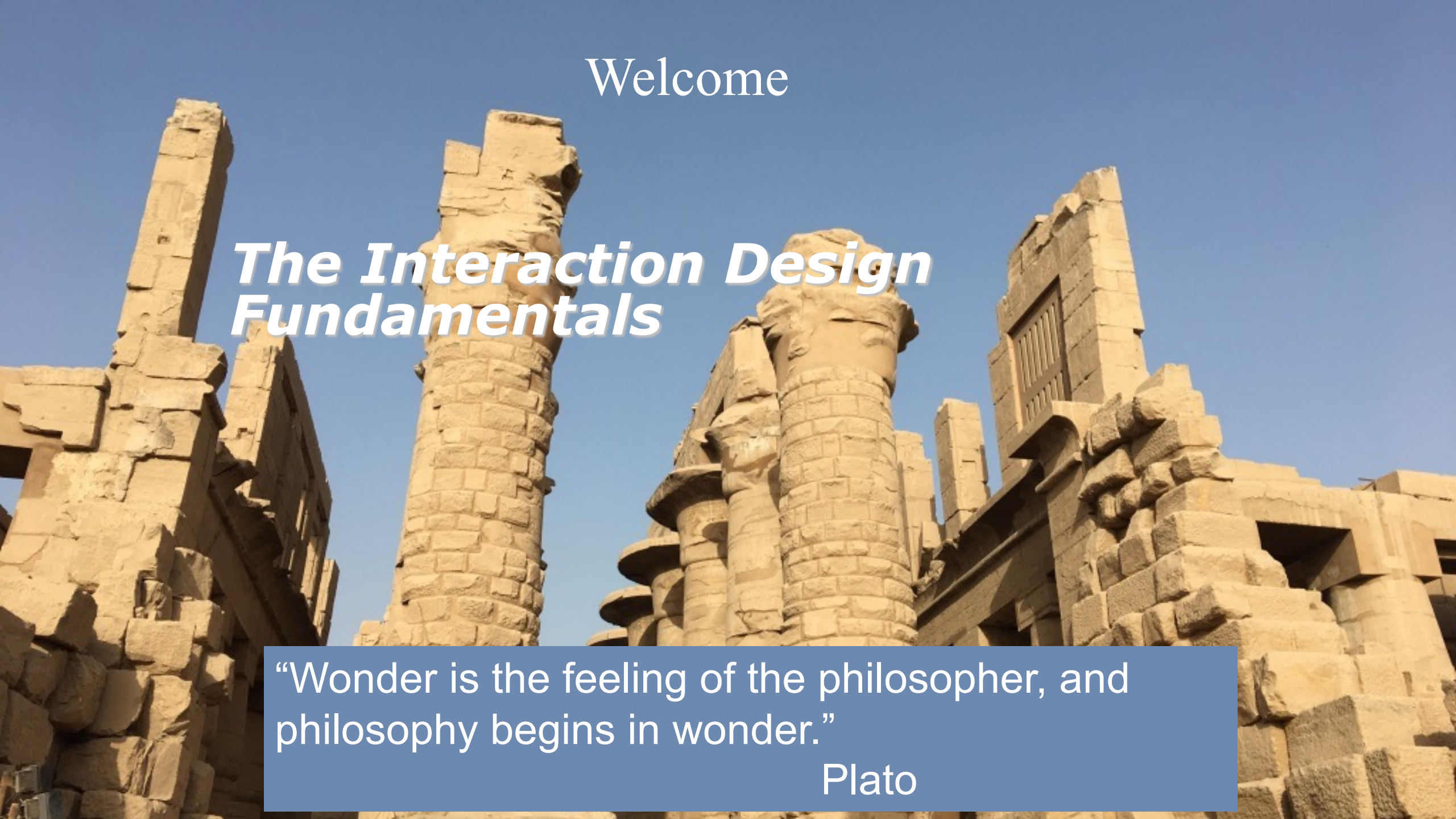


Welcome

The Interaction Design Fundamentals

"Wonder is the feeling of the philosopher, and philosophy begins in wonder."

Plato

The Interaction Design Fundamentals

Abbas Moallem, Ph.D.

Session 4

Overview

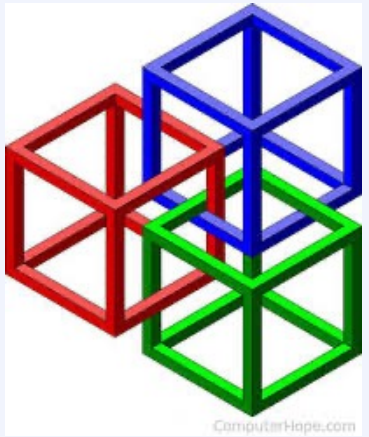
- Introduction
  - Vision, Theory, Models, Frameworks…
- Design
- Interaction Design
  - Ergonomics
  - Accessibility Culture
- Conceptual Design
  - Design Space
- Interaction Types

Introduction

Vision

Theories

Frameworks



Models

Principles

Guidelines

Standards

Visions

- A driving force that frames research and development
- Invites people to imagine what life will be like in 10, 15 or 20 years time
  - e.g. Apple's 1987 Knowledge Navigator
  - Smart Cities, Smart Health
- Provide concrete scenarios of how society can use the next generation of imagined technologies
- Also raise many questions concerning privacy and trust

Theories

- **Theories: High-level widely applicable frameworks to draw on during design and evaluation, as well as to support communication and teaching.**
- **Theories can also be predictive, such as those for pointing times by individuals or posting rates for community discussions.**

Theory

- **Explanation of a phenomenon**
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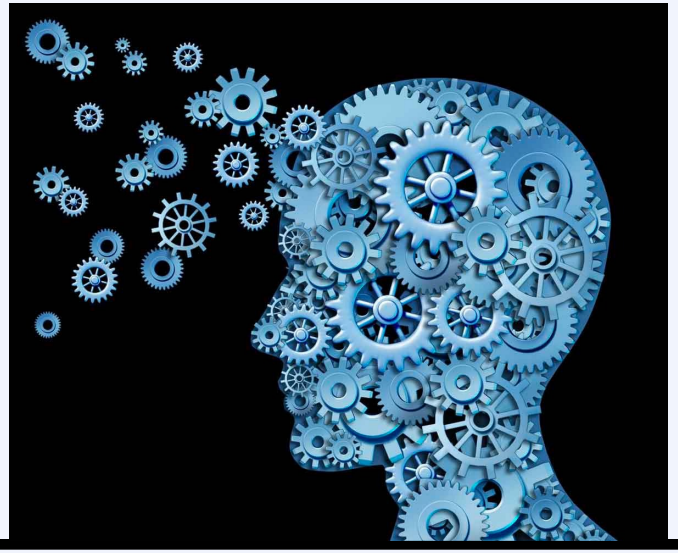


Explanatory & Predictive Theories

- **Explanatory Theories:**
  - Observing behavior
  - Describing activity
  - Conceiving of designs
  - Comparing high-level concepts of two designs
  - Training
- **Predictive Theories:**
  - Enable designers to compare proposed designs for execution time or error rates

Perceptual, Cognitive, & Motor Tasks

- Perceptual or cognitive subtasks theories
  - Predicting reading times for free text, lists, or formatted displays
- Motor-task performance times theories:
  - Predicting keystroking or pointing times

Theories

- Some theories are descriptive
  - Explanatory
  - Prescriptive
  - Predictive
- Some theories are based on human capacity
  - Motor task
  - Perceptual
  - Cognitive

