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Towards a communication model applied to the interface design process

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Abstract

The design of computational artifacts involves many communication acts occurring through different channels; usability tests, for example, have been used as a main communication channel between designers and users. Other channels used during the design process include requirement analysis, scenario construction, prototyping, etc. This work takes the Westley and MacLehan communication model and projects it into the context of interactive artifact design, resulting in a model of fractal nature. Some channels already present during the design process fit in well with the model we are proposing. It also reveals that other channels have not been explored in the global process of communication. Thus, we show how a semiotic-based analysis can unify techniques, methods and tools that support design, as well as make explicit the necessary interactions among designers, users and computers through different channels. © 2001 Elsevier Science B.V. All rights reserved.

Keywords: Communication; Semiotics; Design process

1. Introduction

Semiotic approaches perceive the interface as a communication act between designers and users, using the computer as medium [2,6,12]. The designers establish the limits of this communication and create a set of signs that users can activate [2], which means that the formers are the senders of this communication model. Semiotic Engineering [6] considers the message itself a meta-communication artifact, since the interface exchanges messages with users.

The focus of this work is the communication involved in the design and use of computational artifacts. One aspect of this communication is the dialogue between designers and users. As Adler and Winograd point out [1], this kind of communication is embedded in every kind of artifact. Through their structure and appearance, designed objects express more or less effectively what they are, how they are used, and how they are integrated with the embedded context. According to semiotic approaches in HCI (Human–Computer Interaction), this structure and appearance — i.e. the interface — can be understood as a message sent from designers to users using the computer as channel.

In order to design this message, designers and users need to develop a common understanding about what is going to be done. On one hand, there are the users' needs and expectations; on the other hand, there are contextual, technological, budget and schedule constraints that limit the possible design solutions. Designers and users must engage in a process of negotiation, which we view as a conversational process. In this conversation, many communication acts occur, many messages are exchanged using different channels. Since HCI evolved, the communication channels between designers and users have increased in number: designers talk to marketing people, customer support mediates between developers and users, external consultants help both users' and developers' organizations, etc. This issue is deeply explored in Ref. [8]. The use of different channels is related to the needs of the communication acts: the nature of information desired, the projects' contexts, etc. Usability tests, for example, have been used as a main communication channel between designers and users and their main focus is the evaluation of individual users' performances.

More recently, the importance of the work context in user–computer interaction was widely recognized. Besides the evaluation of the users' performances when they interact in isolation with an artifact, another goal came onto the scene: designers realized that it was also important to analyze how an interface can reflect users' work context and support users' social interactions to execute their tasks. New approaches, like participatory [10] and contextual design [3], were developed and introduced additional channels in user–designer communication.

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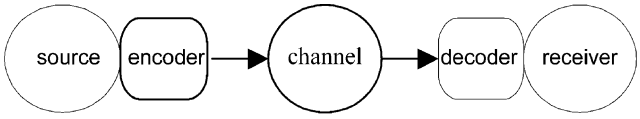

Fig. 1. Shannon and Weaver's communication model.

In order to design the message (i.e. the interface), designers and users must engage in a dialogue using different channels. As Gould and Lewis point out [7], "getting useful design information from prospective users is not just a matter of asking". Designers need to ask questions, represent the information they get and the solutions they provide in a meaningful way to check it, perceive users' questions and reactions and so on [13,15]. The designer–user dialogue is, actually, the successive phases of a design–implement–evaluate loop that characterizes the design process, which is, by its very nature, iterative. In this work, we argue that in order to understand the dimensions involved in the construction of the interface as message we must achieve a better understanding about the dialogue that occurs among the various parties involved in the design activity, how and when it begins and is carried out during the design process. Thus, considering design as a communication process, this work proposes a model that organizes an analysis space for design. This meta-model unifies some current design practices while making visible the dearth of other communicative acts important in the design process.

The paper is organized as follows: Section 2 presents and discusses some models for communication in an attempt to understand them in the context of design. In Section 3, a fractal communication model is proposed to represent the communication acts that occur among designers, users and computers during the design process. Section 4 concludes pointing out the potentialities of the proposed model.

2. Communication models and the design process

To understand communication in the design process, we must first form a coherent understanding of what communication itself involves. Several models for communication have been presented and discussed by thinkers from diverse philosophical schools. We will examine some of them in order to reach the essential aspects of the concept.

