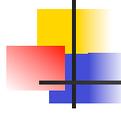


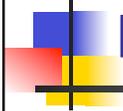


Human-Computer Interaction IS4300 – HCI



Overview for Today

- Quiz
- Humans
- Project Brainstorming



Humans

Benyon Ch 21 & 25

Ramifications for interface design?



Memory

- 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

- 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 ± 2 chunks
- Ramifications for UI design?

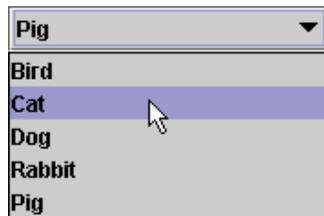


Recognition vs. Recall

- 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.

Recall vs. Recognition

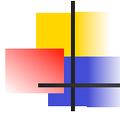
- How used in UIs?
- Which is better? Why?



Implications of STM flushing

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





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



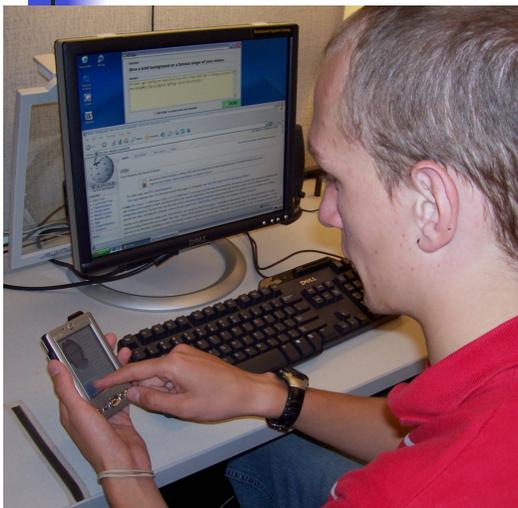
Factors affecting attention

- Stress is the most important.
- Arousal is different from attention: a general increase or decrease in perceptual and motor activity.
- Stressors (stimuli which cause stress) include noise, light, vibration and mental factors such as anxiety, fatigue, anger, threat, lack of sleep and fear
- For all tasks there is an optimal level of arousal.
- As arousal increases, ability to execute a task increases until we reach a point when we are too aroused and our performance falls off sharply.
- Simple tasks are more resistant to increased levels of arousal than are complex tasks.
- The skill of the individual is also a factor.
- A simple task to a highly skilled individual is likely to be seen as complex to a less skilled or able individual.

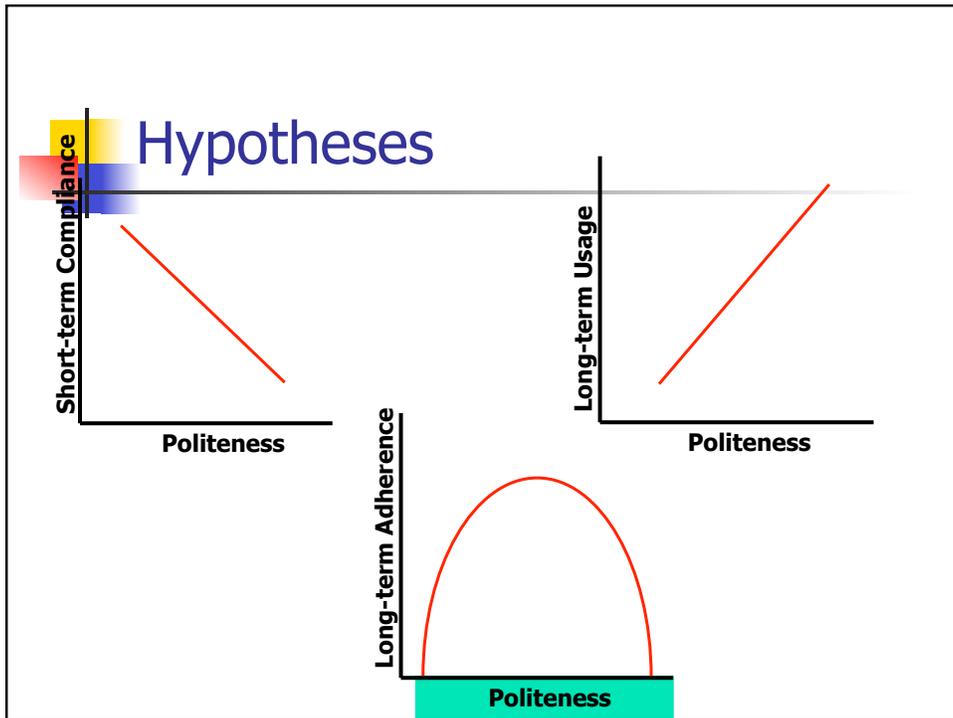
Multi-tasking & Interruption

When to interrupt?
How to interrupt?
What kinds of tasks can be interrupted?

