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HUMAN-COMPUTER INTERACTION

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Abstract: This chapter presents a comprehensive picture of an important sub-discipline of the IS/MIS field, Human-Computer Interaction (HCI). It depicts the substances of the sub-discipline on its identity, research topics and methods, and connections with other disciplines; it surveys the sub-discipline with abundant references to published works; it highlights the liveliness of the sub-discipline with its history and current activities; and it identifies the most influential contributors. The chapter is organized to cover the following contents: (1) HCI as an intellectual sub-discipline of MIS with a historical root, a framework of the boundary and research topics, and its relationships with other disciplines; (2) The theoretical foundations of HCI, including various theoretical works on issues such as users, individual and group work, IT design and development, IT use and impacts, and general issues on theory development and applications; (3) HCI research in applied contexts, such as electronic commerce, collaboration support, culture and globalization, learning and training, user-centered IT development, health care and health informatics, among others; (4) Methodological issues in HCI research, including all elements of research design and conduct, such as contexts of study and research methods, among others; (5) The most prolific authors and their institutions in the HCI sub-discipline; (6) Potential future directions in the HCI sub-discipline; and finally, (7) Summary and conclusions of the chapter.

Keywords: human-computer interaction, disciplinary perspective, computer users, design theory, fit, belief and behavior, affect, aesthetics, socialization, technology acceptance model (TAM), computer-human interaction (CHI), human factors, ergonomics

1 INTRODUCTION

Human-Computer Interaction (HCI) studies in MIS are "concerned with the ways humans interact with information, technologies, and tasks, especially in business, managerial, organizational, and cultural contexts" (Zhang et al. 2002). A key aspect of these studies is the concern about humans, not issues related to humans that would interest a pure psychologist, but in the ways that humans interact with technologies for various purposes.

With the rapid development and deployment of Information Systems, Information and Communication Technology, and related services (in this chapter, we use IT to represent them all), and with IT playing a central role at work and in every part of our lives, HCI issues become more important and fundamental. Interest in the HCI research stream within the MIS discipline was predicted to be resurgent (Banker et al. 2004). The recently active HCI-centered tracks, sessions and workshops at all major MIS conferences, special issues in top MIS journals, two edited volumes of research studies by leading MIS and HCI scholars (Galletta et al. 2006c; Zhang et al. 2006b), the inclusion of HCI materials in the AIS/ACM model curriculum for Masters in Information Systems (Gorgone et al. 2005), a specially written textbook for MIS students on HCI topics (Te'eni et al. 2007) are among the varied testimonies to the importance of and high interests in HCI among MIS researchers.

The rest of the chapter is organized to cover the following contents: (1) HCI as an intellectual sub-discipline of MIS with a historical root, a framework of the boundary and research topics, and its relationships with other disciplines; (2) The theoretical foundations of HCI, including various theoretical works on issues such as users, individual and group work, IT design and development, IT use and impacts, and general issues on theory development and applications; (3) HCI research in applied contexts, such as electronic commerce, collaboration support, culture and globalization, learning and training, user-centered IT development, health care and health informatics, among others; (4) Methodological issues in HCI research, including all elements of research design and conduct, such as contexts of study and research methods, among others; (5) The most prolific authors and their institutions in the HCI sub-discipline; (6) Potential future directions in HCI sub-discipline; and finally, (7) Summary and conclusions of the chapter.

2 HCI AS AN INTELLECTUAL SUB-DISCIPLINE OF MIS

The term HCI within the MIS context can be an abbreviation of different phrases such as Human-Computer Interaction (Banker et al. 2004; Zhang et al. 2002), Human-Computer Interface, User Interface, Human Factors (Carey 1988; Carey 1991; Carey 1995; Carey 1997; Culnan 1986), and Individual (Micro) Approaches to MIS Design and Use (Culnan 1987), among others.

HCI has been well recognized as a sub-discipline of the MIS field (Banker et al. 2004; Zhang et al. 2002; Zhang et al. 2005c). MIS-oriented HCI issues have been visited and addressed for as long as the MIS discipline has been in existence. For example, user attitudes, perceptions, acceptance and use of IT have been long standing issues and major themes of MIS since the early days in computing (Lucas 1975; Swanson 1974), along with studies on programmer cognition and end user involvement in systems development. MIS scholars have identified information systems failures as the potential result of the lack of emphasis on the human/social aspects of system use (Bostrom et al. 1977); have pointed out the need to attend to user behavior in information technology research (Gerlach et al. 1991); and have attempted to tie user-factors, usability, and HCI to the systems development life cycle (Hefley et al. 1995; Mantei et al. 1989; Zhang et al. 2005a). Culnan (1986) identified nine factors or subfields in early MIS publications (1972-1982); of these nine, three (factors 6, 7, and 8) are related to issues of humans interacting with computers. In a later period of MIS publications, Culnan (1987) found five factors where the second factor, individual (micro) approaches to MIS design and use, is closely related to human-computer interaction.

In order to constitute a field of scientific inquiry, a discipline must have a boundary that outlines its components and intrinsic interests (Zhang et al. 2005c). An argument can be made that HCI qualifies as a field of scientific inquiry (Banville et al. 1989). There are HCI courses offered in MIS programs (Carey et al. 2004; Chan et al. 2003; Kutzschan et al. 2006) and HCI is considered an important topic in the most recent AIS model curriculum for masters in information systems (MSIS) majors (Gorgone et al. 2005). Primary MIS journals have been publishing HCI research since the early days of the MIS field. Prestigious conferences of MIS, such as the International Conference on Information Systems (ICIS); all AIS' regional conferences such as the Americas Conference on Information Systems (AMCIS), the Pacific Conference on Information Systems (PACIS), and the European Conference on Information Systems (ECIS); the Hawaii International Conference on System Sciences (HICSS); and the pre-ICIS Annual Workshop on HCI Research in MIS have HCI tracks that are designated for presenting HCI studies within MIS. Finally, an official organization, the AIS Special Interest Group on HCI (SIGHCI), was established in 2001. Members of MIS (and other disciplines) join at their discretion (Zhang 2004). AIS SIGHCI is the largest and most active SIG of AIS.

In this section, we first give a brief historical view of HCI in MIS. Then we present a framework attempting to draw the boundary of the intrinsic interests for the HCI sub-discipline. After that, we present an overview of research topics in the HCI sub-discipline that have been covered in the literature. Finally, we briefly outline the relationships the HCI sub-discipline has with other disciplines such as Computer Science, Psychology, Business and Management, among others.

2.1 A Historical View of HCI in MIS

The MIS community includes scholars who focus on the development, use, and impact of information technology and systems in broadly defined social and organizational settings. MIS has seen a steady shift from what could have been labeled techno-centrism to a broader and more balanced focus on technological, organizational, managerial, and societal problems (Baskerville et al. 2002). MIS-oriented HCI issues have been addressed since the earliest studies in the MIS discipline. For example, users' attitudes, perceptions, acceptance, and use of IT have been long-standing themes of MIS research since the early days of computing (Lucas 1975; Swanson 1974), as have studies on programmer cognition and end user involvement in systems development. MIS scholars have identified information systems failures as the potential result of a lack of emphasis on the human/social aspects of system use (Bostrom et al. 1977), have pointed out the need to attend to user behavior in information technology research (Gerlach et al. 1991), and have attempted to tie human factors, usability, and HCI to the systems development life cycle (Hefley et al. 1995; Mantei et al. 1989; Zhang et al. 2005a). Also extensively studied are IS development theories and methodologies (Baskerville et al. 2004; Hirschheim et al. 1989), collaborative work and computer-mediated communication (Poole et al. 1991; Reinig et al. 1996; Yoo et al. 2001; Zigurs et al. 1999), representations of information for supporting managerial tasks (Jarvenpaa 1989; Vessey 1994; Zhang 1998), and computer training (Bostrom 1990; Sein et al. 1989; Webster et al. 1995).

Culnan (1986) identified nine factors or subfields in early MIS publications (1972-1982), where three are related to issues in humans interacting with computers. In a second study of a later period of MIS publications (1980-1985), Culnan (1987) found the field to be composed of five areas of study where the second, individual (micro) approaches to MIS design and use, is closely related to human-computer interaction. HCI was also considered as a research area in Vessey and colleagues' study on the diversity of the MIS discipline (Vessey et al. 2002). After surveying 50 years of MIS publications in the journal *Management Science*, Banker and Kauffman identified HCI as one of five main research streams in MIS and predicted that interest in HCI research will enjoy a resurgence (Banker et al. 2004).

These long-time interests in the MIS field have touched upon the fundamental issues of human interaction with technologies. From the MIS perspective, HCI studies examine how humans interact with information, technologies, and tasks, especially in business, managerial, organizational, and cultural contexts (Zhang et al. 2002). This differs notably from HCI studies in disciplines such as computer science, psychology, human factors, and ergonomics. MIS researchers emphasize managerial and organizational contexts by analyzing tasks and outcomes at a level relevant to organizational effectiveness. The features that distinguish MIS from other "homes" of HCI are its *business application* and *management* orientations (Zhang et al. 2004c).

As MIS scholars' interest in HCI has increased in recent years, HCI has gained great importance in the MIS discipline. As we have mentioned earlier, HCI issues are addressed in both formal education of MIS (courses, a designated textbook, model curriculum) and research (conferences, journal publications, special journal issues, and edited research collections). Both the total number and the percentage of HCI studies published in primary MIS journals have increased over the recent years (Zhang et al. 2005c). Most importantly, a large number of MIS scholars report their interest in researching HCI-related issues and in teaching HCI-related topics (Zhang et al. 2002), providing the base for a strong scholarly community in this sub-discipline.

Figure 1 depicts the activities of HCI in the MIS field since 2001 since with the establishment of AIS SIGHCI.

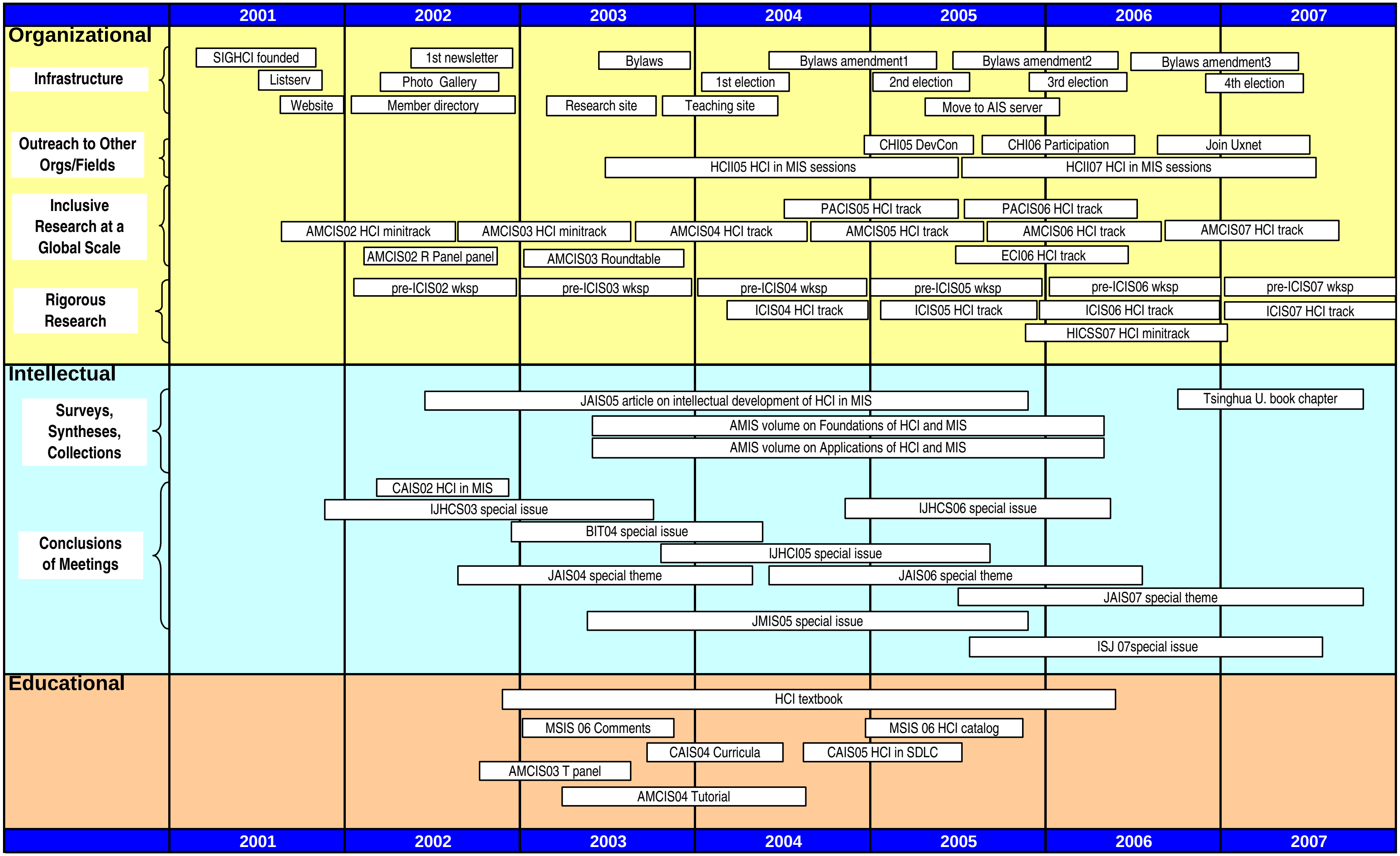

Figure 1. Activities of AIS SIGHCI since 2001

2.2 Bounding HCI: A Framework

A scientific field or discipline, such as MIS or physics, must have a boundary (which may or may not be well defined) that outlines matters of intrinsic interest to the field of inquiry. Based on the definition of HCI research in MIS (Zhang et al. 2002) and a literature survey, Zhang and Li provided a broad overview of important HCI components and issues (Zhang et al. 2005c). The overview is further refined in (Zhang et al. 2006a). Figure 2 represents this broad view of important HCI components that are pertinent to human interaction with technologies. Five components are identified: human and technology as the basic components, interaction as the core of interest, and task and context as the components making HCI issues meaningful. Several topics are listed inside each component to illustrate the components and the relationships among them.