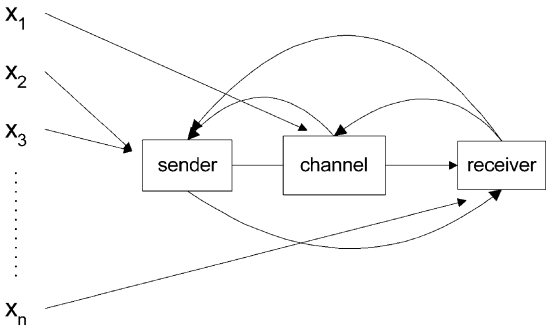

Fig. 2. Westley and MacLehan's communication model.

For a long time, the dominant model in the theory of communication was Shannon and Weaver's Mathematical Theory of Communication [17]. Grounded in the Theory of Information as a system of mathematical basis to study the problems of transmitting messages through physical channels, it is therefore a technique of communication engineering in which source, encoder, channel, noise, decoder and receiver of information is identified, as illustrated by Fig. 1.

To understand the linguistic processes of verbal communication, Jakobson [9] proposed a model in which he identifies six factors that constitute every verbal communication act. The addresser sends a message to the addressee. To be effective, the message requires a context to which it refers, apprehensible by the addressee, a code total or partially common to both (addresser and addressee), and a contact, a physical channel between the addresser and the addressee. As in Jakobson's proposal, the semiotically improved model adds the role of the repertory of signs of both the sender and the receiver and requires the overlapping of the two repertories as a necessary condition for communication.

The direct transposition of the models derived from the Information Theory to understand human communication has some drawbacks, however. Parameters such as entropy or redundancy, while pertinent to 'messages' are not the most important and do not reflect the specific nature of human communication. Another difficulty pointed out in Ref. [5] is the unidirectional movement associated to the communication act, from a source (or addresser) to a receiver (or addressee). Receivers and senders actually engage in dialogues involving a process of meaning negotiation towards a common understanding. What receivers have understood from what a sender has 'said' is frequently revealed in what receivers say themselves when they next take a turn at the communication act [4]. Westley and MacLehan [18] proposed a model derived from mass communication [5] that reflects the various interactions among the entities (sender, receiver and channel) involved in the communication, including the receiver–sender, receiver–channel and channel–sender directions. This model is illustrated in Fig. 2. The following description of the model is presented in Ref. [5]:

- $x_1, x_2, \ldots, x_n$ are the possible messages;
- the sender intentionally selects and transmits a message;
- the receiver asks for and uses information;
- the channel is an agent that should select and transmit information to the receiver;
- feedback is provided from the receiver to channel, from the receiver to sender and from the channel to sender;
- the message obtained by the receiver can be classified in one of the following classes: messages that the receiver can get directly; messages transmitted directly by sender to the receiver; messages transmitted by channel to the

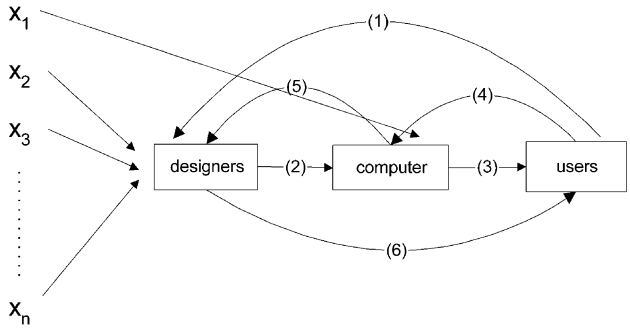

Fig. 3. Westley and MacLehan's communication mode applied to design.

receiver; messages transmitted by the sender to the receiver through the channel.

In this model, the receiver plays an active role. He or she asks for information and it is this question that determines the content and form of the message created by the sender. There are feedback points that seem to better represent the conversational process; through them, the senders can add content to a message or change its form to facilitate the receiver's comprehension.

Due to some of its characteristics, specially, the acknowledge of the bi-univocal relation between senders and receivers [5], the Westley and MacLehan model could be used to describe many of the communication acts that occur in the design process. To illustrate this idea, Fig. 3 presents a parallel that could be drawn between the model and the design process:

- $x_1, x_2, \ldots, x_n$ are the possible design solutions;
- arrow (2) represents the interface being designed;
- arrow (5) represents all kinds of feedback that the primary channel can provide to designers, like log files with user–computer interaction records;
- path (2)–(3) represents the designer–user communication through the interface;
- cycle (3)–(4) represents the user–computer interaction itself;
- cycle (2)–(5) represents the designers' interactions with the interface they are designing (for example, heuristic evaluation);
- cycle (6)–(1) represents interactions between designers and users in order to improve the final interface, such as surveys, conversations, usability tests, etc.

