



Human-Computer Interaction

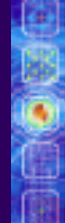
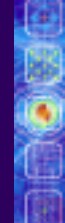
Dr. Ibrar Hussain
25/03/2019



HUMAN-COMPUTER INTERACTION

THIRD
EDITION

DIX
FINLAY
ABOWD
BEALE



the interaction

The Interaction

- **Interaction models** help us to understand what is going on in the interaction between user and system. They address the translations between what the user wants and what the system does.
- **Ergonomics** looks at the physical characteristics of the interaction and how these influence its effectiveness.

The Interaction (Cont.)

- The dialog between user and system is influenced by the **style of the interface** (the nature of user/system dialog).
- The interaction takes place within a social and organizational **context** that affects both user and system.

What is interaction?

Communication

user ↔ system



Models of Interaction

terms of interaction

Norman model

interaction framework

Terms of Interaction

- A **domain** defines an area of expertise and knowledge in some real-world activity. e.g. graphic design.
- **Tasks** are operations to manipulate the concepts of a domain. e.g. ... select fill tool, click over triangle.
- A **goal** is the desired output from a performed task. e.g. create a solid red triangle.
- An **intention** is a specific action required to meet the goal.

Terms of Interaction (cont.)

- **Task analysis** involves the identification of the problem space for the user of an interactive system in terms of the domain, goals, intentions and tasks.
- The concepts used in the design of the system and the description of the user are separate, and so we can refer to them as distinct components, called the **System** and the **User**, respectively.

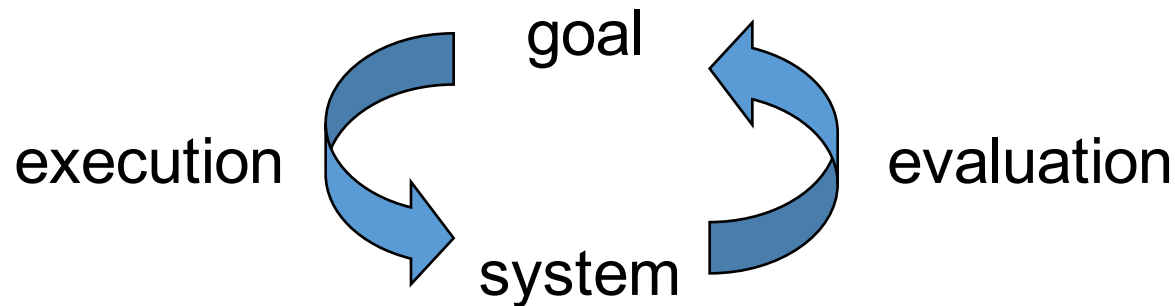
Terms of Interaction (cont.)

- The *System* and *User* are each described by means of a language that can express concepts relevant in the domain of the application.
- The core language describes computational attributes of the domain relevant to the *System* state.
- The task language describes psychological attributes of the domain relevant to the *User* state.

The execution-evaluation cycle (Donald Norman's model)

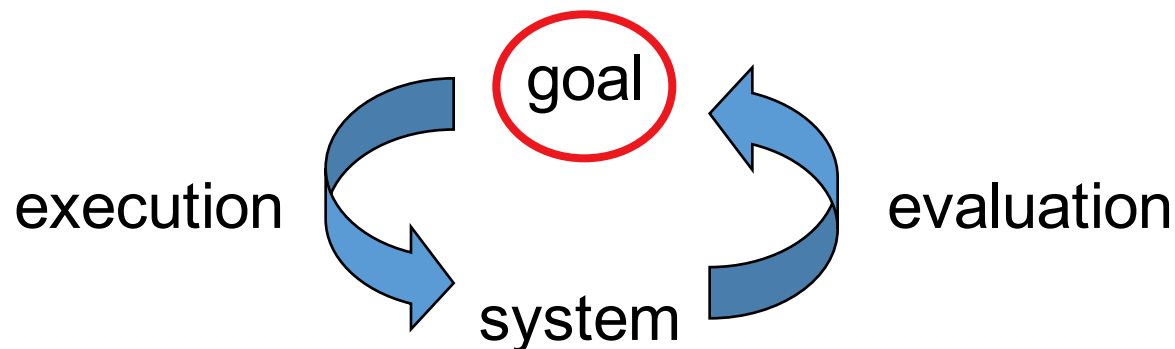
- The interactive cycle can be divided into two major phases: execution and evaluation, and this can be subdivided in seven stages:
 - user establishes the goal
 - formulates intention
 - specifies actions at interface
 - executes action
 - perceives system state
 - interprets system state
 - evaluates system state with respect to goal
- Norman's model concentrates on user's view of the interface