Interruption Studies: Wrist Rests



- What is the best way to interrupt someone at work get them to perform a healthy behavior?





Experimental Design

- Series of Studies with Common Framework
- Primary task: web browsing & typing on PC
- Secondary task: “wrist rests”
- Experimenter: motivates performance of primary task
- Agent: interrupts periodically and motivates performance on secondary task



Experimental Design Measures

- Manipulation check
 - Self-reported politeness of agent
- Short-term compliance
 - Rest time
 - Self-reported effectiveness of agent
- Long-term adherence
 - Self-reported desire to continue
- Attitude towards agent
 - Liking, satisfaction, comfort, etc.



Studies

- Each 4-treatment counterbalanced within-Ss
- Each treatment:
 - Intro dialog with agent
 - Work at primary task for 10 minutes
 - Agent interrupts twice and asks them to take a wrist rest



Studies

- Study 1: Vary politeness of interrupt audio tone
 - 4 tones pre-tested on annoying-polite scale


AUDIO1

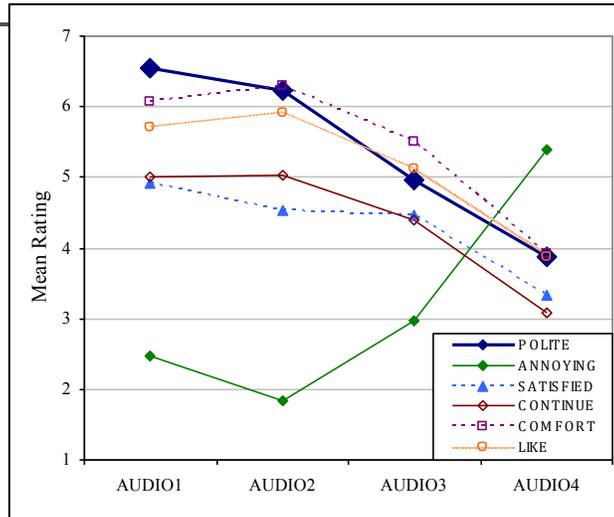

AUDIO2


AUDIO3


AUDIO4

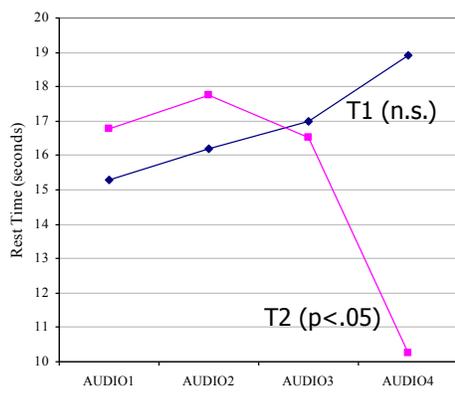


Results – Study 1 Self-report Measures

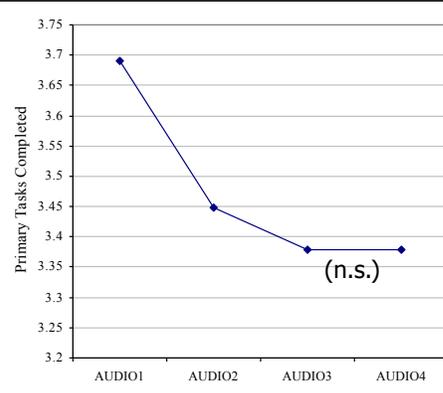


N=29

Results – Study 1 Behavioral



Rest Time



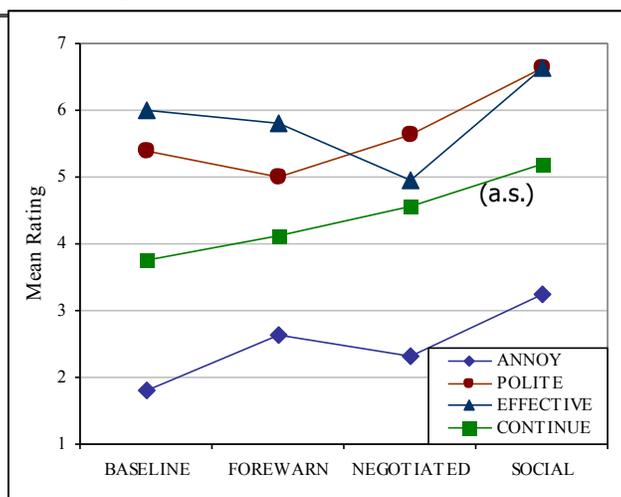
Primary Tasks

Studies

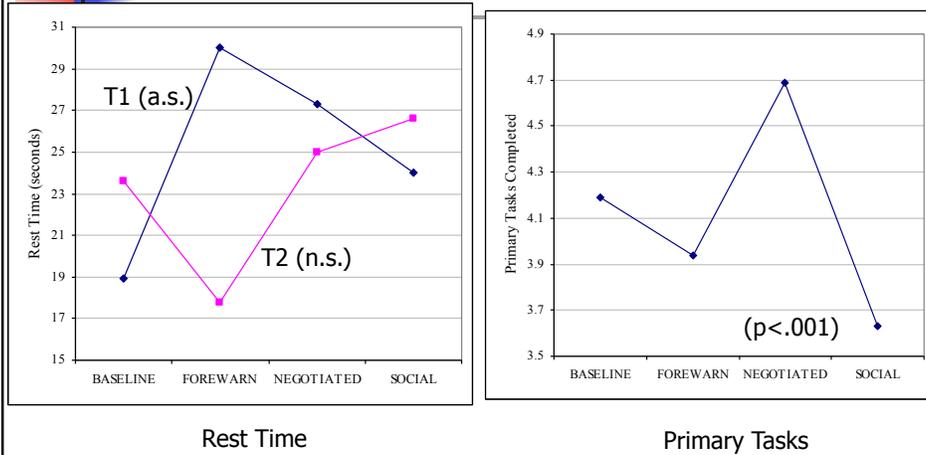
- Study 2: Compare 4 methods from literature on task interruption
 - Baseline
 - Forewarning
 - Negotiated (“snooze” button)
 - Social
 - More chatty/empathetic intro
 - Apologize for interrupt
 - Ask how feeling & empathize

Sorry to interrupt, but it's time for your next rest.
