

Quadrant II – Transcript and Related Materials

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Interaction

Interaction is the communication between user and system which effectively translates between user and system for successful interaction.

The purpose of an interactive system is to aid a user in accomplishing goals from some application domain. A domain defines an area of expertise and knowledge in some real-world activity. Some examples of domains are graphic design, authoring and process control in a factory.

A domain consists of concepts that highlight its important aspects. In a graphic design domain, some of the important concepts are geometric shapes, a drawing surface and a drawing utensil. Tasks are operations to manipulate the concepts of a domain. A goal is the desired output from a performed task. For 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 red triangle centered on the canvas. An intention is a specific action required to meet the goal.

Effective translation between user and system to allow the interaction fails at a number of points and for a number of reasons. The use of models can help us to understand exactly what is going on in the interaction and identify the likely root of difficulties. They also provide us with a framework to compare different interaction styles and to consider interaction problems.

Norman's Execution–Evaluation Cycle

Norman's Execution–Evaluation Cycle is the most influential model of interaction. It is based on basic interaction of user with the system as follows:

- User formulates a plan of action
- Plan of action executed at the computer interface
- User observes the computer interface to evaluate the result after execution of plan
- User determines further actions

The interactive cycle can be divided into two major phases:

- Execution phase
- Evaluation phase

These can then be subdivided further into seven stages. Each stage is an activity of the user.

The seven stages of Norman's execution evaluation cycle are as follows:

1. Establishing the goal. [user's notion of what needs to be done in domain]
2. Forming the intention. [More specific task form of the goal]
3. Specifying the action sequence.
4. Executing the action.
5. Perceiving the system state.
6. Interpreting the system state.
7. Evaluating the system state with respect to the goals and intentions.

The user perceives the new state of the system, after execution of the action sequence, and interprets it in terms of his expectations. If the

system state reflects the user's goal then the computer has done what he wanted and the interaction has been successful. Otherwise the user must formulate a new goal and repeat the cycle.

Consider the following example to understand the stages clearly.

Imagine you are sitting reading as evening falls. You decide you need more light - that is - you establish the goal to get more light. From there you form an intention to switch on the desk lamp. You specify the actions required – to reach over and press the lamp switch. Then Execute the action by actually switching on the lights. After you executed the action you perceive the result-Either the light is on or it isn't. The result interpreted - based on knowledge of the world. If the light does not come on we will interpret this as indicating the bulb has blown or as the lamp is not plugged into the mains. You will formulate new goals to deal with if the light is not on. If the light does come on, we will evaluate the new state according to the original goals – is there now enough light? If so, the cycle is complete. If not, formulate a new intention to switch on the main ceiling light.

Norman's Model of interaction-demonstrates why some interfaces cause problems to their users. This is described in terms of gulf of execution and gulf of evaluation.

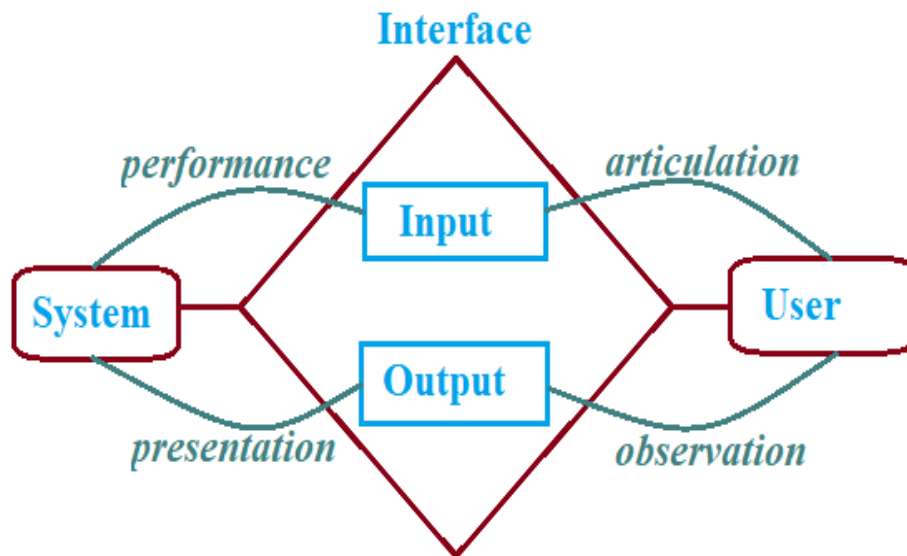
The gulf of execution is the difference between the user's formulation of the actions to reach the goal and the actions allowed by the system. If the actions allowed by the system correspond to those intended by the user, the interaction will be effective. The interface should aim to reduce this gulf.

