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ABSTRACT

The field of human-computer interaction (HCI) is a significant subset of information systems. Despite its importance, there are few systematic reviews of HCI literature, especially as it pertains to the IS discipline. This study attempts to contribute to the discipline by reporting on a review of HCI research published in seven top IS journals over six years (2003–2009). Our review suggests a few critical gaps: 1) there is a dearth of research focusing on CMC-related issues, especially with respect to dyadic communication, 2) while past research acknowledges that culture plays an important role in HCI, and has implications for interface design, few studies have focused on cultural issues, 3) more research is needed in the human-computer interaction involving enterprise systems, and 4) more focus needs to be paid to the "levels of analysis" issues while conducting HCI studies. We also propose specific guidelines for addressing the gaps identified above.

Keywords (Required)

Human-computer interaction, computer-mediated communication, literature review

INTRODUCTION

Human-computer interaction (HCI) is an area closely linked to core streams of IS research (e.g. human-computer system design, Banker and Kaufmann 2004) given its interest in how information systems relate to users (Lim et al. 2007). It is thus not a surprise that SIGHCI sponsors popular tracks at ICIS, AMCIS, PACIS, and ECIS, and is one of the largest special interest groups in the AIS (Zhang et al 2009). Despite the importance of this area, except for Zhang and Li (2005) and Zhang et al. (2009), there are few reviews of the HCI literature. We believe reviews are important to identify research gaps and provide more focused directions to future researchers interested in this area. While the groundbreaking reviews conducted by Zhang and colleagues have added much to our knowledge about the current state of HCI research, the reviews encompass research conducted in a vast range of academic disciplines including (but not limited to) management and IS. This broad focus, we believe, hinders the reviews' contribution to the IS discipline. Further, Zhang et al. (2009) and Zhang and Li (2005) in their review have excluded two prominent IS journals (considered to be within the basket of journals), namely, EJIS and ISJ, which provide added diversity (Lyytinen et al., 2007). Our aim in this manuscript is to analyze recent HCI research in IS (as reflected in the articles published in prominent IS journals), to identify today's main areas of focus, to analyze/examine where the gaps are, and to provide guidelines for future research. The results presented in this paper summarize HCI work published in seven top IS journals over six years (2003–2009). We believe that the current paper complements rather than duplicates the seminal work of Zhang and Li (2005) and Zhang et al (2009) by focusing on the progress of HCI research *within* the IS discipline; hence, our study includes only IS outlets, consisting of top seven IS journals..

Zhang and Li provide a framework for HCI that includes technology, humans, interaction, task, and contexts. Definitions such as "the ways that humans interact with technologies for various purposes" (Zhang and Li 2005) and the term "human-computer interaction" itself suggest that HCI should primarily be concerned with 1) interactions taking place between parties including a) humans and b) computers. We suggest that this idea of interaction describes the HCI core, yet the actual nature of interaction is often neglected in the existing research. Our endeavor in this paper is to identify what areas have been

specifically neglected in the prior HCI research within the IS discipline, and propose specific guidelines for addressing those gaps.

METHOD

Building on Zhang and Li (2005), which covers journals through the end of 2002, we examined articles published between 2003 and 2009. Our study focuses strictly on IS journals, given that IS researchers are more likely to interpret articles in these journals as directly reflective of the field's interest. Our journal resources include the Senior Scholars' basket of six (Saunders et al. 2007), which are the journals with the most prestige and visibility. These six include - European Journal of Information Systems (EJIS), Information Systems Journal (ISJ), Information Systems Research (ISR), Journal of AIS (JAIS), Journal of MIS (JMIS), and MIS Quarterly (MISQ). We also include the AIS Transactions on Human-Computer Interaction, which is a new journal specializing in HCI but poised to become an important specialty journal.

