



# Human-Computer Interaction IS4300 – HCI

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*Please make a name tag...*



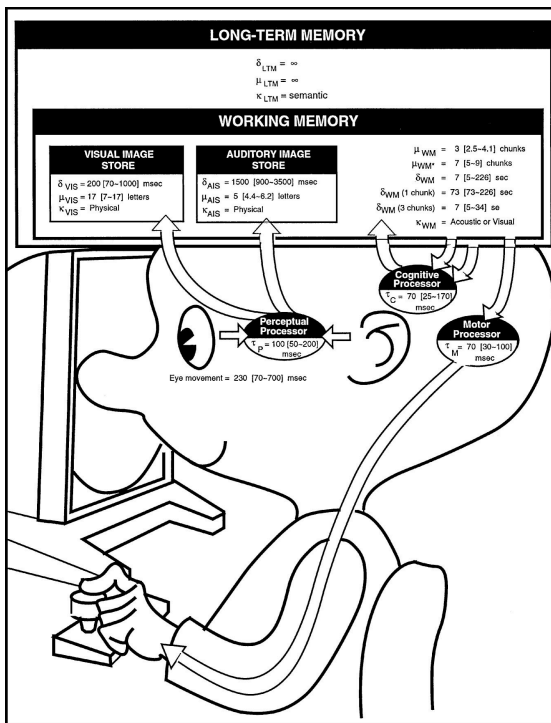
## Overview for Today

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- Mug shots
- Quiz
- Humans (from view of Cognitive Science & HCI)
- Project Brainstorming

# Humans

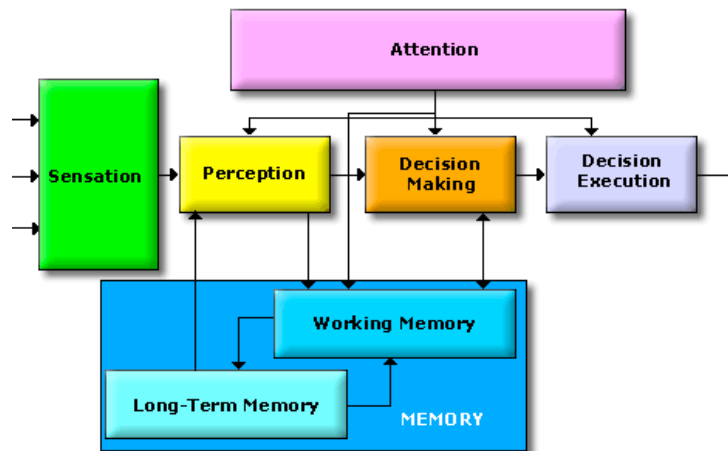
*From a Cognitive Science point of view*



The Psychology of Human Computer Interaction. 1983

Stuart Card  
Thomas Moran  
Allen Newell

# The Human Information Processor



## Perception

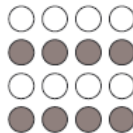
- the organization, identification, and interpretation of sensory information in order to represent and understand the environment.
- Ramifications for UI design?

## Gestalt principles of visual perception

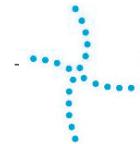
proximity



similarity



continuity



closure



symmetry



8

## Human Vision

- Why can't you use color alone as an output modality?
- 8% males and 1% females color blind
  - Deuteranomaly: Red-green (most common)
  - Protanopia: Blue-green
  - Protanomaly: Red-green
  - Etc.

