Designing mediation

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ABSTRACT

The aim of this paper is to analyze the concept of *mediation* in the context of current HCI research, with a special focus on the use of the concept to inform and guide the design of interactive artifacts and environments. The paper discusses the adoption of the mediational perspective on digital technology in HCI and reflects on how the perspective has informed design-oriented research in the field. It is concluded that there is a general trend of moving beyond relatively basic notions of technology mediation toward a more differentiated view of mediation as a complex, multi-dimensional phenomenon. The paper outlines a set of dimensions, which characterize technological mediation in relation to properties of mediational means, subjects and objects of mediated activities, levels of mediation, dynamics of mediation, and context. Design implications of adopting a view of technological mediation as a multi-dimensional phenomenon are discussed.

Author Keywords

Mediation, technology, human-computer interaction, activity theory, phenomenology, instrumental genesis, instrumental interaction, activity-centric computing, dimensions of mediation.

ACM Classification Keywords

H.5.0. General; H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

When human computer interaction (HCI) emerged as a field of research and practice back in the early 1980s, it was mostly focused on how people interact *with* technology. It did not take long, however, for the field to realize that this focus was too limited and it is important to take into account how people *act through* technology in everyday life contexts (e.g., [3]). In other words, it became clear that interactive systems should be understood as *mediational means*, which are employed by people to achieve their meaningful goals.

Arguably, adopting the notion of mediation in HCI has lead to some important theoretical insights. But is the meditational view of technology relevant to *design?* Can adopting the view actually help to achieve a better understanding of how interactive systems should, or could, be designed? What has been the impact of the concept of mediation on design-oriented HCI research? Does the concept have a potential for supporting future research? And, in general, what does it mean “to design mediation”?

In an attempt to answer these and related questions this paper analyzes key theoretical influences behind the introduction of the concept of mediation to HCI, current uses of the concept in design-oriented HCI research, key trends in conceptualizing mediation in HCI, and the potential of the concept to guide and support the design of future interactive artifacts and environments.

KEY THEORETICAL INFLUENCES

The concept of mediation, in different ways and sometimes in different guises, has been playing an important role in a wide range of conceptual frameworks proposed in social sciences, including pragmatism, phenomenology, semiotics, cultural-historical activity theory (CHAT), distributed cognition, and actor-network theory (see [12]). While a number of these frameworks made an impact on HCI, the main influences have, arguably, come from CHAT [6, 13, 19, 20] and phenomenology [7, 9].

Despite their differences, which are significant, CHAT and phenomenology are similar in very important respects. Both of them are postulating that human beings and their worlds (i.e., *subjects* and *objects*) are inseparable from each other, they represent two sides of a single whole, and interaction

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between the subject and the object transforms each of the interacting entities.

In addition, both approaches claim that "subject-object" interaction is deeply affected by socially and culturally developed mediational means employed in the interaction. Therefore, according to both CHAT and phenomenology, the effect of mediation is not limited to helping subjects to achieve their direct goals; by shaping the "subject-object" interaction, mediational means make a far-reaching transformative impact on both subjects and their worlds.

CHAT, and especially Leont'ev's activity theory [13], informed some influential HCI work published in the late 1980s and early 1990s, including Bødker's book [3] that introduced activity-theory to HCI (and which was characteristically entitled "Through the interface"), and Norman's distinction between different views – the "personal view" and the "system view" – on the interaction between the person and the world, mediated by artifacts [15]. Both of these analyses were instrumental in bringing the notion of mediation to mainstream HCI.

More recently, phenomenologically inspired accounts of technological mediation, directly relevant to HCI, have been proposed. For instance, Verbeek [18] combines Ihde's types of human-technology relationships and actor-network's notion of the mediation of action to outline a vocabulary for analyzing the influence on technology on human perception and action.

Accounts of mediation informed by, respectively, CHAT and phenomenology differ in their research agendas and foci. While the former is predominantly concerned with learning, development, and understanding of concrete activities and practices, the latter mostly focuses on human experience in general.