Framework

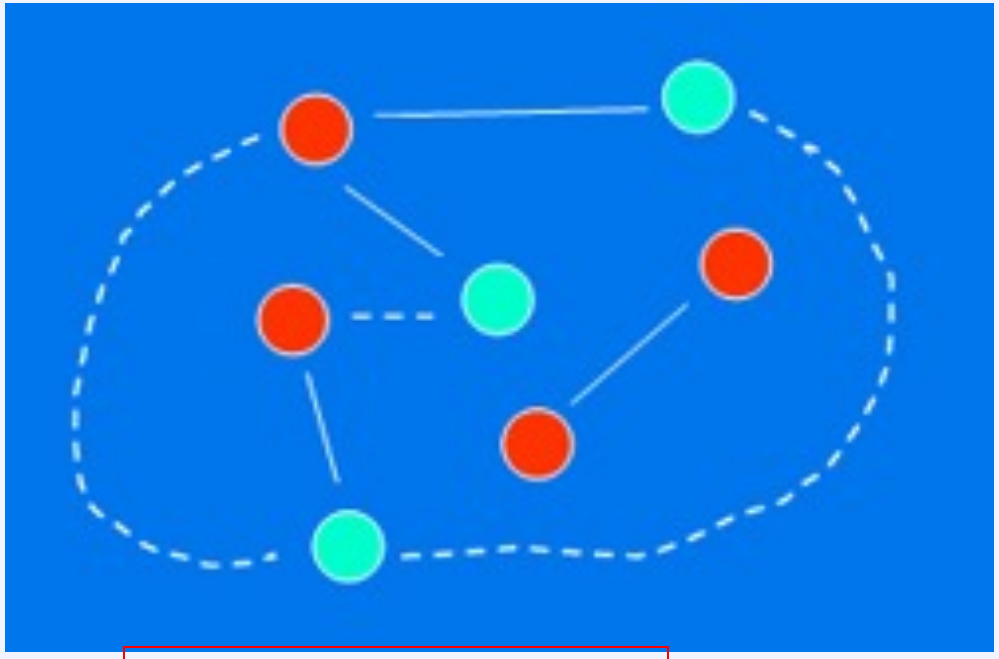
- Set of interrelated concepts and/or specific questions for ‘what to look for’
- Many in interaction design
  - e.g. Norman’s conceptual models, Benford’s trajectories
- Provide advice on how to design
  - e.g. steps, questions, concepts, challenges, principles, tactics and dimensions

Models

- **A simplification of an HCI phenomenon**
  - **intended to make it easier for designers to predict and evaluate alternative designs**
  - **abstracted from a theory coming from a contributing discipline, e.g. psychology, e.g. keystroke model**

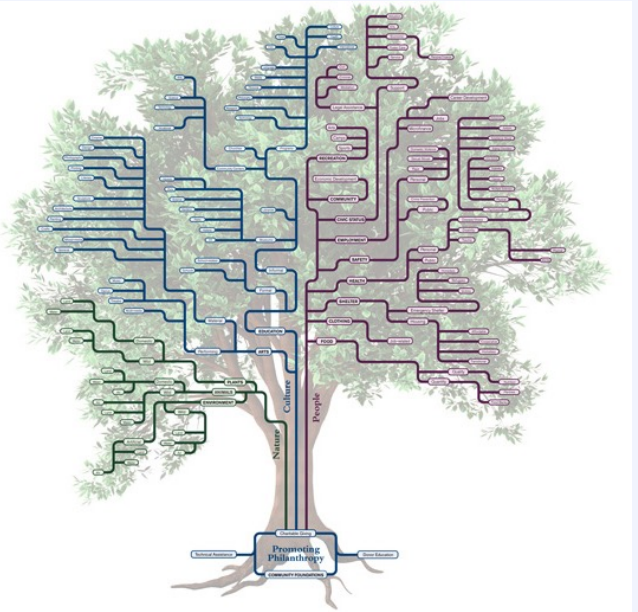
Models of Interaction

- Interaction Terms
- Norman Model
- Interaction Framework



Taxonomy (explanatory theory)

- Order on a complex set of phenomena
- Facilitate useful comparisons
- Organize a topic for newcomers
- Guide designers
- Indicate opportunities for novel products



What is an assumption?

- taking something for granted when it needs further investigation
  - e.g. people will want to watch TV while driving

http://www.ibiblio.org/jlillie/cooltown/lillie.htm

Assumptions: realistic or wish-list?

- People would not mind wearing the glasses that are needed to see in 3D in their living rooms – reasonable
- People would not mind paying a lot more for a new 3D-enabled TV screen – not reasonable
- People would really enjoy the enhanced clarity and color detail provided by 3D – reasonable
- People will be happy carrying around their own special glasses – reasonable only for a very select bunch of users

What is a claim?

- Stating something to be true when it is still open to question
  - e.g. a multimodal style of interaction for controlling GPS — one that involves speaking while driving — is safe

Some Terms of Interaction

Domain

- The area of work under study

  e.g. graphic design

Goal

- What you want to achieve

  e.g. create a solid red triangle

Task

- How you go about doing it
- Ultimately in terms of operations or actions

  e.g. … select fill tool, click over triangle


DESIGN`

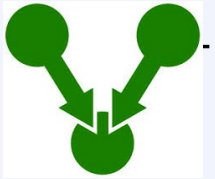
What is design?

Achieving goals within constraints

Goals - purpose

- who is it for, why do they want it

- Constraints
  - Materials, platforms



- Trade-offs
  - Limited Time Design Trade-off

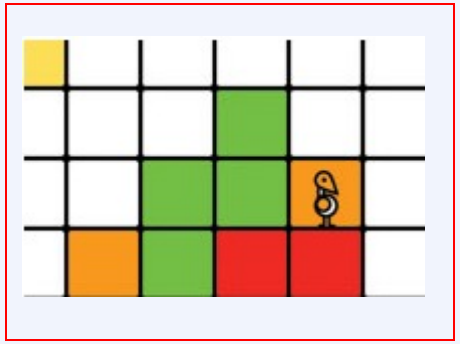
Interaction

- **What is Interaction?**
  - **The purpose of an interactive system is to aid a user in accomplishing goals from some application domain.**
    - **A goal is the desired output from performed task.**

What is interaction?

communication

user ↔ system



What is interaction design?

- “Designing interactive products to support the way people communicate and interact in their everyday and working lives.”
  - Preece, Sharp and Rogers (2015)
- “The design of spaces for human communication and interaction.”
  - Winograd (1997)

What to design

- Need to take into account:
  - Who the users are
  - What activities are being carried out
  - Where the interaction is taking place
- Need to optimize the interactions users have with a product:
  - So that they match the users' activities and needs

Interactions and Interventions

Design interactions not just interfaces

not just the immediate interaction

e.g. stapler in office – technology changes interaction style

- manual: write, print, staple, write, print, staple, …
- electric: write, print, write, print, …, staple

Designing interventions not just artefacts

not just the system, but also …

- documentation, manuals, tutorials
- what we say and do as well as what we make

INTERACTION DESIGN

Interaction Design Goals

- **Develop usable products**
  - **Usability means easy to learn, effective to use and provide an enjoyable experience**
- **Involve users in the design process**

What is involved in the process of interaction design

- **Establishing requirements**
- **Developing alternatives**
- **Prototyping**
- **Evaluating**

Design Principles

- Generalizable abstractions for thinking about different aspects of design
- The do’s and don'ts of interaction design
- What to provide and what not to provide at the interface
- Derived from a mix of theory-based knowledge, experience and common-sense

Usability goals

- Effective to use
- Efficient to use
- Safe to use
- Have good utility
- Easy to learn
- Easy to remember how to use

Usability and user experience goals

- Selecting terms to convey a person's feelings, emotions, etc., can help designers understand the multifaceted nature of the user experience
- How do usability goals differ from user experience goals?
- Are there trade-offs between the two kinds of goals?
  - e.g. can a product be both fun and safe?
- How easy is it to measure usability versus user experience goals?

User experience Goals

Desirable aspects

satisfying	helpful	fun
enjoyable	motivating	provocative
engaging	challenging	surprising
pleasurable	enhancing sociability	rewarding
exciting	supporting creativity	emotionally fulfilling
entertaining	cognitively stimulating	

Undesirable aspects

boring	unpleasant
frustrating	patronizing
making one feel guilty	making one feel stupid
annoying	cutesy
childish	gimmicky

The Interaction

- **Interaction Models**
  - translations between user and system
- **Ergonomics**
  - physical characteristics of interaction
- **Interaction Type**
  - the nature of user/system dialog
- **Context**
  - social, organizational, motivational

Core Characteristics of Interaction Design

- Users should be involved through the development of the project
- Specific usability and user experience goals need to be identified, clearly documented and agreed at the beginning of the project
- Iteration is needed through the core activities

Ergonomics

Physical aspects of interfaces industrial interfaces

Ergonomics

- Study of the physical characteristics of interaction
- Also known as human factors – but this can also be used to mean much of HCI!
- Ergonomics good at defining standards and guidelines for constraining the way we design certain aspects of systems

Design And Culture

- Are cultural differences important?
  - 5/21/2015 versus 21/5/2015?
    - Which should be used for international services and online forms?
  - Why is it that certain products, like the iPod, are universally accepted by people from all parts of the world whereas websites are reacted to differently by people from different cultures?