 ...
 How stressed are you feeling right now?
 ...
 Sorry to hear...

Results – Study 2 Self-report Measures



Results – Study 2 Behavioral



Ambient Interfaces





Automatic Processing

- Automatic vs. Controlled
- Active areas of research
 - Reeves & Nass Media Equation studies
 - Elaboration Likelihood Model of Persuasion
 - Personal Trait (Need for Cognition)



Mental workload

- How (mentally) busy is the user?
- How difficult are the tasks assigned to him or her – can he or she be able to deal with an additional workload?

NASA TLX Workload

Title	Endpoints	Description
Mental demand	Low/end	How much mental and perceptual activity was required (e.g. thinking, deciding, etc.)? Was the task easy or demanding, simple or complex?
Physical demand	Low/high	How much physical effort was required (e.g. pushing, pulling, etc.)? Was the task easy or demanding, slack or strenuous, restful or laborious?
Temporal demand	Low/high	How much time pressure did you feel due to the rate or pace at which the tasks or task elements occurred? Was the pace slow and leisurely or rapid and frantic?
Performance	Perfect/failure	How successful do you think you were in accomplishing the goals of the task set by the experimenter (or yourself)? How satisfied were you with your performance in accomplishing these goals?
Effort	Low/high	How hard did you have to work (mentally and physically) to accomplish your level of performance?
Frustration level	Low/high	How insecure, discouraged, irritated, stressed and annoyed as opposed to secure, gratified, content, relaxed and complacent did you feel during your task?

