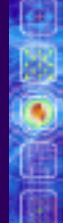
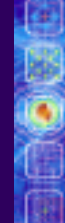




HUMAN-COMPUTER INTERACTION

THIRD
EDITION

DIX
FINLAY
ABOWD
BEALE



chapter 3

the interaction

Introduction

- We have studied about The Human, The Computer in previous lectures
- We are not concerned with them in isolation
- We are interested in, how user uses the computer to perform a specific task
 - In order to do this the user must communicate his requirements to computer

Interaction

- There are number of ways in which the user can communicate with the system
 - At one extreme is batch input
 - In which the user provides all the information to the computer at once and leaves the machine to perform the task
 - At the other extreme are highly interactive input devices and paradigms
 - Direct Manipulation
 - Virtual Reality
 - Here the user is constantly providing instructions and receive feedback

Model of Interaction

- Interaction involve at least two participants
 - The Human and The Computer
 - Both are complex as we have seen
- The interface effectively **translate** between them to allow the interaction to be successful
- This translation can fail at a number of point and for a number of reasons
- The use of model can help us to understand what is actually happening and find root of difficulties

models of interaction

Some terms of interaction

Norman model

Interaction framework

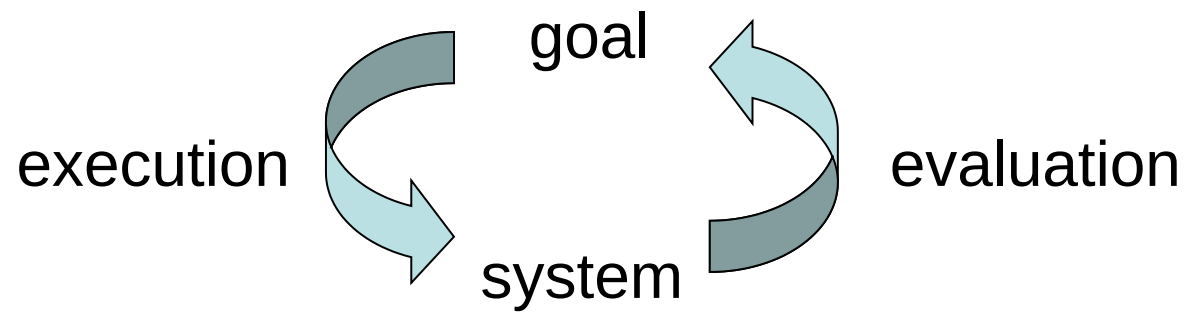
Some terms of interaction

- 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
- Core language** - language that describes the computational attributes of the domain relevant to the system state
- Task language** - language that describes the psychological attributes of the domain relevant to the user state

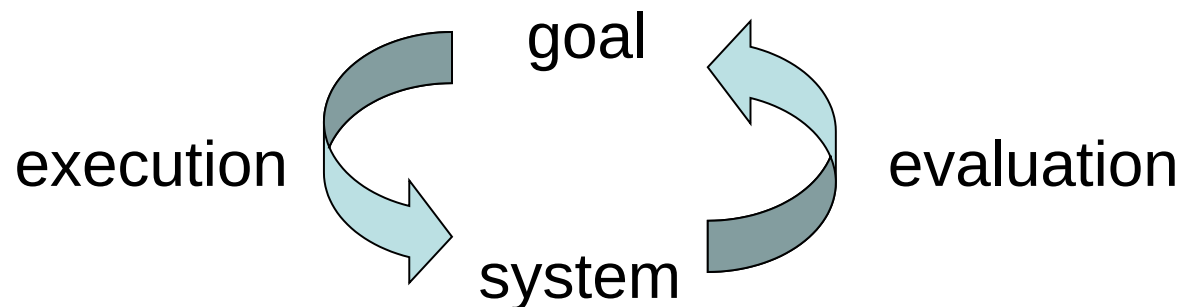
Example

- One **task** within the graphic design **domain** is the construction of a specific geometric shape with particular attributes on the drawing surface. A related **goal** would be to produce a solid triangle centered on the canvas