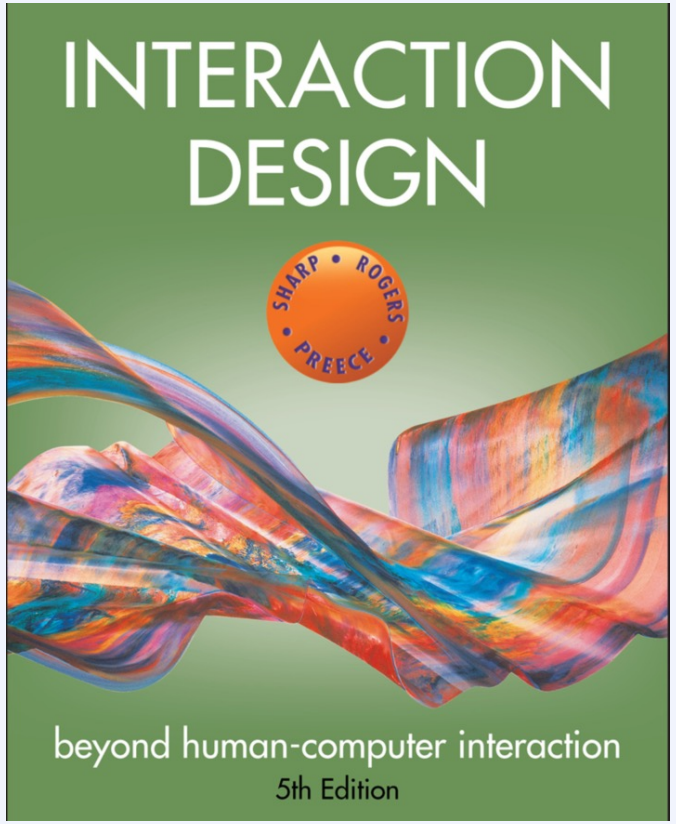
Accessibility

- Degree to which a product is usable and accessible by as many people as possible
- Focus on disability:
  - Have a mental or physical impairment
  - This has an adverse affect on their everyday lives
  - It is long term

CONCEPTUALIZING INTERACTION

Reading Assignments

- Chapter 1: What is Design? Page 1-35
- Chapter 3: Conceptualizing Interaction- Page 69-97



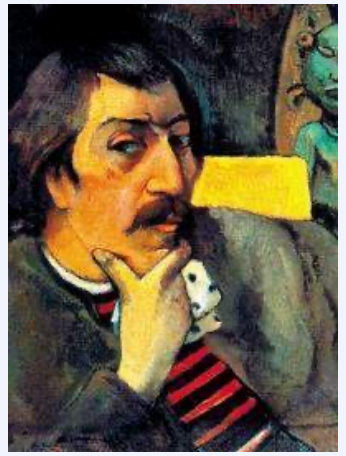
Welcome

- **Fundamental Principles In UI Design**

"I think; therefore I am."

Rene Descartes

THEORIES



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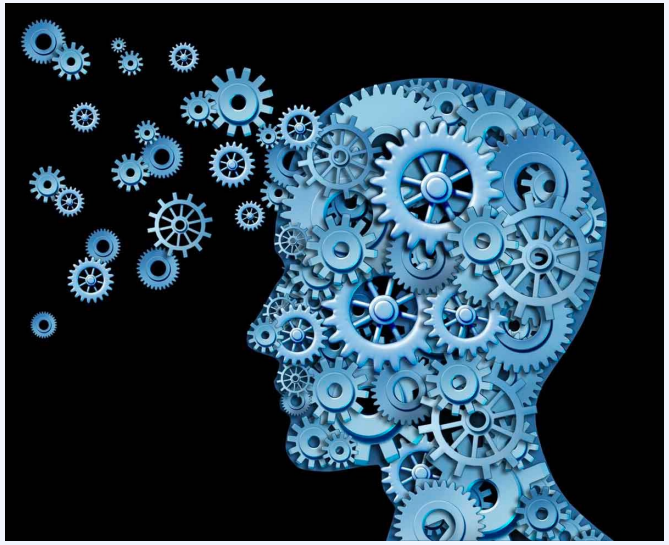

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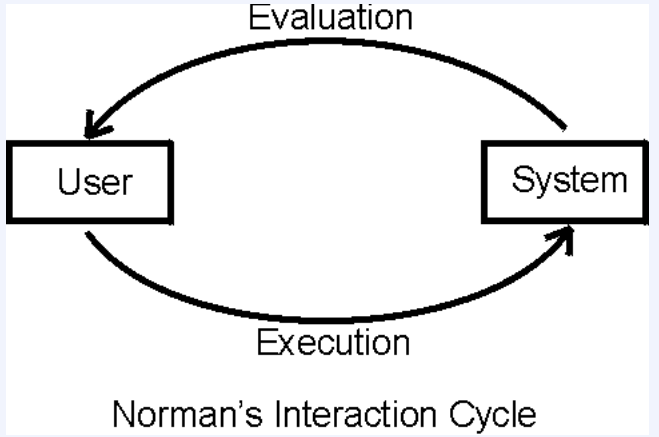
STAGES OF ACTION THEORIES



Norman's Interaction Cycle

Stages of Action Models

- **Norman's seven stages of action**
  1. Forming the goal
  2. Forming the intention
  3. Specifying the action
  4. Executing the action
  5. Perceiving the system state
  6. Interpreting the system state
  7. Evaluating the outcome

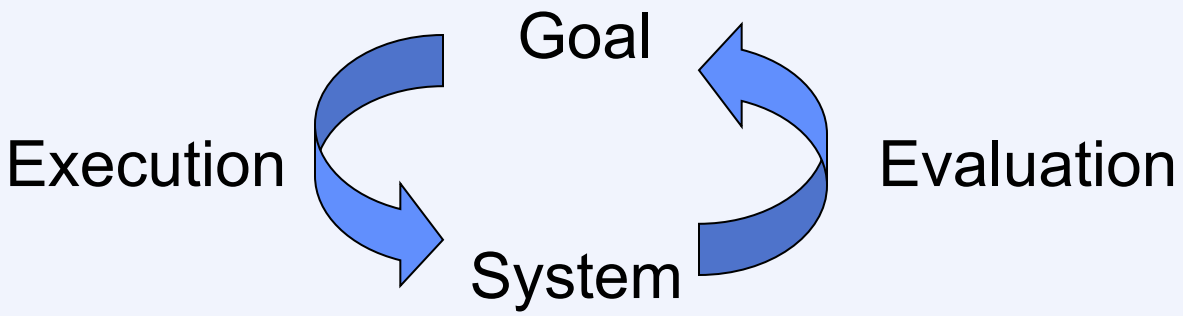
- **Norman's contributions**
  - Context of cycles of action and evaluation.
  - *Gulf of execution:* Mismatch between the user's intentions and the allowable actions
  - *Gulf of evaluation:* Mismatch between the system's representation and the user's expectations

Donald Norman's Model

- Seven stages
  - user establishes the goal
  - formulates intention
  - specifies actions at interface
  - executes action
  - perceives system state
  - interprets system state
  - evaluates system state with respect to goal

