

What is Human-Computer Interaction (HCI)?



- Study and development of computer-based **interfaces** with the express purpose of **making them easier for humans** to use
- HCI involves
 - Study of humans using interfaces
 - Development of new applications for users
 - Development of new devices and tools for users

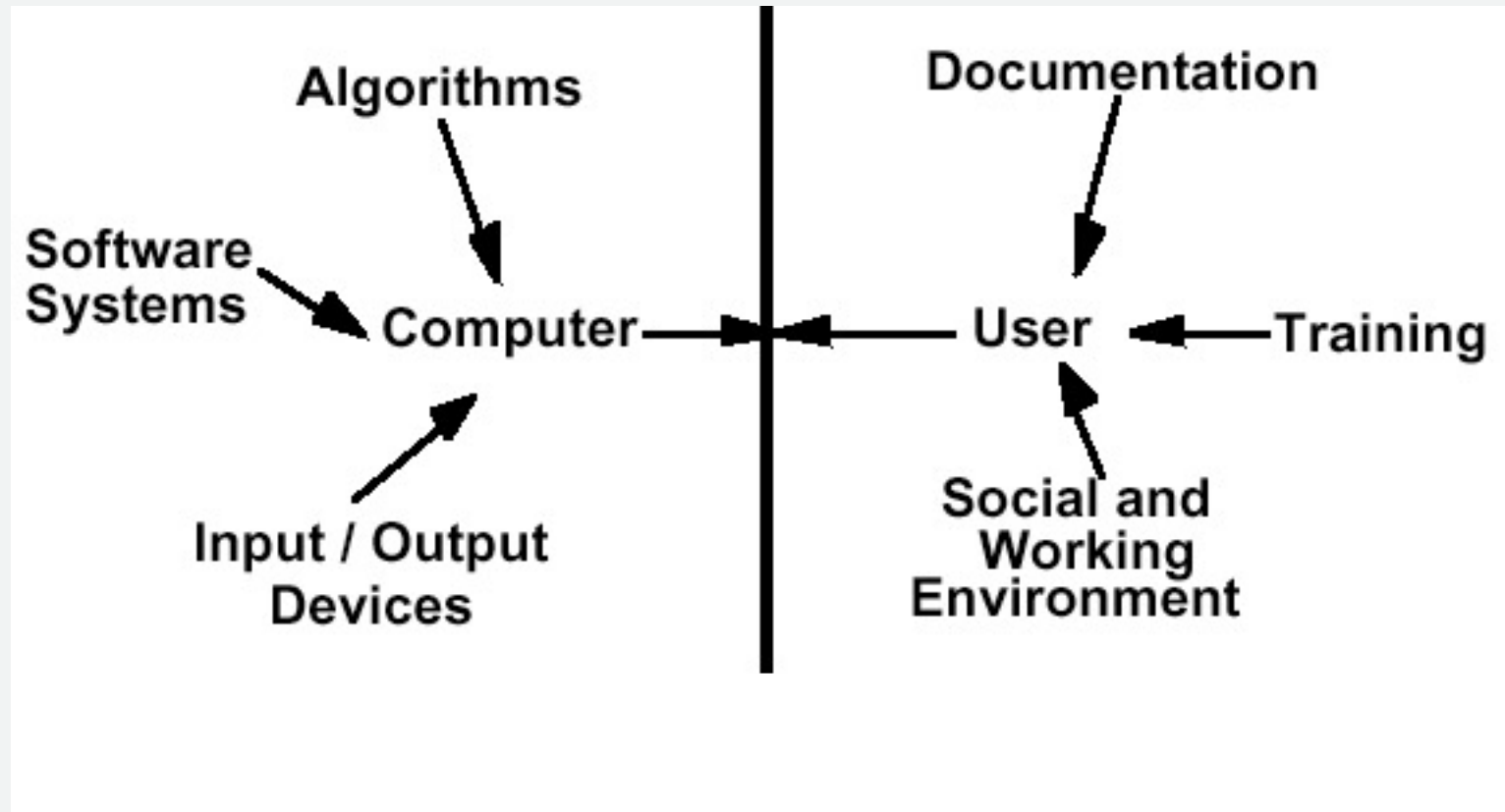
A Word of Caution



The following content is shared to **give you a sense** for what **UX designers / researchers think about**.