Our methodology used keyword searches, assuming that HCI researchers are likely to acknowledge their status by mentioning HCI as a keyword in their papers. We excluded corrections and short editorials. For our research purpose, we used the EBSCO databases for those journals where available, and publisher databases for the remainder. Considering database limitations, we used search terms with and without hyphenation to make certain no article was missed. We included several search terms often used as a keyword in HCI papers:

- "Human-computer interaction" / "Human computer interaction"
- "HCI"
- "User Interaction "
- "Human Aspects"
- "Human-machine relationship" / "Human machine relationship"
- "User-centered" / "User centered"

After determining a list of articles, we ensured that each article indeed focused on HCI (e.g. not simply mentioning it in a journal citation in those cases where databases returned only full text results) and had theoretical or empirical content related to HCI.

RESULTS

We present a list of all the articles that resulted from our search in Table 1. Reasons for retaining this set of papers were: one of the keywords listed above was present *or* the article was in a journal or special issue specific to HCI; and the paper had empirical or theoretical content related to HCI. Surprisingly, few papers in HCI were found in these top seven IS/HCI journals. We found 32 papers in six years of IS research in seven journals, i.e. about one paper per journal per year, despite the fact that Zhang et al (2009) found 225 articles in a subset of these journals (JAIS, JMIS, MISQ, and ISR) in the 2003–2008 time span.

Journal	Year	Title	Selection Criteria	Paper Number
TCHI	2009	The Reader-to-Leader Framework: Motivating Technology-Mediated Social Participation	Theoretical paper in HCI specialized journal	1
THCI	2009	Introducing AIS Transactions on Human-Computer Interaction	Theoretical/editorial paper in HCI specialized journal	2
THCI	2009	Design for Social Presence in Online Communities: A Multidimensional Approach	Empirical paper in HCI specialized journal	3
THCI	2009	The Intellectual Development of Human-Computer Interaction Research: A Critical Assessment of the MIS Literature (1990-2008)	Literature review paper in HCI specialized journal, keyword	4
MISQ	2006	Web and Wireless Site Usability: Understanding Differences and Modeling Use	Empirical paper with keyword "usability guidelines"	5
MISQ	2007	A Task-based Model of Perceived Website Complexity	Empirical paper with keyword "website usability"	6
JMIS	2004	Foundation for the Study of Computer-Supported Collaborative Learning Requiring Immersive Presence	Theoretical paper referring to HCI in text	7
JMIS	2006	Special Section: Human-Computer Interaction Research in Management Information Systems	Editorial in special issue for HCI	8
JMIS	2006	Investigating Coherence and Multimedia Effects of a Technology-Mediated Collaborative Environment	Empirical paper with keyword "human-computer interaction	9
JMIS	2009	Evaluating Anthropomorphic Product Recommendation Agents: A Social Relationship Perspective to Designing Information Systems	Empirical paper referring to HCI in text	10
JMIS	2009	The CMC Interactivity Model: How Interactivity Enhances Communication Quality and Process Satisfaction in Lean-Media Groups	Empirical paper with keyword "HCI"	11
EJIS	2008	The Influence of workspace awareness on group intellective decision effectiveness	Empirical paper referring to HCI in text	12
EJIS	2008	Design of emerging digital services: a taxonomy	Theoretical paper referring to HCI in text	13
EJIS	2008	Interactive innovation of technology for mobile work	Action research paper with HCI keyword	14
EJIS	2008	The role of perceived enjoyment and social norm in the adoption of technology with network externalities	Empirical paper referring to HCI in text	15
EJIS	2006	New frontiers for information systems research: computer art as an information system	Theoretical paper referring to HCI in text	16