execution/evaluation loop



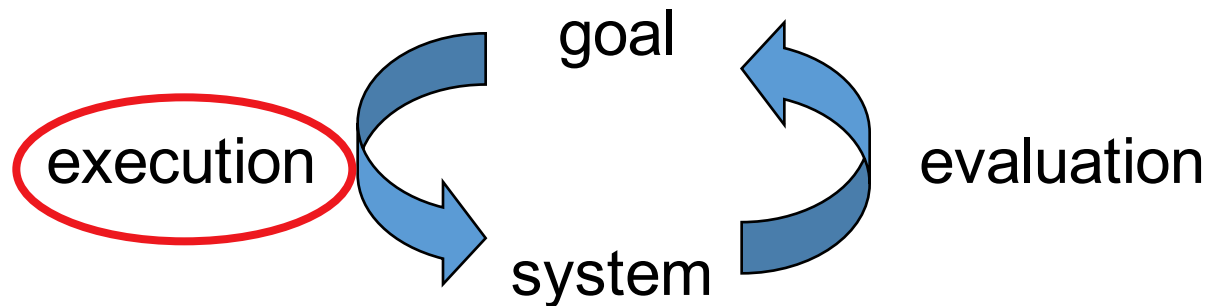
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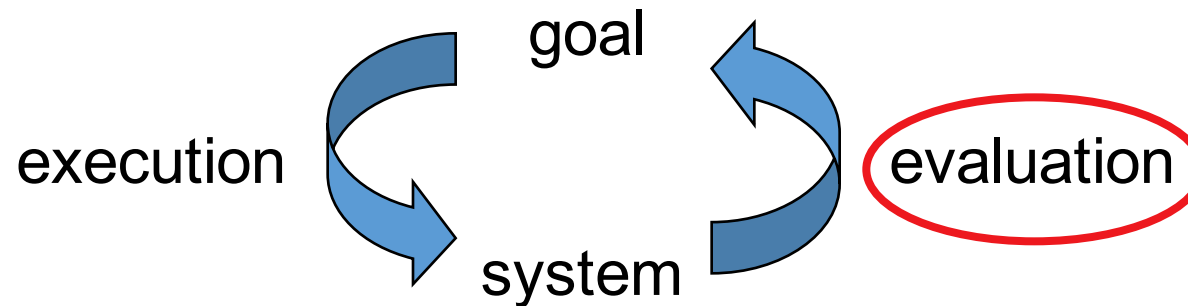
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Using Norman's model

- The **gulf of execution** is the difference between the user's formulation of the actions 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.
- The interface should therefore aim to reduce this gulf.

- The **gulf of evaluation** is 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 goal, the gulf of evaluation is small. The more effort that is required on the part of the user to interpret the presentation, the less effective the interaction.
- Gulf of Evaluation
 - user's expectation of changed system state
 \neq actual presentation of this state

Human Error – Slips and Mistakes

- Human errors are often classified into *slips* and *mistakes*.
- If you understand a system well you may know exactly what to do to satisfy your goals – you have formulated the correct action.
- However, perhaps you mistype or you accidentally press the mouse button at the wrong time. These are called **slips**; you have formulated the right action, but fail to execute that action correctly.

- If you don't know the system well you may not even formulate the right goal. E.g., you may think that the magnifying glass icon is the 'find' function, but in fact it is to magnify the text. This is called a **mistake**.
- Slips may be corrected by, for instance, better screen design, perhaps putting more space between buttons.
- Mistakes need users to have a better understanding of the systems, so will require far more radical redesign or improved training, perhaps a totally different metaphor for use.