It is shared to help inform your future conversations – not to quiz you.

What is a User Interface?





- Telephone on my desk
 - E.g., buttons for “Ring Again”, “Redial” ???
 - Voice mail
 - listen to message = 2
 - delete message = 76
 - save message = ???
 - incomplete prompts

Why are User Interfaces Poor?

- Inadequate training of people developing interfaces
- Diversity of knowledge required to design good interfaces
- Rapid technological advances
- Reluctance of companies to commit resources
- Poor management - programmers do not speak with the user design team, and vice versa

Importance of Good User Interface Design



Motivating example: [Breaking down Amazon's mega dropdown](#)

Importance of Good User Interface Design

- Reduction in coding (labelling) costs
- High costs of interface problems
- Serious life-threatening errors
- Good interfaces sell products
- Increased productivity
- Prevention of work-related disorders

User Interface Code

- In a typical graphical user interface:
 - Estimated 40-90 percent of code concerned with user interface
 - Most estimates around 70 percent
 - If done wrong, has to be redone
 - If not fixed, cost passed on to users



- A good user interface may result in:
 - Increased productivity
 - Reduced training cost
 - Preventable user errors
 - Reduced employee turnover
 - User satisfaction
 - Higher quality products produced

Increased Productivity

	20 users
X	230 days
X	100 screens per day
X	10 sec per screen (savings)
<hr/>	
=	1278 hours
	or 32 weeks

Reduced Training Costs

	20 employees
X	2 systems/applications per year
X	2 1/2 days per application
<hr/>	
=	100 days or 20 weeks

Training and support often more costly than hardware and software

Preventable User Errors

	500 users
X	20 errors per year
X	15 minutes per error

=	2500 hours lost or 63 weeks
----------	--

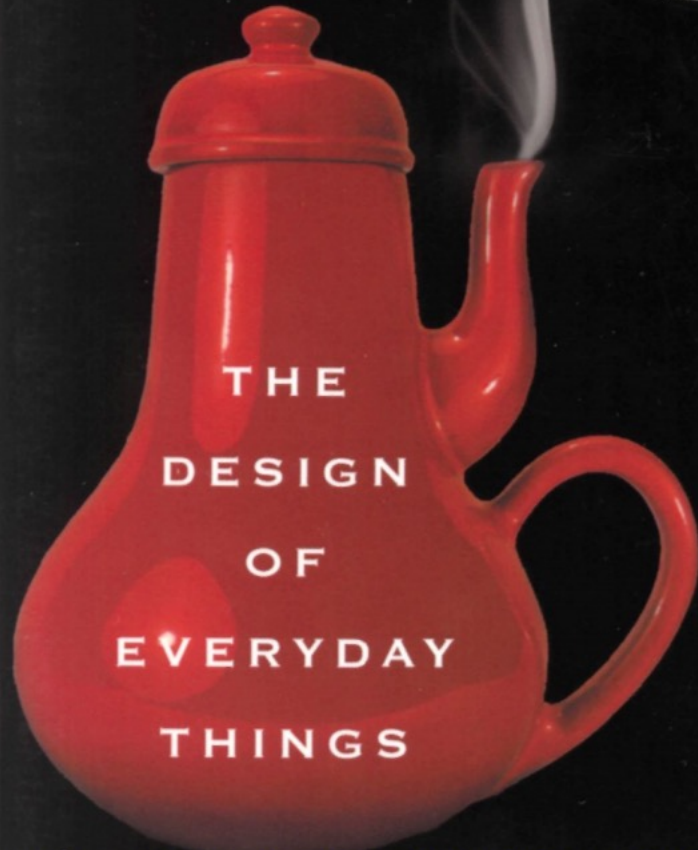
Serious Life-threatening Errors

- Airline crashed in 1996 into a mountain-side in Colombia killing all aboard.
 - Pilot typed in "R" rather than full name of airport
 - Guidance system took first airport in the list beginning with "R": wrong airport
 - Plane ran into a mountain as result
- HCI can save lives.