- Norman's model concentrates on user's view of the interface

Execution/Evaluation Loop



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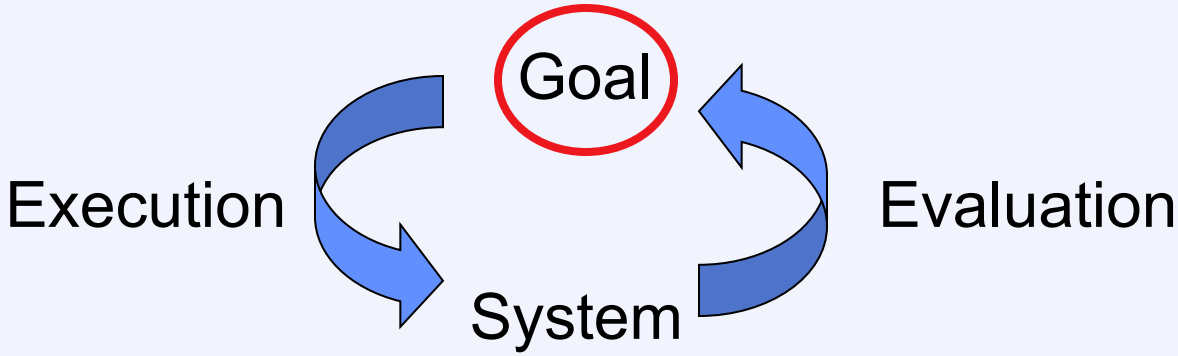

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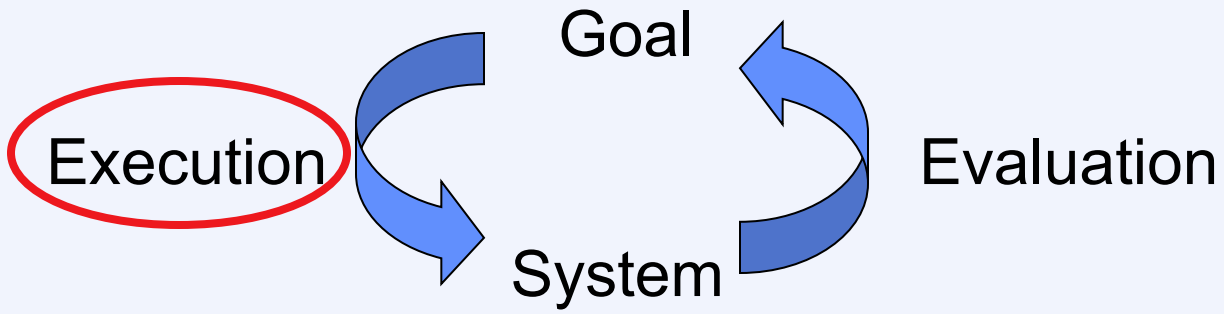

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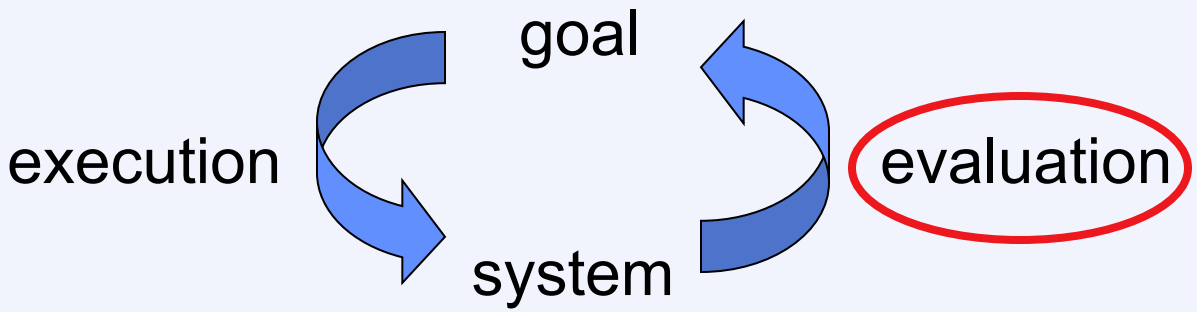


- user establishes the goal
- formulates intention
- specifies actions at interface
- executes action
- **perceives system state**
- **interprets system state**
- **evaluates system state with respect to goal**