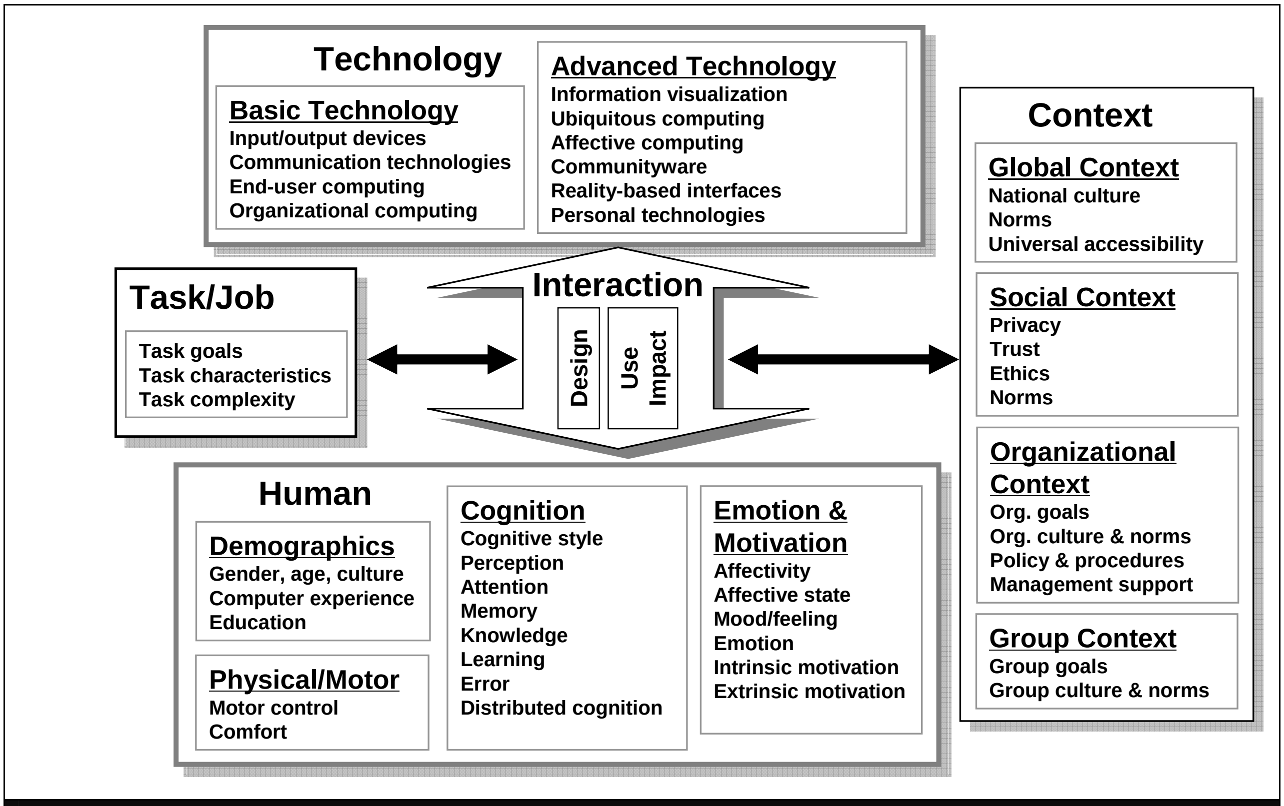

Figure 2. An Overview of Broad HCI Issues (Zhang et al. 2006a)

The two basic components encompass human and technology. There can be many different ways of understanding humans in general and their specific characteristics pertinent to their interaction with IT. Figure 2 includes four categories: (1) demographics; (2) physical or motor skills; (3) cognitive issues; and (4) affective and motivational aspects. Personalities or traits can be examined within both the cognitive and affective categories. Many issues in the Human component fall into the ergonomics and psychology disciplines. HCI focuses, though, on the interplay between the human component and other components.

Technology can be broadly defined to include hardware, software, applications, data, information, knowledge, services and procedures. Figure 2 indicates one way of examining technological issues when studying HCI. Many of these technological issues have interested researchers in the HCI field for a long time (Shneiderman 1987; Shneiderman et al. 2005). The figure was developed from the perspective of technology types often found in technical fields such as computer science or studies associated with ACM computer-human interaction (CHI).

The thick vertical Interaction arrow (the "↕" arrow) between Human and Technology represents the "I" in HCI. It is the core or the center of all the action in HCI studies. Interaction issues have been studied from two aspects of the IT artifact life cycle: during the IT development stage (before release), and during its use and impact stage (after release). Traditionally, HCI studies, especially research captured by ACM SIGCHI conferences and journals, were concerned with designing and implementing interactive systems for specified users, including usability issues. The primary focus has been the issues prior to the technology's release and actual use. Ideally, concerns and understanding from both points of view—human and technological—should influence design and usability issues.

The "Use/Impact" box on the right side inside the "I" arrow in Figure 2 is concerned with actual IT use in real contexts and its impact on users, organizations, and societies. Design studies can and should be informed by what we learn from the use of the same or similar technologies. Thus, use/impact studies have implications for future designs. Historically, use/impact studies have been the focal concern of MIS, along with human factors and ergonomics, organizational psychology, social psychology, and social science disciplines. In the MIS discipline, studies of individual reactions to technology (e.g., Compeau et al. 1999), IS evaluation from both individual and organizational levels (e.g., Goodhue 1997; e.g., Goodhue 1995; Goodhue 1998; Goodhue et al. 1995), and user technology acceptance (e.g., Davis 1989; Venkatesh et al. 2000; Venkatesh et al. 2003) all fall in this area.

Humans use technologies not for the sake of those technologies, but to support tasks that are relevant or meaningful to their jobs or personal needs. In addition, people carry out tasks in settings or contexts that impose constraints on doing and completing the tasks. Four contexts are identified: group, organizational, social, and global. The Task and Context boxes add dynamic and essential meanings to the interaction experience. In this sense, studies of human-computer interaction are moderated by tasks and contexts. It is these broader task and context considerations that separate the primary foci of HCI studies in MIS from HCI studies in other disciplines. Later, we will discuss more disciplinary differences.

2.3 An Overview of HCI Research Topics

Based on a literature assessment of HCI studies in seven prime MIS journals between thirteen years from 1990 and 2002, Zhang and Li further provided a classification of the HCI subject topics (Zhang et al. 2005c). Table 1 lists this classification.

The assessment of the thirteen years publications in the seven prime MIS journals show that in general, HCI research efforts spread out among various topics, although some topics (e.g. B1 Cognitive belief and behavior, B2 Attitude, and B5 Performance) gained more attention than others. For each particular topic, there has been little consensus yet (except the well studied user technology acceptance research, which covers topics B1 Cognitive belief and behavior, and B2 Attitude).

Table 1 Topic Classification Scheme (Zhang et al. 2005c)			
ID	Category		Description and Examples
A	IT development		Concerned with issues that occur at the stage of IT development and/or implementation that are relevant to the relationship between human and technology. Focus on the process where IT is developed or implemented. The artifact is being worked on before actual use.
	A1	Development methods and tools	Structured approaches, Object-oriented approaches, CASE tools, Social-cognitive approaches for developing IT that consider users/IT personnel's roles.
	A2	User analyst involvement	User involvement, User participation, User-analyst difference, User-analyst interaction
	A3	Software/hardware development	Programmer/analyst cognition studies, Design and development of specific or general applications or devices that consider some human aspects
	A4	Software/hardware evaluation	System effectiveness, efficiency, quality, reliability, flexibility, and Information quality evaluations that consider people as part of the factors.
	A5	User interface design & development	Interface metaphors, Information presentations, multimedia
	A6	User interface evaluation	Instrumental usability (e.g. ease of use, error rate, ease of learning, retention rate, satisfaction), Accessibility, Information presentation evaluation
	A7	User training	User training issues during IT development (prior to product release or use)
B	IT use and impact		Concerned with issues that occur when humans use and/or evaluate IT; issues related to the reciprocal influences between IT and humans. The artifact is released and used in a real context.
	B1	Cognitive belief and behavior	Self-Efficacy, Perception, Belief, Incentives, Expectation, Intention, Behavior, Acceptance, Adoption, Resistance, Use
	B2	Attitude	Attitude, Satisfaction, Preference
	B3	Learning	Learning models, Learning processes, Training in general (different from user training as part of system development)
	B4	Emotion	Emotion, Affect, Hedonic quality, Flow, Enjoyment, Humor, Intrinsic motivation
	B5	Performance	Performance, Productivity, Effectiveness, Efficiency
	B6	Trust	Trust, Risk, Loyalty, Security, Privacy
	B7	Ethics	Ethical belief, Ethical behavior, Ethics
	B8	Interpersonal relationship	Conflict, Interdependence, Agreement/Disagreement, Interference, Tension, Leadership, Influence
	B9	User support	Issues related to information center, end-user computing support, general user support
C	Generic Research Topics		Concerned with general research issues and topics

2.4 Connection with Other Disciplines

2.4.1 Closely Related Disciplines

The most closely related disciplines to HCI in MIS might be the human factors and ergonomics area that is mostly in Industrial Engineering, and computer-human interaction (CHI) which is the name of an association of scholars and practitioners in a field named human-computer interaction, originated by scholars in computer science and psychology in the early 1980s.

Taking a historical perspective, Grudin compared three closely related disciplines that all have an intrinsic interest in HCI issues: human factors and ergonomics, computer-human interaction (CHI), and management information systems (MIS) (Grudin 2005; Grudin 2006). He examined a rich set of historical events for each discipline. One frustration Grudin mentioned is the terminologies used by MIS scholars are sometimes inconsistent with those of CHI scholars.

On the surface, the different uses of the same terms do seem overwhelmingly confusing, as noted by Grudin repeatedly (Grudin 1993). Yet, they may indicate some fundamental differences among the different disciplines, or the differences in shifting emphases among the different disciplines. A good example is the level of analysis in MIS and CHI: MIS emphasizes the macro level of IT development and use that is relevant and meaningful at the organizational level (Zhang et al. 2002); CHI, on the other hand, emphasizes the micro level of humans directly interacting with technology, with limited consideration of organizational meaningfulness (Zhang et al. 2006a).

Historically, CHI research did include some explicit consideration of organizational issues, especially with respect to managing a project for greatest usability. For example, the classic piece by Gould and Lewis (1985) specifies that the first step in designing usable systems is identifying users and their tasks. Failing to gain such an understanding could lead to vexing design problems, such as presenting dialog boxes or prompts that use terminology unfamiliar to users, or requesting users to follow steps that they cannot find in any documentation or training materials. Equally as vexing, designers sometimes err by providing detailed instructions for performing well-known tasks such as selecting File-Save to save a file or File-Print to print a document. Amidst the bountiful obvious instructions, it might be difficult to find the key aspect of help needed, or that key aspect might have not been provided at all (Galletta et al. 2006b).

Such a focus has existed in the MIS field for a long time in work on systems analysis and design. The organizational context for practical problems is often provided by a business analyst (i.e., an MIS person). A business analyst is a compelling candidate for designing a user's experience. He can speak the user's business language to gain a quicker and more accurate representation of the task. He can develop more effective design specifications with richer organizational knowledge. He can produce test goals and benchmarks that are meaningful to the organization. He can determine if usability is of adequate quality for release to users. Broadening the analysis to organizational needs for overall efficiency can point more clearly to the proper decision and save millions of dollars. Further, additional analysis of customer satisfaction, company image, and IT strategy might provide crucial input to the decision as well (Galletta et al. 2006b). All these decision points can be informed by HCI research within the MIS field.

2.4.2 Contributing Disciplines

Due to its nature, HCI studies in general and within MIS are interdisciplinary. Many traditional disciplines contribute to address the concerns and research questions. Zhang and Li's assessment of 337 articles over the 13 years in seven prime MIS journals identified 23 contributing disciplines (Zhang et al. 2005c). Of the 337 articles examined, only 38 (11.3%) articles relied on just one discipline. 119 (35.3%) articles drew upon two disciplines, 122 (36.2%) built on three, 49 (14.5%) on four, and 9 (2.7%) on five disciplines. Together, these 23 disciplines were referenced 903 times, averaging 2.68 disciplines per paper. Among the 903 references for the 23 disciplines, the three most referenced disciplines were Information Systems (36%), Psychology (24%), and Business and Management (17%). One caution is that the Information Systems discipline is more than just MIS, including several other areas. More than 96% of the 337 papers used Information Systems as the contributing discipline, 65% built on Psychology, and 47% relied on Business and Management. These 23 disciplines constitute larger fields. Three fields are identified to be were the most frequently referenced fields that supported theoretical or conceptual development in HCI studies: Information-Computing-Communication, Commerce-Management-Tourism-Services, and Behavioral-Cognitive Sciences (Zhang et al. 2005c).

2.4.3 Collaboration with Related Disciplines

With so many shared concerns (Zhang et al. 2003) among several related disciplines, it makes sense that these disciplines talk to each other and work together to move our understandings of HCI related phenomena forward. The MIS field's main academic association, the Association for Information Systems (AIS), is participating in the dialog and movement (Galletta et al. 2005). Other professionals include ergonomists, graphic designers, business analysts, product designers, engineers, and health professionals from both academia and industry (Zhang 2006b).