MORE THAN 100,000 COPIES SOLD
WITH A NEW INTRODUCTION BY THE AUTHOR

"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

Previously published as *THE PSYCHOLOGY OF EVERYDAY THINGS*

DONALD A. NORMAN

AUTHOR OF EMOTIONAL DESIGN

Why Study User's Cognition?



- A human-machine network can be regarded as a complex information-processing system
- And users themselves are also complex information-processing systems
- It is useful to know about users' information-processing capabilities, so that one can adapt information-processing capabilities of their tools to match!

USER EXPERIENCE DESIGN: Focus on the “I” in HCI

- FIF: Form Implements Function (Famous phrase: “Form follows function”)
 - Psychology, Sociology, Philosophy
- Function
 - Physiology, Ergonomics
- Function & Form
 - Industrial & Graphic Design, Sound Design, Cinema,
- Form & Function & Implementation
 - Software Engineering
- Function & Implementation
 - Electrical Engineering
 - Implementation

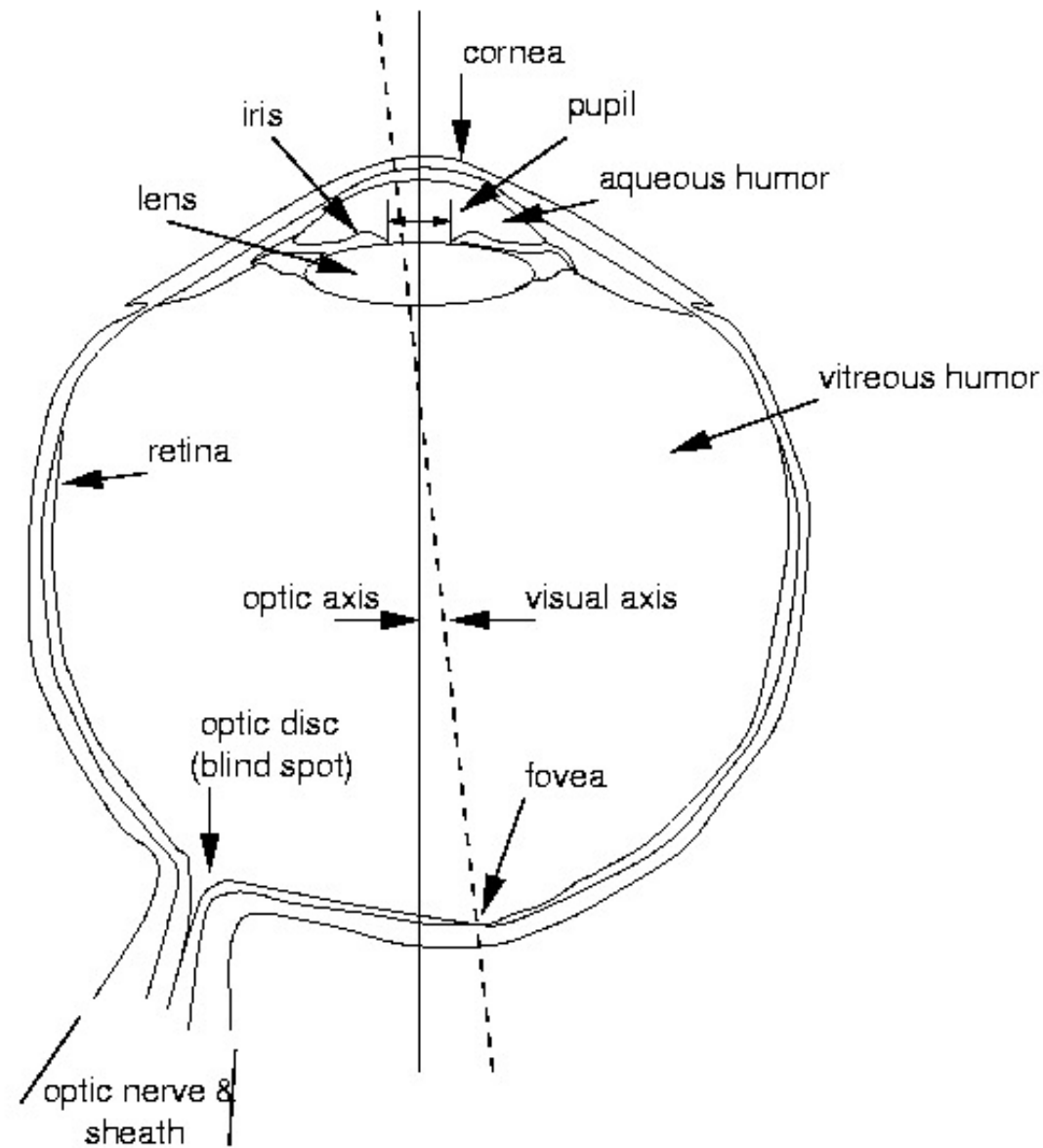
- **There are three levels of control in schemas (Rasmussen, 1983):**
 - Skill-based**
 - Preprogrammed scripts that can be triggered
 - Routine tasks with automatic S/R,
 - No execution feedback required
 - Rule-based**
 - General rules to be applied in different situations
 - Task consists of repetitive skills, activated after rule selection
 - Stimuli are used in determining rule to trigger.
 - Knowledge-based situations**
 - No fixed rule exists
 - Use of abstract knowledge to solve problem
 - Choose between alternative solutions and their consequences

