Research Commentary

HCI Research: Future Challenges and Directions

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This commentary reflects my personal views of the future research challenges and directions in human-computer interaction (HCI) research in the field of Management Information Systems (MIS). It may be that many in our community do not share my concerns about the issues I consider important and the challenges we face. My intent here is not to argue that others should pursue approaches similar to mine, or to predict what type of work would be most fruitful and important in the future. Rather, my intent is to share some of the principles and ideas I would like to follow in my future research. I hope that these comments will lead to a debate (in this *AIS Transactions*) about how our community should plan for the future in HCI research and how we can make it more relevant, interesting and exciting. I will discuss my views below:

DESIGN

I have often commented to my students that research worth doing should be new, true, interesting[1], and relevant (to practice). I strongly believe that to be interesting and relevant, research in HCI should have a design component coupled with an evaluation of this design. This belief may be due to my training as a doctoral student and influenced by my experience working on my doctoral thesis, which was part of the original Minnesota Experiments (Dickson, Senn, and Chervany, 1977). The design component can take the form of a particular IS or IT (such as interface, format, guidance, navigation, etc.), preferably as an antecedent influencing the constructs of interest (such as usability, effectiveness, understanding, etc.), in the models or theories that are tested. In my earlier papers I have advocated the inclusion of a design component, arguing that it is important for both creating a unique identity (Benbasat and Zmud, 2003) and increasing the practical relevance of our work (Benbasat and Barki, 2007). Some of the work that deals with adoption research in HCI eschews the design element in the models tested; focusing instead on surrogate variables that reflect the perceived quality of (an unspecified) design, such as its usefulness and ease of use. This type of study cannot generate any specific design advice for HCI practitioners. I have similar views about other key and often studied variables such as trust in HCI adoption models of e-commerce applications. It is the responsibility of the HCI researcher to think about how to design an IT artifact to effectively increase trust in that artifact and its utilization (for example, see Wang and Benbasat, 2008).

One of the challenges we face as MIS HCI researchers is to differentiate our research from research conducted in other fields such as Computer Science, Library and Information Sciences, and Marketing. Does a "Design and

Evaluation" approach provide a unique profile for us? Probably not, since our colleagues in Computer Science follow the same approach and even have the advantage of implementing more sophisticated designs than we do. While in the past we may have implemented the empirical evaluation aspect of HCI studies better, any differences, if they exist, are very small today. However, compared to the large majority of Marketing studies about electronic commerce interfaces, a topic that has also been of high interest to MIS HCI researchers during the last decade, we have an even higher interest in design aspects of electronic commerce web sites. We have not had a comprehensive debate about what differentiates our work from those of the rest of the HCI community in general. Maybe this is not an issue of concern or interest to the readers of this journal, but when I read papers describing design features in MIS HCI about response times, colors and aesthetics of web pages or navigational tools, I feel that this low level of detail may be best left to other HCI researchers. Perhaps we should be focusing on topics that reflect "higher level" designs such as those that impact decision making, virtual groups, company-customer relationships and other matters that are in line with a management focus in MIS. This should be where we have a comparative advantage and where our design contributions should lie. I will add more to this point in the next section when I discuss the kind of constructs or criteria on which we should focus in MIS HCI research.

One final thought about design and evaluation concerns the recent rise of Design Science (Hevner, March, Park and Ram, 2004) into prominence in MIS. It is interesting to note that evaluation plays an indispensable role in design science (Hevner et al., 2004). While I would be honored to join the ranks of design scientists, I do not think they would consider me to be one according to discussions I have had with my design scientist colleagues. I believe the key difference between HCI and design science is that design scientists' main focus is on "how to design well" based on well-defined principles, ontologies, and methods (see for example, Wand and Weber, 2002), whereas ours is on evaluation. This led me to think about where ideas and justifications for HCI designs are best derived from. While we can rely on some rules of thumb and several theories in Cognitive Psychology, Ergonomics and MIS, they are not fully adequate to inform us about many of the designs we find in MIS HCI research.