While efforts are underway to pool resources, the disciplines will remain distinct. Ergonomists will continue to emphasize physical impacts in human factors work, graphic designers will focus on layout and presentation, and mechanical engineers will go on analyzing materials that will go into a physical product. It is striking that all of them spend significant resources on usability and users' experience of their products. All camps attempt to maximize user understanding while minimizing the need for training, all try to make the product behave as users expect, and all attempt to provide great product appeal. Likewise, all of these concerns are shared by systems designers in the MIS field. What distinguishes MIS researchers is the organizational context (Galletta et al. 2006b).

The organizational context provides researchers and practitioners alike a notion of an organization's strategic goals and therefore serves as a driver for users' tasks. For researchers, the organizational context helps us choose research problems and methods. In a similar fashion, for practitioners, the organizational context bounds the problems that are examined and leads to approaches for solving them. The differentiating factor is that researchers are most often interested in acquiring generalizable knowledge, while designers are focused on providing a solution to the organization, with systems that have improved usability or enjoyment (Galletta et al. 2006b).

3 THEORETICAL FOUNDATIONS OF HCI RESEARCH

3.1 Disciplinary Perspectives

HCI started as an interdisciplinary field, has stayed interdisciplinary, and can be predicted to continue to be interdisciplinary. This is because no single discipline can completely cover the complex, extensive issues involved; as Dillon states: "There is no one field that can cover all the issues worthy of study" (Dillon 2006). Given their relevance to many aspects of our lives and societies, HCI issues have attracted researchers, educators, and practitioners from many different fields. Interdisciplinary tension, as Carroll calls it, "has always been a resource to HCI, and an important factor to its success" (Carroll 2006). The key to success is to keep an open-minded attitude and to facilitate dialogue among various related disciplines, thus making the best of each discipline's unique perspectives and strengths.

MIS as a discipline has a lengthy and strong interest in information and in the role information plays in business decision-making and organizational effectiveness. For example, Banville and Landry (1989) concluded that the original perspective of MIS centered on either management, information, systems or on a combination of these. A number of disciplines, such as MIS, HCI, and information science, share this strong interest in information. As such, information can be used as a bridge among these related disciplines. An emphasis on information should also allow MIS and other disciplines to examine shared concerns, common approaches, and the potential for collaboration. For example, Dillon examined how different disciplines treat information in order to identify the similarities and differences between MIS and HCI (Dillon 2006). From an informational basis, "MIS can be considered to be primarily concerned with identifying, abstracting and supporting the data flows that exist in organizations, and developing or supporting the technological (broadly conceived) means of exploiting the potential to serve organizational ends. Similarly, HCI seeks to maximize the use of information through the design of humanly acceptable representational and manipulatory tools." Based on such analyses, Dillon outlines a number of research areas that can bridge the disciplines of MIS and HCI (Dillon 2006).

As we have demonstrated, MIS scholars have built their HCI research on a large number of diverse disciplines. Accordingly, HCI issues have been examined from a striking variety of analytical perspectives inherited from these disciplines. Kutzschan and Webster argued that MIS researchers, with their big-picture perspective, strong theories, and rigorous methodologies, are distinctively positioned to address HCI issues. Due to the increased sensitivity of HCI issues to businesses and marketplaces, MIS now benefits from a great opportunity to study HCI. Therefore, MIS is a natural home for HCI research (Kutzschan et al. 2006).

3.2 The User

The Human is an important component in HCI studies, regardless of the researcher's disciplinary perspective. Because studies of humans as users rely heavily on ideas about human psychology, both HCI and MIS have been able to connect directly with a basic science; this connection, in turn, gives its research depth and credibility. Historically, MIS research has studied humans at both stages of the IT life cycle: the IT development stage and the IT use and impact stage (Zhang et al. 2005c). MIS studies that have direct impact on IT development and use also examine humans' different roles—as developers, analysts, and designers of IT; as users or end users of IT; and as managers and stakeholders. Tables 2 and 3 list some of the MIS research topics that explicitly consider humans as individuals or groups during the IT life cycle (Zhang et al. 2006a). They are meant to be illustrative rather than exhaustive.

Users or end users have been studied from at least the following perspectives in the MIS discipline (Zhang et al. 2006a).:

- Users with individual differences such as general traits, IT-specific traits, cognitive styles, and personality (e.g., Agarwal et al. 1998; e.g., Benbasat et al. 1978; Huber 1983; Webster et al. 1992). Banker and Kauffman (2004) provided a detailed summary of MIS studies in this area.
- Users as social actors in the design, development and use of information and communication technologies (ICT) (Lamb et al. 2003). Lamb and Kling argued that most people who use ICT utilize multiple applications, in various roles, and

as part of their efforts to produce goods and services while interacting with a variety of other people, often in multiple social contexts. Only if we take such a view of users can we better understand how organizational contexts shape ICT-related practices, and what complex and multiple roles people fulfill while adopting, adapting, and using ICT.

- Users as economic agents whose preferences, behaviors, personalities, and ultimately their economic welfare are intricately linked to the design of information systems (Bapna et al. 2004).

It is noteworthy that supporting individuals or groups is not the only concern of HCI research in MIS. As noted by many, the mobile and pervasive nature of modern computer use by various people and organizations call for new challenges and opportunities (Lyytinen et al. 2004). Overall, the views of users have been broadened significantly. DeSanctis examined how the concept of user has evolved from an individual user to a group of people, then to an entire firm or organization, and finally to a diffuse community with dynamic membership and purpose (DeSanctis 2006). This inevitable evolution challenges the design and research issues MIS scholars face, but also provides them with opportunities to advance their understanding of broad HCI issues (Zhang et al. 2006a).

Table 2. Some MIS Studies on Individuals during the IT Life Cycle (Zhang et al. 2006a)

	IT Development	IT Use and Impact
Developers, Designers, Analysts	Programmer/analyst cognition (Kim et al. 2000; Zmud et al. 1993) Novice and expert system analysts (Pitts et al. 2004; Schenk et al. 1998) Developers' intention to use methodologies (Hardgrave et al. 2003)	Power relations between users and IS professionals (Markus et al. 1987) Analyst's view of IS failure (Lyytinen 1988)
Users, End Users	User participation and user involvement (1989; e.g., Barki et al. 1994; Saleem 1996) Customer-developer links in system development, and Joint Application Design and Participatory Design (Carmel et al. 1993; Keil et al. 1995) User developed applications (Rivard et al. 1984)	Cognitive styles and individual differences (Benbasat et al. 1978; Harrison et al. 1992; Huber 1983; Webster et al. 1992) Individual reactions to IT (Compeau et al. 1999) IT acceptance (Davis 1989) Individual IT performance and productivity (Goodhue et al. 1995) User training and computer self-efficacy (Compeau et al. 1995a)
Managers, Stockholders	Building systems people want to use (Markus et al. 1994)	Challenges to management on a personal level (Argyris 1971) Users' resistance (e.g., Dickson et al. 1970) Raising intrinsic motivation (Malhotra et al. 2005) Duality of technology (Orlikowski 1992) [1]

[1]In this paper, Orlikowski considered all types of human agents: technology designers, users, and decision makers. She also considered both stages of the IT life cycle, looking at technology as a product of human action and technology as a medium of human action, with institutional consequences. Therefore, this study should not just fit this cell but all six cells.

Table 3. MIS Studies on Groups during the IT Life Cycle (Zhang et al. 2006a)		
	IT Development	IT Use and Impact
Developers, Designers, Analysts	User centered design of collaborative technology (Olson et al. 1991) Global software team coordination (Espinosa et al. 2005)	
Users, End Users	The user interface design issues for GDSS (Gray et al. 1989)	Group performance and productivity (Dennis et al. 2003; Dennis et al. 2001) Collaborative Telelearning (Alavi et al. 1995) Cognitive feedback (Sengupta et al. 1993) Behavior in group process (Massey et al. 1995; Zigurs et al. 1988) The effect of group memory on individual creativity (Satzinger et al. 1999) On the development of shared mental models (Swaab et al. 2002) Satisfaction with teamwork (Reinig 2003)
Managers, Stockholders	Developing Systems for Management of Organizational Knowledge (Markus et al. 2002) GDSS design strategy (Huber 1984) [1]	Organizational Learning (Senge 1990)

[1]In this paper, Huber actually covered both the development/design and use/implementation stages of the GDSS life cycle.

3.3 Theories for Individuals and Group Work

In the context of promoting user-centered design of collaborative technology to support group work, Olson and Olson identified the different design approaches that existed at the time (Olson et al. 1991).

Olson and Olson note that in a user-centered design strategy, a design begins with detailed considerations of users' tasks and capabilities: Who are the potential users? How varied are they? What is their current work like? Which aspects of their work are difficult? What are their needs? There are three key aspects to this design strategy: involving users, iterative design, and the role of theory about users (Olson et al. 1991).

In the MIS literature, it is important to use theoretical understanding to guide designers on developing information systems that support individuals and groups. Here we mention a few theoretical work to demonstrate the importance of such design theories.

Given a long history of developing decision support systems (DSS) to help decision makers make a specific decision or choose a specific course of action, the issue of decision makers' confidence in decision quality becomes an important one. Kasper and Andoh-Baidoo presented an extension of DSS design theory for user calibration, which is defined as the correspondence between one's prediction of the quality of a decision and the actual quality of the decision (Kasper et al. 2006). In a related paper, Silver broadened theoretical work published a decade ago on how a DSS enlightens or sways its users as they choose among and use the system's functional capabilities (Silver 2006). The broadened theoretical work can be used to study not only DSS but a variety of other interactive information systems (Silver 2006).

In a group setting, coordination becomes an important activity to ensure group success. Coordination activities relate to organizing and allocating group activities, both during and after the development project. They include such activities as goal stating, agenda setting, history keeping, floor control, activity tracking, and project management (Olson et al. 1991). Coordination theory (Malone et al. 1994) provides a detailed theoretical understanding of the dependencies between the tasks the different group members are carrying out and how the group coordinates its work. Built on research in several different disciplines, such as economics, organizational theory, and computer science, coordination theory has influenced many studies since its initial publication in 1994. Crowston and his colleagues provided a ten-year retrospective on the development, use and impact of coordination theory (Crowston et al. 2006).

3.4 Theories for Design and Development

The theoretical works in this section continue to shed light on developing effective information systems that can benefit individuals, groups, and organizations.

Two important MIS models: cognitive fit by Iris Vessey and task-technology fit by Dale Goodhue have been recently expanded. Cognitive fit (CF) theory (Vessey 1991; Vessey et al. 1991) was initially introduced to explain the inconsistent results in the area of information presentations where graphs and tables are used to support information acquisition and information evaluation tasks. Vessey recently surveyed the broad applications of CF, discusses the fundamental theoretical framework of CF theory, and points out future directions (Vessey 2006).

Task-technology fit (TTF) studies the causal chain connecting information technology with its performance impact (Goodhue et al. 1995). The key idea of TTF is that a technology can only have a positive performance impact if it fits the task that is being supported. TTF also analyzes the impact of the fit on other factors, such as system utilization, user attitude, and user performance—where users can be both individuals and groups (Zigurs et al. 1998). TTF's focus moves beyond technology acceptance or utilization to analyze how technology impacts actual task performance. Despite the obvious importance of this construct, Goodhue argued that it is often neglected in major MIS models on information systems and performance (Goodhue 2006).

An organizational information system does more than simply support productivity. Expanding the cognitive-affective model of organizational communication with IT support (Te'eni 2001), and building on both cognitive fit and task-technology fit, Te'eni presented a well-rounded and broad concept of fit that has to do with physical, cognitive, and affective fit between human and computer (Te'eni 2006).

Recently, a new theoretical perspective on designing motivating information and communication technology was proposed (Zhang 2007). The perspective argues that one of the fundamental reasons that people utilize technology is to support their well-being by fulfilling their various needs. Taking this motivational perspective, Zhang suggested that the purposes and utilities of information and communication technology should support various human needs. She then proposed ten design principles to guide the design of motivating technology (Zhang 2007).

3.5 Theories on Use and Impact: Beliefs and Behavior

The ultimate goal of developing IT is to support and positively impact individuals, groups and organizations. Human interaction with technology is goal-oriented behavior that presents two main questions: what causes users to use technology, and why the use of technology is different from the use of other innovations (Zhang et al. 2005a). IS researchers have built heavily on psychological research into motivations and goal-oriented behaviors to understand how people behave around computers. In particular, IS researchers are interested in understanding how and why a computer-related behavior develops and how it influences future behavior. Influenced heavily by the theory of reasoned action and theory of planned behavior (Ajzen 1991; Ajzen et al. 1980; Fishbein et al. 1975), a significant amount of IS research has been conducted in identifying relevant cognitive beliefs that lead to certain behavior (Zhang et al. 2006a).

Long established as a research topic, user acceptance of technology is considered "one of the most mature research areas in the contemporary IS literature" (Venkatesh et al. 2003). Organizations that spend millions of dollars on information technologies (IT) are primarily concerned with how their investments will influence organizational and individual performance (Torkzadeh et al. 1999). However, the expected productivity gains and organizational benefits delivered by IT cannot be realized unless IT is actually accepted and used (Hackbarth et al. 2003).