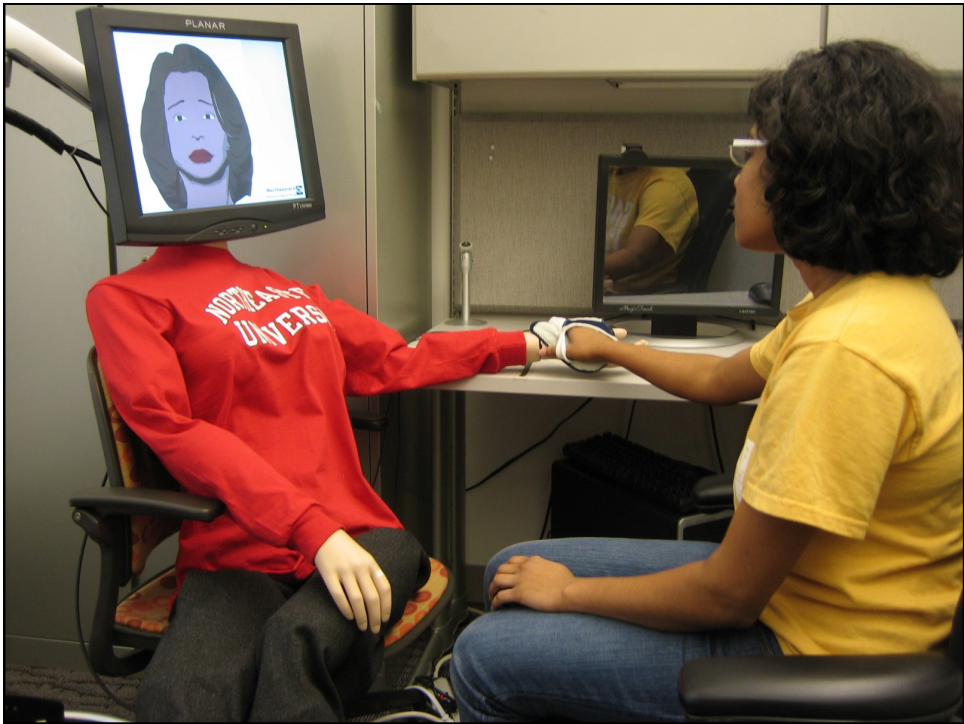


# How do we design for Visual Human Input?



# Haptic Human Input

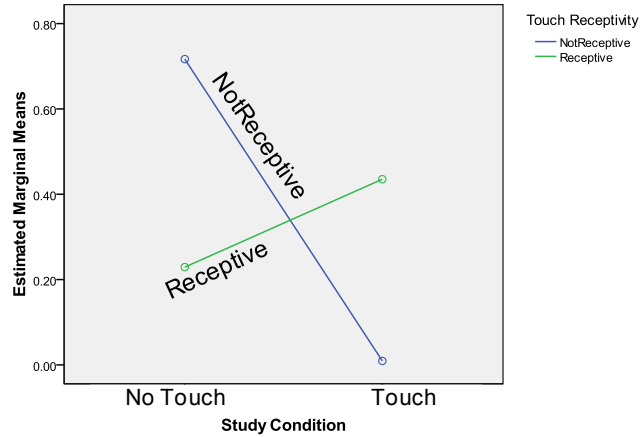




# Empathic Touch



Estimated Marginal Means of Change in WAI Over Baseline



# Vestibular Human Input



## Olfactory Human Input



## Taste Input Tongueduino



## Tricking Perception

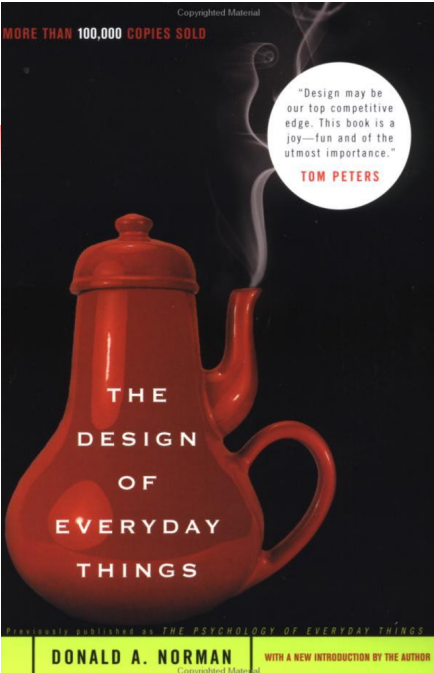


- Augmenting Endurance...
- Ban, et al, CHI' 13

## Attention

- “the concentration of mental effort on sensory or mental events”
- Selective (or focused) attention
  - whether or not we become aware of sensory information.
  - Eg, cocktail party effect
- Divided attention
  - attention can be thought of in terms of mental resources that can be divided between tasks being performed simultaneously
- Why important for HCI?
  - Safety critical systems
  - Design multi-tasking environments






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TOM PETERS

THE DESIGN OF EVERYDAY THINGS

THE PSYCHOLOGY OF EVERYDAY THINGS  
DONALD A. NORMAN WITH A NEW INTRODUCTION BY THE AUTHOR  
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Slips vs. Mistakes



## Slip vs. Mistake

- Slip
  - Error in executing action
- Mistake
  - Error in formulating intention & action



## Human error - slips and mistakes

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### slip

- 😊 understand system and goal
- 😊 correct formulation of action
- 😞 incorrect action

### mistake

- 😞 may not even have right goal!

How to prevent these?