How, then, do we justify the designs we implement in MIS HCI research? I think we should approach design in an instrumental fashion. We begin with the aim of achieving managerial (e.g., decision making, adoption of advice-giving systems) and organizational goals (e.g., e-commerce adoption, communication in virtual teams) with the design of the interface serving as a mechanism to advance such goals. The particular design chosen is then justified based on some theory, usually not within the MIS domain (though that would be desirable). For example, in the work we conducted on advice-giving systems, one of our goals was to increase the user's trustworthiness perceptions of the agent providing the advice. Given the asymmetry between the user and the agent (the user does not know how the agent reasons), we relied on agency theory and used explanation provision as a form of signaling on the part of the agent to reduce information asymmetry, hence increasing trust (Wang and Benbasat, 2008). Of course, this is not the only design that improves trust. For example, we have also applied similarity theories and the Computers are Social Actors (CASA) paradigm to posit that users will more likely rely on software-based agents that are like them (Al-Natour, Benbasat, and Cenfetelli, 2006). However, similarity theory is not specific enough to help us develop a particular design, given that similarity between users and advice-giving agents can be achieved in many different ways. We have implemented similarity based on personality, decision-making behavior, and demographics , but other ways exist too. In addition, we are not sure if design scientists would consider the designs we implemented to be the best, because they were developed to test a particular theory rather than testing design principles. For example, similarity theory predicts that humanoid avatars used as the interface to an advice-giving agent should match the users in gender and ethnicity in order to enhance the agent's adoption. Thus, I believe the goal of the MIS HCI researcher is to demonstrate the managerial effectiveness associated with different designs, rather than demonstrating the quality of the design itself. The challenge we face as a community, then, is how to develop a theory base that will guide the design of interfaces to a whole host of potential systems that can support many objectives, ranging from increasing managerial effectiveness to encouraging adoption of electronic commerce.

NATURE OF EVALUATION AND CONSTRUCTS OF INTEREST

The way we conduct evaluations and what we are evaluating both influence the constructs of interest in HCI research.

The design of interfaces for business-to-consumer electronic commerce has been an area of high interest to MIS HCI researchers in the last decade. This is partly due to the widespread growth of electronic communication and digital interfaces that are the sole way of interacting with pure e-tailers. For example, there are many products sold on the Internet that can not be experienced directly, and this has opened up a new avenue of research concerning how to design interfaces to enable users to understand such products better. More importantly, it has expanded the goal of HCI research from objectives such as improving the effectiveness and usability of interfaces to relationship and loyalty building, which become important targets when the computer interface is the online company's "window to the world." While we have focused on constructs such as trust and social presence in evaluating e-commerce interfaces, I do not think that we have done a good job of understanding how a company builds rapport with its customers via this interface. In other words, the research has focused more on evaluating the interface and less on the ultimate

objective of that interface, which is helping a company establish a communication link to build a relationship *with* its customers as well as *among* its customers. Some of the research we have conducted has dealt with customers interacting with "components" of the online company, such as its sales assistants, its products, and its advice-giving agents, each part necessitating a different set of evaluation constructs. Some has dealt with the concept of service (Cenfetelli, Benbasat and Al-Natour, 2006) where we showed that the company has to provide both the content of service (such as order tracking), as well the traditional HCI goal of delivering this content via the best possible interface. In summary, I believe that we now need to focus on two sets of key variables: those dealing with the interface between a person (customer) and a technology, and those that describe the quality of the reciprocal relationship or the quality of the communication between a customer and another entity, the online company.