Due to its importance, several theoretical models have been developed in this research. For example, Venkatesh and colleagues (Venkatesh et al. 2003)reviewed eight models that have gained MIS scholars' attention in recent decades. Among the many efforts and models, the technology acceptance model (TAM) (Davis 1989; Davis et al. 1989) is considered the most studied model and has generated much research interest and effort in the MIS community. Since the publication of TAM in late 1980s (Davis 1989; Davis et al. 1989), abundant studies have been done to test the model (Adams et al. 1992; Davis 1989; Davis 1993; Davis et al. 1989), extend it (Igbaria et al. 1997; Venkatesh 2000; Venkatesh et al. 1996; Venkatesh et al. 2000), compare it with other models (Davis et al. 1989; Dishaw et al. 1999; Mathieson 1991; Taylor et al. 1995; Venkatesh et al. 2000), and perfect it by considering various moderating factors and other factors (Schepers et al. 2007; Sun et al. 2006b). Recently, Fred Davis discussed how early HCI research inspired him during his dissertation work on TAM. He also discusses the evolution and current status of TAM research (Davis 2006).

One important belief that is related to computer use is computer self-efficacy (CSE) (Compeau et al. 1995b). CSE is defined as "an individual judgment of one's capability to use a computer" (Compeau et al. 1995b, p192). CSE has been found to influence user acceptance and learning about technology. Based on a thorough review of MIS literature on CSE, Compeau and colleagues recently found that the formation of CSE, along with its careful conceptualization and measurement, is much less studied (Compeau et al. 2006). They presented the state of research on CSE, including its conceptualization, influence, and formation. They also introduced a number of ongoing research programs in addressing the gaps and opportunities in this area. Finally, they concluded with an agenda for future research on CSE (Compeau et al. 2006).

Among the many studies of behaviors related to information technology, behavioral information security has become an important area of research in recent years. Stanton and colleagues defined behavioral information security as the human actions that influence the availability, confidentiality, and integrity of information systems (Stanton et al. 2006). They noted that despite the multibillion dollars spent on information security by commercial, non-profit, and governmental organizations around the world, the success of security appears to depend upon the behavior of the individuals involved (Stanton et al. 2006). Appropriate and constructive behavior by end users, system administrators, and others can enhance the effectiveness of information security while inappropriate and destructive behaviors can inhibit its effectiveness. Stanton and colleagues used social, organizational, and behavioral theories and approaches, and conducted a series of empirical investigations in developing a taxonomy of security behaviors and identifying the motivational predictors of such behaviors (Stanton et al. 2006).

Information security is also heavily engineering and technology oriented, as much of the information security spending is in these areas. Just how are the human and technological aspects of security issues different and related? Dhillon and May used a semiotic framework to illustrate the holistic nature of information security issues (Dhillon et al. 2006). Such a semiotic framework has six layers: physical, empiric, syntactic, semantic, pragmatic, and social. The first three are technically oriented, and the last three are human issues. Besides identifying the role of each layer, it is important to understand the impact each layer has on other layers. Based on existing studies on using semiotic research in IS, Dhillon and May argued that when HCI or IS research considers only some layers when studying and designing information security, the results can be dysfunctional and dissatisfactory (Dhillon et al. 2006). The semiotic framework proves to be a useful tool, given that it can be used to analyze existing security principles. For example, Stanton and colleagues' paper on behavioral information security (Stanton et al. 2006) places more emphasis on the pragmatic and social layers of the semiotic framework.

3.6 Theories on Use and Impact: Affect, Aesthetics, Value and Socialization

Researchers have investigated aspects of technology use that lie beyond cognitive reasoning. These include but not limited to affect and emotion, aesthetics, human values, and social influence.

Affect (mood, emotion, feeling) has been found to influence reflex, perception, cognition, and behavior (Norman 2002; Russell 2003; Zhang et al. 2005a; Zhang et al. 2004b) and has been studied in psychology, marketing, organizational behavior, and other disciplines. Although it has received less attention than cognitive approaches, affect has been covered in the IS literature for a long time and to quite some extent. Sun and Zhang examined the theoretical advancement of affect studies in several IS reference disciplines and propose an abstract model of an individual interacting with objects; they then develop an IT-specific model by applying the abstract model to integrate and interpret affect studies in the MIS discipline (Sun et al. 2006a).

A specific aspect of affect is the pleasantness or unpleasantness that may be generated by visual attractiveness, or aesthetics, as Tractinsky puts it (Tractinsky 2006). Tractinsky made a strong argument that aesthetics has become a major differentiating factor between IT products that many products now provide the same functionality and meet the same needs; this has happened because aesthetics satisfies basic human needs and because human needs are increasingly supplied by IT (Tractinsky 2006). Perceived aesthetics (Tractinsky et al. 2000), perceived visual attractiveness (van der Heijden 2003) and first impression (Everard et al. 2006; Schenkman et al. 2000) have all been found to influence people's judgment of IT, as they regard what is beautiful is usable (Tractinsky et al. 2000). As Norman stated, beautiful things work better (Norman 2004).

Values refer to what people consider important in life; they include trust, privacy, human welfare, freedom from bias, and autonomy, to name a few. According to Friedman and colleagues, an important and longstanding interest in designing information and computational systems should be to support enduring human values (Friedman et al. 2006). Value-sensitive design is a theoretically grounded approach to the design of IT that accounts for human values in a principled and comprehensive manner throughout the design process. Friedman and colleagues described in detail the approach and provided some examples in their paper (Friedman et al. 2006).

Forever social, we humans live in social environments and behave socially. Consequently, we treat everything in our environment, including other humans and even artifacts, socially. The media equation theory (Reeves et al. 1996) predicts and explains why people respond unconsciously and automatically to communication media (or artifacts in general) as if they were human. Computers are continuously regarded as social actors. How can HCI design help? Recently Nass and colleagues presented abundant investigations to explore social consistency issues that are at the center of the more socially demanding interfaces of today's technology, including personality, gender, emotion, and the use of "I" (Nass et al. 2006).

3.7 Theory Development and Testing

Consistent with the majority of MIS studies, HCI research is strongly theoretically bound. Theories can be developed, tested or validated, and applied. Theories are addressed in different ways by researchers and practitioners. While researchers attempt to develop and test theory, practitioners will use theory to design systems or evaluate products.

Researchers have provided theory in many areas, but that work is not complete and there are is much room for further work. Likewise, theory that has been developed has not been applied in every potential area. The latter shortfall is caused by sheer numbers; there is perhaps an infinite set of application areas for HCI theories, frameworks, and principles. Not only can broad types or categories of systems be investigated, but a bewildering array of highly detailed aspects of those systems can be studied too (Galletta et al. 2006b). Researchers should be concerned with some basic questions: Where (i.e., to what kinds of problems) is theory applied? How is it applied?

3.7.1 Where Is Theory Developed?

Categories of systems, at several different levels, have been examined. The categories have tended to include shortlists that are mutually exclusive and exhaustive. For example, the HCI field studied graphical, menu, and command-based interfaces as three general ways to manage a dialog with the user. Within menu-based systems, researchers have subdivided the types into static and dynamic menus. Within static menus, researchers have investigated different arrangements of menu items, such as alphabetical order, functional or categorical order, frequency order, temporal order, and even random order (Galletta et al. 2006b).

Detailed aspects of systems have also served to define our understanding of systems, and although many very interesting studies have been conducted, only some areas have been covered. These considerations are not as well-defined or exhaustive as the categories. Perhaps inspired by the categories, they represent phenomena that are observed by researchers. When studying menu-based systems, for instance, several researchers noticed that response time differed substantially among different systems and among different times of day when using one particular system. When studying graphical interfaces, some researchers noted that reading speed and comprehension differed when comparing paper against CRT screens of the 1980s (Galletta et al. 2006b).

3.7.2 How Is Theory Developed?

Combining a large set of options and outcomes enabled early researchers to explore without many expectations. In the early days (e.g., see Dickson et al. 1977), researchers listed options for presentation of information such as summarized versus detailed, or paper versus screen. They also examined outcomes such as "confidence" and "accuracy." As time passed, the MIS discipline began to mature. Researchers began to apply theory by "borrowing" and adapting theoretical developments from other fields, or even by developing new ones from previous studies (Galletta et al. 2006b).

UTAUT (Venkatesh et al. 2003) is an example of a perspective adapted from outside the field. Its predecessor model TAM (the technology acceptance model) (Davis 1989) was derived from the theory of reasoned action (Fishbein et al. 1975) from social psychology. Many other models have been imported and adapted in this manner (Galletta et al. 2006b).

By contrast, an example of a theoretical development that originated in the field is the theory of cognitive fit (Vessey 1991; Vessey et al. 1991). Seeds for that study were sown in 1981, when Professor Gary Dickson at the University of Minnesota required PhD students at that time to reconcile the disparate findings of previous "graphs versus tables" studies. Coursework on organizational psychology with Professor John P. Campbell, also at the University of Minnesota, provided another seed. Professor Campbell taught that disparate findings usually demanded a contingency approach. The following cycle seemed to hold in many disciplines: (1) new management tools are introduced and heralded as the "next big thing"; (2) the tools sometimes work and sometimes do not work; and (3) someone finally discovers why, by identifying situations (contingencies) in which they will and will not work. A third seed was planted in the mid-1980s when Vessey and Galletta were auditing a well-known cognitive science course taught at Carnegie Mellon by the late Nobel Prize winner Herbert Simon. They discussed the possibility of capitalizing on the previous two seeds and launched the experiments. Vessey's expertise and leadership provided a sensible framework and name for the theory. As the first experiment was under way (Vessey et al. 1991), she then went on to analyze the previous studies in that light (Vessey 1991), making a seminal and frequently-cited contribution to the field of MIS and HCI (Galletta et al. 2006b).

3.7.3 Theories in System Design and Evaluation

Practitioners have developed, over the years, new creative interaction techniques or tools, such as ergonomic keyboards, special dials on handheld devices, and new pointing devices (e.g., Briggs et al. 1993). The creativity of designers has propelled these developments, and few, if any, of our current theories could have formulated the new tools. As Shneiderman pointed out (Shneiderman 2006), theories describe objects and actions, explain processes, predict performance, prescribe guidelines, or generate agendas. They do not allow the practitioner to plug in parameters and view the resultant 3D design for a new product on a screen (Galletta et al. 2006b).

It would be difficult to expect theories to create new products or systems. For example, existing theory could not have *specified* the IBM ThinkPad "pointing stick" and its location between the G and H keys on the keyboard. Indeed, Rutledge and Selker point out the trial-and-error process that led to its design and final placement (Rutledge et al. 1990). Alternative solutions—such as integrating the pointing stick with the “J” key, or placing it below the space bar or and above the function keys—were explored (Galletta et al. 2006b).

Application of theory was quite useful to the ThinkPad team. The GOMS model (Card et al. 1983) and Fitts’ Law (Fitts 1954), both derived from psychological theory, allowed the designers to *evaluate* the device systematically and in a standard way. They measured the extent to which “mental time,” having to pause and think about how to initiate the “J” key pointer, disturbed the efficiency of that option. Their designs were evaluated in Fitts’ time-versus-difficulty plots (Galletta et al. 2006b).

Such events are not relegated to hardware design. Practitioners have also benefited from analysis of design alternatives by applying Fitts’ Law. Callahan et al. designed a “Pie Menu,” which does not require users to move to the top of the screen as in a pull-down menu (Callahan et al. 1988). By clicking the mouse button, a menu surrounds the pointer at its current location. The menu requires only slight movement in any direction to choose the desired option. Several software packages make use of such menus, and theory was helpful to practitioners in evaluating the general type (Galletta et al. 2006b).

3.8 Theory Applications

From the perspective of applying theory, the MIS field has models that would benefit the HCI field by providing such context more systematically. For instance, the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003) contains both effort expectancy and performance expectancy. In this model, performance expectancy, along with outcomes of these expectancies, provide a useful context for effort expectancy. Effort expectancy by itself seems to provide a focus that is incomplete (Galletta et al. 2006b).

Theory is applied in a multitude of ways by researchers and practitioners, and there are important differences in the purpose and the application itself. A framework in Table 4 outlines such differences (Galletta et al. 2006b).

Table 4. Framework for Applying Theory (Galletta et al. 2006b).

	Academic Researcher	Practitioner
Goals	Generalization	Problem-solving
Activities	Theory development and testing	System design and evaluation

Both academic researchers and practitioners are concerned with issues that arise at the organizational, system, user, and task level. What differentiates them is the level of generalization and problem-solving that each desires (Galletta et al. 2006b).

Researchers who study a particular organizational system, user, or task are interested in what it will teach them about future systems, users, and tasks. Generalizability is of primary concern for building models and publishing papers. If the knowledge is not generalizable in some way, it is unlikely that other researchers will take an interest in that knowledge. Lessons learned can be shared with others and progress can be made for the entire field (Galletta et al. 2006b).

On the other hand, practitioners want to solve organizational problems. They need to build a system or make a particular decision. Sometimes theories published in journals are not immediately useful or visible to practitioners. However, some research undoubtedly filters through to practitioners, as many attend conferences, hear presentations by researchers, or read materials generated by researchers. In that case, pieces that they find useful could drive their problem solving (Galletta et al. 2006b).

The difference between the researcher's and practitioner's purpose is actually unifying. Applying theory to an organization's problems should allow practitioners to develop systems that are responsive to the needs of the organization and its members. This puts MIS in a unique position to provide the necessary organizational focus (Galletta et al. 2006b).

4 HCI RESEARCH IN APPLIED CONTEXTS

In addition to being multidisciplinary and theoretically grounded, HCI in MIS is also a strong practical and application-oriented area. Applications requiring interactions with human users can be found everywhere in our surroundings, and are therefore of significant concern to both researchers and practitioners in a wide variety of disciplines. Long-term efforts are under way to pull these researchers and practitioners under a single metaphorical umbrella where duplication of effort can be avoided and synergies can be exploited (DevCon 2005; Galletta et al. 2005; Instone 2005).

