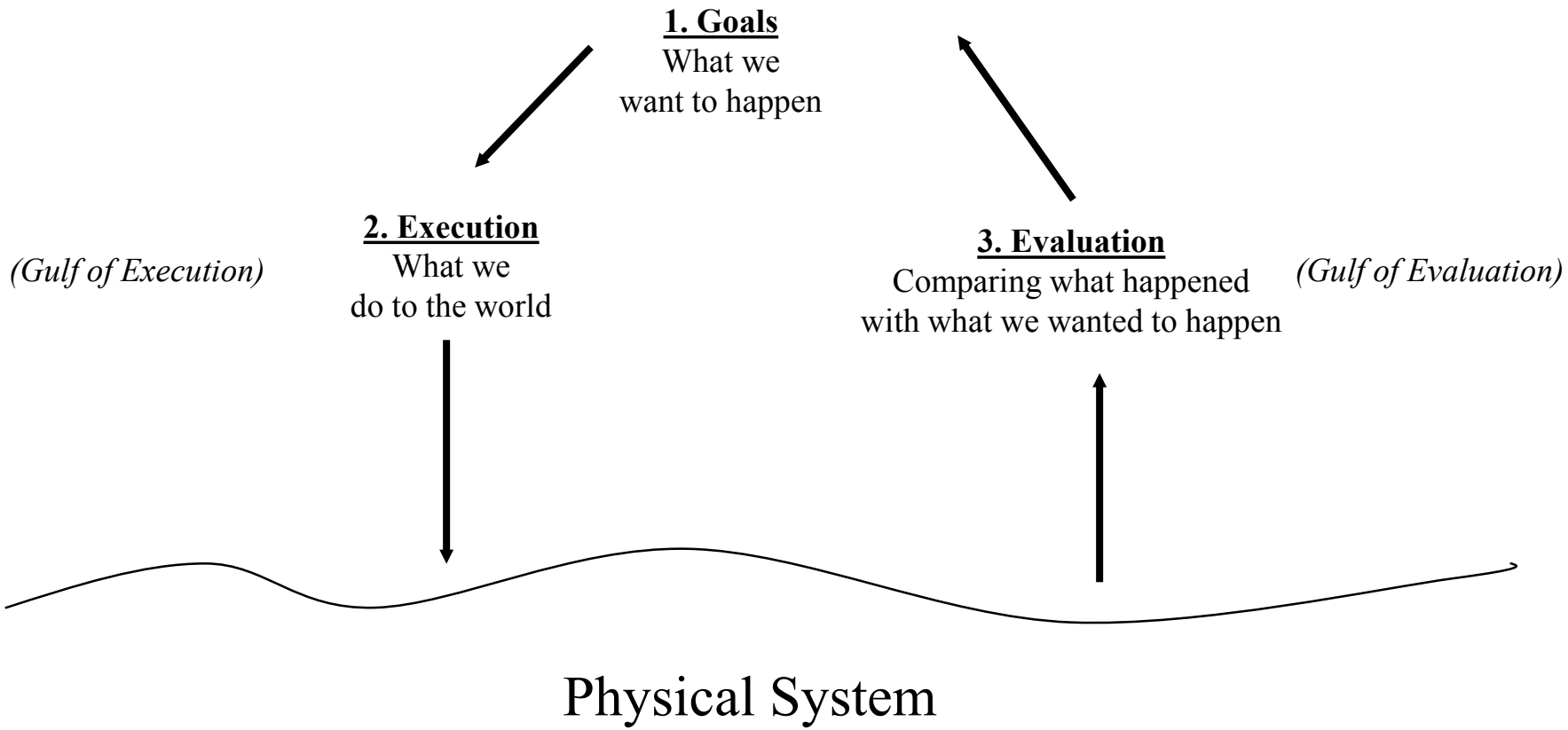
https://www.youtube.com/watch?v=ahtOCfyRbRg