Another type of two-way communication we have advocated involves viewing the interaction between the user and the technology as a relationship that changes over time based on the events and outcomes that occur when the two parties interact and how the user assesses these interactions not only at a single point in time, but over repeated interactions (Al-Natour and Benbasat, 2009). This is different than the research which showed that over time the user assesses a technology based on different criteria, such as putting less emphasis on ease-of-use over time. Such research has viewed the technology as a tool to be evaluated on different dimensions. Our new perspective, informed by the Computers are Social Actors paradigms, is to view an interaction between a person and a technology as we would view an interaction between two people. For example, caring and rapport are two constructs we have utilized in our research on advice-giving systems that deal with sensitive issues, such as providing advice on skin care products for which the system has to ask questions about the user's medical conditions. We find that when the user's impression is that the system exhibits sympathy and understanding through its interaction, the person reveals more information about herself and has fewer concerns about doing so. Note that constructs such as trust (which also indicates a social relationship) are of more interest when dealing with products like cameras or laptop computers, whereas rapport and sensitivity constructs are more relevant when dealing with sensitive products. This indicates the need for moderators, such as product type, in evaluating person-technology interactions.

METHODS OLD AND NEW

It would not be very revealing or informative to advocate the use of tried-and-true old methods such as process tracing analysis or longitudinal designs. While I have applied them in the past and found them highly valuable, the various costs and challenges associated with them have precluded their frequent and widespread use.

Nonetheless, I would encourage HCI researchers to partner with neuroscience experts, if and when possible, to utilize fMRI and a host of other neuroscience methods (Riedel et al, forthcoming; Dimoka, Davis, and Pavlou, forthcoming). Similar to process tracing methods, fMRI studies have the advantage of revealing new variables that influence outcomes as well as identifying the neural correlates of some of the constructs we commonly utilize in HCI research, such as trust or usefulness. It is also beneficial when constructs that are socially sensitive, such as gender and ethnicity similarity preferences, are measured; fMRI will provide more valid measures due to the social desirability bias associated with traditional questionnaire-based data collection methods. We utilized fMRI data collection in a study (mentioned above) that tested the predictions of similarity theories in the context of designing interfaces to advice-giving agents. The theory posits that humanoid avatars used as the interface to an advice-giving agent should match the users in gender and ethnicity in order to enhance the agent's adoption. We had previously tested this theory using traditional laboratory experimentation. fMRI was beneficial in identifying whether users valued similarity or felt anxious about dissimilarity when interacting with avatars that matched or mismatched their gender and ethnicity. It also revealed that the gender of the user played an important moderating role in reactions to matching or mismatching avatars. Furthermore, it yielded some results about the ethnicity of the avatars that we did not have a strong enough theory with which to make a priori predictions. The benefit we gained from using fMRI was a better and deeper understanding of why some users adopted or rejected certain types of interfaces.

Another method that we have applied in our e-commerce interface research uses a marketing company to provide a sample of subjects who are exposed to different experimental treatments on the web. Participants then respond to the standard construct measurement scales that are administered on the web (Al-Natour, Benbasat, and Cenfetelli, 2006). We found this method to be very effective when collecting data from a diverse group of participants beyond the typical student population, thus improving external validity. Using this method, data collection can take place in a very short period of time compared to a typical lab study, which may require a duration of several weeks. Overall, this approach is more cost-effective.

TOPICS OF INTEREST

Typically, we have studied interface designs for information systems implemented for improving the effectiveness or efficiency of users during tasks ranging from decision-making to purchasing on the Internet. These are what I would

call neutral systems with no agenda of their own (or on the part of their designers). An example is a product recommendation agent that identifies the products that would best fit a person's needs based on the type of attribute preferences that the person has revealed to the agent or were elicited by the agent. Another type of system is one that tries to persuade the user to choose a particular course of action (Oinas-Kukkonen and Harjumaa, 2009), such as switching from a regular to a "green" product. Here, a recommendation agent is designed with a particular agenda or intent, albeit one that its designer believes will serve some overall good (and not only for its designer). We can also think of systems that are designed to deceive[2] (Xiao and Benbasat, forthcoming) to benefit a particular entity, such as an online store or manufacturer, to the detriment of the user. There could be variations of these types of systems, such as systems that try to create greater rapport with users to encourage the user to use the system as in the case concerning sensitive subjects, though still to benefit the user. The interface design implications for these systems are interesting in that the designs should differ based on whether the goal is assisting in an objective way (which has been our focus in MIS HCI research to date), to persuade (Fogg, 2003), or to deceive (Xiao and Benbasat, forthcoming). The study of these differences opens up a new avenue of research for our community.