Donald Norman's model

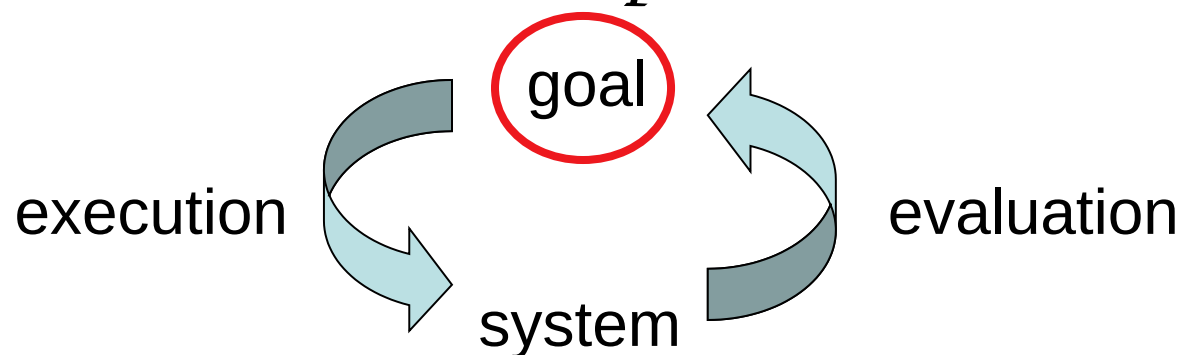


execution/evaluation loop



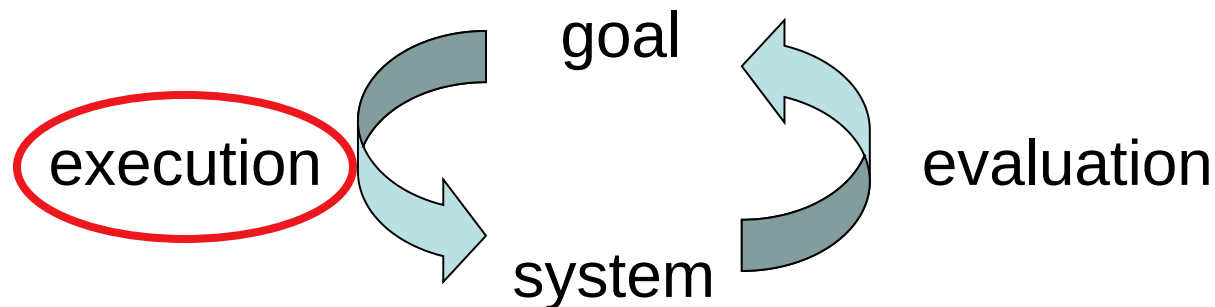
- user establishes the goal
- formulates intention
- specifies actions at interface
- executes action
- perceives system state
- interprets system state
- evaluates system state with respect to goal

execution/evaluation loop



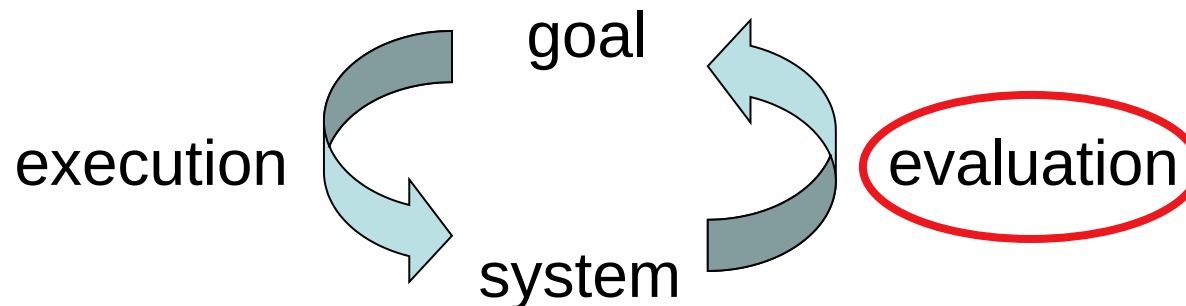
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execution/evaluation loop



- ~~user establishes the goal~~
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execution/evaluation loop



- user establishes the goal
- formulates intention
- specifies actions at interface
- ~~executes action~~
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- interprets system state
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*The Norman's Execution-Evaluation cycle : **Reasons** Why Some Interfaces Cause Problems to Users*