Researchers and practitioners alike can benefit from the application of theory. Researchers can develop and apply theory to generalize to other situations. They develop and test models that are either derived from applications of theory, or that lead to new theory. Practitioners can use it to solve problems, often for evaluation of new software or hardware (Galletta et al. 2006b).

Many applications of theory can be found in the literature. These areas are diverse, interesting, and important, and have either direct or indirect relevance to researchers and practitioners alike. This section mentions several specific areas with representative articles. These topics have evolved over an extended time or over an extended set of studies. The application areas include electronic commerce, team collaboration, culture and globalization, user learning and training, system development, and health care. Many of these areas have built a distinctive literature and can be further developed.

4.1 Electronic Commerce

The Web and electronic commerce have become important areas in HCI/MIS. Because computer users exist in greater numbers than ever before, but have less training than ever before, electronic commerce provides an unprecedented and rich research laboratory for HCI in MIS. The MIS researchers' interest of studying hypertext or the Web has expanded from early days of building decision support systems (Minch 1990) to a much broader range of research interest. According to Galletta (Galletta 2006), electronic commerce has taken computer usage to many more users than ever before. Adding to the importance of usability is the problem that these new users are not able to benefit from corporate training for their systems. Previously, users were business professionals or clerical individuals, a rather specialized segment of the population. Today, the new world order has unprecedented numbers of regular citizens as Internet users: statistics from February 2005 show that about two-thirds of Americans have Internet access (Internet World Stats 2005).

Benbasat outlined several studies on various difficulties imposed by the physical decoupling of retail stores from their customers (Benbasat 2006). Benbasat first explored types of communication, and then described various tools that can enrich the experience. These tools include ways in which service can be provided virtually, how customers can browse with another person, and how customers can experience products more thoroughly (Benbasat 2006).

The phenomenon of Web delay has been an interest to several researchers (Galletta et al. 2006a; Nah 2004). For example, Galletta and colleagues examined delay in a progression of four experiments: a study to determine how long users will wait until they lose patience, a study that examines user reactions to delay in two different cultures, and two studies that include factors that interact with delay (Galletta et al. 2006a). Interacting factors included user familiarity with Web site terminology and depth of the site in the first experiment, and feedback on page loading progress and variability of the delay in the second experiment (Galletta et al. 2006a).

Other electronic commerce research addresses animation in pop-up advertising, and describes eight years of research in that area (Zhang 2006a). Three studies found consistent evidence that animation impairs performance because it diverts a user's limited attention capacity for her primary task. The first study examined other related factors such as task difficulty, relevance of the animation to the task, and bright versus dull colors. The second study examined the timing, location, and repetition of the animation. The third study focused on user experience with animation (Zhang 2006a).

4.2 Collaboration Support

Collaboration through electronic means is easier and cheaper than ever before. People who cannot be near each other have been brought together electronically, but even people who are physically together can accomplish a variety of tasks more effectively using certain technologies. This topic has received widespread attention and has a semiannual conference devoted to it. Due to the large number of tasks that are too large or complex for a single individual to perform, this area is quite important (Galletta et al. 2006b).

Olson and Olson examined several challenges faced by distributed teams, based on several studies in both the field and in the laboratory. In their early work, the challenges included the nature of work, the common ground of team members, the competitive/cooperative culture, the level of technological competence of team members, and the level of technical infrastructure (Olson et al. 2006). The paper focused on new challenges, including alignment of incentives and goals, difficulty of establishing trust, awareness of colleagues and their context, the motivational sense of the presence of others, and the need for explicit management. Data from two hundred "collaboratories" were used to construct conceptual technical and social "bridges" to solve the difficulties (Olson et al. 2006).

Hiltz and colleagues focused on groups that are separated by time and distance (also known as asynchronous teams) (Hiltz et al. 2006). Results from several field and laboratory experiments were described, and the results pushed in a variety of directions. Future research needs were outlined to help uncover a model for understanding this area better (Hiltz et al. 2006).

Zigurs and Munkvold examined collaboration technologies, tasks, and contexts, and provides an analysis of how these three elements have been addressed in MIS research. They also reviewed several typologies, as well as the evolving nature of these concepts (Zigurs et al. 2006).

4.3 Culture and Globalization

As information is passed among more and more people, it sometimes crosses cultural boundaries. Multinational firms find that people need to understand people of other cultures to ensure that they are communicating accurately. Software and hardware design should be culturally sensitive, or designers might create the technological equivalent to trying to sell the Chevrolet “Nova” in Mexico several years ago. The literal translation of “Nova” from Spanish to English is “will not go,” as General Motors later found (Galletta et al. 2006b).

Kim and colleagues representing a collaboration of researchers in three Asian countries studied mobile Internet (Kim et al. 2006). Specifically, metrics for examining cultural aspects of technology were proposed and tested. Rather than force-fit the established dimensions of culture, the authors developed a layered approach that assumes that most elements of culture exist in deeper layers that cannot easily be observed. The metrics were adapted from two sets of cultural dimensions in the previous literature. The researchers tested the instrument by examining logs of 1,075 actual mobile Internet users in Korea, Hong Kong, and Japan. Thorough examination of the instrument was provided (Kim et al. 2006).

Hubona and colleagues collected data that are complementary to the above Asian mobile Internet study (Hubona et al. 2006). Their paper focused on organizational use, and includes several countries throughout the world. Hubona et al. demonstrated that North American models of technology acceptance are not necessarily applicable in other countries. They examined socio-cultural factors (for example, motivation and norms) and globalization factors (for example, government policy and national economics) in a framework to understand adoption and use of IT in other countries (Hubona et al. 2006).

4.4 Learning and Training

Over the years, a dedicated community has examined user learning and training (e.g., Cronan et al. 1990; Davis et al. 1990; Kang et al. 2004; Sein et al. 1989). Their work is becoming more important as the years pass, as more and more technology reaches the physical but perhaps not the cognitive grasp of users. Evidence that supports investing in training research can be found in legends about users who make errors, such as the famous tale of the user who believed a CD drive was a cup-holder. A humorous Web site entitled Computer Stupidities (http://www.rinkworks.com/stupid) provides several more potentially true tales about users: One photocopied a floppy disk, another held up a printer to his monitor so that the computer could “see” (and thus find) it, and still another misinterpreted a request to right-click on an icon and used a permanent marker to write the word “click” on her video display. If even a small proportion of the dozens of stories are actually true, the serious need for training is obvious (Galletta et al. 2006b).

It is important to provide a firm understanding of technological capabilities to prevent some of these errors. It is also important to provide a better glossary of the terminology used when referring to technologies to avoid misunderstandings. Some of the training might be needed to make up for failures in design, and the need could pass after these difficulties are eliminated. However, interactions with hardware and software are quite complex, and making each system self-tutoring could result in systems that are quite cumbersome after extended use (Galletta et al. 2006b).

Sasidharan and Santhanam reviewed the literature on technology-based training (Sasidharan et al. 2006). Early studies seem to have focused on the technologies themselves, to determine how the outcomes of training might be improved. Later studies, however, have devoted their attention more to learners than to technologies. Taken together, the existing studies provide background in understanding characteristics of the learner, the instructor, the technology, and the course. Much more research is needed to make significant progress in this area (Sasidharan et al. 2006).

Olfman and colleagues examined how to develop a training strategy from an HCI perspective (Olfman et al. 2006). The approach outlines how to design, implement, and deliver software training that is consistent with a framework that extends from corporate strategy to learning strategy to training strategy. The authors presented their original model from several years ago, and described several studies related to that model. They also took the unusual step of providing a detailed critique of their own work. Finally, after discussing the framework and industry best practices, they provided an agenda for future researchers (Olfman et al. 2006).

Shayo and Olfman provided another paper on learning and training, offering a perspective on “learning objects,” small chunks of digitized instructional content that can be delivered online (Shayo et al. 2006). The authors reviewed the literature in this area, focused on the benefits and difficulties of such a technology, and suggested what needs to be done in this area from a “Value Chain” perspective (Shayo et al. 2006).

4.5 User-Centered Information Systems Development

Most information systems are developed in response to a need that is determined to exist. That need could originate from the organizational level, as in an enterprise-wide system, or at the individual level, for making decisions more accurately, strategically, or quickly. In either case, individuals will use the system, facing its screens and needing to understand and respond to its prompts. Developing systems from the perspective of users is therefore a logical, yet sometimes neglected, strategy (Galletta et al. 2006b).

Browne supplied a review of research in information requirements determination, a framework of the requirements determination environment, and an inventory of research questions that have or have not been addressed satisfactorily (Browne 2006). The four stages of IRD are used to understand the environment: pre-elicitation conditioning, elicitation, representation, and verification. The second and third stages have received most of the attention. Browne pointed out additional research needed to better understand cognitive, emotional, communication, experience, environmental, organizational, task, and individual issues in requirements determination (Browne 2006).

Carroll and Rosson surveyed participative design (PD) under a framework of six dimensions of participation: participatory impetus, ownership, scope of design, nature of the participatory process, scope of cooperation, and expectations about learning and human development (Carroll et al. 2006). The framework provided for an analysis of traditional and emerging PD models, some of which date back two decades. Contemporary studies throw all of the models into a new light, and provide for an up-to-date view of PD (Carroll et al. 2006).

Zhang and colleagues proposed a human-centered systems development life cycle model HCSDLC (Te'eni et al. 2007; Zhang et al. 2004a; Zhang et al. 2005a). HCSDLC integrates HCI development into the modern systems development lifecycle process. The methodology emphasizes both organizational information needs and human's various needs (physical, cognitive and affective), and advocates that both types of needs should be addressed together and from the very beginning of the system development life cycle in order to achieve human-centered information systems (Te'eni et al. 2007; Zhang et al. 2004a; Zhang et al. 2005a).

4.6 Health Care and Health Informatics

The health-care arena is one in which technology decisions can have powerful impacts on the well-being of people. There are many interesting IT issues to study in a health-care context; yet only a limited number of studies exist (e.g., Hu et al., 1999). Information technologies for health care can either address health records or the process of treatment. Inaccurate records can result in complications for a patient, especially when urgent steps must be taken and little information is available about drug allergies or current medications being used. From the treatment side, new advances provide exciting prospects for people who might have given up hope without the new opportunities in receiving leading-edge care (Galletta et al. 2006b).

Agarwal and Angst defined and discussed health information technology and illustrated opportunities for MIS research in this area (Agarwal et al. 2006). Focusing on adoption decisions on an electronic personal health record (PHR), Agarwal and Angst reported on an empirical study that supports the notion that different demographic and health conditions lead to different perceptions of value of a PHR, and ultimately to adoption of the technology (Agarwal et al. 2006).

Randolph and Hubona reported on significant cutting-edge efforts for developing assistive technologies for people with disabilities (Randolph et al. 2006). They examined organizational adoption and diffusion of such technologies, to perhaps minimize the disproportionate levels of unemployment and poverty of the millions of working-age people with disabilities. Eight predictive models and two case studies were presented. The first case study addressed BrainBrowser, a promising but developing technology that will eventually allow people with motor disabilities to control certain functions with brain impulses. The second relies on galvanic skin response to accomplish the same goal in users who are not good candidates for BrainBrowser due to complicating diseases (Randolph et al. 2006).

5 METHODOLOGICAL ISSUES IN HCI

5.1 Philosophical Issues

Methodological issues can be at different abstract levels. For example, historically there was a debate in the HCI field over "hard" science and "soft" science (Carroll et al. 1986; Newell et al. 1985; Newell et al. 1986), which represents a philosophical concern. Carroll (2006) recently provided a unique retrospective of his and Robert Campbell's famous "soft versus hard science" debate with Allen Newell and Stuart Card twenty years ago. Although Newell has since passed on and Card was not available for a similar retrospective, Carroll's account and analysis helped us to think more thoroughly about the prospect that predictive mathematical or technical studies could drive out social and behavioral approaches. The paper (Carroll 2006) serves as the missing final rebuttal by Carroll, with whom Campbell decided many years ago not to debate the matter further. In the paper, Carroll referred to the debate as an "essential tension," and two key questions were examined. The first question is whether there is a problem introduced by soft sciences in a multidisciplinary field, and the second is whether "hardening" all of the contributing sciences is desirable. Carroll demonstrated that additional "soft" sciences have entered the HCI milieu, and HCI's base in science is actually more eclectic and softer than it was during the initial debate. Cognitive modeling is no longer the default paradigm for HCI studies. Even with this happily multifaceted emergent discipline, Carroll noted that some less confident researchers will, even today, shy away from "soft" studies and pass up interesting opportunities because of this debate, and closed the thoughtful piece by asserting that long-running crises sometimes lead to what Kuhn calls extraordinary science, where researchers question assumptions, abandon conventions, and routinize innovative practices

On a more micro level, researchers are often interested in making sure that they are examining appropriate problems, and are examining those problems in the correct manner. This level of concern has to do with putting the "correct" ingredients into a research design. The types of research ingredients for HCI research normally include research topic (addressing a phenomenon), study context, level of analysis, research method, contributing disciplines, whether to consider individual characteristics, and whether to consider IT in the study. We have touched upon research topics and contributing disciplines earlier in the chapter. The rest of this section will address the other ingredients.

5.2 Context of Study

Zhang and Li (2005c) found that the 337 HCI studies they assessed reveal the following information on contexts:

- 308 (91.4%) studies considered one context, nine used two contexts, one used three contexts, and 19 papers had no contexts specified in their studies.
- A total of 348 context occurrences existed in the 337 papers, among which 276 (or 83.9%) were Organizational and Workplace context, 30 Marketplace (9.1%), 2 Home (0.6%), 7 Social (2.1%), 5 Cultural (1.5%), and 9 others (2.7%).
- About 81.9% of the 337 papers used the Organization and Workplace context, followed by about 8.9% of papers using the Marketplace context.