- slip – better interface design
- mistake – better understanding of system



## Kinds of Slips

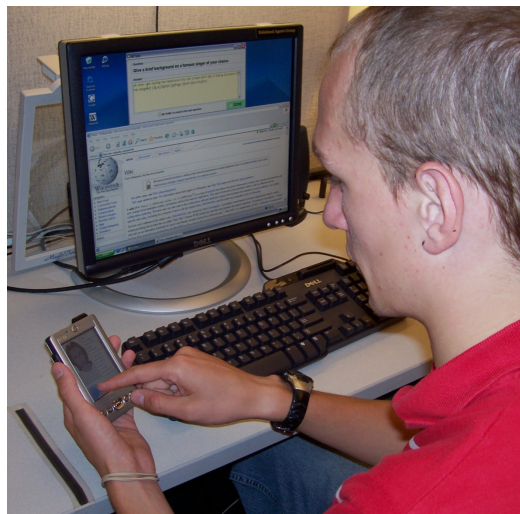
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- Capture errors
  - start of task sequence same, e.g., drive to store, but end up going to work
- Description errors
  - two tasks are very similar, e.g., throwing laundry in toilet
- Data-driven errors
  - counting, but confronted with another number and get confused
- Associative activation errors
  - internal associations between tasks, e.g., freudian slips
- Loss-of-activation errors
  - forgetting why you started a task
- Mode errors

## Attention Question

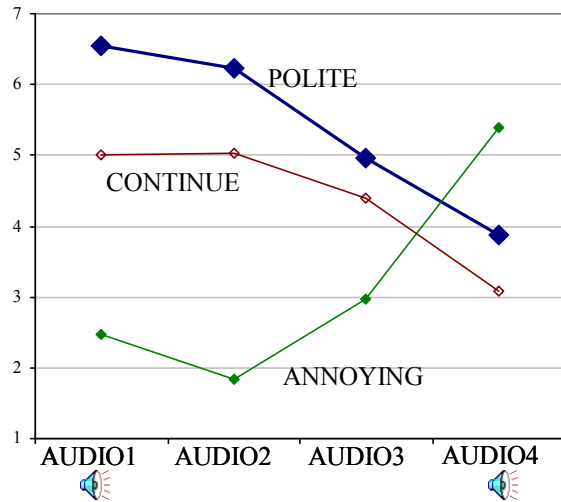
- Do problems with attention affect slips or mistakes more?

## Interruption Studies: Wrist Rests



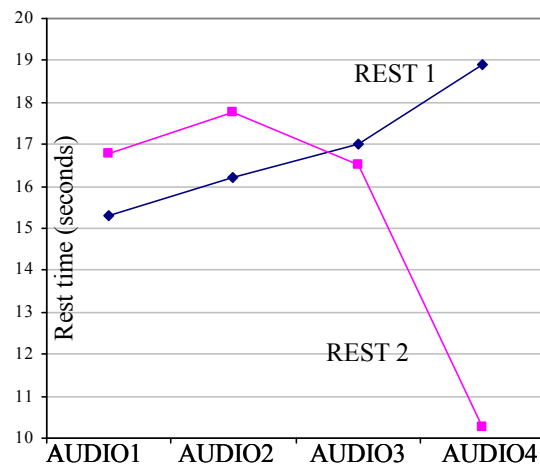


## Results – Study 1 Self-report Measures



N=29

## Results – Study 1 Behavioral



Rest Time



## Memory

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- not a single, simple information store
  - it has a complex, and still argued over, structure.
- short-term– long-term memory divide:
  - working memory is very limited but useful for holding such things as telephone numbers while we are dialing them.
  - long-term memory stores, fairly reliably things such as our names and other biographical information,
- memory is not a passive repository; it comprises a number of active processes.



## Memory Chunking

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- The capacity of working memory is approximately 4-5 “chunks”, where a chunk of information (an item) may be a word or a phrase or an image.
  - older sources suggest  $7 \pm 2$  chunks
- Ramifications for UI design?



## Recognition vs. Recall

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- Recall
  - individuals actively search their memories to retrieve a particular piece of information.
- Recognition
  - Given a piece of information - searching our memory and then deciding whether the piece of information matches what we have in our memory.



## Recognition vs. Recall in UIs

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- Which should you rely on more in the UI?
- Why?
- Examples?

## Implications of STM flushing

Early ATMs gave the customer money before returning their bank card...