- What is an error?
 - The failure of **psychological functions**
 - In our context: such that it leads to **not achieving our goals**
- Due to
 - The wrongful **selection** of a schema
 - Or the wrongful **execution** of a schema
 - Wrong design** of system or organization

Two Types of Errors

- **Slips**
 - Errors in execution of a sub-schema that was correctly selected for execution
 - E.g., hitting throttle instead of break
 - Skill-based, rule-based
 - Errors easily discovered**
- **Mistakes**
 - Triggering of the wrong rule, leading to execution of the wrong sub-schema
 - E.g. Arrived to work and there is nobody there: it's a Bank Holiday!!!
 - Rule-based, knowledge-based
 - Errors only discovered when it is too late**

The Eye

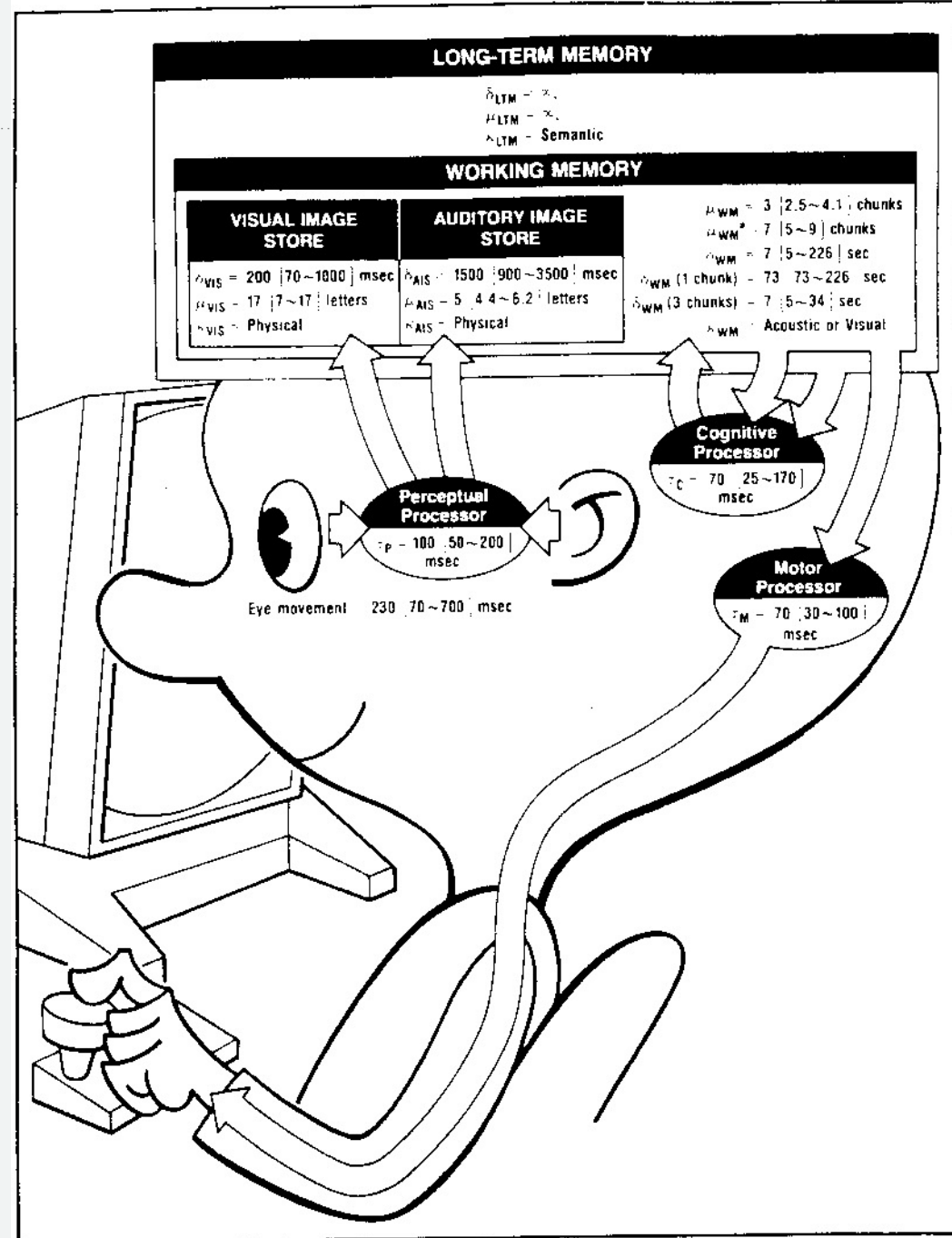


Acuity Requires Eye Movements

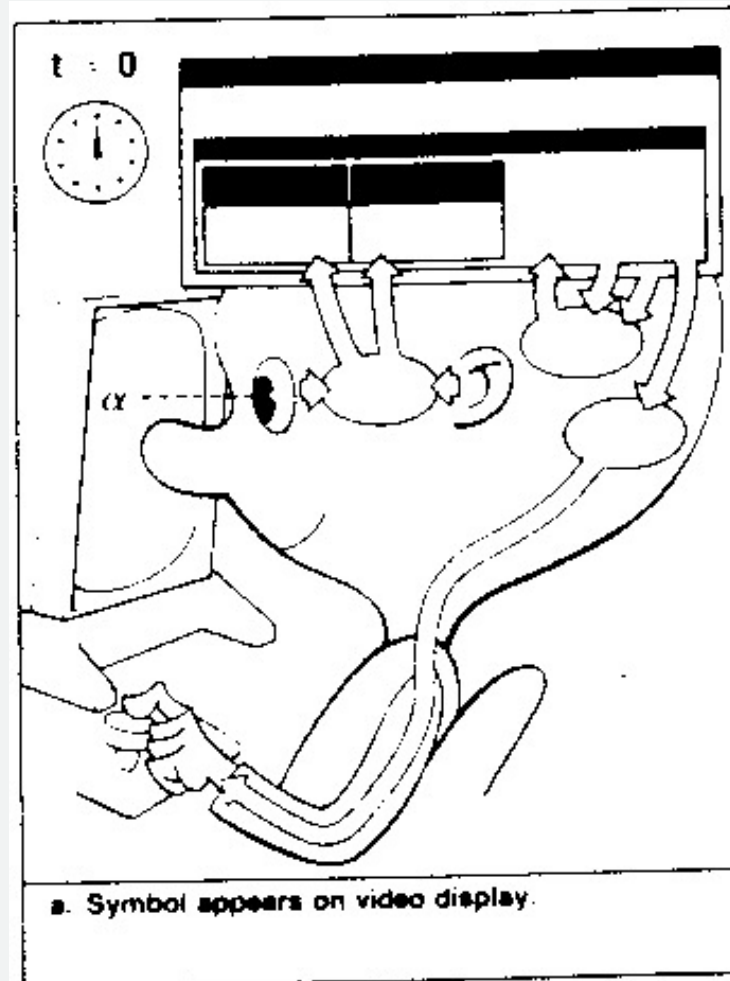
- Eye movements reposition the fovea
- Five main classes of eye movements
 - Convergence/divergence: focus movements
 - Smooth pursuit: smooth tracking movements
 - Saccadic: ballistic movements
 - Nystagmus: sawtooth movements while tracking
 - Fixations (no movement)