Visual Search

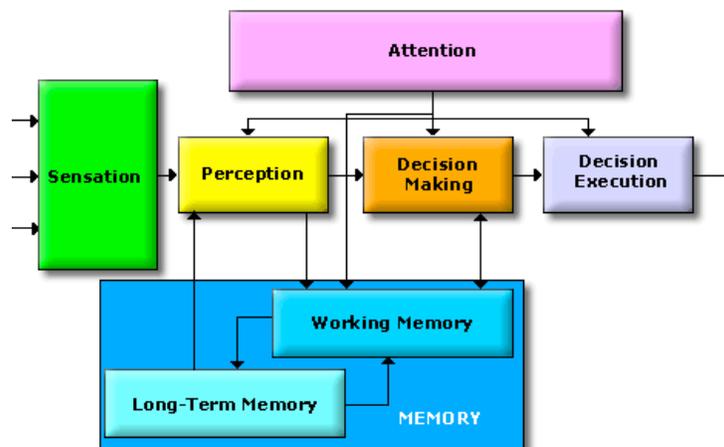
What drives what you look at?

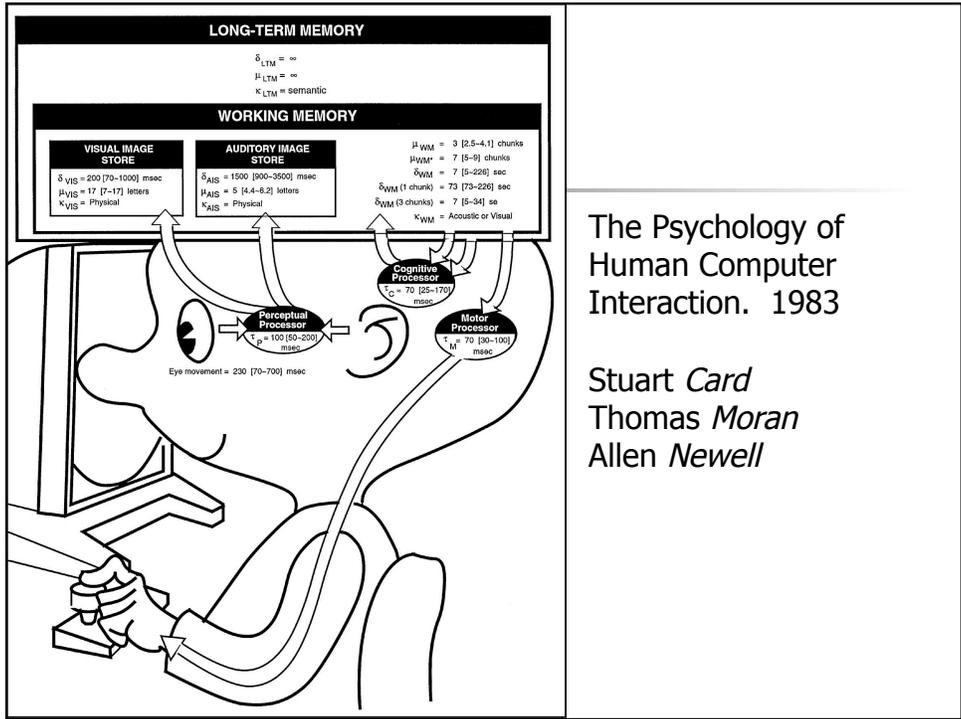


How can we discover this for a new interface?

Digression: The Human Information Processing Model

The Human Information Processor





The Psychology of Human Computer Interaction. 1983

Stuart Card
 Thomas Moran
 Allen Newell

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"Design may be our top competitive edge. This book is a joy—fun and of the utmost importance."
TOM PETERS