- **Gulf of Execution**
 - The difference between the user's formulation of the action to reach the goal and the actions allowed by the system
 - If the actions allowed by the system correspond to those intended by the user, the interaction will be effective
- **Gulf of Evaluation**
 - The distance between the physical presentation of the system state and the expectation of the user
 - If the user can readily evaluate the presentation in terms of his/her goal, the gulf of evaluation is small
- Interface design should aim to reduce the gulfs



The Norman's Execution Evaluation cycle : Human Error

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

Limitations

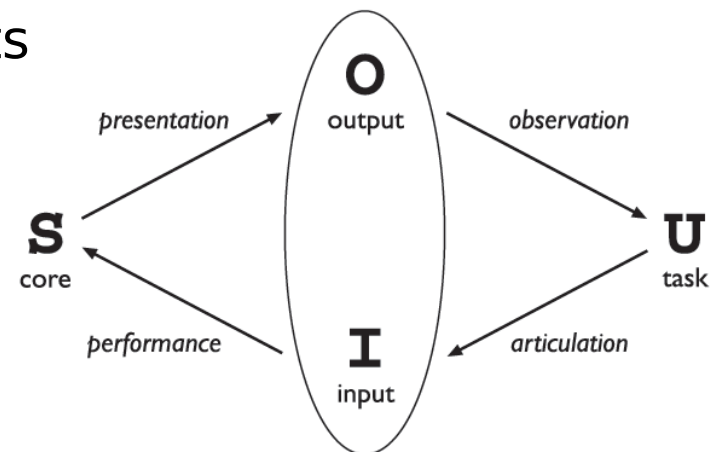
- Concentrates only on the user's view of interaction
- Does not deal with the system's Communication through the interface

Interaction Framework:

Abowd and Beale framework

extension of Norman...

- More realistic description of interaction by including the system explicitly, and breaks it into four main components
 - user
 - input
 - system
 - output
 - each has its own unique language
- interaction \Rightarrow translation between languages



Interaction framework

- Articulation Translation
 - Articulation is the user's translation of their task into the input language.
 - Consider a user who wants to turn on the lights at the far end of a room.
- **Poor Articulation**
 - The user sees a bank of unlabelled switches. The user has no idea which switch controls the lights at the far end of the room.
 - The problem here is that the language provided (the unlabelled switches) does not allow the user to articulate the goal (turn on the lights at the far end of the room).

Cont...

– **Good Articulation**

- The switches are clearly labelled. The user articulates their task of pressing the switch that is labelled "the far end of the room".
- The language provided here (the labelled switches) allows the user to articulate their task without difficulty

Cont...

- **Performance Translation**

- Performance is the interface's translation of the input language into stimuli to the system. **This translation is determined by the designer or programmer (not the user).**

- **Poor Performance**

- Consider a remote control for a television without a button for turning off the television. The user must go directly to the device and turn it off on the control panel.

• **Presentation Translation**

- Presentation is the translation of the system's new state into the output language of the interface. **This translation is determined by the designer or programmer.**

– **Poor Presentation**

- Consider writing an essay using a word processor. You need to see the effects of your editing as a whole.
- However, the word processor only displays the immediate paragraph without the surrounding text or other pages. The surrounding text and other pages may have changed as well during the editing. In effect, all of the state changes cannot be displayed in the output language. You cannot readily confirm the effect of your editing throughout the essay.

Cont...

- Observation translation
 - Observation is the translation of the output language into personal understanding. This translation is done by the user.

ergonomics

physical aspects of interfaces
industrial interfaces

Ergonomics

- Study of the physical characteristics of interaction
 - how the controls are designed
 - the physical environment in which the interaction takes place
 - and the layout and physical qualities of the screen
- Also known as human factors

Ergonomics - examples

- arrangement of controls and displays
 - e.g. controls grouped according to function or frequency of use, or sequentially
- surrounding environment
 - e.g. seating arrangements adaptable to cope with all sizes of user
- health issues
 - e.g. physical position, environmental conditions (temperature, humidity), lighting, noise,
- use of colour
 - e.g. use of red for warning, green for okay, awareness of colour-blindness etc.