I find social networks a very rich area for HCI research. It involves interactions among a variety of entities (e.g., person-person, person-technology, person-group) depending on various types of communication (e.g., synchronous vs. asynchronous communication), aiming at different objectives (e.g., friendship, persuasion, collaboration) utilizing different functionalities, some generated by the users themselves (e.g., tags, lead users). In our research on collaborative shopping (Zhu, Benbasat, and Jiang, forthcoming) we found that even obvious-sounding design solutions, such as physical synchronization of the two shopping partners, lead to dysfunctional outcomes and need imaginative designs to separate public from private communication. Another area of design interest is how to have distantly located shopping partners collaborate on the design of products online that would appeal to one or both of the partners.

The challenge of deciding how to provide service online, mentioned earlier, is another interesting area of HCI research. Such service can take place in different contexts (B2C and B2B electronic commerce, and e-government) and caters to different types of users. In addition to the challenge of what services to provide (i.e., the content of service, such as advice), the delivery (interface) component is of key interest to HCI researchers. Surprisingly, little solid theory exists to guide us on issues such as human- versus technology-delivered service online, and little research on evaluating the different ways to deliver human services (e.g., via text or voice, face-to-face through technologies such as Skype or not, via the use of avatars, on Second Life, etc.). As more and more services are being delivered online, this is a rich and interesting research area for our community.

Lastly, we need to expand our "user base" from professional and managerial users and customers to other audiences. The most obvious one is a user population that is aging. Designing interfaces for such users is an interesting challenge, but our community seems to have missed the boat on this opportunity. Many others are already working on such topics. Nevertheless, users in application areas such as e-government, health care, and the digital divide provide us with ample opportunities to break out from our focus on only certain types of user populations, including the traditionally employed student population.

CONCLUDING COMMENTS

This commentary began with an appeal to MIS HCI researchers to be more cognizant of the role and importance of design in our research. Unlike design science researchers who tend to focus on the quality of the design, we are interested in evaluating design as an antecedent of a managerial or organizational goal. Typically, HCI design is informed by theory borrowed from a reference discipline, such as theories of similarity, which help us decide how to best design an interface. Thus, as we are evaluating this design, we are also testing the predictions of that particular theory, (i.e., doing theory testing). The challenge we face is to identify the theories that are applicable to a certain situation. Sometimes multiple competing theories exist to inform us about a particular interface design, which makes our task more challenging.

In terms of evaluating interfaces, my suggestion is to treat technology as more than a static, objective, tool-like entity. A different view is to examine an interaction with technology serving as a social actor in communication. During this interaction, our evaluation of the actor changes over time based on the events and outcomes that occur. This relationship view is valuable in those cases where the issues at hand are sensitive in nature, such as a software agent providing advice about private medical treatments. Another important aspect of evaluation is to go beyond focusing on the assessment of the technological interface and evaluate the objectives of the entities that are communicating via the interface, such as the communication between an online company and customers to build loyalty.

In terms of methods, I recommend that HCI researchers consider the benefits of state-of-the-art methods such as fMRI. In terms of future research topics, I suggest taking into consideration the diversity of the types of systems for which interfaces are built (neutral, persuasive, deceptive) and the diversity of user types for which interfaces are built.

The issue of service-enhancing interfaces and the increasingly popular social networks are areas rich in challenges for HCI researchers.

As I noted in the beginning, these are my personal views intended not as decrees that all should follow, but rather the seeds for future discussion and debate about the future of MIS HCI research that will hopefully take place in this journal and at our conferences.

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[1] These criteria were mentioned by a former editor of a leading Accounting journal in response to a doctoral student's query about what constitutes a publishable paper

[2] It is important to mention that the ultimate goal of such research is not to harm, but find ways to prevent such deception

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