Table 1. HCI Articles, 2003–2009

EJIS	2006	A conceptual framework for the implementation of enterprise information portals in large organizations	Theoretical paper referring to HCI in text	17
EJIS	2006	The dynamics of control and mobile computing in distributed activities	Empirical paper referring to HCI in text	18
EJIS	2005	User involvement and user satisfaction with information-seeking activity	Empirical paper referring to HCI in text	19
EJIS	2005	Investigating enterprise systems adoption: uncertainty avoidance, intrinsic motivation, and the technology acceptance model	Empirical paper referring to HCI in text	20
EJIS	2005	Understanding Web home page perception	Empirical paper referring to HCI in text	21
EJIS	2005	Designing consumer interfaces for experiential tasks: an empirical investigation	Empirical paper with keyword "human-computer interaction"	22
ISJ	2009	From generative fit to generative capacity: exploring an emerging dimension of information systems design and task performance.	Empirical paper with keyword "human-computer interaction"	23
ISR	2006	The Effects of Trust-Assuring Arguments on Consumer Trust in Internet Stores: Application of Toulmin's Model of Argumentation	Empirical paper with keyword "human-computer interaction"	24
ISR	2005	Web Personalization as a Persuasion Strategy: An Elaboration Likelihood Model Perspective	Empirical paper with keyword "human-computer interaction"	25
ISR	2004	Information Overload and Message Dynamics of Online Interaction Spaces: A Theoretical Model and Empirical Exploration	Empirical paper with keyword "human-computer interaction"	26
JAIS	2009	Engineering E-Collaboration Processes to Obtain Innovative End-User Feedback on Advanced Web-Based Information Systems.	Empirical paper with keyword "human-computer interaction"	27
JAIS	2007	Exploring the Importance of Participation in the Post-Implementation Period of an ES Project: A Neglected Area	Empirical paper with keyword "human-computer interaction"	28
JAIS	2006	The Role of Design Characteristics in Shaping Perceptions of Similarity: The Case of Online Shopping Assistants	Empirical paper with keyword "human-computer interaction"	29
JAIS	2009	Toward Building Self-Sustaining Groups in PCR-based Tasks through Implicit Coordination: The Case of Heuristic Evaluation	Empirical paper with keyword "human-computer interaction"	30
JAIS	2005	The Intellectual Development of Human-Computer Interaction Research: A Critical Assessment of the MIS Literature (1990-2002).	Literature review with keyword "human-computer interaction"	31
ISR	2005	A Theoretical Integration of User Satisfaction and Technology Acceptance	Literature review with keyword "human-computer interaction"	32

Table

1. HCI Articles, 2003–2009, continued

In reviewing these articles and analyzing the state of HCI research, we chose selected topics from the findings of Zhang and Li (2005). First, according to Zhang and Li (2005) a large percentage of technology-focused papers (38.6%) addressed some aspect of computer-mediated communication (CMC), including individual and group communication, group DSS, and

computer-supported collaborative work. So, in our analysis we categorized papers according to their emphasis on CMC, specifically, to examine if there are any specific trends in the last six years. Second, we were struck by the fact that only 1.5% of the papers in Zhang and Li (2005) were placed in cultural, national, or geographical contexts. We therefore examined whether there has been an increasing emphasis on cultural issues in the past six years. Third, preliminary analysis of our work showed that a large number of papers in our sample were web- or e-commerce–related, a fact not reflected in the 8.7% found by Zhang and Li (2005) due to the early timeframe (1990–2002) of their study. So, we also discuss our finding related to this issue. Fourth, it was surprising to see that only 7.7% of papers in Zhang and Li's set of articles used a group level of analysis. This seemed significantly low to us in light of the increasing focus on groups and macro-level structures within IS. Finally, Zhang et al (2009) highlights that only about 8.9% of articles are concerned with "user-interface design, development and evaluation issues." This raised a concern as only a very small percentage of papers addressed the actual interaction issues related to the user interface. Therefore, we became interested in classifying how each paper related to interaction. Next, we discuss our findings related to each of the above-mentioned issues.

Focus on Computer-Mediated Communication

A large proportion of the papers (twelve of 32, or 38%) addressed CMC, using a broad definition that included communication from computers to humans, from humans to computers, human dyadic communication, and human group communication.