Different layouts of controls

- Functional controls and displays
 - organized so that those that are functionally related are placed together
- Sequential controls and displays
 - organized to reflect the order of their use in a typical interaction
- Frequency controls and displays
 - organized according to how frequently they are used, with the most commonly used controls being the most easily accessible.

Layout and arrangement of controls

- the entire system interface must be arranged appropriately in relation to the user's position.
 - So, for example, the user should be able to reach all controls necessary and view all displays without excessive body movement.
- Critical displays should be at eye level.
- Lighting should be arranged to avoid glare and reflection distorting displays.
- Controls should be spaced to provide adequate room for the user to manoeuvre.



Office interface vs. industrial interface?

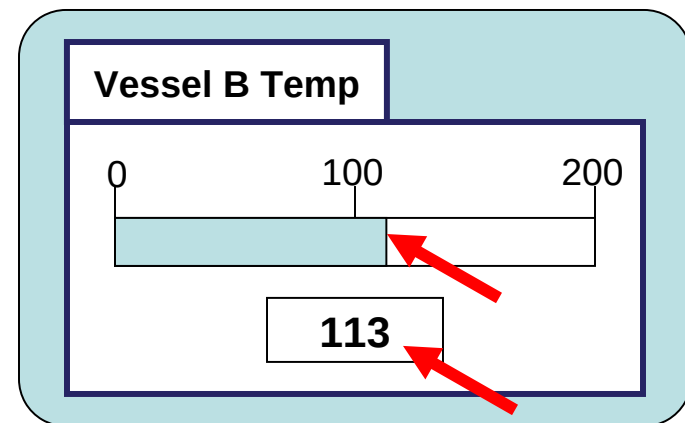
Context matters!

office	industrial	
type of data	textual	numeric
rate of change	slow	fast
environment	clean	dirty

... the oil soaked mouse!

Glass interfaces ?

- industrial interface:
 - traditional ... dials and knobs
 - now ... screens and keypads
- glass interface
 - + cheaper, more flexible, multiple representations, precise values
 - not physically located, loss of context, complex interfaces

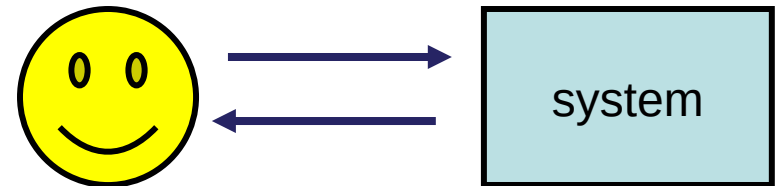


multiple representations
of same information

Indirect manipulation

- office- direct manipulation

- user interacts
with artificial world

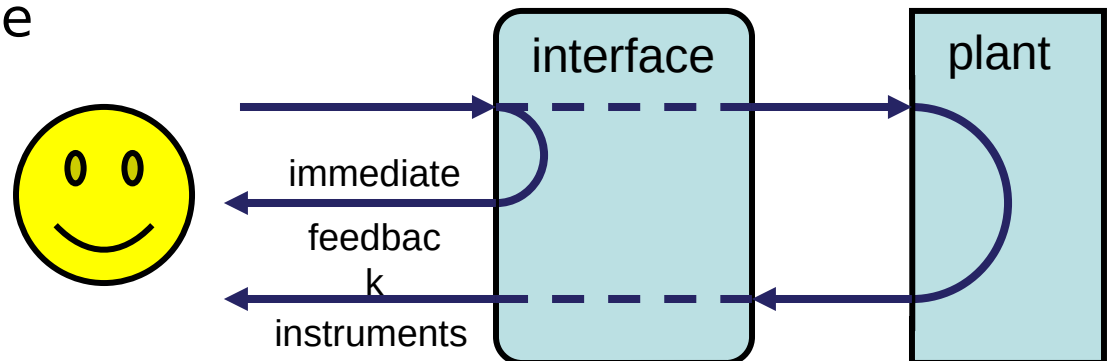


- industrial - indirect manipulation

- user interacts
with real world
through interface

- issues ..