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

Abowd and Beale framework

extension of Norman...

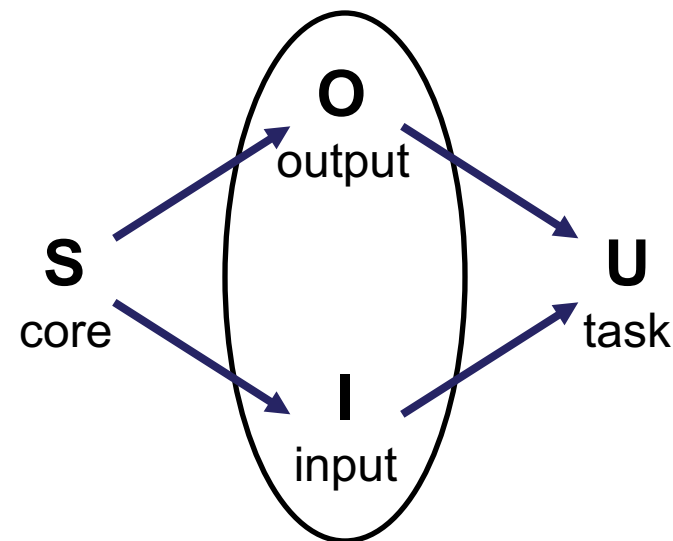
their interaction framework has 4 parts

- user
- input
- system
- output

each has its own unique language

interaction  translation between languages

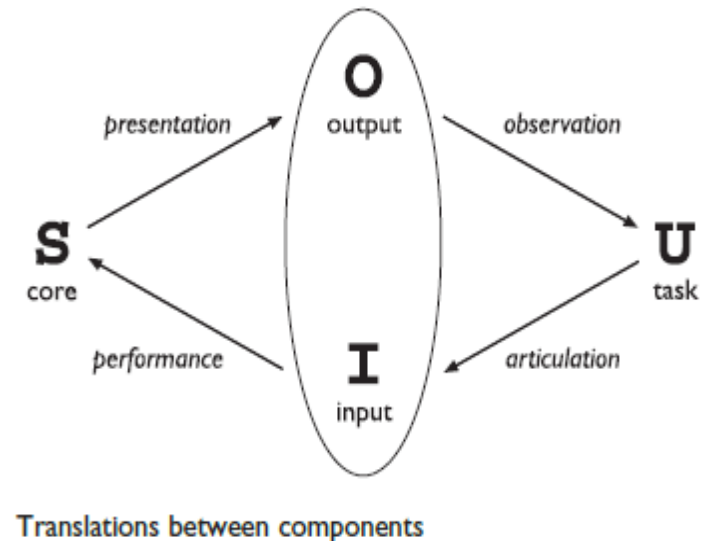
problems in interaction = problems in translation



Using Abowd & Beale's model

User intentions

- 🗣️ translated into actions at the interface
- 🗣️ translated into alterations of system state
- 🗣️ reflected in the output display
- 🗣️ interpreted by the user



General framework for understanding interaction

- not restricted to electronic computer systems
- identifies all major components involved in interaction
- allows comparative assessment of systems
- an abstraction