The predominant context over the years was organizational and workplace. This is consistent with the nature of most MIS studies being situated in the organizational and workplace context. The second most dominant setting was the marketplace, which demonstrated an increasing trend in recent years. This coincides with the e-commerce related research in recent years, although one would expect more studies than what have been shown in this table. The low frequencies of other settings indicate that MIS researchers paid little attention to issues that are relevant to these contexts such as home, social environment, and cultural/geographical settings (Zhang et al. 2005c).

5.3 Levels of Analysis

Zhang and Li (2005c) found that 304 (90%) of the 337 HCI studies they assessed were conducted at the individual level only, 15 at the group level only, and 6 papers at both individual and group levels. The majority of papers (93.8%) in this collection were concerned with individual level analysis. This result is consistent with the conventional wisdom that studies concerning human aspects are conducted mostly at the individual level (Zhang et al. 2005c).

5.4 Research Methods

MIS scholars have utilized a large number of different research methods. Zhang and Li (2005c) revealed that almost all of the methods in Alavi and Carlson's research type framework (Alavi et al. 1992) have been used, indicating methodological pluralism and a true "blooming of many flowers" (Banville et al. 1989, p56). The most commonly utilized method, however, is the controlled lab experiment (used by 35.6 percent of the 337 HCI papers), followed by surveys (by 25.5 percent of the 337 papers) and field studies (by 12.5 percent of the 337 papers). Among the 378 total methods used, empirical methods (90.5%) dramatically exceeded non-empirical ones (9.5%). The low frequency of non-empirical studies has been fairly stable over the years. Empirical studies have been conducted almost entirely on events/processes. In particular, lab controlled experiment, survey, and field study were the three most utilized methods, followed by field experiment, instrument development, and others. This indicates that positivist research has been conducted more often than other forms of research. There also seems an increasing trend of using multiple methods in one study, although the majority (298 or 88.4%) used one method, 37 papers used two, and two papers used three methods (Zhang et al. 2005c).

Dennis and colleagues addressed issues and concerns in conducting lab experiments, from initial conception of a study to publication, in a paper that should be on every experimenter's desk (Dennis et al. 2006). Four main issues are addressed: how to find and select ideas for studies, how to use theory, how to design an experiment, and how to write (and revise) the experimental paper (Dennis et al. 2006).

5.5 Individual Characteristics

Not all HCI studies consider individual characteristics. For example, among the 337 articles in (Zhang et al. 2005c), only 50 or 14.8% of articles considered explicitly individual characteristics. 19 papers (8%) considered personality, 27 (9.2%) considered demographics, and 8 papers considered both. The number of articles that did not consider individual characteristics at all constituted more than 85% of the 337 papers (Zhang et al. 2005c).

5.6 Technology and/or Service being Studied

Owing to the nature of MIS and HCI research, one would expect that general of particular technologies or services should be studied thus reported in published articles. Zhang and Li (2005c) found that 244 (72.4%) out of the 337 papers studied one type of technology or service, 5% two types, about 1% three types, and 21.7% of papers did not specify technology/service in the studies. Among the 361 times technologies and services were studied, 55.9% were organizational computing tools, 38.2% end user computing tools, and 5.9% were services. Among the 337 papers, 19.3% papers studied DSS, followed by 11.6% of the papers on individual productivity tools. Other types of technologies were studied to some extent. Service was studied in 5% of the papers (Zhang et al. 2005c).

6 THE MOST PROLIFIC AUTHORS

An important component of a scientific field is its members or knowledge contributors. Thus it would be very interesting to know who the main contributors of the HCI sub-discipline are. Keep in mind, of course that such a list is always time dependent and source-dependent. Related to the contributing authors is the question of which institutions home these authors. This has implications for many people including graduating Ph.D. students who are passionate about HCI and seeking academic employment where their research is appreciated, encouraged, supported, and has the possibility for collaboration. It could also impact choices of prospective doctoral students for the same reason. In academia, people often switch institutions from time to time. Thus we are interested in the authors' academic homes at the time the papers are published (Zhang et al. 2005c).

In this section, we provide information on the sources we use to compile knowledge contributors, the ways contribution is calculated, and the results of only the top contributors and institutions due to display space limit.

6.1 Sources of Publications

We hope to have as exclusive as possible a coverage of the sources of HCI research to demonstrate the knowledge contributions of HCI scholars. Zhang and Li (2005c) covered seven prime MIS journals from 1990-2002: *Management Information Systems Quarterly* (MISQ), *Information Systems Research* (ISR), *Journal of Management Information Systems* (JMIS), *Management Science* (MS), *Decision Sciences* (DS), *The Data Base for Advances in Information Systems* (DB), and *Journal of the Association for Information Systems* (JAIS). We continued the coverage of these seven journals to May 2007 to reflect recent developments. In addition, *Communications of the Association for Information Systems* (CAIS) is included in the prime MIS journal list due to its continued high ranking and reputation within the MIS scholars. The inception of CAIS occurred in 1999, and consistent with the other journals, we will cover up to May 2007. The judgment of whether a study is HCI research or not is made by two independent scholars using the same criteria Zhang and Li used in their study (Zhang et al. 2005c).

In addition to the eight prime MIS journals, we also consider all the activities and outcomes that are sponsored by AIS SIGHCI since its inception in 2001. This is especially important because the official organization has played an important role in boosting the energy and participation in the HCI sub-discipline, yielding an impressive result. Specifically, SIGHCI has sponsored peer reviewed conference tracks, minitracks, and sessions at all major MIS conferences and also at conferences of other associations such as ACM SIGCHI and HCI International. These conference meetings often lead to journal special issues that include high quality expansions of the best complete papers from the conferences. Recent movement in the HCI sub-discipline also produced one designated textbook and two edited books that involved more than 70 highly recognized scholars. All the contributors of these books are considered knowledge contributors to the HCI sub-discipline. These HCI specific publications have already been judged to be HCI-relevant during the selection and review process, thus we consider them all HCI research to be included in our analysis.

Table 5 summarizes the sources across the 17.5 year span (1990-May 2007) and the number of HCI articles in each source.

Table 5 Numbers of HCI Articles in Various Sources																				
		90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	Total
Regular Journal Papers	MISQ	3	4	4	8	6	7	6	8	5	7	6	7	5	10	7	7	16	4	120
	ISR	5	4	3	1	5	6	6	3	5	7	7	8	11	5	9	6	11	2	104
	JMIS	4	3	1	5	3	7	12	4	8	4	4	3	5	10	10	9	6	5	103
	DS	2	7	5	2	8	2	3	9	4	7	1	8	2	2	2	3	5	1	73
	MS	3	1	0	1	1	6	2	1	1	0	1	0	1	2	2	3	6	0	31
	DB	2	2	3	1	3	3	1	7	5	1	2	4	6	1	6	6	10	2	65
	JAIS											3	4	2	7	7	4	7	2	36
	CAIS										2	1	3	1	6	6	11	10	4	44
	Total	19	21	16	18	26	31	30	32	28	28	25	37	33	43	49	49	71	20	576
Special Issues Papers	IJHCS														6			4		10
	BIT															6				6
	IJHCI																8			8
	JMIS																5			5
	JAIS															2				2
	Total														6	8	13	4		31
Conference Papers	ICIS															10	6	11		27
	pre-ICIS													12	17	17	14	13		73
	AMCIS													18	27	51	38	44		178
	ECIS																	15		15
	PACIS																6	3		9
	HICSS																		7	7
	HCII																12		17	29
	CHI																1	1		2
	Total													30	44	78	77	87	24	340
Edited Books Chapters	AMIS-1																	21		21
	AMIS-2																	20		20
	Total																	41		41
Grand Total																				988

6.2 Most Prolific Authors and Institutions

For analyzing the most prolific authors and institutions, we decided to cluster the sources to reduce the total number of categories. Articles in academic journals, including the eight journals mentioned early and the six special issues sponsored by AIS SIGHCI, are considered as one cluster for analysis. The other cluster includes all conference meeting articles sponsored by AIS SIGHCI and the chapters appearing in the two edited books.

Research identifying prolific authors and institutions has used three methods: normal rank, adjusted rank, and straight rank (Chua et al. 2003; Romano et al. 2001). Normal rank is based on the assumption that all authors perform equal-value work, thus every co-author of an article receives one point. Adjusted rank assumes that the marginal contribution of an author is greater for works with fewer authors, thus each co-author of an article receives only a fraction of a point determined by the number of co-authors. For example, each of the two coauthors of a paper receives half a point, and each of the three co-authors of a paper receives one third point. Finally, straight rank is based on the belief that the first author is solely responsible for idea creation, thus is the only person receiving credit. It should be noted that the straight rank method is limited in representing the fact that many co-authors agree to be listed alphabetically in their publications. Thus all three ranking methods together should provide a clearer picture. Since not all authors can be displayed within the limited space in this paper, we only present the most prolific authors.

A total of 444 different authors from 240 institutions contributed to the 607 journal articles in the first cluster, and a total of 288 different authors (some overlap with the 444 authors in journals) from 158 institutions contributed to the 381 conference papers and book chapters in the second cluster. Tables 6 and 7 summarize the first cluster's authors and institutions; Table 8 and 9 summarizes the authors and institutions for the second cluster.

Table 6 The Most Prolific Authors of Journal Articles

Normal Rank	Author	Normal Count	Adjusted Rank	Author	Adjusted Count	Straight Rank	Author	Straight Count
1	Benbasat, Izak	27	1	Benbasat, Izak	11.58	1	Venkatesh, V.	11
2	Galletta, Dennis	15	2	Venkatesh, V.	7.58	2	Gefen, David	10
3*	Gefen, David	13	3	Gefen, David	7.33	3*	Agarwal, Ritu	7
3*	Venkatesh, V.	13	4	Galletta, Dennis	5.20	3*	Zhang, Ping	7
3*	Zhang, Ping	13	5	Agarwal, Ritu	5.17	4*	Dennis, Alan	5
4	Agarwal, Ritu	12	6	Zhang, Ping	5.00	4*	Doll, William	5
5	Todd, Peter	10	7	Todd, Peter	4.42	4*	Galletta, Dennis	5
6*	Davis, Fred	9	8	Vessey, Iris	4.37	4*	Pavlou, Paul	5
6*	Dennis, Alan	9	9	Bhattacherjee, Anol	4.00	5*	Alavi, Maryam	4
6*	Straub, Detmar	9	10	Straub, Detmar	3.92	5*	Bhattacherjee, Anol	4
6*	Tam, Kar-Yan	9	11	Davis, Fred	3.75	5*	Chin, Wynne	4
6*	Vessey, Iris	9	12	Dennis, Alan	3.67	5*	Kettinger, William	4
7	Pavlou, Paul	8	13	Tam, Kar-Yan	3.50	5*	Lim, Kai	4
8*	Chin, Wynne	7	14*	Alavi, Maryam	3.33	5*	Massey, Anne	4
8*	Guimaraes, Tor	7	14*	Pavlou, Paul	3.33	5*	Shaft, Teresa	4
8*	Valacich, Joseph	7	15*	Chau, Patrick	2.92	5*	Webster, Jane	4
8*	Wei, Kwok-Kee	7	15*	Chin, Wynne	2.92	5*	Yi, Mun	4
9*	Bhattacherjee, Anol	6	15*	Te'eni, Dov	2.92	6*	Barki, Henri	3
9*	Chau, Patrick	6	16*	Goodhue, Dale	2.83	6*	Chau, Patrick	3
9*	Cronan, Timothy	6	16*	Guimaraes, Tor	2.83	6*	Compeau, Deborah	3
9*	Doll, William	6	17	Higgins, Christopher	2.67	6*	Goodhue, Dale	3
9*	Grover, Varun	6	18*	Cronan, Timothy	2.50	6*	Hong, Weiyin	3
9*	Higgins, Christopher	6	18*	Shaft, Teresa	2.50	6*	Hunton, James	3
9*	Igbaria, Magid	6	18*	Szajna, Bernadette	2.50	6*	Igbaria, Magid	3
9*	Karahanna, Elena	6	18*	Webster, Jane	2.50	6*	Kim, Sung	3
9*	McCoy, Scott	6	19*	Valacich, Joseph	2.42	6*	Limayem, Moez	3
9*	Morris, Michael	6	19*	Wei, Kwok-Kee	2.42	6*	Mathieson, Kieran	3
9*	Speier, Cheri	6	20*	Karahanna, Elena	2.33	6*	McKeen, James	3
9*	Te'eni, Dov	6	20*	Limayem, Moez	2.33	6*	Nah, Fui-Hoon	3
9*	Watson, Richard	6	20*	Speier, Cheri	2.33	6*	Piccoli, Gabriele	3
9*	Yi, Mun	6				6*	Satzinger, John	3
						6*	Speier, Cheri	3
						6*	Stewart, Katherine	3
						6*	Szajna, Bernadette	3
						6*	Te'eni, Dov	3
						6*	Todd, Peter	3
						6*	Vessey, Iris	3

Note: * indicates ties, ordered alphabetically within the same rank.