Nine of the twelve (75%) considered group communications via computers, while the other three (25%) examined other forms of CMC: individual-to-individual communication, computer-to-person communication (communication to promote trust), and asynchronous communication between a person and a computer system (in contexts of personalization and product recommendations). No research papers were found on dyadic communication.

Six of the twelve papers (or 50%) primarily examined human aspects of group communication, including a wide range of human phenomena such as social presence, peripheral awareness of the group, individuals' roles within the group, the sense of community within the group, trust, liking/disliking of products, information overload, group size, and group memory. In contrast, three papers (25%) emphasized technical aspects of CMC and how technology can be improved to enhance CMC, specifically communication media richness, avatars, and comparisons of text, speech, and text-to-speech. Three remaining papers (25%) included both human and technological aspects.

Because 75% of the CMC papers studied group communication aspects, we sought to further classify these papers according to the group functions/structures that the technology supported. For this purpose, we drew on Nunamaker et al.'s (1991) influential work which proposes four key group-related functions that technologies can support: task support, task structure, process support, and process structure. After analyzing these papers according to Nunamaker et al.'s group mechanisms, we found that five of the nine papers (56%) mainly focused on process structure. Two (22%) papers studied process support. Task support and task structure mechanisms were emphasized in one paper each.

Paper Number	Core Topic	Communication Direction	Human analysis	Technology analysis	Nunamaker's Classification
Paper 1	What communication roles are taken by the people in a community	Group	Yes	Yes	Process Support
Paper 10	Yes - how should the product recommendation agents (PRA) communicate with the customers so as to make them more trustful about the website and make them more excited to use that website and its products.	Computer to Human and Human to Computer	No	Yes	N/A
Paper 11	Enhancement of communication using lean media	Group	Yes	Yes	Process Support
Paper 12	How the awareness of other group members affects the way people communicate	Group	Yes	No	Process Support
Paper 24	Yes - How can vendors successfully communicate to their customers that the site is trustworthy	Computer to Human	Yes	No	N/A
Paper 25	Yes - How can web personalization be improved through effective communication	Computer to Human and Human to Computer	Yes	Yes	N/A
Paper 26	Yes - studies how people deal with information overload on interactive public online group discourse spaces.	Group	Yes	No	Process Support
Paper 27	Yes - designing a GSS abd CE based system for collecting user feedback for designing and maintaining WIS	Group	Yes	Kind of - a little bit in the sense that which type of GSS technology would be better for taking feedback etc.	Process Structure
Paper 3	Social presence affects how people communicate in a group	Group	Yes	No	Process Support
Paper 30	Yes - Building Self-Sustaining Groups in PCR-based Tasks through Implicit Coordination	Group	Yes.	Kind of - What features of CSW (**collaborative software**) tools help in building group	Process Structure

Table 2. Articles Involving Computer-Mediated Communication

Cultural aspects

None of the papers resulting from our literature search focused on the issue of culture. Only 2 (or 6%) of the articles mentioned culture as a potential area of research. It was a surprising result considering that many of the papers addressed research topics (such as trust, social technologies, control, and adoption) in which culture could have played an influential role. Interestingly, many of the articles also report on studies involving participants from different countries such as US, UK, Finland, Hong Kong, and which, we believe, provided an excellent platform for cross-cultural comparisons. Table 3 lists articles that present a scope for cross-cultural research; we also provide specific culture-related questions that could have been investigated in each of these papers.