Execution-Evaluation cycle

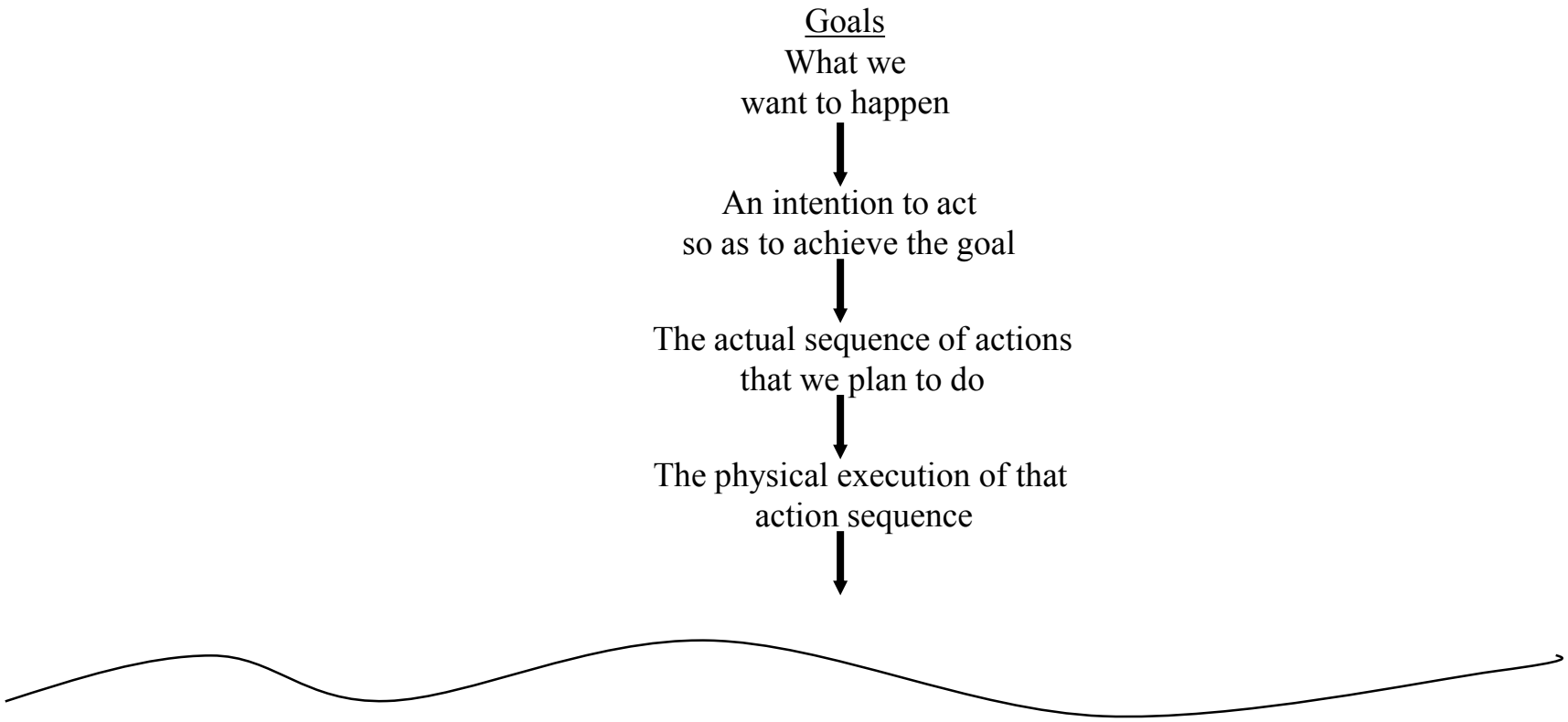
Norman (DOET, p. 46)