- How Large Should a Quarter Be?
 - Dime: 18 mm Nickel: 21 mm Quarter: 23.5 mm
 - Difference between quarter and nickel big enough?
- **Weber's law $\Delta S/S = k$**
 - Just noticeable difference/size = constant**

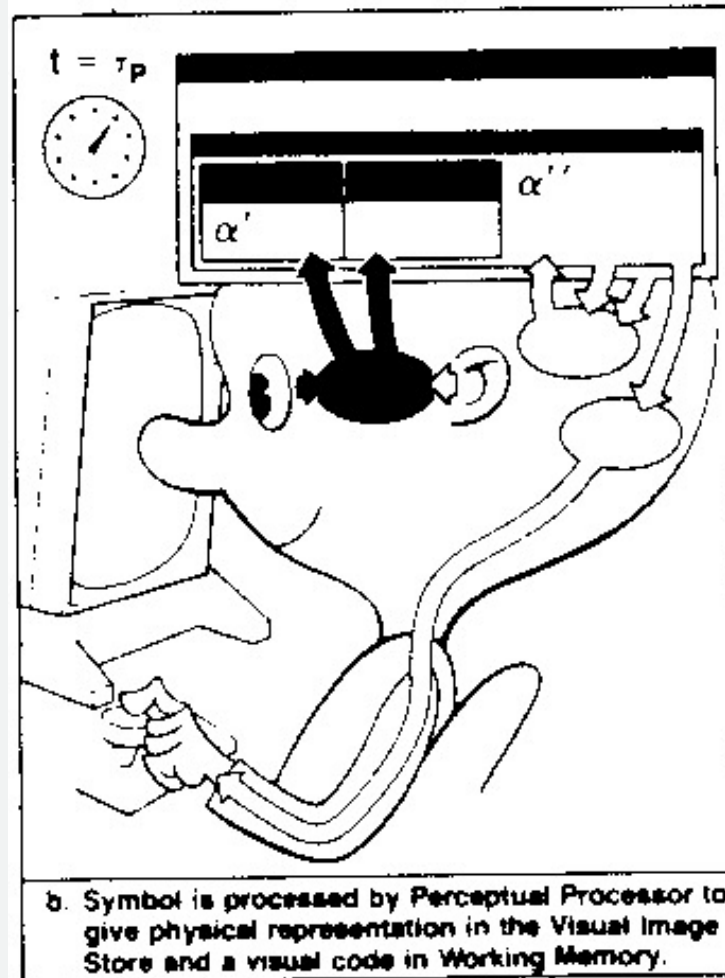
- Model Human Processor
- Card Moran & Newell (1983)



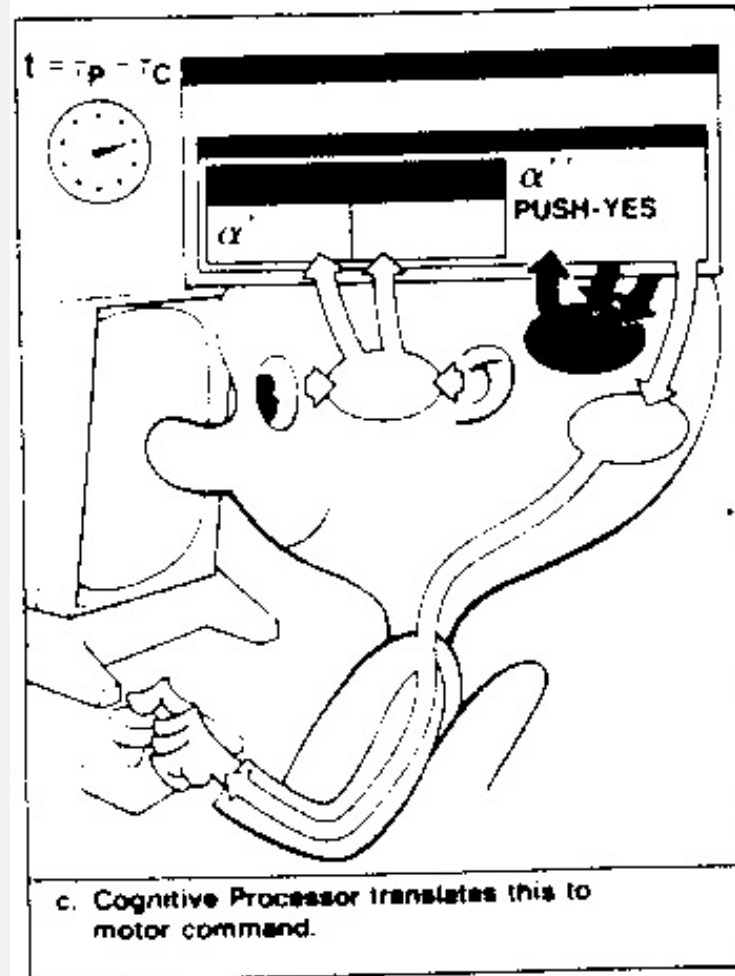
An Example: Basic Response Time Prediction