Table 7 The Most Prolific Institutions of Journal Authors

Normal Rank	Institute	Normal Count	Adjusted Rank	Institute	Adjusted Count	Straight Rank	Institute	Straight Count
1	U. of British Columbia	48	1	U. of British Columbia	21.42	1	U. of Maryland	21
2*	Indiana U.	37	2	U. of Maryland	18.33	2	Indiana U.	14
2*	U. of Maryland	37	3	Indiana U.	15.13	3*	City U. of Hong Kong	13
3*	City U. of Hong Kong	32	4	U. of Pittsburgh	12.43	3*	Drexel U.	13
3*	U. of Pittsburgh	32	5	City U. of Hong Kong	11.92	3*	U. of British Columbia	13
4	U. of Arkansas	26	6	U. of Arkansas	11.42	4*	National U. of Singapore	11
5*	National U. of Singapore	23	7	Drexel U.	9.67	4*	Syracuse U.	11
5*	U. of Georgia	23	8	Georgia State U.	9.47	5	Florida State U.	10
6*	Georgia State U.	22	9	U. of Georgia	9.25	6*	U. of Pittsburgh	9
6*	U. of Minnesota	22	10	National U. of Singapore	8.92	6*	U. of South Carolina	9
7*	Carnegie Mellon U.	21	11	U. of Minnesota	8.39	7*	Case Western Reserve U.	8
7*	U. of South Carolina	21	12	U. of South Carolina	8.08	7*	Michigan State U.	8
8*	Drexel U.	19	13*	Carnegie Mellon U.	7.83	7*	Queen's U.	8
8*	Florida State U.	19	13*	Queen's U.	7.83	7*	U. of Arkansas	8
8*	Queen's U.	19	14	Syracuse U.	7.67	7*	U. of Calgary	8
8*	Syracuse U.	19	15	Florida State U.	7.58	7*	U. of South Florida	8
9*	Hong Kong U. of Sci & Tech	18	16	Michigan State U.	7.17	8*	Carnegie Mellon U.	7
9*	U. of Arizona	18	17	U. of South Florida	7.08	8*	Georgia State U.	7
10	Washington State U.	17	18	Hong Kong U. of Sci & Tech	7.03	8*	U. of Arizona	7
11	Michigan State U.	16	19	U. of Calgary	6.25	8*	U. of Georgia	7

Note: * indicates ties, ordered alphabetically within the same rank.

Table 8 The Most Prolific Authors of Conference and Book Articles								
Normal Rank	Author	Normal Count	Adjusted Rank	Author	Adjusted Count	Straight Rank	Author	Straight Count
1	Zhang, Ping	19	1	Zhang, Ping	9.67	1	Zhang, Ping	8
2	Nah, Fui-Hoon	17	2	Nah, Fui-Hoon	7.08	2*	Galletta, Dennis	6
3	Galletta, Dennis	11	3	Benbasat, Izak	5.17	2*	Nah, Fui-Hoon	6
4	Benbasat, Izak	9	4	Galletta, Dennis	4.08	2*	Sun, Heshan	6
5	Siau, Keng	8	5	Sun, Heshan	3.50	3*	Dishaw, Mark	4
6*	Chan, Susy	7	6	Te'eni, Dov	3.25	3*	Siau, Keng	4
6*	Fang, Xiaowen	7	7*	Lin, Shin-Jeng	3.00	4*	Chen, Xiaoyu	3
6*	McCoy, Scott	7	7*	Schneider, Christoph	3.00	4*	Fang, Xiaowen	3
6*	Teo, Hock-Hai	7	8	Siau, Keng	2.83	4*	Grandhi, Sukeshini	3
7*	Everard, Andrea	6	9	Everard, Andrea	2.75	4*	Lin, Shin-Jeng	3
7*	Hiltz, Starr	6	10	Shneiderman, Ben	2.70	4*	Lowry, Paul	3
7*	Jones, Quentin	6	11*	Jones, Quentin	2.50	4*	McCoy, Scott	3
7*	Kim, Jinwoo	6	11*	Strong, Diane	2.50	4*	Schneider, Christoph	3
7*	Polak, Peter	6	12	Teo, Hock-Hai	2.37	4*	Tan, Chuan-Hoo	3
7*	Sun, Heshan	6	13	Hiltz, Starr	2.08	4*	Te'eni, Dov	3
8*	Brzezinski, Jacek	5	14*	Chan, Hock-Chuan	2.03	4*	Wang, Xinwei	3
8*	Schneider, Christoph	5	14*	Kim, Jinwoo	2.03			
8*	Sheng, Hong	5	15*	Carroll, John	2.00			
8*	Strong, Diane	5	15*	Chung, Wingyan	2.00			
8*	Te'eni, Dov	5	15*	McCoy, Scott	2.00			
8*	Tremaine, Marilyn	5	15*	Xu, Yunjie	2.00			
9*	Carroll, John	4	16*	Chan, Susy	1.87			
9*	Chan, Hock-Chuan	4	16*	Fang, Xiaowen	1.87			
9*	Compeau, Deborah	4	17*	Tremaine, Marilyn	1.83			
9*	Dishaw, Mark	4	17*	Zahedi, Fatemeh Mariam	1.83			
9*	Loiacono, Eleanor	4	18	Polak, Peter	1.75			
9*	Lowry, Paul	4	19*	Lowry, Paul	1.67			
9*	Olfman, Lorne	4	19*	Roberts, Tom	1.67			
9*	Roberts, Tom	4	19*	Sheng, Hong	1.67			
9*	Ryan, Terry	4						
9*	Shneiderman, Ben	4						
9*	Tam, Kar-Yan	4						
9*	Tan, Chuan-Hoo	4						
9*	Turoff, Murray	4						
9*	Valacich, Joseph	4						
9*	Xu, Shuang	4						
9*	Zahedi, Fatemeh Mariam	4						

Note: * indicates ties, ordered alphabetically within the same rank.

Table 9 The Most Prolific Institutions of Conference and Book Authors								
Normal Rank	Institute	Normal Count	Adjusted Rank	Institute	Adjusted Count	Straight Rank	Institute	Straight Count
1	National U. of Singapore	51	1	National U. of Singapore	20.17	1	National U. of Singapore	24
2	NJIT	49	2	Syracuse U.	20.08	2	Syracuse U.	21
3	Syracuse U.	42	3	NJIT	17.25	3	U. of Nebraska-Lincoln	15
4	U. of Nebraska-Lincoln	40	4	U. of Nebraska-Lincoln	15.42	4	NJIT	14
5	DePaul U.	30	5	Washington State U.	12.25	5	Washington State U.	12
6	Washington State U.	29	6	U. of British Columbia	9.67	6	DePaul U.	10
7	Pennsylvania State U.	20	7	DePaul U.	9.50	7	U. of British Columbia	8
8*	U. of British Columbia	18	8	Pennsylvania State U.	8.00	8*	Pennsylvania State U.	6
8*	Yonsei U.	18	9	U. of Wisconsin-Milwaukee	6.67	8*	U. of Pittsburgh	6
9*	Georgia State U.	16	10	Yonsei U.	5.50	8*	U. of Wisconsin-Milwaukee	6
9*	WPI	16	11	WPI	5.45	9*	Claremont Graduate U.	5
10*	Claremont Graduate U.	13	12	U. of Maryland	5.40	9*	Georgia State U.	5
10*	U. of Western Ontario	13	13	City U. of Hong Kong	5.17	9*	U. of Maryland	5
10*	U. of Wisconsin-Milwaukee	13	14	Georgia State U.	5.00	9*	U. of Western Ontario	5
11*	City U. of Hong Kong	11	15	U. of Western Ontario	4.42	9*	WPI	5
11*	U. of Pittsburgh	11	16*	Claremont Graduate U.	4.25	9*	Yonsei U.	5
12*	McMaster U.	10	16*	U. of Delaware	4.25	10*	City U. of Hong Kong	4
12*	U. of Queensland	10	16*	U. of Queensland	4.25	10*	Drexel U.	4
13*	CICESE	9	17	Virginia Commonwealth U.	4.17	10*	George Washington U.	4
13*	Florida Atlantic U.	9				10*	LeMoyne College	4
13*	U. of Maryland	9				10*	U. of Delaware	4
						10*	U. of Memphis	4
						10*	U. of Wisconsin-Oshkosh	4
						10*	Virginia Commonwealth U.	4

Note: * indicates ties, ordered alphabetically within the same rank.

7 POTENTIAL FUTURE DIRECTIONS

A number of future directions can be drawn from different perspectives. Here we summarize some of the directions Zhang and Li suggested recently (Zhang et al. 2005c) on the future of the HCI sub-discipline.

7.1 Ad hoc Opportunistic Research

Banville and Landry predicted that MIS as a whole is unlikely to have long term, theoretically-oriented research due to its “vocational school” nature (Banville et al. 1989, p57). MIS is to be closely linked to practice and consulting (Banville et al. 1989). This makes opportunistic research a necessity for being on the cutting edge, competitive and reputation-enhancing for researchers (Zhang et al. 2005c).

7.2 Long Term Theoretically Oriented Research

On the other hand, researchers in the HCI sub-discipline have an option to actually focus on long term theoretical work. HCI research is inherently inclined toward human characteristics and human cognitive, affective, motivational, and behavioral factors. These human characteristics and factors do not change as frequently or quickly as technology or contexts, and some of them are transferable across contexts or IT artifacts. This gives HCI researchers the advantage of emphasizing the fundamental theoretical understandings of humans and their interaction with IT, and to apply or test such understandings in new IT development and IT use contexts to further enhance or enrich such understandings. In the history of HCI studies in MIS, we have seen tremendous efforts around Group Decision Support systems in the 80s and 90s. What did we learn from those studies that can be applied or tested in today’s virtual environments for decision making or other tasks? (Zhang et al. 2005c)

One advantage of studying fundamentals is that a research line can have longevity and survive the fast-paced changes of IT development and use contexts. For example, the interest in the effectiveness of table vs. graph presentations of information (DeSanctis 1984; Jarvenpaa 1989; Vessey 1991) seems never to die (Hong et al. 2004; Vessey 2006; Zhang 2000) and has survived many other “hot” topics that seem to emerge from time to time. And, one can predict that this line of research will continue to stay in the next several years. This is because we will continue to interact with various devices in various contexts and for various purposes. Owing to their cognitive limitations and fragmented attention, humans always have a need to receive information that is presented contextually in effective and efficient ways (Zhang et al. 2005c).

Related to long term theoretical work is the development of conceptual frameworks to understand the HCI sub-discipline as a whole. Currently, there are few studies focusing on providing frameworks and high-level overviews. This may have to do with what Teng and Galletta discovered more than a decade ago (Teng et al. 1991), that few MIS researchers appear to rely on research frameworks. Frameworks and models may have failed to gain sufficient attention in guiding and structuring research findings. However, good frameworks and models do enhance our understanding at a higher level, and thus advance the sub-discipline. With the increased importance of HCI in IT development and use, and more need for guiding practice, informative and parsimonious frameworks and models are much needed. Thus we predict potential for future growth in this area (Zhang et al. 2005c).

Theoretical work should also emphasize making informed design possible. That is, theoretical understandings of human interaction with technology should feed back to design of new and improved technologies. This should be done consciously both within the MIS discipline, and between MIS and other design oriented disciplines such as Computer Science, Engineering, and Design. Within the MIS discipline and the HCI sub-discipline, we have seen less interest in the design side of the interaction box in Figure 1. This can become a concern because theoretical understandings that do not feed design can eventually lose their relevance. MIS researchers realize this, and some efforts are in the wings to rejuvenate the interest in this important area, as evidenced by recent calls for a conference and an MISQ special issue on design science (Chatterjee 2005; Saunders 2005). Effort should be put into making HCI research in MIS known to other design disciplines, and to making the work of other disciplines known to MIS researchers, because each side has a great deal to contribute to ultimate IT products. Only a strong collaborative spirit and environment can enable informed designs to produce better IT that is aware of human, organizational, and societal needs. The AIS SIGHCI has done a number of activities to make this happen. But more effort is needed (Zhang et al. 2005c).

7.3 Implications for Research

By demonstrating the multifaceted view of the sub-discipline, this study outlines the ingredients of a typical HCI study. In addition to being used to assess a literature, the seven types of ingredients may be used by a scholar to design a research study, including dissertation research (Zhang et al. 2005c).

There can be some very interesting explorations that are triggered by this comprehensive description of the HCI sub-discipline. For instance, scholars may explore which research methods have been proven to be effective (or ineffective) in examining what phenomenon and which methods might lead to a fresh viewpoint and thus be worth exploring. For topical components to be included in a study, Figure 1 gives a high level overview and illustrates the potential relationships of the components. Finally, there are a number of very useful classification schemes that can guide future studies. For example, the classification of HCI research topics is very comprehensive and allows dialogues with other related disciplines such as design oriented disciplines. Each of the topics in the scheme can be further examined in terms of their current status and future directions. An existing classification framework for methods (Alavi et al. 1992) is expanded to reflect current research methods. The classification of contexts depicts the rich environments where MIS oriented HCI studies are conducted (Zhang et al. 2005c).

7.4 Implications for Education

This comprehensive description of the HCI sub-discipline can have implications for IS/MIS teaching and education, especially in preparing our doctoral students who are interested in broad HCI issues. In addition to studying the IS discipline, students might well familiarize themselves with knowledge and issues from several other disciplines, especially psychology and business, and be able to conduct research using a variety of research methods. The recent trend toward multiple topics within a study challenges our future scholars to prepare themselves accordingly for designing research studies. Frequently-used methods should be taken into consideration when doctoral program directors or curricula committees decide what methodological courses should be offered (Zhang et al. 2005c).

7.5 Implications for Practitioners

While designing IT in general and user interfaces in particular, practitioners are strongly encouraged to examine what happens after previous or similar products have been released and put into use in real contexts, as depicted by the two-stage Interaction arrow in Figure 1. Such an examination should provide abundant insight for the design of new products. The majority of

HCI studies in the MIS discipline are particularly interested in issues that occur in the use and impact stage, thus its research results are worth referencing by the practitioners. The topic classification scheme (Table 1) lists a variety of issues and concerns that can provide a HCI designer with broad perspectives pertinent to human interaction with technologies in various contexts (Zhang et al. 2005c).

