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Introductory Chapter: Multimedia and Interaction

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1. Introduction

Interactive media are means of communication in which the output values depend on inputs. This means that the user is actively involved in the communication. The media still has the same purpose, but entries or inputs made by user create the interaction and some interesting options when it comes to the output of the system. Interactive media is referred to conceptual design of interaction, new media, interactivity, interaction between people and computers, graphical user interface, digital culture, interactive design, and virtual reality. One of the most important characteristics of interactivity is the interaction between user and machine, where each of them has an active role.

Interactive multimedia allows the user to control, combine, and manipulate a variety of media types, such as text, computer graphics, audio and video materials, as well as animation. Interactive multimedia integrates computer, storage, data, phone, TV, and other information technologies. The most common interactive multimedia applications include education and training programs, video games, electronic encyclopedias, and travel guides. The user or participant in an interactive multimedia application changes their role—for the viewer becomes an active participant. It is expected that interactive multimedia systems become the next generation of electronic information systems. It should be mentioned that another name for interactive multimedia is hybrid technology, because it is able to combine the possibilities for storage capacities of computers and a digital database with an advanced tool for viewing and manipulating these materials.

Nowadays, the fastest-changing area is dedicated to the development of teaching materials based on usage of computers, particularly interactive multimedia programs that run on personal computers. These new computer and information technologies offer students and teachers access to materials like never before. Through the storage capacity of the computer, multimedia can "deliver" enormous amounts of data to users in more useful and accessible ways [1, 2].

2. Interaction models

The interaction itself involves at least two parties—the user and the system. The previously mentioned participants are complex and completely different in the way of communication and perception of task. The interface must be a link between them in order to have successful interaction. This transcription can fail in a great number of cases for several reasons. The usage of interaction models can help better understand what is happening in the interaction and to identify possible problems. Models allow, together with developing environment, to compare the different styles of interaction and to discuss issues of interaction as well [3].

2.1 Terms of interaction

Traditionally, the purpose of an interactive system is to assist the user in achieving the goals from the application domain. **Domain** defines the area of expertise and knowledge in real-world activities. The domain consists of concepts, which emphasize its important aspects. **Tasks** represent operations for manipulation of concepts within the domain. **Objective** is defined as desired output of the accomplished task, while the **intention** represents the specific action which is required for task accomplishment.

Task analysis includes the identification of problems in terms of domains, objectives, intentions, and tasks. It can use human knowledge about tasks and objectives, in order to assess an interactive system that is designed to support them. The terms (concepts) which are used in the design of a system and a customer description are separated, so that they can be treated as separate components—the system and the user, respectively [3–5].

2.2 Ergonomics

The term **ergonomics** or **human factors** is traditionally related to the study of interaction of physical characteristics—design of controls, physical environment in which the interaction takes place, arrangement, and the physical properties of display. The primary focus is on the user's performances and how interface affects them. In order to assess these aspects of interaction, ergonomics will certainly touch on human psychology and systems' limitations.

2.2.1 Display and control setup

Besides cognitive aspects of design, physical aspects are also important. Sets of controls and display components should be grouped logically, in order to allow faster access to the user. This is not so important when only one user is active. But, when we take controls in power plants, aircrafts, and air traffic into consideration, it becomes vital. In each of these cases, users are under pressure, and they are faced with a huge range of displays and controls, so their appropriate physical appearance is significant.

The importance of a logical grouping of controls has already been mentioned, as well as the fact that the controls should not be separated. The exact manner of organization (which will be presented) will depend on the domain of application itself. Possible ways of organizations can include the following things:

- **Functional controls and displays** are organized to place together the elements which are functionally linked.

- **Sequential controls and displays** are organized to reflect the order of their use in a typical interaction.

- **Frequent controls and displays** are organized according to the frequency of usage, but the most commonly used controls should be easily accessible.

Apart from setting up the controls and displays, the whole interface system should be properly distributed according to the position of the user himself. Thus, for example, a user should be able to reach all necessary controls and to see all the displays without excessive body movement. The most important displays should be at eye level, and controls should be adjusted for space maneuvering. Display reflections should be avoided as well [3, 6].

2.2.2 Interactions of the physical environment

Ergonomics deals with solving physical problems in the interface schedule and arrangement and takes into account the design of work environment as well. Where will the system be used? Who will use it? Will people sit, stand, or move around? Again, this will depend on the domain in a great extent, and it will be critical when it comes to specific controls and operational settings. However, the physical environment in which the system is used can affect the health and safety of its users. This should be taken into account in any design [2].

2.2.3 Health issues

Work on computer should not be considered as a dangerous activity, but one should bear in mind the possible implications of design on the health and safety of users. Factors in the physical environment directly affect the quality of interaction and user's performances:

- **Position of a user.** As previously mentioned, users should be able to fetch all of the controls comfortably and to see all the screens. Users should not stand for a long time, and if they are sitting, they should be provided with the rear seat backrest. If the user is ought to be in a certain position for a long time (e.g., when typing), one should be provided with a certain period of time to rest.