Using Norman's Model

Some systems are harder to use than others

Gulf of Execution

user's formulation of actions

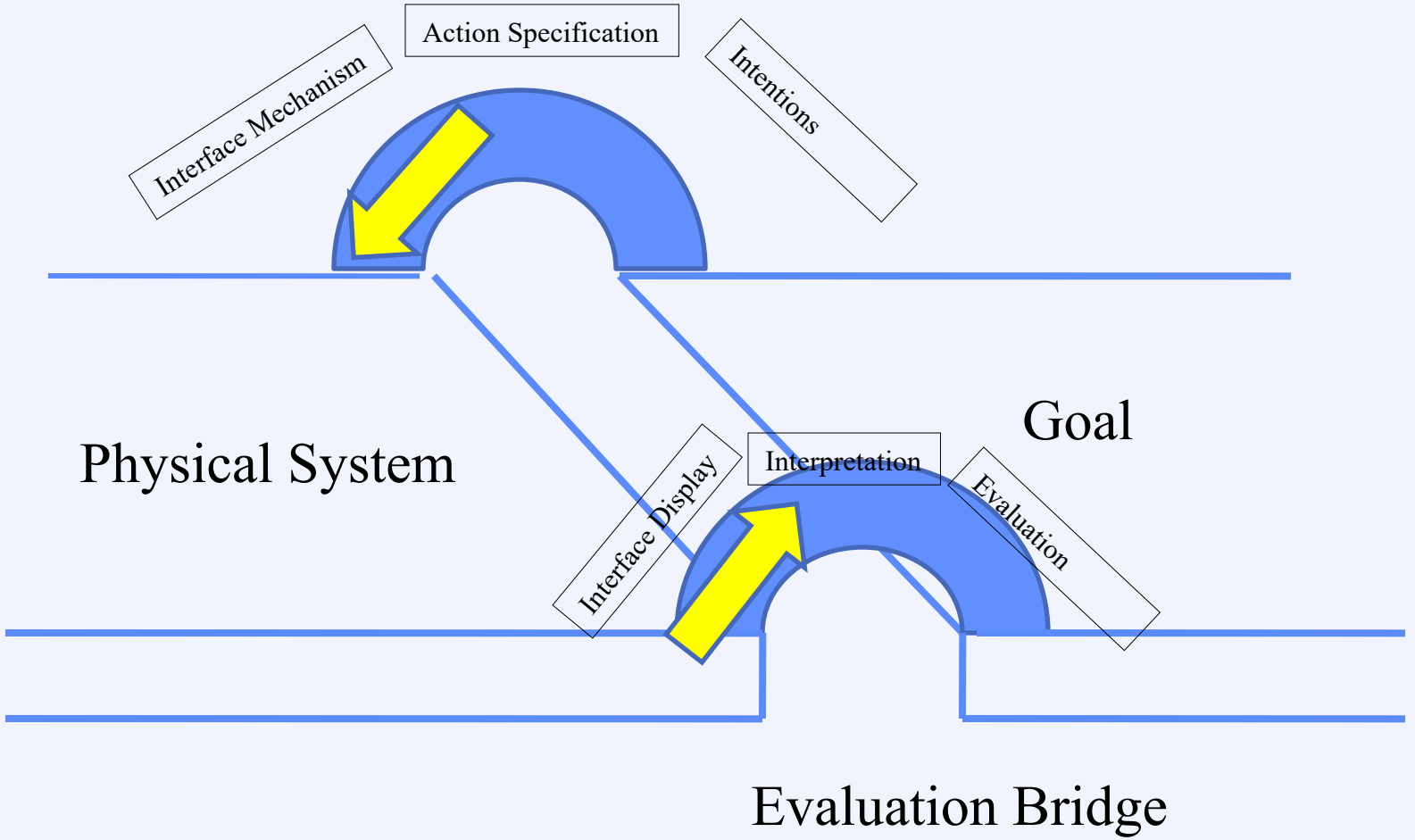
≠ actions allowed by the system

Gulf of Evaluation

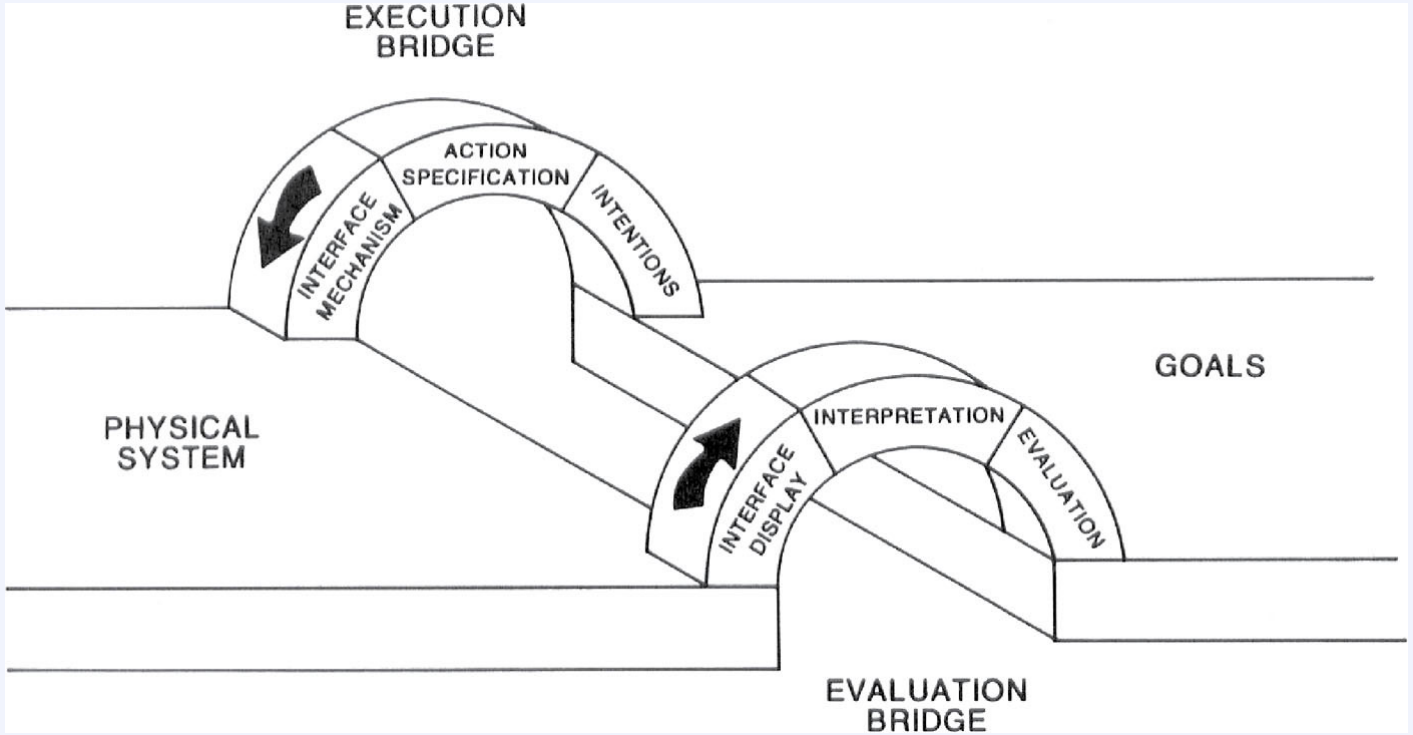
user's expectation of changed system state

≠ actual presentation of this state

Norman's Seven Stages of Action



Bridging the gulfs



Gulfs of execution and evaluation

- The ‘gulfs’ explicate the gaps that exist between the user and the interface
- The gulf of execution
  - the distance from the user to the physical system
- The gulf of evaluation
  - the distance from the physical system to the user
- Bridging the gulfs can reduce cognitive effort required to perform tasks

Norman, 1986; Hutchins *et al*, 1986

Stages of Action Models

- Four principles of good design
  - State and the action alternatives should be visible
  - Should be a good conceptual model with a consistent system image
  - Interface should include good mappings that reveal the relationships between stages
  - User should receive continuous feedback
- Four critical points where user failures can occur
  - Users can form an inadequate goal
  - Might not find the correct interface object because of an incomprehensible label or icon
  - May not know how to specify or execute a desired action
  - May receive inappropriate or misleading feedback

Prevent errors

- Make error messages specific, positive in tone, and constructive
- Mistakes and slips (Norman, 1983)
- Correct actions
  - Gray out inappropriate actions
  - Selection rather than freestyle typing
  - Automatic completion
- Complete sequences
  - Single abstract commands
  - Macros and subroutines

Human Error - Slips and Mistakes

Slip

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

Mistake

- may not even have right goal!

Fixing things?

slip – better interface design

mistake – better understanding of system

See You Next Week

“I think; therefore I am.”

Rene Descartes

Thank You For Your Participation

Welcome

- **Fundamental Principles In UI Design**

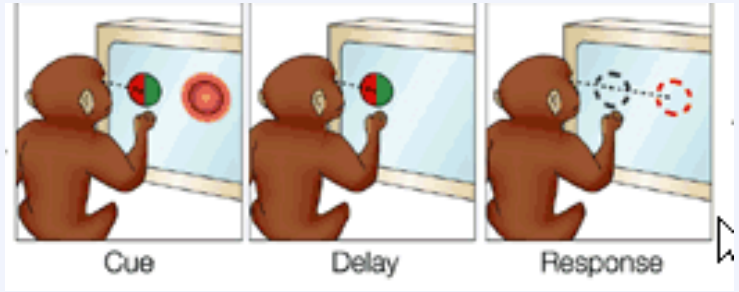
"I think; therefore I am."

Rene Descartes

CHOICE REACTION TIME

Response Selection

- Refers to those processes involved in determining what response to made to particular stimulus.
- It is affected by the variables of number of alternatives, stimulus-response compatibility.
- As the number of stimulus-response alternative increases, reaction time in crease as logarithmic function of the number of alternative (Hick, 1952; Hyman 1953)



How long will take to find A name?

Owen
Emma
Olivia
Ava
Isabella
Sophia
Charlotte
Benjamin
Elijah
Lucas
Mason
Mia
Amelia
Harper
Evelyn
Liam
Noah
William
James
Oliver

How long will take to find “Sesco”?

♀ Irina Messier
♂ Lucius Pahl
♀ Candis Eslick
♀ Lillian Nicolson
♀ Treva Croston
♂ Elden Orban
♀ Susy Ewalt
♀ Dinorah Lathem
♀ Louanne Eland
♀ Petronila Leek
♀ Emely Sesco
♂ Shon Devries
♀ Kiara Bebout
♂ Randal Sommer
♀ Krysta Towle
♀ Gwenn Dudash
♂ Raymundo Axford
♀ Verlie Whitesides
♂ Jonathon Cotton
♀ Terrilyn Erdman

Hick-Hayman Law

- **Choice Reaction Time**
  - **Given a set of n stimuli, associated one for one with n responses, the time to react (RT) to the onset of a stimulus and to make the appreciate response is given by**
  - **RT = a + b log2 (n)**
  - **Where a is the base processing time and be is the amount that RT increases with increases in N.**

The slop of the Hick-Hyman function is influences by many factors. For example, the slope decreases as subjects become practiced at a task.

Hick Hayman Law

- Hick-Hyman law, describes the time it takes for a person to make a decision as a function of the possible choices he or she has.
- Given “n” equally probable choices, the average reaction time “T” required to choose among them is approximately
- T = blog2(n + 1)
- where b is a constant that can be determined empirically by fitting a line to measured data. Operation of logarithm here expresses depth of "choice tree" hierarchy. Basically log2 means that you perform binary search. According to Card, Moran, and Newell (1983), the +1 is "because there is uncertainty about whether to respond or not, as well as about which response to make." The law can be generalized in the case of choices with unequal probabilities pi of occurring, to
- T = bH
- where H is the information-theoretic entropy of the decision, defined as
- H = \sum_i^n p_i \log_{2}(1/p_i + 1)
- Hick's law has a logarithmic form because people subdivide the total collection of choices into categories, eliminating about half of the remaining choices at each step, rather than considering each and every choice one-by-one, requiring linear time.