Paper Number	Cultural Scope
Paper 1	What differences in virtual community members' involvement and disclosure exist in different cultures?
Paper 10	Will users from all cultures form the same kind of relationship with agents?
Paper 11	Are lean media more or less effective in some cultures due to different communication norms?
Paper 12	Do people from different cultures perceive or act on workspace awareness differently?
Paper 13	Is the taxonomy robust under cross-cultural elaboration?
Paper 17	Do the same concepts play a role in information portal implementation in all cultures?
Paper 20	Do all cultures provoke the same relationship between uncertainty avoidance and control and adoption?
Paper 21	Is "place" perceived in the same way cross-culturally?
Paper 23	What kind of cultural differences should be addressed while designing more generative user interfaces?
Paper 24	What is the effect of trust-assuring statements on people from different cultures?
Paper 25	How should one personalize websites based on cultural differences?
Paper 27	How should the implementation of collaboration engineering be modified while working with people from different cultural background?
Paper 29	How can artifacts be designed to satisfy people with a variety of cultural backgrounds?
Paper 3	Do users from all cultures perceive social presence dimensions or their importance differently?
Paper 5	Does the same relationship between usability guidelines and usage exist for users from all cultures? E.g. do some cultures need different guidelines; are some cultures more patient with unusable designs?
Paper 6	Are certain kinds of complexity more readily understood or accepted in certain cultures?
Paper 7	Do cross-cultural differences in communication expectations make some features desirable in one culture and undesirable in another?

Table 3. Articles with Scope for Cultural Research

Web-related and e-commerce research

Much recent work in HCI concentrates on issues like building trust of customers on websites and improving the online shopping experience. Fourteen (41%) of the recent papers (presented in table 3) on HCI published in ISJ, JAIS, and the ICIS HCI track focus on web-related interface issues, and out of these, eight (57%) focus on e-commerce. Although we agree that

these are very relevant and frequently used IT services, many other platforms (desktop and mobile) also host applications used by huge numbers of end-users at places like libraries, banks, and hospitals.

Paper Number	Web related	E-Commerce related
Paper 10	Yes	Yes
Paper 13	Yes	Yes
Paper 17	Yes	No
Paper 19	Yes	No
Paper 21	Yes	Yes
Paper 22	Yes	Yes
Paper 24	Yes	Yes
Paper 25	Yes	No
Paper 26	Yes	No
Paper 27	Yes	No
Paper 29	Yes	Yes
Paper 3	Yes	No
Paper 5	Yes	Yes
Paper 6	Yes	Yes

Table 4. Articles Concerning Website Design and Electronic Commerce

Levels of analysis

We found little discussion of HCI specific to organizational contexts, despite our focus on IS journals; rather, the individual unit of analysis limited the scope of the studies. In fact, in most instances we found that the context was only implicit, as though an individual is the same within all contexts. Only five articles (15%) explicitly addressed group level research questions, and three (60%) of these articles did not appear to use group level data collection or analysis. Table 5 presents a list of articles which could have used group level of analysis.

Title	Research question	Method used	Suggested group level methods
Paper 12	Does workspace awareness impact group accomplishment?	They appear to aggregate individual ratings.	Consider asking the group members to come to a shared judgment on the group's accomplishments and mutual awareness of the workspace.
A Theoretical Integration of User Satisfaction and Technology Acceptance	Studying a new model that combine TAM and user satisfaction. TAM and user satisfaction cannot be studied at individual level alone.	But they use only data collected at individual level	
Paper 26	Studies the impact of strategies used for coping with information overload on large-scale online group discourse.	They collect data at the individual level only, by analyzing user postings.	Analyze interaction spaces by "thread" or discussion to determine whether certain strategies promote or suppress desired outcomes to the entire conversation; where possible, perform follow-up interviews with participants to determine whether they felt differently about the discussion after a coping strategy was used.

Table 4. Articles Calling for Group Level Research

Interactions in Human-Computer Interaction

The micro-phenomenon of "interaction" was not explicitly examined in any of the listed HCI research. Some papers touched on the *results* of interactions, such as an individual's interpretation and evaluation of an interface via ratings of satisfaction, organization, or other abstractions, but this central idea was not deeply embraced in itself. In other words, the coverage of the HCI "core" seems to be limited.