Using Abowd & Beale's model

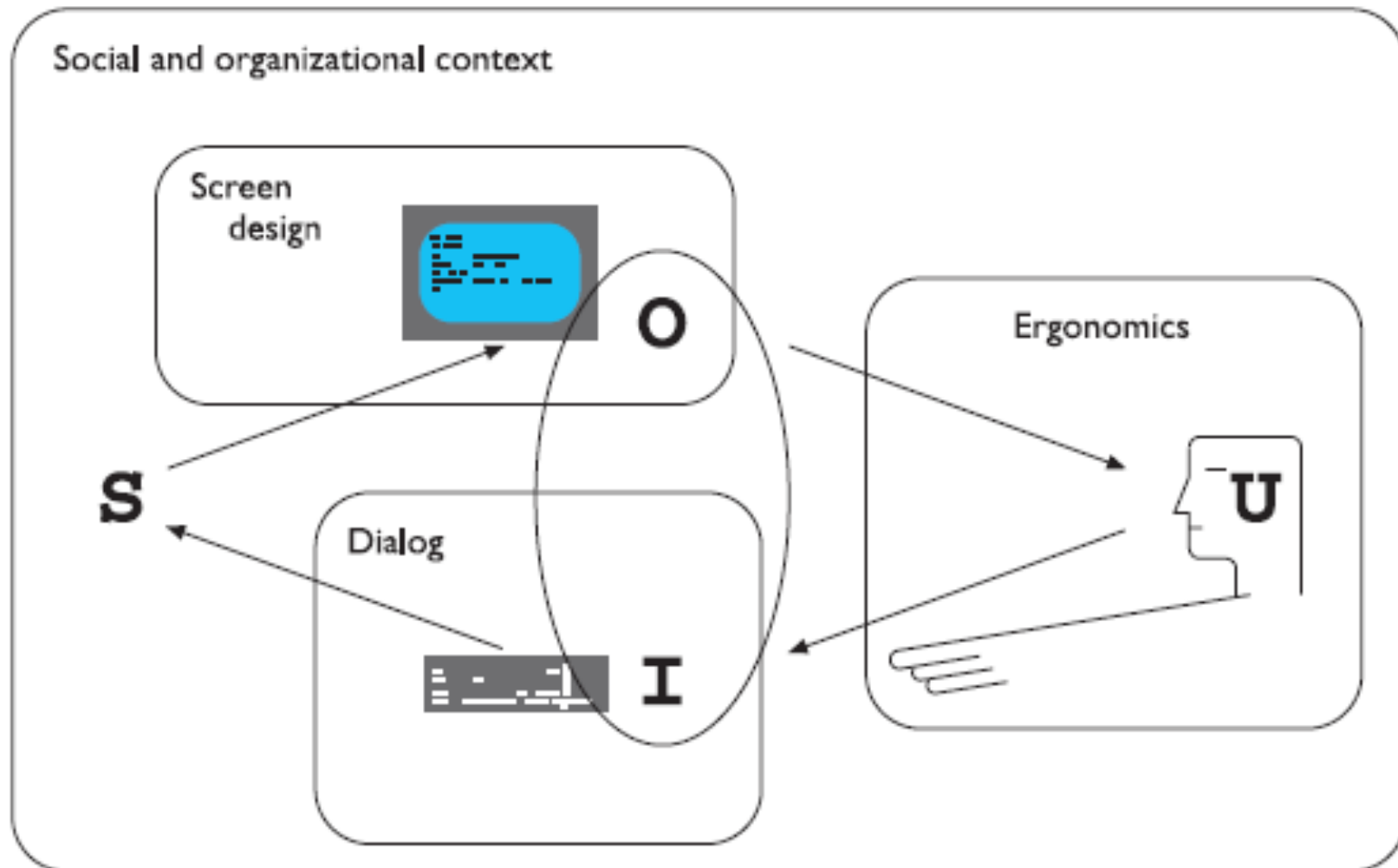
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A Framework for HCI



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

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.



Industrial interfaces

Office interface vs. industrial interface?

Context matters!

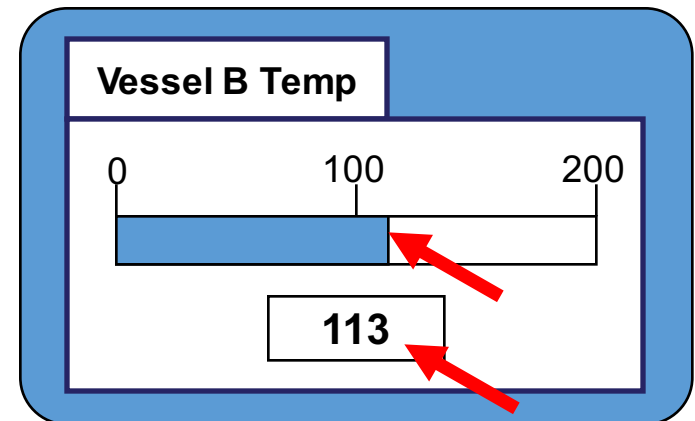
	office	industrial
type of data	textual	numeric
rate of change	slow	fast
environment	clean	dirty

... 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
- may need both



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