Hick-Hyman Law

- Developed simultaneously by Hick 1952) and Hyman (1953)
- Given a set of *n* stimuli, associated one-for-one with *n* responses, the time to react (*RT*) to the onset of a stimulus and make the appropriate response is given by

$$RT = a + b \log_2(n)$$

- $\text{Log}_2(n)$ has units "bits"
- *a* and *b* are constants determined empirically through linear regression

Hick-Hyman Law Example

- **Question:**
  - If $n = 26$, what is RT?
- **Answer:**
  - $RT = 0.2 \log_2(26) = 0.940$ seconds
- **Is this useful?**

Entry Speed on Soft Keyboards

- If the layout is novel, users must scan the keyboard looking for each letter
- This is a reaction time task with *n* = 26
- Examples:

Opti

Q	F	U	M	C	K	Z
space		O	T	H	space	
B	S	R	E	A	W	X
space		I	N	D	space	
J	P	V	G	L	Y	

Fitaly

Z	V	C	H	W	K
F	I	T	A	L	Y
space		N	E	space	
G	D	O	R	S	B
Q	J	U	M	P	X

Entry Speed on Soft Keyboards (2)

- ***RT* = 0.940 seconds places an upper bound on the walk-up text entry speed (*S*) for soft keyboards with novel layouts**
- **I.e., if entry is fully captured by *RT*, then**

$$S = (1 / 0.940) \times (60 / 5) = 12.8 \text{ wpm}$$

Converts “seconds per character” to “words per minute)

- **If other behaviors are present, the time per character increases and the entry speed decreases**

Empirical Test (1)

Novel layouts:

S < 12.8 wpm

Familiar layout:

S > 12.8 wpm

Table 1

Entry Speed vs. Keyboard Layout

Keyboard Layout	Entry Speed (wpm) [a]	
	Mean	*Std. Dev.*
Qwerty	20.2	4.9
Dvorak	8.5	2.0
ABC	10.6	1.7
Fitaly	8.2	2.2
Telephone	8.1	1.9
JustType	7.3	1.5
Mean	10.5	-

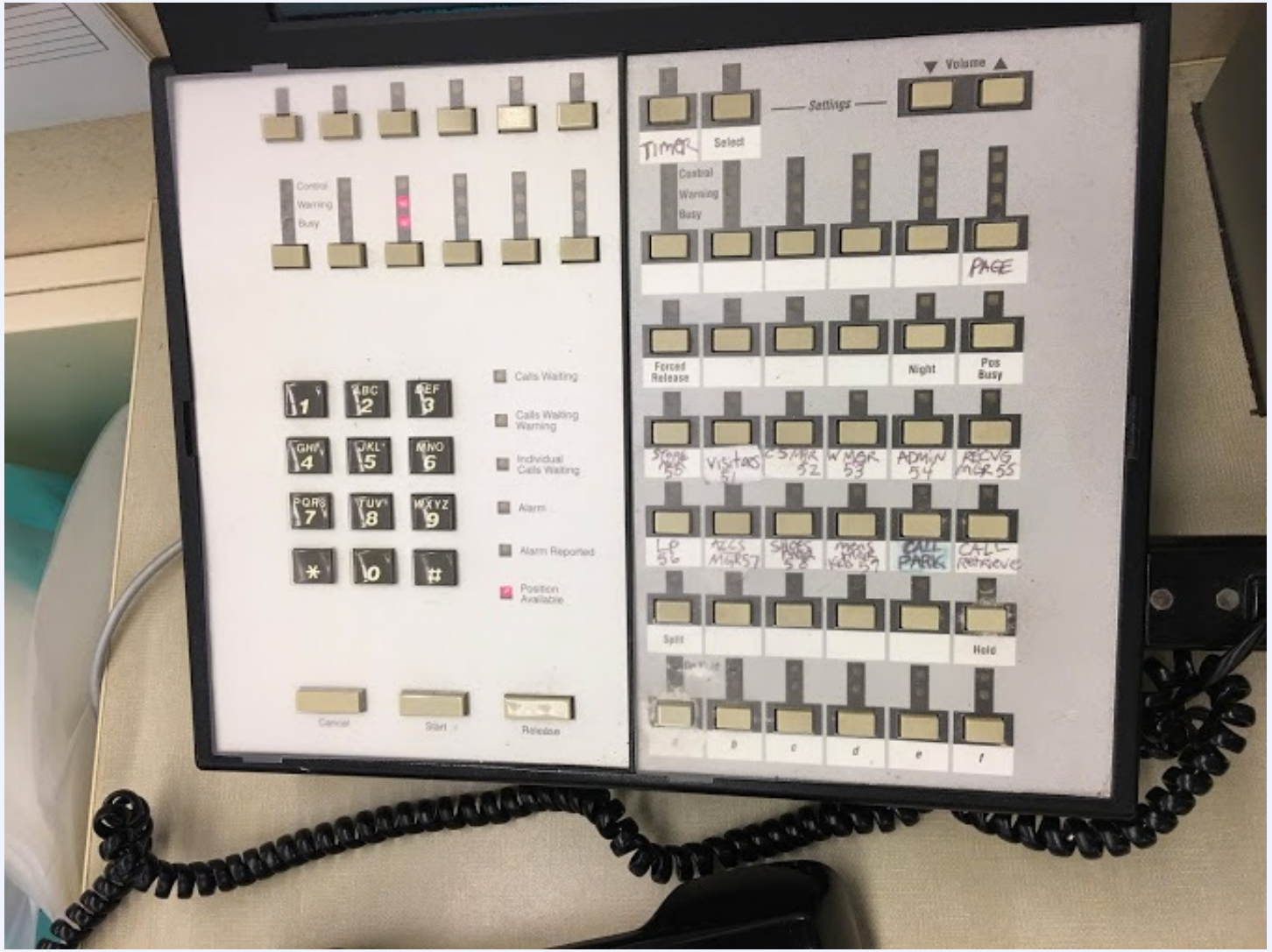
[a] $n = 24$ subjects

From:
MacKenzie, I. S., Zhang, S. X., & Soukoreff, R. W. (1999). Text entry using soft keyboards. *Behaviour & Information Technology*, *18*, 235-244.