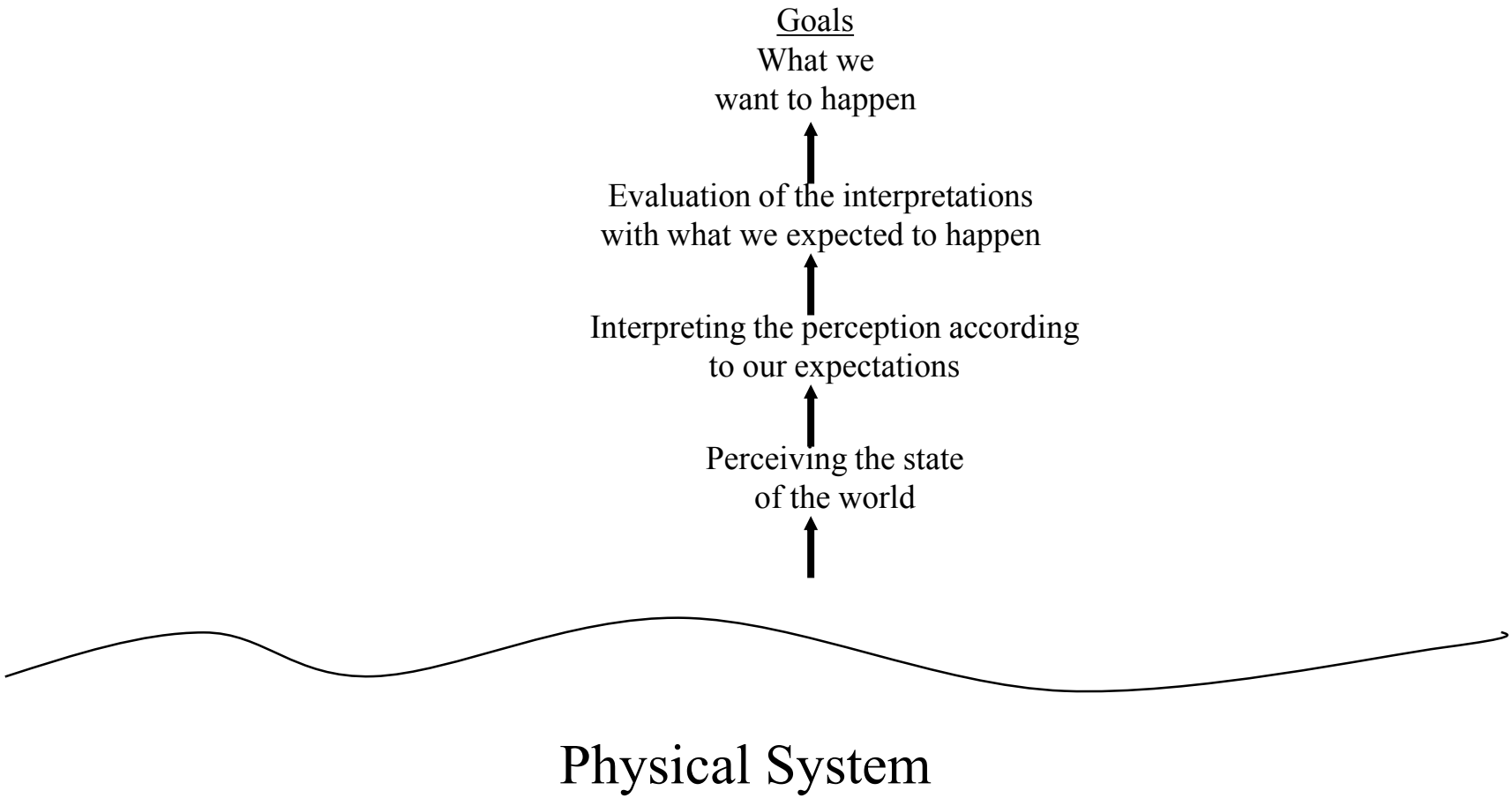
3 Stages: Goals, Execution, Evaluation



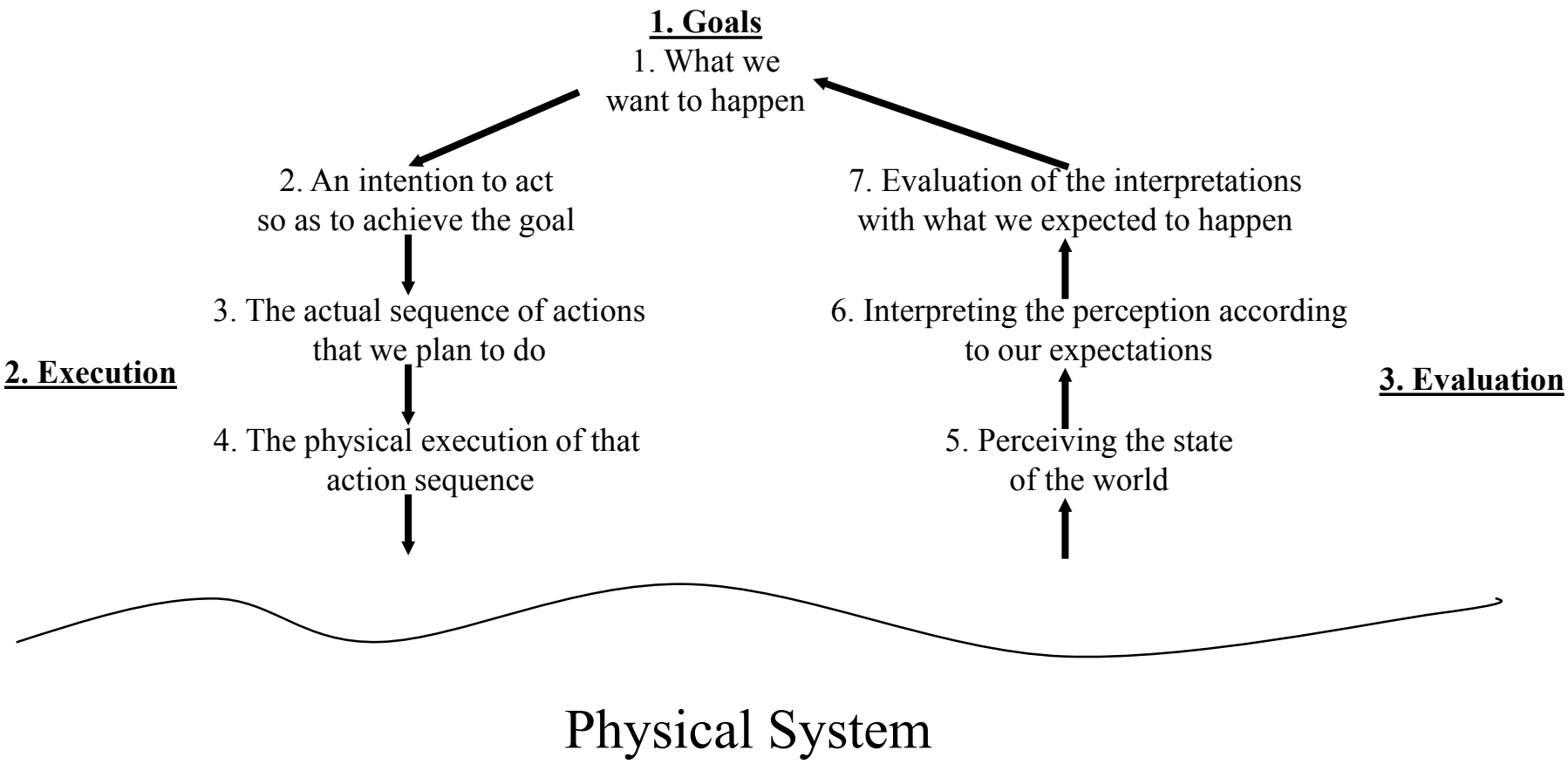
Stage 2. Execution



Stage 3. Evaluation



7 Steps: All Together



Revisit: Reading a Book Example

- 1. Forming a Goal
  I can't read my book because the room is dimly lit. I need more light in order to read my book.
- 2. Intention to Act
  There is a light next to my chair. Turning on the light would allow me to read my book.
- 3. Planning the Action
  I need to reach over and turn on the light.
- 4. Executing the Action
  I reach over to turn on the light.
- 5. Feedback from the Action
  The light turns on.
- 6. Interpret the Feedback
  Am I now able to see the text and can read my book?
- 7. Evaluate the Outcome
  Positive – I'm able to read my book. No further action is needed.
  Negative – The light doesn't work. The Action Cycle is either repeated or a new goal is formed.

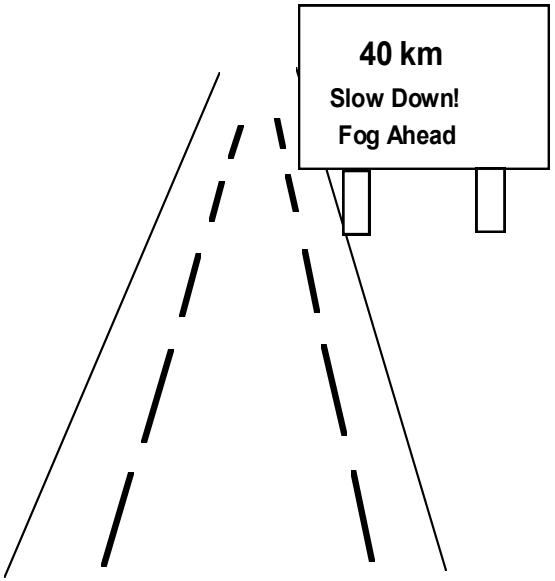
http://petekinser.com/norman-action-cycle/

The Psychopathology of computers

Britain 1976

- Motorway communication system operated 40% of it's highways
- police controlled it in real time to
  - change lane signs, direction signs, speed limits, etc

- On December 10th, failure to change the speed limit signs when fog descended
  - 34 vehicles crashed
  - 3 people killed
  - 11 people injured and trapped in their vehicles
  - motorway closed for 6.5 hours



Slide ideas from David Hill

Example problems

cryptic input codes

- 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 system response

cryptic error messages

- “Error code 7”

teletype machine was old, text illegible

- people could not see what they typed or system’s reply

operator overloaded with other chores

- also handled radio and telephone traffic

Some quotes

Police (at inquest)

- “The system did not accept the instruction”

Dept of Transport (after examining computer logs)

- “There is no evidence of technical failure”

System designers

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

The Coroner’s court

- judged it as "operator error"
  - the police operator:

    “failed to follow written instructions for entering the relevant data”