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 is the interaction.

The Interaction Framework

The interaction framework attempts a more realistic description of interaction by including the system explicitly, and breaks it into four main components. The nodes represent the four major components in an interactive system - the System, the User, the Input and the Output. Each component has its own language. In addition to the User's task language and the System's core language, there are languages for both

the Input and Output components. Input and Output together form the interface.



Four steps in the interactive cycle are

- Articulation
- Performance
- Presentation
- Observation

Each step corresponds to translation from one component to another.

The System then transforms itself as described by the operations; the execution phase of the cycle is complete and the evaluation phase now begins. The System is in a new state, which must now be communicated to the User. The current values of system attributes are rendered as concepts or features of the Output. It is then up to the User to observe the Output and assess the results of the interaction relative to the original goal, ending the evaluation phase and, hence, the interactive cycle. There are four main translations involved in the interaction: articulation, performance, presentation and observation.

Ergonomics

Ergonomics (or human factors) is traditionally the study of the physical characteristics of the interaction: how the controls are designed, the physical environment in which the interaction takes place, and the layout and physical qualities of the screen. A primary focus is on user

performance and how the interface enhances or detracts from this. In seeking to evaluate these aspects of the interaction, ergonomics will certainly also touch upon human psychology and system constraints. It is a large and established field, which is closely related to but distinct from HCI, and full coverage would demand a book in its own right. Here we consider a few of the issues addressed by ergonomics as an introduction to the field. We will briefly look at the arrangement of controls and displays, the physical environment, health issues and the use of colour. These are by no means exhaustive and are intended only to give an indication of the types of issues and problems addressed by ergonomics.

Arrangement of controls and displays

The exact organization that this will suggest will depend on the domain and the application, but possible organizations include the following:

1. **Functionally related controls** and displays are placed together.
2. **Sequential controls** - Displays organized to reflect the order of their use in a typical interaction. Appropriate in domains where a particular task sequence is enforced such as aviation
3. **Frequency controls** - Organized according to how frequently they are used. The most commonly used controls made most easily accessible

The physical environment of the interaction

Physical issues in the layout and arrangement of the machine interface, ergonomics is concerned with the design of the work environment itself. This will depend largely on the domain and will be more critical in specific control and operational settings than in general computer use. The physical environment in which the system is used may influence how well it is accepted and even the health and safety of its users. It should therefore be considered in all design. The first consideration here is the size of the users. Obviously this is going to vary considerably. All users should be comfortably able to see critical displays. For long periods of use, the user should be seated for comfort and stability.

Seating should provide back support. If required to stand, the user should have room to move around in order to reach all the controls.

Health issues

There are a number of factors that may affect the use of more general computers. Again these are factors in the physical environment that directly affect the quality of the interaction and the user's Performance:

1. **Physical position** - Users should be able to reach all controls comfortably and see all displays
2. **Temperature** - Most users adapt to slight temperature changes, extremes of hot or cold will affect performance of the user
3. **Lighting** - Adequate lighting should be provided to allow users to see the computer screen without discomfort or eyestrain.
4. **Noise** - Excessive noise is harmful - causing the user pain and loss of hearing. Noise levels should be maintained at a comfortable level.
5. **Time** - Time users spend using the system should also be controlled. For example, excessive use of CRT displays is harmful.

The use of color

Colors used in the display should be as distinct as possible and the distinction should not be affected by changes in contrast. Blue should not be used to display critical information. If color is used as an indicator it should not be the only cue: additional coding information should be included. The colors used should also correspond to common conventions and user expectations. Red, green and yellow are colors frequently associated with stop, go and standby respectively. Therefore, red may be used to indicate emergency and alarms; green, normal activity; and yellow, standby and auxiliary function. These conventions should not be violated without very good cause.