- feedback
- delays



interaction styles

dialogue ... computer and user

distinct styles of interaction

Common interaction styles

- command line interface
- menus
- natural language
- question/answer and query dialogue
- form-fills and spreadsheets
- WIMP
- point and click
- three-dimensional interfaces

Command line interface

- Way of expressing instructions to the computer directly
 - function keys, single characters, short abbreviations, whole words, or a combination
- suitable for repetitive tasks
- better for expert users than novices
- offers direct access to system functionality
- command names/abbreviations should be meaningful!

Typical example: the Unix system

Menus

- Set of options displayed on the screen
- Options visible
 - less recall - easier to use
 - rely on recognition so names should be meaningful
- Selection by:
 - numbers, letters, arrow keys, mouse
 - combination (e.g. mouse plus accelerators)
- Often options hierarchically grouped
 - sensible grouping is needed
- Restricted form of full WIMP system

Natural language

- Familiar to user
- speech recognition or typed natural language
- Problems
 - Vague and ambiguous
 - The boy hit the dog with the stick
 - The word '**pitch**' may refer to a sports field, a throw, a waterproofing substance
 - hard to do well!
- Solutions
 - try to understand a subset
 - pick on key words

1. Throw or toss with a light motion
"pitch me the beachball"
2. Move abruptly
"The ship suddenly pitched to the left"
3. Fall or plunge forward
"She pitched over the railing of the balcony"
4. Set to a certain pitch
"He pitched his voice very low"
5. Sell or offer for sale from place to place
6. Be at an angle

Query interfaces

- Question/answer interfaces
 - user led through interaction via series of questions
 - suitable for novice users but restricted functionality
 - often used in information systems
- Query languages (e.g. SQL)
 - used to retrieve information from database
 - requires understanding of database structure and language syntax, hence requires some expertise

Form-fills

- Primarily for data entry or data retrieval
- Screen like paper form.
- Data put in relevant place
- Requires
 - good design
 - obvious correction facilities

The screenshot shows a web browser window with the title 'Go-faster Travel Agency Booking'. The main heading is 'Go-faster Travel Agency Booking'. Below it, the text 'Please enter details of journey:' is displayed. The form contains several input fields and radio buttons:

- 'Start from:' with a text box containing 'Lancaster'.
- 'Destination:' with a text box containing 'Atlanta'.
- 'Via:' with a text box containing 'Leeds'.
- Three radio buttons for class: 'First class' (selected), 'Second class', and 'Bargain'.
- Two radio buttons for type: 'Single' and 'Return' (selected).
- 'Seat number:' with an empty text box.

On the left side of the form, there is a vertical sidebar with three buttons: 'Favorites', 'History', and 'Search'.

Spreadsheets

- first spreadsheet VISICALC, followed by Lotus 1-2-3
MS Excel most common today
- sophisticated variation of form-filling.
 - grid of cells contain a value or a formula
 - formula can involve values of other cells
e.g. sum of all cells in this column
 - user can enter and alter data spreadsheet maintains consistency

WIMP Interface

Windows

Icons

Menus

Pointers

... or windows, icons, mice, and pull-down menus!

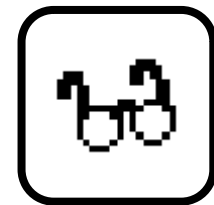
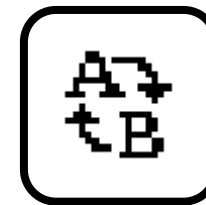
- default style for majority of interactive computer systems, especially PCs and desktop machines

Point and click interfaces

- used in ..
 - multimedia
 - web browsers
 - hypertext
- just click something!
 - icons, text links or location on map
- minimal typing

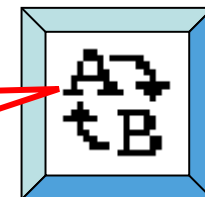
Three dimensional interfaces

- virtual reality
 - 3d interfaces for oculus rift goggles
- 3D workspaces
 - use for extra virtual space
 - light and occlusion give depth
 - distance effects



flat buttons ...

click me!



... or sculptured



USER CONTROLS

The interface is operated with two touchpads. The touchpads display a keyboard, as well as tools for confirmation and live UI interaction.