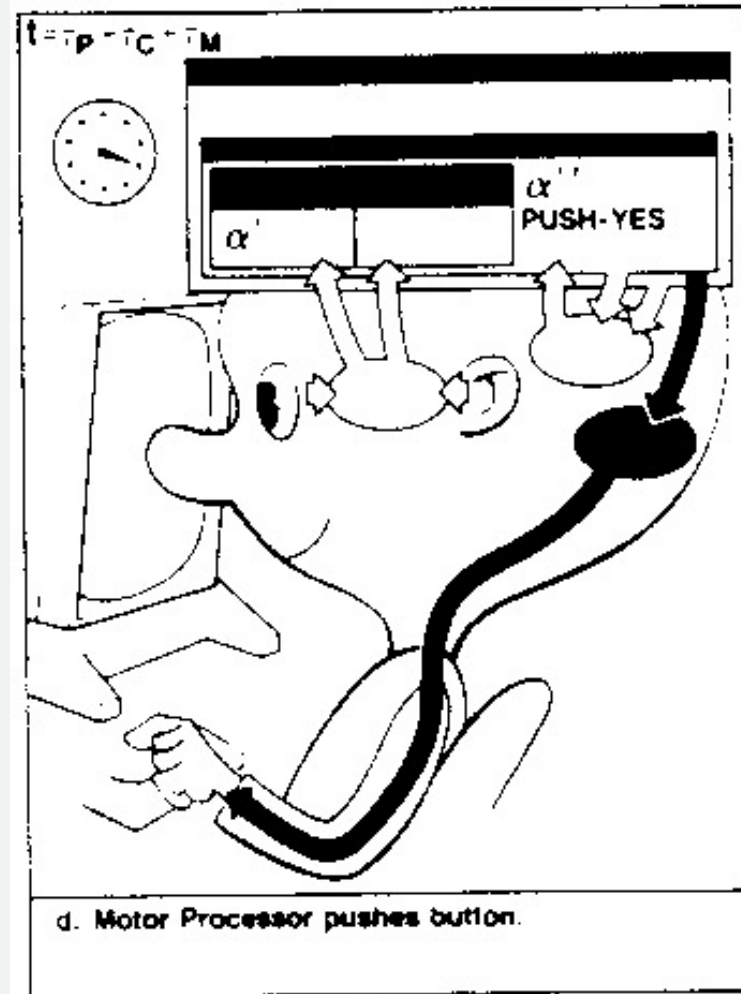
An Example: Basic Response Time Prediction



An Example: Basic Response Time Prediction



An Example: Basic Response Time Prediction



Three Basic Laws of HCI

- Power Law of Practice
- Hick's Law
- Fitts's Law

Power Law of Practice



- The time to perform a task on the n th trial follows a power law.
 - People get better with practice, but will asymptote at a certain performance level.

Hick's Law

- Decision time increases with uncertainty about a decision to be made
 - Decision time increases **logarithmically** as number of choices increase

- Measurement of time to move something to a target (hand, mouse, head, ...)
 - A function of **distance** and **target size**
- Hick's Law explains this, to a degree:
 - The further away/smaller the surface, the more decisions made
 - The faster the feedback loop, the smaller time per decision

Summary

- Human-Computer Interaction
 - It makes good economic sense
 - It makes the user happier
 - It makes a better product