Example


POWER
TV
INPUT
CH
VOL
MENU
ENTER
SHARP
LCDTV
GB036WJSA
DVD
OK
RETURN

Example

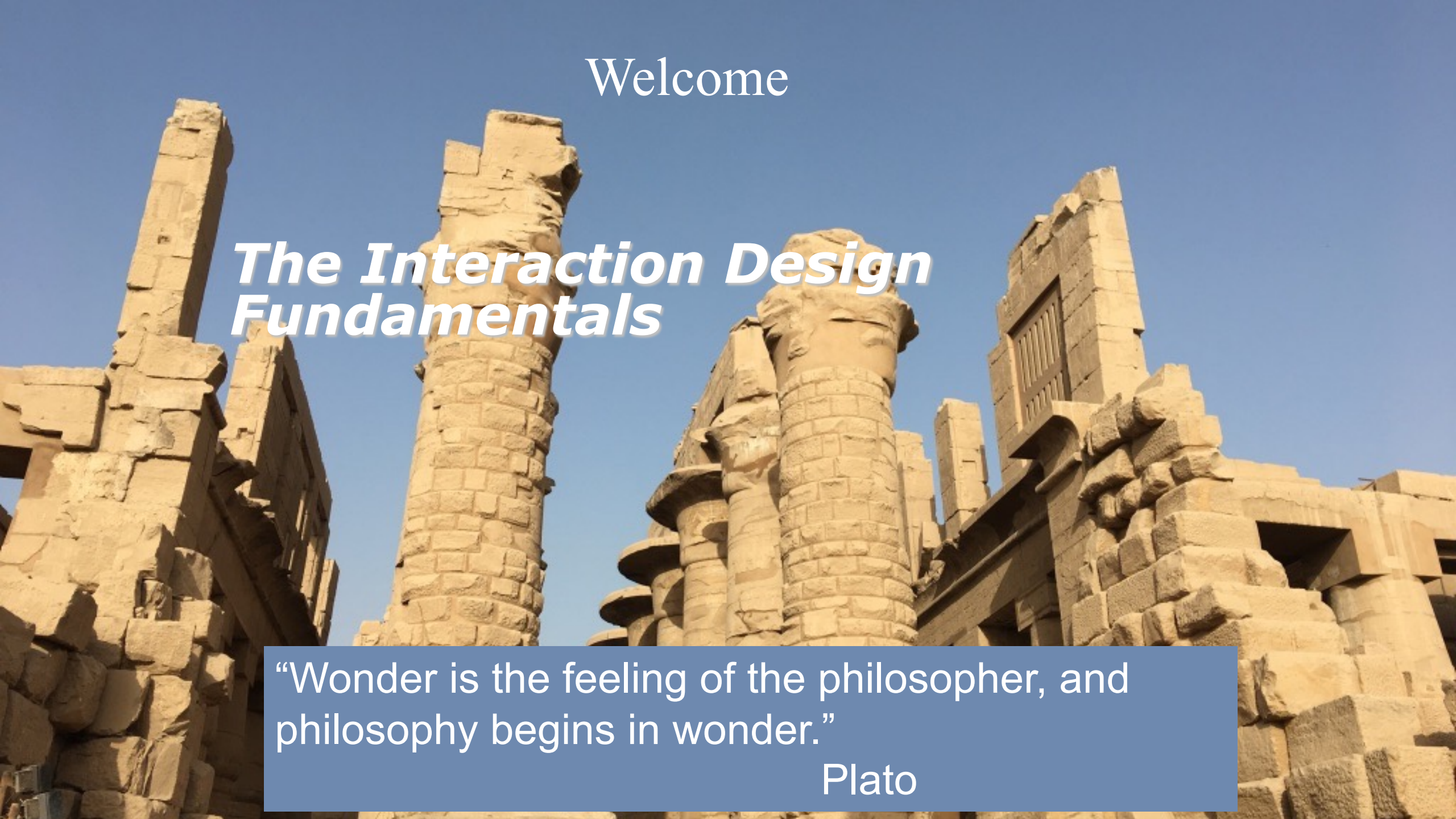

Volume
Settings
TIMER
Select
Control
Warning
Busy
PAGE
Forced Release
Night
Pos Busy
Visitors
ADMIN 54
Split
Hold
Calls Waiting
Calls Waiting Warning
Individual Calls Waiting
Alarm
Alarm Reported
Position Available
Cancel
Start
Release

See You Next Week

“I think; therefore I am.”

Rene Descartes

Thank You For Your Participation



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Abbas Moallem, Ph.D.

Session 4

Interaction Type

- Introduction
  - Vision, Theory, Models, Frameworks…
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- Interaction Design
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  - Accessibility Culture
- Conceptual Design
  - Design Space
- Interaction Types

Interaction Types

- Instructing
  - issuing commands and selecting options
- Conversing
  - interacting with a system as if having a conversation
- Manipulating
  - interacting with objects in a virtual or physical space by manipulating them
- Exploring
  - moving through a virtual environment or a physical space

Instructing

- Where users instruct a system and tell it what to do
  - e.g. tell the time, print a file, save a file
- Very common conceptual model, underlying a diversity of devices and systems
  - e.g. word processors, VCRs, vending machines
- Main benefit is that instructing supports quick and efficient interaction
  - good for repetitive kinds of actions performed on multiple objects

Conversing

- Underlying model of having a conversation with another human
- Range from simple voice recognition menu-driven systems to more complex ‘natural language’ dialogs
- Examples include timetables, search engines, advice-giving systems, help systems
- Also virtual agents, toys and pet robots designed to converse with you

Conversational model

- Allows users, especially novices and technophobes, to interact with the system in a way that is familiar
  - makes them feel comfortable, at ease and less scared
- Misunderstandings can arise when the system does not know how to parse what the user says

Would you talk with Siri?

Manipulating

Interacting with objects in a virtual or physical space by manipulating them

Why are DM interfaces so enjoyable?

- Novices can learn the basic functionality quickly
- Experienced users can work extremely rapidly to carry out a wide range of tasks, even defining new functions
- Intermittent users can retain operational concepts over time
- Error messages rarely needed
- Users can immediately see if their actions are furthering their goals and if not do something else
- Users experience less anxiety
- Users gain confidence and mastery and feel in control

What are the disadvantages with DM?

- Some people take the metaphor of direct manipulation too literally
- Not all tasks can be described by objects and not all actions can be done directly
- Some tasks are better achieved through delegating
  - e.g. spell checking
- Can become screen space 'gobblers'
- Moving a mouse around the screen can be slower than pressing function keys to do same actions

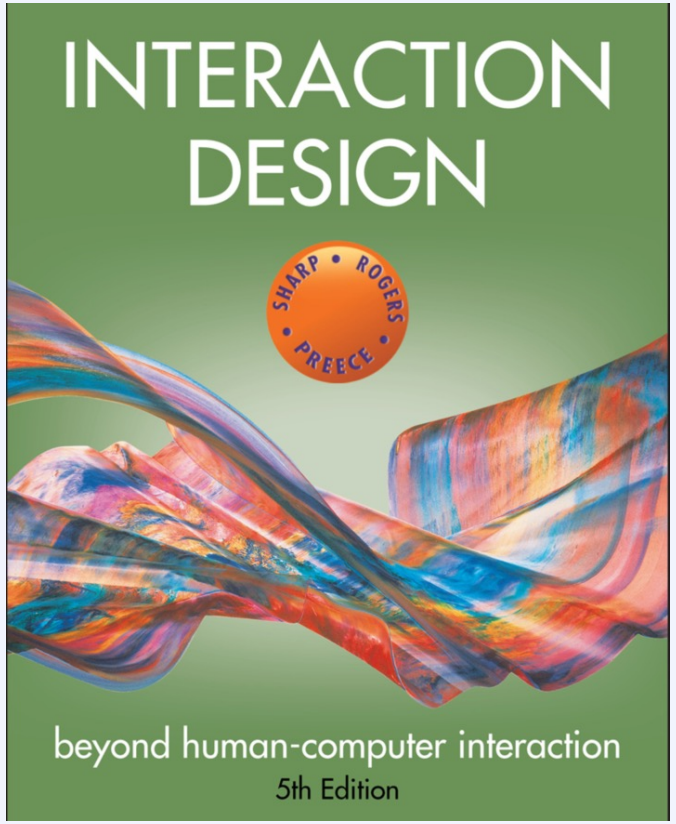
Exploring

- Involves users moving through virtual or physical environments

- Physical environments with embedded sensor technologies
  - Context aware

Reading Assignments

- **Chapter 1: What is Interaction Design? Page 1-35**
- **Chapter 3: Conceptualizing Interaction- Page 69-97**



Welcome

- **Fundamental Principles In UI Design**

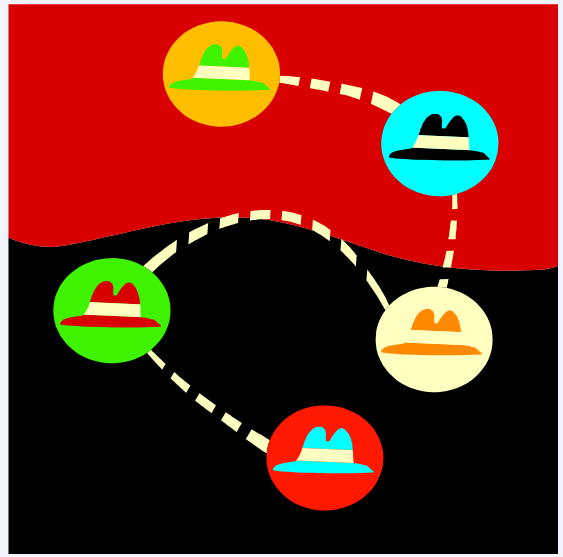
"I think; therefore I am."

Rene Descartes

CONSTRAINS

Constraints

Constrains limit the number of possibilities of what can be done to an object, whereas affordance suggests the scope of an object in terms of what can do and how can interact with it.



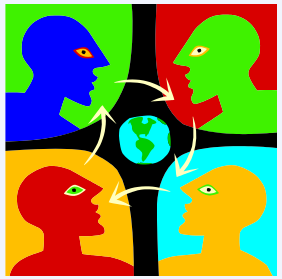
FEEDBACK

Feedback

Defined as sending information back to the user about what action has actually been done and what result has been accomplished. Types include:

- Visual
- Auditory
- Tactile

Feedback should be compatible with the principles of direct manipulation.