THE DESIGN OF EVERYDAY THINGS

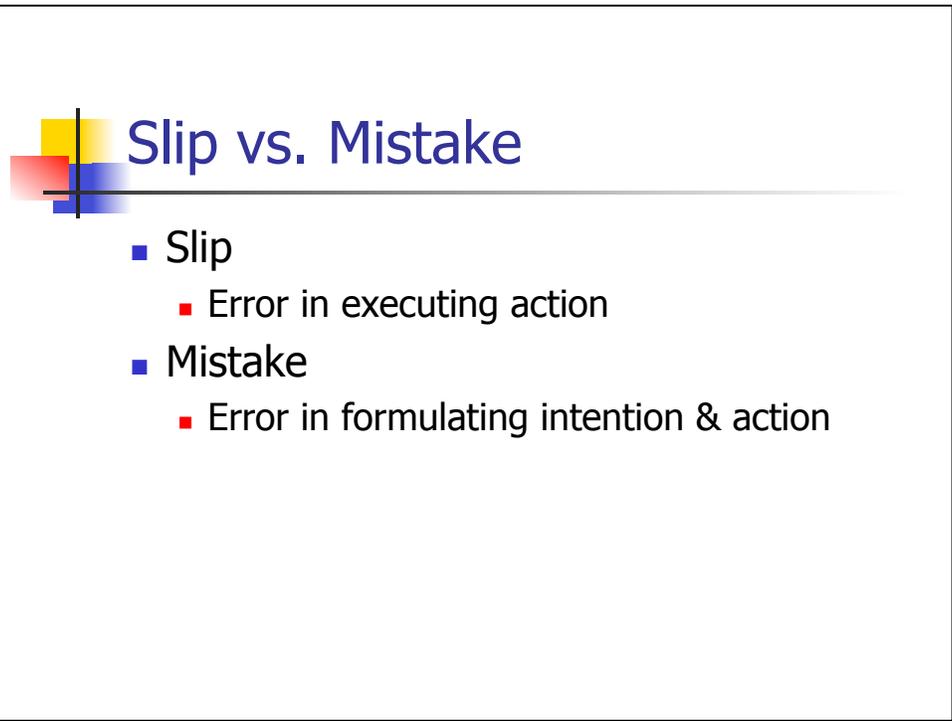
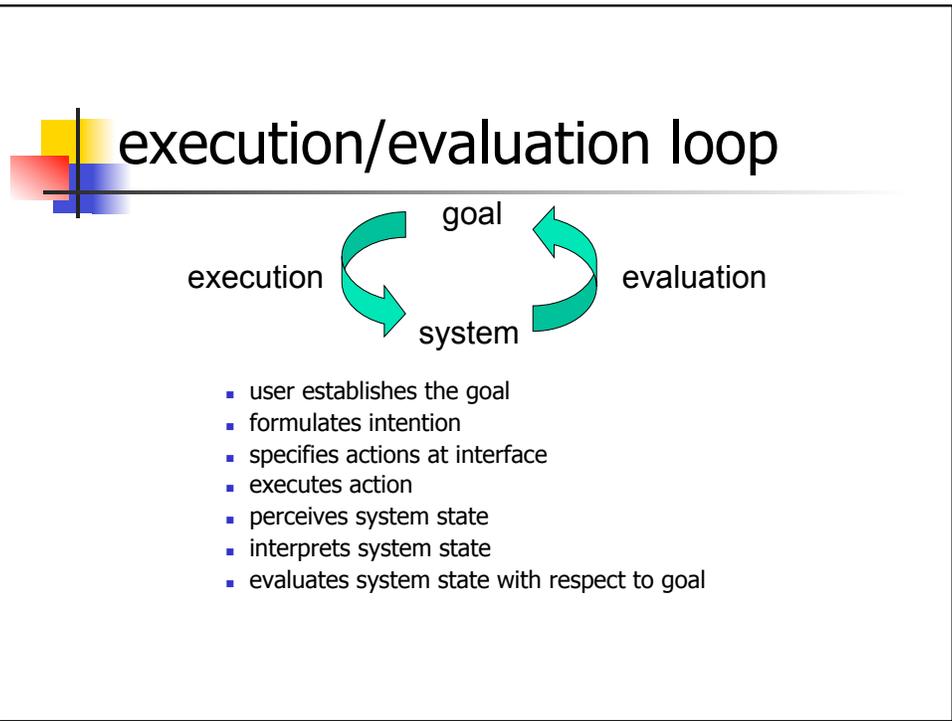
Revised and published by THE PSYCHOLOGY OF EVERYDAY THINGS

DONALD A. NORMAN WITH A NEW INTRODUCTION BY THE AUTHOR

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Slips vs. Mistakes





Human error - slips and mistakes

slip

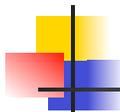
- 😊 understand system and goal
- 😊 correct formulation of action
- 😞 incorrect action

mistake

- 😞 may not even have right goal!

How to prevent these?

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



Kinds of Slips

- 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 Questions

- Do problems with attention affect slips or mistakes more?
- Do confirmation dialogs help with slips or mistakes more?