THE CONCEPT OF MEDIATION IN DESIGN-ORIENTED HCI RESEARCH

The introduction of the concept of mediation to HCI pointed to the need to understand technology as placed between users and their objects of interest [3]. This insight had direct implications for the development of design-oriented concepts and frameworks in the field. First, it emphasized the importance of integrating two types of relationships, the "technology-user" relationship and the "technology-object of interest" relationship, in the design of concrete artifacts. For instance, Beaudouin-Lafon [2] proposes the instrumental interaction model to support analysis and design of interaction instruments, and Kaptelinin and Nardi [11] offer a re-conceptualization of a key design concept, affordances, from a mediated action perspective.

Second, the mediational view on technology implies that various resources provided to human actors by interactive artifacts and entire environments should be organized around actors' meaningful goals, rather than around applications or devices. This idea was elaborated into conceptual frameworks for design, such as activity-based computing [1], and resulted in the development of a number of concrete systems [1, 10].

With some notable exceptions, early attempts to apply the concept of mediation in design-oriented HCI research were mostly based on a relatively basic notion of mediation, and typically focused on a single actor carrying out a single activity using a single artifact. The limitation of this notion soon became obvious in HCI research, as conceptual analyses, studies of concrete practices, and design explorations revealed the complexity of mediation taking place in real-life contexts and activities.

Studies of technological mediation in real life settings (see [10]) show that each of such settings typically features a variety of mediational means, which means are related to each other. The studies suggest that it is important to understand how such means are integrated in actual work practices. Another key aspect of technological mediation in such settings is that mediational means are employed not only in individual activities; collaborative activities carried out by groups, teams, and entire organizations are also mediated by various means [6].

Furthermore, the development of frameworks for designing specific technologies, such as peripheral displays [14] or computer support for activities at hospitals [1] foregrounded the importance of designing technologies that can simultaneously support a range of activities, rather than one individual activity.

Finally, the complex nature of mediation has been explored in conceptual analyses in HCI and related fields. In particular, the instrumental genesis framework [16] specifically focuses on the transformation of artifacts, which initially only have a potential to become fully appropriated instruments, through reciprocal processes of instrumentation and instrumentalization. A framework for understanding complex webs of mediation has been proposed by Bødker and Andersen [4] in their analyses informed by both CHAT and semiotics.

In sum, empirical studies, design explorations, and conceptual analyses in HCI all indicate that technological mediation in natural, real-life settings should be understood as a complex, multi-dimensional phenomenon.

DIMENSIONS OF MEDIATION AND THEIR IMPLICATIONS FOR DESIGN

Analyses of mediation in current HCI research suggest that the following tentative set of dimensions, which characterize technological mediation, can be identified. The dimensions correspond to the main aspects of mediation, namely mediational means, subjects of mediated activities, objects of mediated activities, levels of mediation, dynamics of mediation, and context.

Mediational means: "Me vs. the world". Some technologies, such as activity tracker bracelets, are designed to form a part, an extension, of the individual (i.e., to become "personal technologies"). Other technologies, such as TV sets, constitute more external objects "out there in the world", with which we interact.

Mediational means: Coupling between different means. This dimension represents the degree, to which the use of a technological artifact is integrated with the use of other mediational means. A loose coupling denotes a relatively independent use of the artifact, while a tight coupling implies high dependency between the artifacts. For instance, some activity trackers are designed so that they can be used independently from other devices, while other models can only be used in combination with a smartphone.

Mediational means: Versatility. Mediational means can be differentiated on the basis of the range of activities they support. Some mediating means (e.g., a vending machine) can be used for one single purpose while others are multi-purpose mediational means. Such means, for instance, word processors, can be used for a variety of purposes, both anticipated and unanticipated ones.

Subject of mediated activity: Diversity. The subject of activity mediated by a certain technology can be narrowly defined by requirements related to the skills, age, socioeconomic status, work position, physical capabilities, etc., of prospective users. Alternatively, mediational means can be designed to support a broad range of subjects of activity.