Example


601-610
501-516
401-420
301-321
201-221
101-121
Lobby


8
6
7
4
5
2
3
L
LOBBY

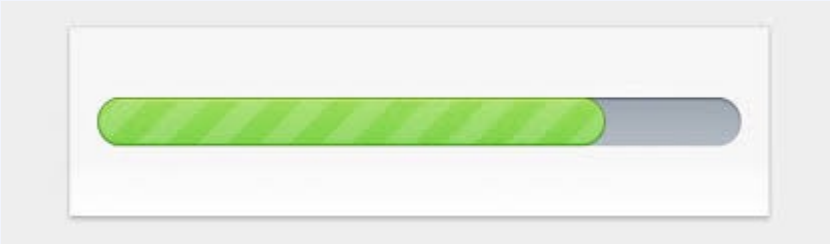

G
2
3
4

Feedback

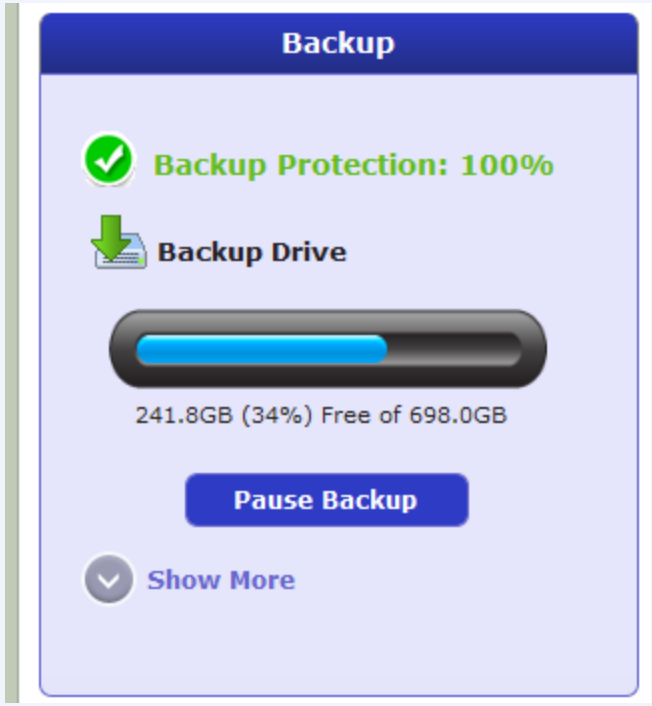
- Sending information back to the user about what has been done
- Includes sound, highlighting, animation and combinations of these

Example: Visual Feedback

Visual



Textual



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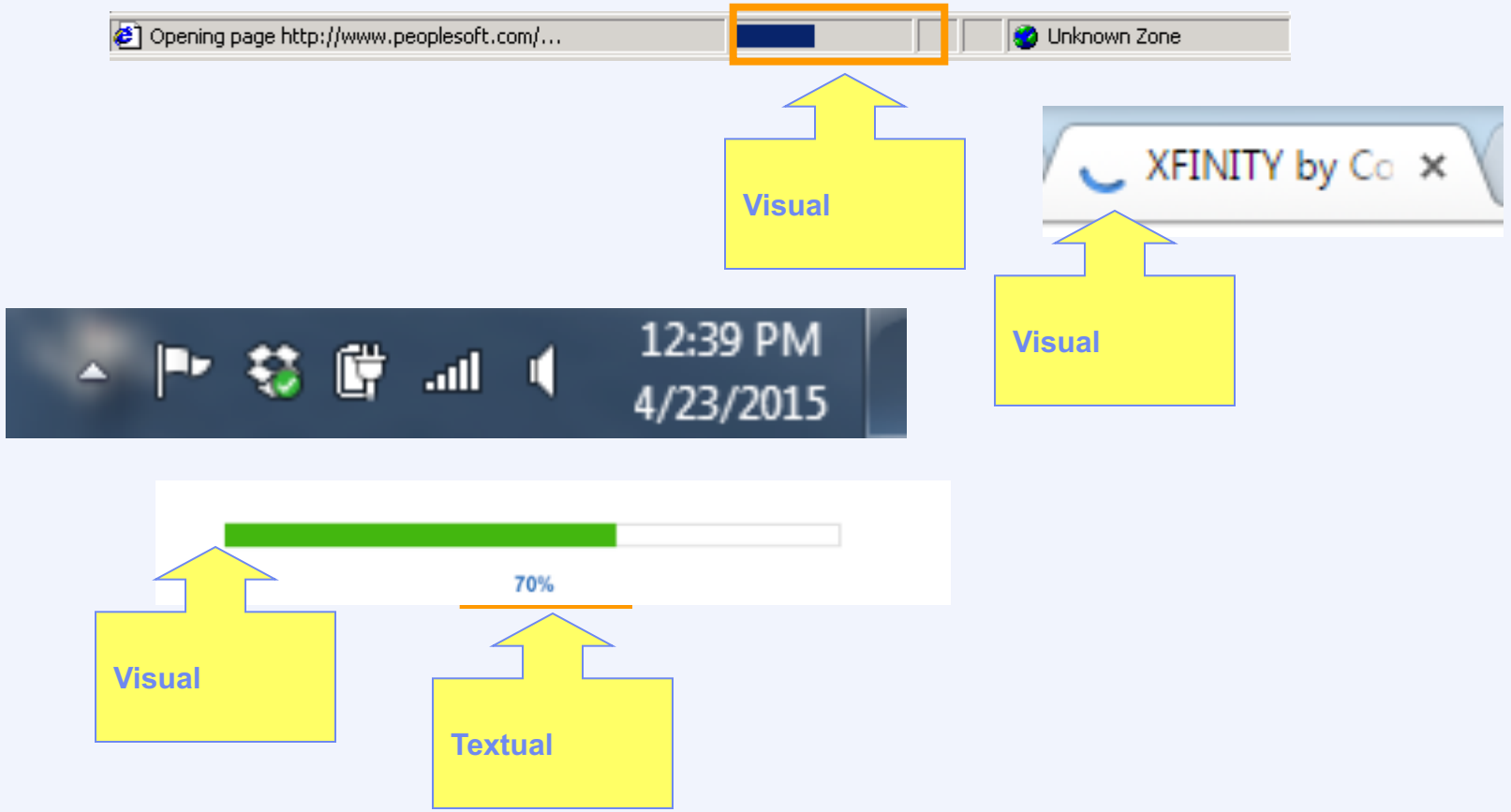
Example: Visual Feedback



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Summary

- Focusing attention at interface is an effective way to help users to focus attention on specific part of user interfaces.
- Many techniques and visualization tools can help designers to bring users' attention to specific part of user interfaces.
- Multitasking divide user's attention. Consequently if it is important to focus full attention on UI elements the distraction and multitasking needs to be constrained.

A FEW MORE DESIGN RULES

Visibility

"The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.”

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!

Consistency

- Design interfaces to have similar operations and use similar elements for similar tasks
- For example:
  - always use ctrl key plus first initial of the command for an operation – ctrl+C, ctrl+S, ctrl+O
- Main benefit is consistent interfaces are easier to learn and use

When consistency breaks down

- What happens if there is more than one command starting with the same letter?
  - e.g. save, spelling, select, style
- Have to find other initials or combinations of keys, thereby breaking the consistency rule
  - e.g. ctrl+S, ctrl+Sp, ctrl+shift+L
- Increases learning burden on user, making them more prone to errors

Internal and External Consistency

- Internal consistency refers to designing operations to behave the same within an application
  - Difficult to achieve with complex interfaces
- External consistency refers to designing operations, interfaces, etc., to be the same across applications and devices
  - Very rarely the case, based on different designer's preference

See You Next Week

“I think; therefore I am.”

Rene Descartes

Thank You For Your Participation

Questions

What do You Tghink about this screen

eNETS

Wednesday, 23 November 2016

Consumer eNETS

- Privacy Policy
- Security Guidelines
- Customer Service

credit/debit card payment

If you are using a pop-up blocker, please add the following list as your allowed sites. Otherwise, the relevant transaction pages from the banks may not be displayed, or your transaction request may not be completed.

1. www.enets.sg

TRANSACTION INFORMATION

MasterCard SecureCode. Verified by VISA

Merchant Name	GALALUZ PTE LTD
Merchant Reference Code	MMTVISA46E3BFA81FE94
NETS Reference Code	20161123033004983
Amount	USD 50.00

Important Notice: Please note down the transaction information in this section just in case you need to raise any query on this transaction.

CREDIT/DEBIT CARD INFORMATION

MasterCard VISA

Name on Card

Card Number

Please note that the Credit Card Number should be 13 or 16 digits.
Please input your card number without space or dash.

CVV / CVC2 [What is CVV/CVV2/CID]

Expiry Date Month ▼ (eg: 2016)

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