- **Temperature.** Most users certainly can adapt to small changes in temperature, with no adverse effect, but extreme temperatures (excessively warm or cold) will affect their performance and in excessive cases will affect their health. Experimental studies have shown that the performance deteriorates at high or low temperatures, and users are not able to concentrate.

- **Brightness.** The brightness level will, again, depend on the working environment. Adequate lighting should allow users to view the computer screen without discomfort or eyestrain. The light source should be positioned in such a way to avoid glare.

- **Noise.** Excessive noise can be harmful to health, causing user's pain, and, in acute cases, can lead to hearing loss. The noise level should be maintained at an appropriate level in the work environment. This does not necessarily mean that there is no noise at all. Noise can be an incentive for users and can provide the necessary confirmation of system activity.

- **Time.** The time users spend using the system should be controlled. As previously mentioned, it has been said that excessive use of CRT displays can be harmful to users, especially for pregnant women [4, 6].

2.3 Ways of interaction

The interaction can be observed as a dialog between the user and the computer. The choice of interface style can have a profound effect on the nature of a dialog. There is a great number of common interface styles including:

- Command line inside the interface

- Menus

- Natural language

- Dialogs with inquiries, questions, and answers

- WIMP (windows, icons, menus, pointers) interface

- 3D interfaces [1, 2]

3. Interaction design

Some of the interactions between humans and computers (or machines or technology) focus on understanding, which means that the attention is paid to the way how people interact with technology. However, a great deal of interaction between man and computer refers to how things work and how they are created. The credits for these features go to **design** [4].

In this part, attention will be paid to the **interaction design** or **design interactivity**. It should be borne in mind that it is not only thought about the design of interactive systems but about interaction design itself. Thus, interaction design is not just an artifact[1] that is produced, regardless of whether it is a physical device or a computer program. Apart from that fact, the artifacts do not give people only these devices and programs but also guides, tutorials, and online help systems. In some cases, it may be understood that no additional system is necessary for all elements, but it is probably easier to propose a different way of using existing tools [3, 5, 7].

3.1 About design in general

When someone is asked what design is, simple definition might be that the design is related to the achievement of objectives within the constraints. This definition does not say everything about the design, but it helps users to focus on the following elements:

- **Objectives**—What is the purpose and design of future product? For whom is it made? Why do they want it?

- **Limitations**—What materials should be used? What standards should be adopted? How much will it cost? How much time is needed to develop the product? Are there any health and safety issues?

- **Exchange (compromise)**—One should choose and define the objectives or restrictions which may be adopted in a milder form, and limits must be respected to the smallest detail.

It is impossible to accomplish all of the user's objectives within constraints, but in life, everything is a matter of compromise, even in such cases. The best designs are created in areas where the designer understands the compromises and the factors affecting them.

The most important part of interaction design or interactivity is user. It is necessary to set up a user in the first place and to keep the user in the central place [3, 6, 8].

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[1] The artifact is every object that is made or revised and used by a man. The artifact may be a final product but can also be a by-product of the production process.

3.2 Briefly about design process

Here is a brief overview of the simplified view of the four major phases focused on interaction design and interactivity, as well as supporting iteration loop:

- **Requirements.** The first phase is based on definitions of needed requirements. Before phase one, it is necessary to know what is currently happening. For example, how do people watch movies? What kind of personnel is currently being used?

- **Analysis.** The results of observations and interviews should be delivered so that the key issues can be removed from them for the later stages of design. Usually, this is about the scenarios, the stories about the interaction, which may be combined with a task analysis or be independently recorded in order to create a colorful and real interaction.

- **Design.** There is a central phase when it starts from "what is desired" to "how to do it." There are a number of rules, guidelines, and principles of design, which can be used as an aid in order to obtain good results.

- **Repetitions (iterations) and prototyping.** People are complex and cannot be expected to reach the right design immediately. That is the reason why the design should be evaluated in order to be seen how it works and where it could be improved.

- **Implementation and deployment.** Finally, when it comes to the stage when the design is rated as well as done, then it should be created and applied. This includes the development of appropriate elements, writing documentation, and manuals.

One man cannot read and look at all the required techniques. Time is limited and there is no link between the period of design and quality of the final design. This means that a design should be accepted as final, even if it is not perfect; it is often better to have a product which is acceptable, is done on time, and costs less than to have one that has perfect interaction but was not done on time and was over a budget. For example, if a user encounters a system that appears to be perfect, one can be pretty sure that it is a poorly designed system; the system is poorly designed, not because the design is bad but because a lot of effort has been spent for the design process and designing [7, 8].

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