Subject of mediated activity: Individual / Collective. Both individual and collective activities can be mediated, and these two types of activities have somewhat different, if closely related, requirements for mediating means. The distinction is reflected in the relationship between two major fields of research and practice dealing with the human use of technology: HCI and CSCW (Computer Support for Cooperative Work). The latter, which specifically deals with technological support for collaboration, is virtually inseparable from HCI, but still has its own distinct focus.

Subject of mediated activity: The impact of mediation. The impact of mediation on subjects of mediated activities can range from short-term effects, such as helping to achieve an immediate goal, to long term effects, such as intentional or unintentional transformation of one's habits and even the personality.

Object of mediated activity: Types of objects of interest. Mediational means can be employed by subjects of activities to act on different types of objects of interest. Such objects of interest may be things, events, other people, and the subjects themselves, and different mediational means are required for, say, ordering pizza, keeping in touch with one's family, or managing one's exercise program.

Levels mediation: Mediational means in the structure of activity. Human activities are taking place at several levels, and different levels can be mediated by different means. For instance, we may to scroll a document using a scroll bar, while making an online hotel reservation. The latter, a higher-level action, can be mediated by a whole combination of digital and non-digital means.

Dynamics of mediation: Appropriation. The status of the same technology as a mediational means depends on whether or not the technology in question is appropriated by its user (or users). Using the instrumental genesis approach terminology, a not-yet-appropriated technology is just an "artifact", which over time can become an appropriated "instrument" [16]. Both personal and more external artifacts, mentioned above (e.g., activity trackers and TV sets), can be appropriated.

Dynamics of mediation: Disruptive/ incremental remediation. New technologies typically substitute existing meditational means, and the adoption of new technologies causes *re-mediation*. Re-mediation can be associated with a significant disruption of activities that results from the switching to a new means, or it can be incremental and take place with little or no disruption. Re-mediation "costs" are not solely determined by the attributes of new technology; they rather depend on the relationship between new and existing mediational means.

Context of mediation: Diversity. Some technologies, such as desktop computers, can be used in stable contexts, such as offices. Other types of technology, such as smartphones, can be employed in various, and dynamically changing, types of contexts.

The dimensions of technological mediation, outlined above, can be applied in both analysis of existing technologies and the design of new ones. In that former case, that is, when the dimensions are used as an analytical tool, they can be employed in a relatively straightforward way. In particular, the set of dimensions can be applied as a checklist for analyzing currently ubiquitous mobile technologies.

Arguably, understanding mediation as a multi-dimensional phenomenon has design implications, as well. The very aim of design can be described as creating /shaping artifacts so that they would successfully mediate purposeful, meaningful human activities, so a clear notion of mediation is beneficial for framing design activities. An elaborated concept of mediation can be of special help when the objective of design is to support sustainable development of concrete real-life practices, such as work activities at the hospital [1] or collaborative authoring and learning in a technology-rich environment [17]. Given that emerging technologies (such as the Internet of Things and 3D printing) are likely to induce large-scale transformations of everyday practices, the design of concrete applications of such technologies could benefit from understanding

mediation as comprising a set of related but distinct dimensions.

CONCLUSION

The concept of mediation has already made an impact on design-oriented HCI. The concept suggests that interactive technologies should be understood as having (at least) two related facets, with one facet being turned to the user and another one being turned to the object of interest, and a key design issue is how to integrate these facets. This issue is addressed, for instance, in the instrumental interaction framework [2]. In addition, the concept of mediation implies that various types of resources need to be integrated around users' meaningful goals, rather than around applications or devices. This fundamental insight underlies design-oriented work within the activity-centric computing approach (e.g. [1, 11]).

However, so far HCI was mostly employing a relatively basic interpretation of the concept. This paper argues that existing research points to complexity and multidimensionality of mediation, and identifies a tentative set of dimensions of technological mediation. It is suggested that the proposed dimensions can be used to support the design of artifacts and systems employing emerging technologies, such as the Internet of Things and 3D printing, which are likely to induce large-scale transformations of everyday settings and practices.

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