Benyon Ch 25

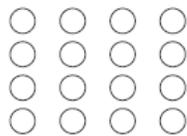
Perception & Navigation

Perception

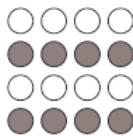
- the organization, identification, and interpretation of sensory information in order to represent and understand the environment.
- Ramifications for UI design?

Gestalt principles of visual perception

proximity



similarity



continuity



closure



symmetry





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.

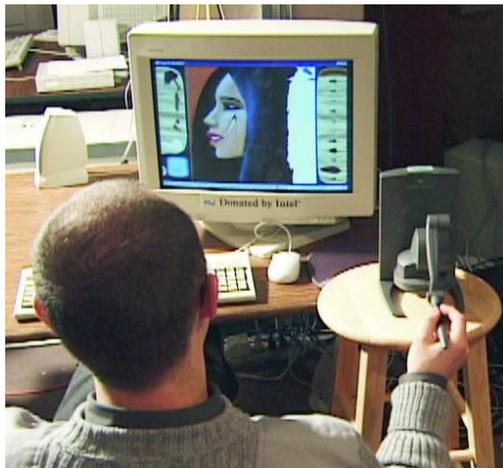


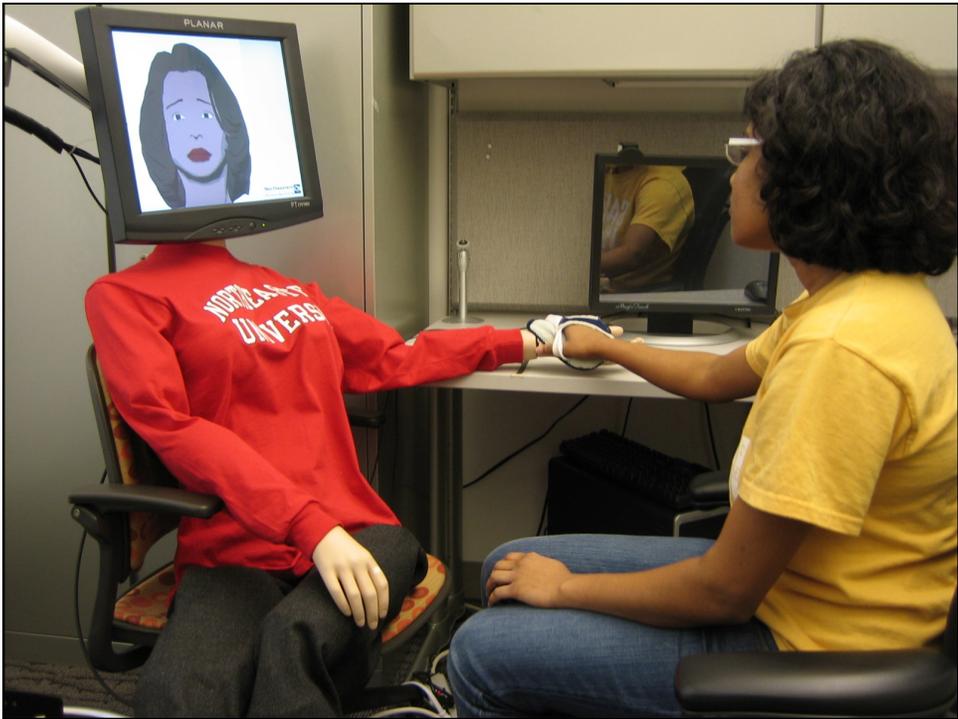
What human senses can we design inputs for?

How do we design for Visual Human Input?

