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## **A Model of Interaction**

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**Abstract**

In this paper, we make the case that definitions and descriptions of interactions, in most cases, are not based on a detailed enough model of the primary entities of human-computer interaction. Instead of

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viewing interaction as simply the relationship between a person and an artifact, we suggest an expanded model. We argue that such a model is necessary if our attempt is to create an interaction description language that can cope with the full complexity of interaction without making it too simplistic.

**Keywords**

Interaction, user, interface, experience, model

**ACM Classification Keywords**

H.5.2 [User Interfaces]: Interaction styles, Theory and methods.

**Introduction**

In the quest to define user interface description languages (UIDL), we need to answer the basic question of how to think about “interaction” as such. In this position paper we will present a model of interaction that builds on some of our earlier work [4].

The most frequent words used when describing interaction are *user*, *artifact*, *interface*, and *interaction*. It is clear that we are dealing with the fundamental relationship between a person and an artifact (or a group of people and a system of artifacts). This fundamental relationship has been defined and described in many different ways by researchers and practitioners in the field.

In this paper we will make the case that these definitions are, in most cases, not based on a careful analysis of the meanings of the primary entities of human-computer interaction. Instead of viewing interaction as the direct relationship between a person

and an artifact, we suggest a model with more detail, hopefully without leading to disturbing complexity.

### A model of interaction

Before we introduce our model, let's look at the model that is pervasively recognized and accepted. In this simple model there are basically only two parts:

user ↔ artifact

Interaction is understood as the way a user interacts with an artifact. In many cases this model is sufficient and it gives us a simple and good understanding of what is going on and how to think about users and artifacts. But, with new innovative and advanced interactive technologies, and with the growing pervasiveness of digital technology in our environments, this may not always be a sufficient model.

In our earlier proposed model, we separate 'interaction' from the 'artifact' part and the 'user' part, and put it as a separate entity in-between those two entities:

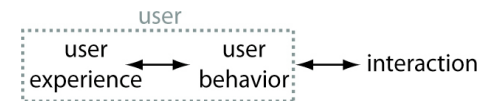
user ↔ **interaction** ↔ artifact

In earlier papers, we have argued for an understanding of *interaction* as its own distinct entity emerging between a user and an interactive artifact [4]. We have also argued that it is useful to understand any interaction as a composition of qualities that creates a unified whole, greater than the sum of its parts. We have made the case that thinking about interaction in this way invites designers to more concretely and explicitly explore the possible interaction design space.

However, we believe that in order to support the notion of creating a *description language for interaction*, this

model is still not detailed enough. The motivation of our proposal in this paper is based on the fact that when people try to describe interaction, it is not uncommon that they end up mixing words and concepts that describe distinctly different parts of the model. For instance, it is very different to describe interaction as a *user experience* or as a *technical quality* of the artifact. Both descriptions are correct and both belong in an overall interaction description language, but we argue that it is crucial that they are related and valued in regard to their respective part of the interaction model.

So, in order to make the model more useful we have expanded it. Its 'left' side can be viewed as follows:



Such a division creates a difference between what a user is *experiencing* as a result of the interaction and what the user is actually *doing*. *User experience* as an aspect of interaction has recently been examined and described by many researchers [2, 5]. Less emphasis has been devoted to the notion of *user behavior*, except in relation to usability studies. The *user behavior* is determined by the *space of possible actions* defined by the artifact itself. The *user experience* of an interaction is influenced by the behavior the artifact requires or inspires, but is not determined by it. Two users can behave in exactly the same way while having distinctly different experiences.

In a similar way it is possible to expand the right side of our initial model:



This division distinguishes the two different aspects of the artifact, which create the space of possible actions for interaction. It is clear that many of the traditional *styles of interaction* are about the part we label the *artifact interface*. The *artifact function* is about purpose, function, and performance, all influencing the design of an interaction. However they do not influence the interaction in the same direct way as the artifact interface. In interaction design, it is for instance not unusual to make prototypes that have partial functionality, poor performance, while the interface is fully developed since it is the interface that is being tested.

### Using the model

The purpose of our model is that it can serve as a foundation for different attempts aimed at developing description languages for human-computer interaction.

Even though there is a need for an overall description language of interaction, each part of the model could be the focus of a more specific description language. In our earlier work we have [4], for instance, developed a “language” that describes the *shape of an interaction*, which is the concept in the middle of the model (that we have not discussed here).

In this earlier work [4], we have developed a number of *attributes* that are unique to the shape of an interaction and that distinguishes it from the other parts of the model. For instance, with *interaction attributes* such as state (fixed-to-changing), continuity

(discrete-to-continuous), connectivity (independent-to-networked), and directness (direct-to-indirect), it is possible to describe the shape of an interaction even though it is a quite abstract entity.

We believe that many attempts in HCI have been devoted to develop languages for different parts in the model. For instance, McCarthy & Wright made a serious attempt to formulate aspects of the *user experience* [5]. Forlizzi & Battarbee also proposed a framework for defining experience [2].

In a previous workshop (to this one at CHI 2006 [3]) several attempts were made which can be seen as examples of a language describing the *artifact interface*, such as virtual and augmented reality, ubiquitous, pervasive, and handheld interaction, tangible user interfaces, lightweight, tacit, passive, or non-command interaction, perceptual interfaces, context-aware interfaces, ambient interfaces, embodied interfaces, sensing interfaces, eye-movement-based interaction, and speech and multimodal interfaces.

In usability research, user behavior has been studied and some attempts to form a language of user behavior exist [1, 6].

Even though all these attempts have served their purpose to some degree, we would argue that these attempts, if related to a model like ours inclusive to the various parts of the whole interaction, could lead to a more comprehensive description of interaction. It would make it possible to relate different aspects of interaction to each other, and it could open up for new levels of analysis and understanding of interaction.

The model also makes it possible to even further focus on the details of just one part. For instance, the *artifact interface* can be divided into sub-areas, and for each of those it would be possible to further develop a precise and detailed description language without the risk of being accused of losing the big picture. This means that detailed sub-languages can be developed, sensitive to fast technological developments or radical changes in use behavior. The overall model shown below can still be the same and function as a foundation and coherent core for such developments.



The overall model can also function as a bridge between different parts. The model makes it possible to analyze how changes in one part (for instance, the artifact interface) would or can affect another (such as the user behavior), or even with more distance, how the performance of the *functions in the artifact* relates to the *user experience* of the interaction. It is, according to the model, impossible to discuss such relationships without discussing how the parts that exist in-between those two parts, namely, artifact interface, interaction, and user behavior, influence the relationship of those two. It is in this case clear that these "effects" has to "travel" through both the artifact interface, the interaction, and the user behavior to "reach" the user experience.

### Conclusion

It is clear that *interaction* is a complicated thing. The overall argument in this paper is that, even though real progress has been made in the examination and description of interaction, we need an overall model of interaction. We need a model that is simple, while at

the same time detailed enough to make various aspects of the interaction between humans and artifacts visible and distinct. We need such a model in order to further develop description languages that can support and further analysis and design of interaction. We believe our proposed model is a first step in that direction.

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