It is important to highlight, however, that the Westley and

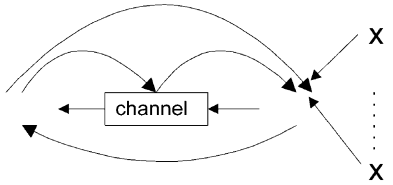

Fig. 4. Fractioned view of arrow 1 of Fig. 3.

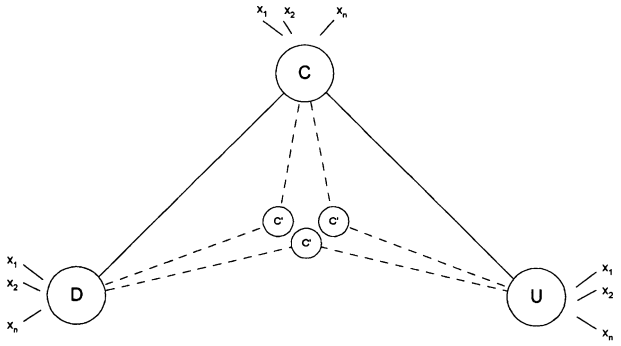

Fig. 5. Fractal Communication Model.

MacLehan model, has itself some objectionable features. We criticize the view of some communication acts being non-mediated. Arches 1 and 6 in Fig. 3, for example, represent a direct exchange between senders and receivers. Moreover, the authors take a perspective of just one medium (or class of mass media) as channel, and do not explore alternative channels through which the communication between senders and receivers also take place. In our view, the diversity of channels used for communication is what makes it inherently complex and powerful.

In designing the interface (i.e. the message), users must express their needs and expectations, describe their tasks, work process, and so on. They exchange ideas with designers, present documents describing internal process to designers, show the designers the codes they use to represent their data, and so on. In doing so, users are communicating with designers using channels other than the computer artifact alone, so the designers can understand what needs to be designed. On the other hand, designers must check what they understood against what users have 'said'; they must represent it in a meaningful way so they can 'talk' to users about it. They are also using channels to exchange these other messages; frequently, they are even creating new codes to carry out these communication acts. So, to reflect this view of the design process, a communication model should also consider the fractioned messages and channels used to compose the interface. We consider this aspect extremely important, since the design of a message is highly influenced by the channel used to convey the message [11].

3. The fractal communication model and the design process

According to the model presented in Fig. 3, users could be perceived as receivers that make the initial question — they demand a computational system. However, at some points of the design process, they will be asked by designers about themselves, their tasks and their impressions of the interface — through surveys, usability tests, etc. At these moments, the designers are demanding some information; they can be perceived as the receivers and the users can be perceived as senders who need to elaborate an appropriate response to the