DISCUSSION

Despite the fact that Zhang et al. (2009) found 225 articles when hand coding a subset of these journals (JAIS, JMIS, MISQ, and ISR) in the 2003–2008 time span, we found only fifteen (7% of the Zhang et al. set) articles in this same subset. Clearly, keyword searches do not yield the same results as examination of every article by hand. Why are there so dramatically few articles that claim to be HCI? Reasons may include researcher uncertainty (i.e. whether they are "really" doing HCI), neglect, or doubt about the relevance of HCI, despite Zhang et al.'s inclusive definition of HCI. Perhaps surveys or interviews of these authors may reveal their perceptions of HCI and its relationship to their research.

Computer-Mediated Communication

Although CMC is an important topic in IS, very few CMC-related studies describe themselves as a form of HCI research. Further literature review is needed on whether some CMC HCI IS research simply fails to recognize itself as such or whether it is seriously lacking. 75% of the CMC papers we found address group communication, whereas the remaining 25% study one way communication either from computer to human or human to computer. Based on the papers that were explicit, little has been done recently on computer-to-person communication, despite the popularity of technologies like internet-based help agents. Only one paper in our identified group of studies (8%) explicitly addressed computer-to-human communication. As computers replace humans in e.g. customer service applications, more research is needed in this area.

Surprisingly, no papers studied purely dyadic communication—from one person to another, mediated by a computer. Dyads are important because they are common in organizations (Topi et al., 2002), and there are arguments suggesting a qualitative difference between dyads and groups (Moreland 2010). Computer-to-human communication could also be viewed as dyadic communication, so the HCI topic of comparing dyads in which one participant is a computer to those in which both are humans could be very relevant.

We further classified the 75% of CMC papers which primarily focused on group communication according to Nunamaker et al.'s (1991) classification of group support mechanisms. According to our analysis, only two of the nine papers studied task support and task structure, whereas the remainder looked at process aspects. Also, within the process mechanism, the majority of the papers focus on process support. However, we believe that clear group coordination is a foundation for successful communication; hence, future research should focus more on process structure. Similarly, because information provided through technology is critical to CMC, we suggest that more research should study task support and task structure.

The relatively low engagement with technology aspects also suggests a need for more research. Only 25% of papers focus on the technology aspect exclusively, so we suggest that more research work should focus on enhancing technology for improving computer-mediated group communication. While certain emerging technologies have been receiving increased attention (avatars, speech, etc.), more work is needed in an age of technology convergence and ubiquity. For example, how does having multiple pieces of computer hardware (desktop, laptop, iPod, smart phone) available change technology practices? In addition, as online agents are being used more and more, how can we make them more successful?

Cultural Aspects

None of the articles (0%) addressed research questions pertaining to cultural aspects of HCI, despite the fact that research topics likely to show cultural differences were studied. Our analysis suggests that half of them (17 of 34) would have been well-suited for the examination of cultural issues. This leads us to ask why culture is often ignored in HCI. One reason would be that one's own culture is "invisible": one often does not realize what aspects of culture influence until one spends time with another culture. Another reason is that HCI traditionally focused on the individuals (AMIS 2006); however, this may be as much a historical issue, from when most systems were not networked, most work groups were local, and most HCI researchers came from computer science or cognitive psychology. Culture is of growing importance when considering globalization, multi-national companies, and distributed work teams (Shachaf 2008). Although culture is a potentially relevant contextual factor for most HCI studies, little HCI research has focused on culture. Although one might argue that our case for considering cultural differences is very broad as it could be applicable to any research question, we would like to highlight some areas in HCI research where cultural sensitivity is highly important. For example, ERP systems are a

commonplace application of information systems in large organizations, yet these large organizations are also very likely to have locations around the world that may lead to cultural differences. Thus, identifying areas where cultural differences may impact use of the interface would be very valuable. Researchers should certainly be culturally sensitive while addressing research questions related to trust, web personalization, and other personal and social technologies. As one example, Thanasankit (2002) indicates how different cultural aspects such as power-distance relationships can affect user behavior and overall performance. We also suggest that journals should promote cultural research in HCI, for example by introducing special issues or requests for papers.