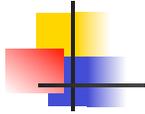


Haptic Human Input

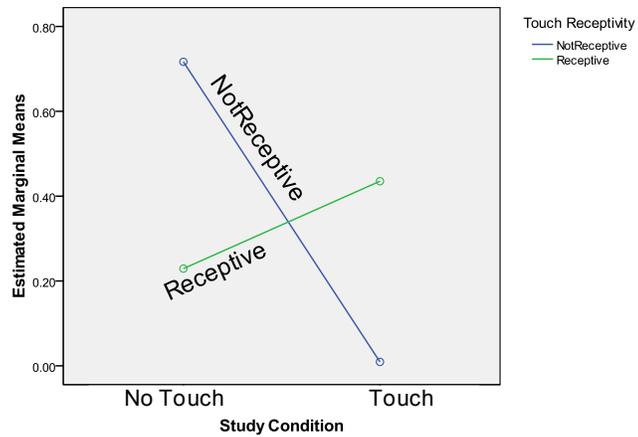




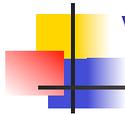
Empathic Touch



Estimated Marginal Means of Change in WAI Over Baseline



Vestibular Human Input



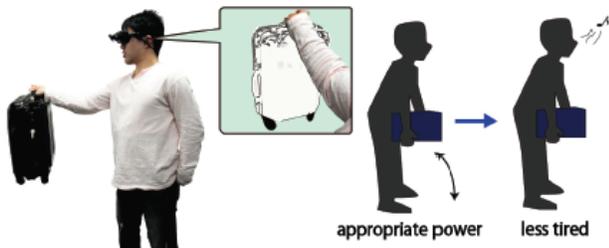
Olfactory Human Input



Taste Input Tongueduino



Tricking Perception



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

What human outputs can we use in our UIs?

Motor: Computer Input



Motor: Touch



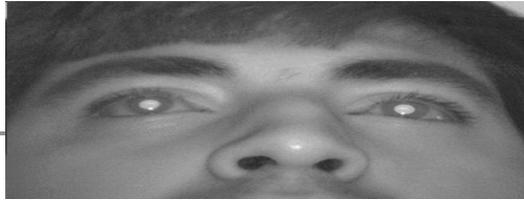
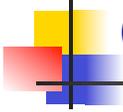
Motor: Gestural, "Natural" Interfaces



Motor: Head

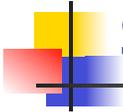


Motor: Gaze

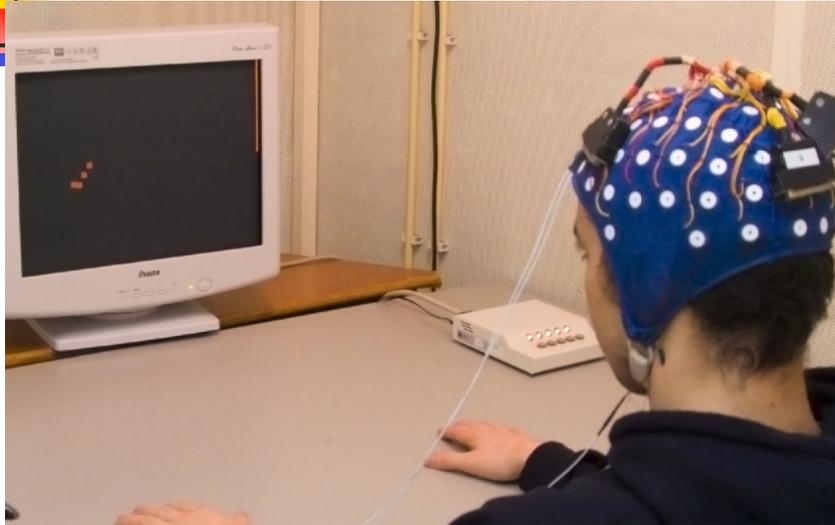


Gaze tracking

Speech



BCI



Respiration



Abdominal expansion sensor GSR sensor



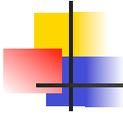
Other aspects of the Human Information Processor

Fitt' s Law

- Time to hit a target on the screen

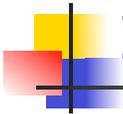
$$a + b \times \log_2(d \times \text{distance}/\text{size} + e)$$





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

- 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

- 
- ## Project Review
-
- Must have a substantial UI
 - UI must be interactive
 - Creative, original, non-obvious is better
 - Ideas: research papers & past CHI, UIST, IUI
 - Each project should have 2-4 members
 - Ideally complementary skills



Projects

- Now
 - You each present your top idea to the class
- By 9/21
 - Email me a brief description and list of team members.
 - I'll reply with OK, or suggestions for change.
- 9/26 – Project proposal due



Project Brainstorming

- Describe your favorite 1-2 ideas in 1 minute!



Prep for Next Class

- Ethnography
 - Read Benyon Ch 2 & 7
 - Read Fetterman; 2 CHI papers
- Finish Homework I2 (UI Critique)
- Start teaming up...
 - 1 week to self-organize