## Human Output / UI Input

## Motor: Computer Input



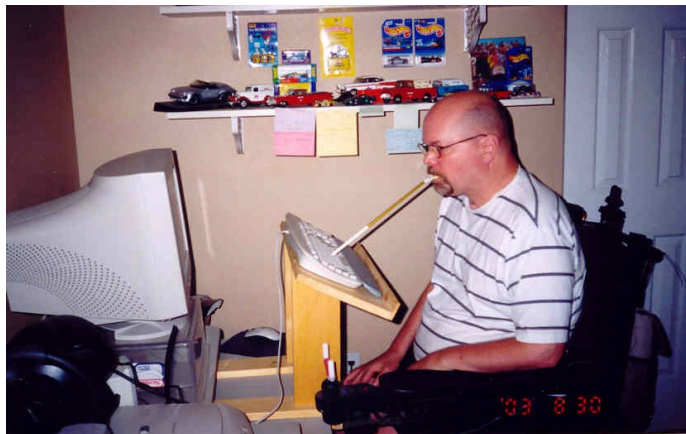
## Motor: Touch



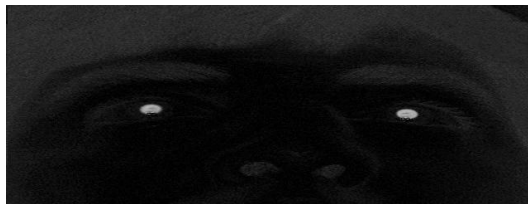
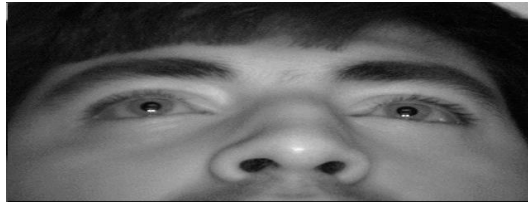
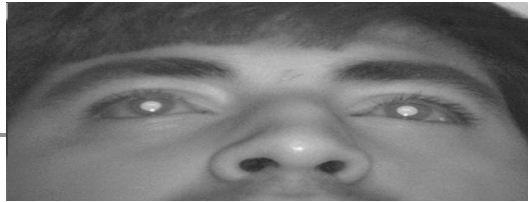
## Motor: Gestural, "Natural" Interfaces



## Motor: Head

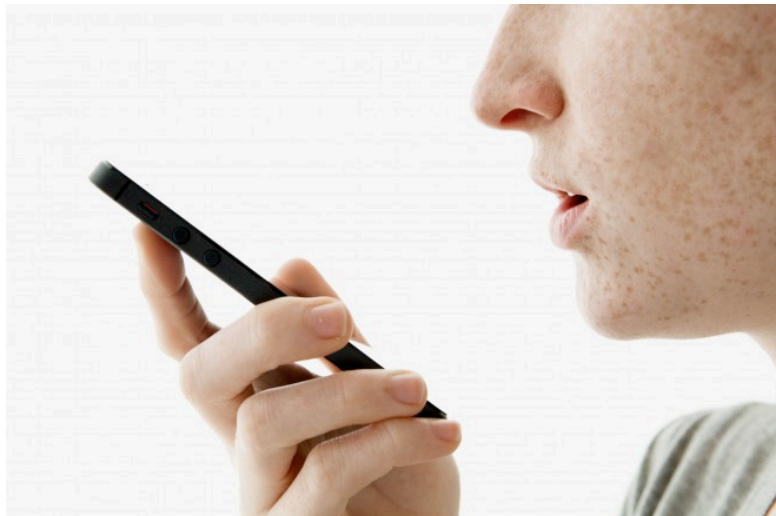


## Motor: Gaze



**Gaze tracking**

## Speech



## BCI



## Other aspects of the Human Information Processor

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## Fitt's Law

- Time to hit a target on the screen

$$a + b \times \log_2(d \times \text{distance}/\text{size} + e)$$



## Cognitive Science Review Question

- How can you tell if your display will cause users to become dizzy or nauseous?
- Test it with real users!



## Individual Differences

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- People vary significantly in all types of physical and mental ability, knowledge, skills and values.
- **Your user is not you**
- Know your user.



## Group Project Brainstorming

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## Projects



- Each project should have 3-5 members
- By 9/23 (1 week)
  - Send me a brief description of your project and partners
  - I'll reply with "OK" or suggested tweaks
  - If I don't hear from you, I may recommend that you join a particular group
- On 9/28 – project proposal due
  - 2-3 pages
  - Sketch
  - Motivation: What need does it fill?
  - Who are your users?

## Project Brainstorming



- Describe your favorite idea in 30 seconds!



## Prep for Next Class

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- Ethnography
- Read
  - Doing observational studies, Fetterman
  - Sample research papers (3)
- Finish Homework I2 (UI Critique)
- Start teaming up...
  - 1 week to self-organize