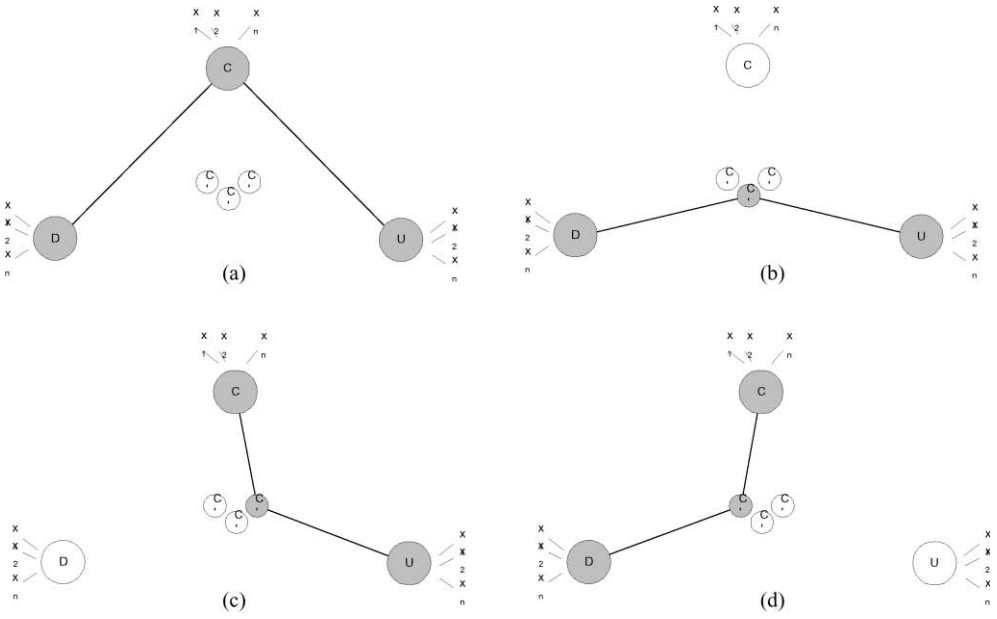

Fig. 6. The communication levels of the design process represented in the fractal model.

question. This fact can be better represented replacing arrow (1) in Fig. (3) by the diagram of Fig. 4

On the other hand, in designing a survey, for example, designers are making a question for users, but they need to determine an appropriate content and form to present their question, they need to do pilot tests and redesign the survey and so on. So, the diagram of Fig. 4 can also replace arrow (6). Actually, this analysis can be applied to all the arrows of Fig. 6, which reveal the fractal nature of the design process.

In the model we are presenting in this work, the interface is understood as a unity-message that reflects what was grasped through the fractioned messages. So, the interface as a unity-message is directly affected by the choice of channels used to compose fractioned messages during the design process. This means that, in designing the interface, or the unity message, many fractioned messages are being exchanged. Each one of those messages is also being designed and they should be carefully designed to make the designer–user communication through the unity-message smoother. Designers and users are also both senders and receivers in this communication process. They cooperate on the development of the interface. The proposed communication model that grasps the discussed issues is presented in the diagram of Fig. 5

In this diagram, nodes represent users (U), designers (D) and channels (C and C′). The arrows are bi-directional, which means that a node sends and receives messages. The fractal nature is represented by nodes C′. Fig. 6 emphasizes some communication foci of the design process that are represented by the fractal model. Fig. 6(a) highlights the designer–user communication using the interface as message. The interface is the unity-message conveyed by the computer, which is the first channel. Fig. 6(b) emphasizes the designer–user communication using other channels than the first one [2]. All communication acts that occur between designers and users for the construction of the unity-message fall in this category, which is extremely important, since the proposed interface almost entirely emerges from it. Fig. 6(c) underlines the user–computer interaction. Fig. 6(d) stresses the designer–artifact communication. This communication between the designers and the emerging artifact, although metaphorical, has a great influence in the design [16].

This model reflects the authors' understandings about design means. In the model, users are sometimes senders sometimes receivers of messages; the same happens to designers. This structure can better reflect the potential contributions of each part in the whole process. Also, in designing the interface, designers should also design other messages and choose appropriate channels to send them. The design of the fractioned messages is highly influenced by the development context [8] and the particular characteristics of each project. This conversational process (see Fig. 6(b)) and the designers' communication with the emerging artifact (see Fig. 6(d)) are made explicit in the proposed model as we consider them fundamental aspects to improve the quality of the communication emphasized in Fig. 6(a) and (c).

[2] Note that the first channel is just the adopted terminology to express the channel under analysis when we focus on the unity-message. Eventually, the same channel (i.e. the computer) can be used to convey fractioned messages.

4. Conclusion

In this work, we presented our understanding of design as a communication process and proposed a model that accommodates all the activities of the design process. While a general model for communication, the proposed model captures the necessary contributions that should occur between designers and users, since both are senders and receivers in this communication process. It also stresses the fact that, in order to design the final interface, designers must carefully design other messages and choose appropriate channels to transmit them, always considering the projects' resources and limitations.

In summary, the fractal communication model organizes an analysis space which unifies some current independent practices of design while brings new issues which deserve more investigation to light. Several questions can be addressed with support of this meta-model, as for example: What are the necessary and sufficient conditions for communication in the design process? Is there a type of communication act best suited for the design of a specific artifact? What are the consequences of a 'broken' communication resulting from lack of appropriate channel or code?

Further work is being done through case studies to evaluate how different design approaches fit into the meta-model proposed. The possibility of making explicit the communication levels stressed by the application of a particular technique or methodology brings new possibilities of analyzing all the elements involved in the design of computer artifacts. We are also investigating the possibilities of 'walking' through the model, for inspection of the effectiveness of communication.

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