Web-Related and E-Commerce Research

Although much recent and valuable work in HCI concentrates on web-related issues (41%), including e-commerce topics (57%) like building trust of customers on websites and improving the online shopping experience, many other platforms (desktop and mobile) also host applications used by huge numbers of end-users at places like libraries, banks, and hospitals. Although these users are not technically trained in IS, they are performing knowledge-intensive tasks pertaining to their professional expertise. Our observation is supported by Zhang, Nah, and Benbasat (2006), who claim that most MIS HCI research is really quite generic HCI research and that the special interests of MIS should "afford emphasis and special importance to managerial and organizational contexts by focusing on the analysis of tasks and outcomes at a level that is relevant to organizational performance and effectiveness." Thus, it would be encouraging to see more HCI research in commonly used organizational software like ERP systems, banking software, and other organizationally focused expert software. The HCI research for such software should not be limited to designing a single user interface, but rather focus on the integration and continuous flow from one interface and use scenario to another, facilitating easy collaboration and information movement across organizational units. Individual models should follow design models so that people across the organization can easily collaborate with each other and feel comfortable using most of the supported features.

Levels of Analysis

According to Zhang et al. (2009), more research is being published in social contexts, sociology is growing as a reference discipline, and group level analysis is growing. However, our results indicate that HCI researchers have ignored methodological aspects of the group level research, as only five papers (15%) address a group level research question and out of these five, only two (40%) of the articles are mindful about group phenomena and address the group level research question using proper group level measures. According to Markus and Robey (1988), two primary sources of mismatched levels of analysis include problems of inference (such as mistaking the goals of organizational leaders for the goals of the organization), and ideological biases (macro-level researchers may argue for organizational outcomes without reference to the individuals in the organization, while micro-level researchers may suggest that the organization does not exist as its own entity). Researchers should be mindful about these two problems and try to overcome them by choosing correct level of analysis irrespective of their personal preferences (Klein, Dansereau, and Hall 1994).

Where Is the "I" in HCI?

In our review of the articles, we found that there is limited focus on the actual human-computer *interaction*. Further, the existing literature also lacks in systematic evaluations of the interface and its relationship to individual and organizational causes and effects. Zhang and Li (2005) state that "interaction, the 'I' in HCI, is the core or the center of all the actions in HCI studies." However, it seems that the IS HCI research very rarely links to this interaction concept. We propose adapting Don Norman's (1988) model of interaction in HCI, perhaps by viewing them at a variety of levels that would lend themselves to mixed-level organizational research. According to Norman, the interaction process can be broken down into following seven stages of action:

1. Forming the goal,
2. Forming the intention,
3. Specifying an action,
4. Executing the action,
5. Perceiving the state of the world,
6. Interpreting the state of the world, and
7. Evaluating the outcome.

Zhang and Li argue that a key component of HCI in MIS is "the ways that humans interact with technologies for various purposes." They add that the task and organizational contexts are important factors for HCI. If this defines the core of HCI, it is important to try to unpack these ways, purposes, technologies, and contexts in order to make a thriving contribution to information systems research. The issues we have pointed out are several important ones in reaching this goal.

Future Work on the Literature of IS HCI

To include more emerging literature on HCI, we plan to expand this analysis to include high quality conference tracks such as the HCI tracks at ICIS and HICSS. We would also like to analyze the proposed reasons behind the difference in the number of HCI articles found by us and Zhang et. al (2009) to determine which reason is the most likely. Finally, we would like to discover how IS researchers view their use or lack of use of HCI terms and membership; as Zhang and Li (2005) described it, HCI in IS is a "fragmented adhocracy," so that researchers may not even know whether or not they should consider themselves as doing HCI research.

CONCLUSION

Although the HCI field has a long history in information science, it also has suffered from a degree of neglect by IS researchers. Updating notions of HCI to include computer communication, group research, and cultural diversity would help to expand the relevance of HCI, while a return to the HCI "core" ideas, perhaps by using multi-level analyses, would invigorate the identity of HCI in IS.

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