8 SUMMARY AND CONCLUSION

HCI research in the MIS discipline has a long and an extensive history and is becoming more and more important. Many different disciplines contribute to the development and enrichment of HCI research within the MIS discipline. After reading this chapter, it may be evident that MIS scholars emphasize organizational and business tasks and concerns, consider broad organizational and social contexts in their studies, and draw implications that are meaningful to organizations and management (Zhang et al. 2005c). We hope that the chapter also demonstrates the richness of HCI research topics in the MIS discipline.

It may also become evident that the interest in HCI research in MIS will continue, just as Banker and Kauffman (2004) predicted and the current activities indicate. This has a lot to do with the recent advancement of technologies and relatively easy development of many sophisticated applications. More people are creating computer applications that affect many more people than ever before. User interfaces and human factors become the bottlenecks of acceptance and deployment of many promising technologies. In addition, being more productive and efficient are but two of several goals of technology users (Reinig et al. 1996; Te'eni 2001; Zhang et al. 2002). We want to enhance not only our work, but also our life outside work, our connection with friends and families, and our capability to be more creative (Shneiderman 2002). We should realize that we as users are much more diverse than ever before and our use context can be much different in many ways, thus IT has become universally accessible (Shneiderman 2000). Overall, human-centeredness is becoming more critical than ever before (Zhang et al. 2005a). Together with other aspects of MIS research, and with other disciplines related to HCI, we hope that HCI research in MIS will continue to grow and influence practice so that we make human experiences with technologies more pleasant, interesting, rewarding, and fulfilling, thus generating more business values for organizations and more social values for societies (Zhang et al. 2005c).

It is our hope that researchers in HCI will be better prepared for a possible period of extraordinary science. There seems to be no end to the development of exciting new technologies, and developers should be able to make them usable and useful to people in all walks of life. It is our responsibility to develop and impart to our students and/or colleagues the principles that enable and enrich these applications (Zhang et al. 2005c). We call for more research effort in this exciting sub-discipline of MIS.

9 APPENDIX A. CAREER STORIES

9.1 Ping Zhang

PING ZHANG had dreamed to be a psychologist so that she would figure out what people would be thinking about, why they would think in that way, and what they would do. This was of course when she was very young and was often intimidated by her surroundings, including people. Then she was recommended by her high school teachers to major in Computer Science because it was the hottest major at the time. Learning logic and writing efficient programs captured most of the fun during her college years in the computer science department at Peking University (PKU) in China. During the summer of 1984, she was vacationing in her hometown right after graduation and before starting her masters program at PKU. Then a telegram came: she was summoned to immediately go to Nanjing (a major city that would take about 20 hours train ride or two hours air time to get from Beijing where PKU is) to be part of a project. Later she learned that this was the very first management information system ever developed in China. At the time, the Chinese government wanted to explore the possibility of applying computer technology to solve business and managerial problems. There were no such commercial systems yet. The government sponsored the project, and a model organization, Nanjing Automobile Factory (the third largest automobile factory in China) was chosen to be the organization to receive the application. The system (named IBMIS) had to be specifically developed for this organization and was intended to be a comprehensive system that covered most parts of the organization's management and operation. Interestingly, few professors knew how to develop such an application, and none of the development team members had any knowledge about management, organizations and their strategies, operations, or other related aspects. One professor just finished visiting the US and brought home a little blue colored book called Software Engineering. This became our cookbook for the project. In fact, now thinking back, the book was not good at all! It is no wonder because the whole field was still developing in the mid 80s.

Ping spent most of the next two years with her peers in Nanjing developing the system and doing distance learning on her courses in the masters program. Some of the younger students attended the project during the summer months. The professors would come during critical stages and milestone moments (such as evaluations). The two years were filled with excitement, frustration, struggle, fun, more frustration, more struggle, fulfillment, and most importantly to Ping, deep thinking. Among all the challenges and frustrations they faced, very typical to all the reported challenges and issues in the MIS literature, what was most eye opening to Ping was the realization that computer systems must be designed with its potential users in mind. The end users at the factory struggled very much to understand and be able to use the system. Training alone seemed very limited and did not solve the problems. This made Ping realize that regardless how advanced computer technology can be, the user interface, the layer between the system and the user, is the bottle neck. Designers need to put a lot of thought into the design of the system so that it not only has the required functionality (something the team tried extremely hard to achieve during the develop process), but also must have certain quality to make it usable. Otherwise, all is a waste.

IBMIS eventually was finished, released, celebrated, and put in real use in the organization. All team members were left and went back to PKU to finish their Masters theses and eventually graduated. Ping then became a junior faculty at PKU. Naturally, she became the consultant for supervising the system's execution and maintenance, helping the factory train their staff for managerial issues and system use, and doing maintenance herself. During this period, small or big problems with the system or its use would find their ways to Ping. Many times she would have to fly to Nanjing and sometimes it would only take a few minutes of her time to fix a problem. Many lessons and experiences learned from this first project were extremely beneficial for the second and third projects she was involved. The second project was for Beijing Television Factory, and the third was for Beijing Insurance Company. Both of them were located in Beijing, taking less than one hour bicycle riding to get to. Both involved users from the very beginning of the development life cycle. Among many new experiences gained and new observations made, Ping became greatly interested in MIS and the user interface issues of information system development.

Doing a PhD in MIS became very clear to Ping to be the next step in her career development. In December 1989, she came to the US. In 1995, she received her PhD degree in MIS from the University of Texas at Austin. In her doctoral dissertation entitled "Visualization for Decision Making Support," she attempted to address the early realization of the user interface bottle neck issues, and additional observations and thoughts from those projects. During the research, she was fascinated by this field called Human-Computer Interaction. The childhood dream of being a psychologist is partially realized by vast knowledge in cognitive psychology, and the dream seemed continuously finding its way to meet the strong curiosity. She found many interesting perspectives and ideas that can be used to address her concerns, yet she also developed more questions and observations. With her research interest rooted in the information systems for real world organizations (her dissertation was targeted for an IBM Assembly Line in Austin), she found the traditional HCI focus less satisfying. She believed that there are unique considerations in the MIS field in addressing human factor issues that are not well-realized by the traditional HCI folks. Yet few scholars have articulated these unique considerations. Such differences are in some ways similar to those between computer science and MIS: one is more concerned with developing an efficient program to meet the given requirement; while the other is more concern with defining and justifying the requirements. The abstraction level of focus, the level of analysis, and the role of context are so dauntingly different between traditional HCI research and the type of HCI research within the MIS field.

In addition, the more she learned about the MIS field, the more dissatisfied she became because research on human factors and human interaction with technology was not considered as important as many other MIS topics thus was not the mainstream of MIS. By her personal experience, this should not be the case. Organizational issues, managerial issues, economic issues are important, so are the issues concerning users and other related people (e.g., customers, system developers). After all, organizations are made of people, and people make things happen or not happen. The bottle neck issue she realized early should be realized by more people. The broader issues concerning human interacting with technology during the entire technology lifecycle (both development and use stages) should be addressed as an important research area in the MIS field.

In 2001, Ping and Fiona Nah (University of Nebraska Lincoln), with the support from a good number of senior scholars, formed the AIS special interest group on HCI. It is a forum for scholars of similar mind and interest to exchange ideas and support each other. It became the largest SIG within AIS. Over the last several years, it successfully held meetings at all major AIS conferences, collaborated with other associations (such as ACM SIGCHI, HCI International), and sponsored top MIS journal special issues and top HCI journal special issues. HCI material has also been added to the AIS/ACM sponsored model curriculum for MIS. Gradually, HCI is now in the spotlight of the MIS field and is being acknowledged as one of the important MIS areas.

As Ping continuously explores the various issues in HCI within the MIS context, she realizes that her childhood dream is being fulfilled to the fullest extend. It is not the title of an official psychologist that satisfies her, it is the real action of figuring out what people would be thinking about, why they would think in that way, and what they would do. All the explorations are related to human interacting with technology within contexts. The early interest in the cognitive side continues, but more recently, she is less satisfied with the cognitive paradigm. She is taking a holistic view to study human interaction with technology that includes cognition, affect and emotion, motivation, and behavior. It is not for coping anxiety as her dream was intended to alleviate, but for helping the scholarly and practice community to build better understanding of humans and the ways they interact with technology, thus to build better technology that are human-centered, and to eventually let everyone have a better life. The detour of being trained as a computer scientist is so very necessary that it provides the substance and becomes a stepping stone for where Ping is intellectually now.

9.2 Dennis Galletta

DENNIS F. GALLETTA began his academic career with strong interest in teaching and an acute sense that he wanted work to be fun. As a young auditor, he was very sad to hear, on frequent occasions, office workers on Monday say out loud "Four more days until Friday!" It stuck him that they were wishing away fully five-sevenths of their lives. He discovered he did not enjoy doing an audit as much as teaching junior accountants how to do the audit. After two years, he decided that he should pursue teaching on a full-time basis.

After being told by several institutions that an MBA-CPA was not enough for teaching, and that it was crucial to have a PhD to pursue this interest in teaching, he reluctantly applied to doctoral programs. He began studying Accounting part-time at one school which shall remain nameless, and was told that most of the Accounting faculty had left the school so he was to begin taking courses in his minor, MIS. In one particular MIS course, the faculty member did a great job making the field very interesting. Dennis inquired about a double-major, and was sent to discuss this with the Dean. The Dean wisely asked what Dennis would really prefer if he could only choose one major, and on the spot he realized that MIS was going to be his major. He went back to class and listened to his professor repeatedly describe the University of Minnesota as a desirable place to study MIS, so Dennis filled out an application to the University of Minnesota and was accepted.

In his application he was required to state possible topics he would like to study in his research. Not having much interest in research, he stated "Small Business Systems." Once at Minnesota, he began right away as a research assistant to Professor J. David Naumann. While they were on the road on the way back from data collection, he mentioned to Prof. Naumann that it is a shame how large universities do not care about teaching, evidenced by the common occurrence of teaching award winners failing to get tenure. He had experienced some excellent teaching from Prof. Naumann, so he expected Prof. Naumann to agree. Instead, Prof. Naumann informed him that a doctoral-granting institution MUST do research, and without it, they had no business granting the PhD. This was the first time he realized the importance of research. He also met some wonderful fellow students at Minnesota, who showed Dennis the fascinating world of research. Every time he would read a paper by fellow student Bob Leitheiser, for example, he was in awe of Bob's deep thought process and clear writing. He began to want to be able to do the same thing, but did not know where he would place his focus. He did know, however, that "Small Business Information Systems" was probably not going to match the research program at Minnesota, and, it was a bit too broad to be a viable topic for his work.

At one of the weekly Minnesota research workshops, a faculty member had the students read an article called "Etude and the Folklore of User Interface Design" (Good 1981). He read this paper more closely than any prior workshop papers, and was fascinated. He remembers his reaction vividly: "Are people actually ALLOWED to do research that is this interesting?" He immediately decided that understanding more about the user was going to be his passion. Later, he would discover that this was called "Human-Computer Interaction." He combined his passion for teaching and learning with his interest in the user by focusing intently on HCI, dropped his minor in Accounting, and replaced it with a minor in Psychology, which fortunately was a major strength at Minnesota.

His most influential Psychology professor was Ellen Berscheid, who fascinated the class with stories of her experiments. He also found intense interest in Social Psychology, and had nearly the same "Are we allowed to study something so interesting?" reaction that he did when he first read the Etude article. So he combined several types of Psychology courses in his minor, chose his thesis topic very early in his program, and decided that he wanted to spend his working life doing experiments.

When he arrived at the University of Pittsburgh's business school in 1985, he found that he was at a major research university. His colleague Bill King provided several opportunities, most notably the earliest one: becoming the ICIS Doctoral Consortium local arrangements chair in 1987. Working with Henry Lucas, screening PhD dissertations, and attending ICIS Executive Committee meetings was extremely rewarding work that made research even more interesting and exciting. He was in awe of the "big players" in the field.

In the early years, however, he found that it was difficult to focus on research with a teaching schedule that involved all different courses—no repeats. He then decided to try and help the situation by ironically proposing yet another new course: a PhD seminar in HCI. By the early 1990s, he kicked off that course by requiring the class to do an experiment. The class agreed to study spreadsheet errors, and the outcome of the study was accepted at *Accounting, Management, and Information Technologies*, the journal that is now called *Information and Organization.* A follow-up was undertaken by the following year's seminar class, and it was accepted by the Hawaii International Conference on Systems Sciences, then fast-tracked to the *Journal of MIS.* The outcomes of further classes provided a number of other successes, at outlets such as *Information Systems Research, Communications of the ACM, Journal of AIS,* ICIS, and AMCIS. There were also some news stories published about those studies, most notably on the "word crawl" on CNN television and articles in the Wall Street Journal (front page), *Business Week, Computerworld,* and several newspapers.

Over the years, his direct experiences as student and faculty at five institutions and indirect experiences through his graduates showed that substantial rewards come with research, but few come with teaching. As the articles began to be accepted with increasing frequency and news media attention occasionally provided a spotlight, he found the research rewards to be more striking and attractive as the years progressed, and began to lose touch with his teaching. At one point, he harbored many ill feelings about having to teach and wanted to spend more and more time with research. He remembers (and now regrets) telling a fellow academic “teaching is poison.” Publishing with his PhD students became his favorite work activity, and he resented having to put aside this work to go into the classroom. As many of those papers began to gain acceptance on an accelerating basis, he gained teaching load reductions but his teaching evaluations began to spiral downward.

With a new opportunity to teach three sections of the same course, and enrollments in MIS beginning to flag, he took new interest in teaching. Over the past three years, his evaluations have increased substantially to such an extent that they are no longer embarrassing. Working with more graduates than ever, he is finding that there are not enough hours in the day and it is becoming difficult to be as responsive as he had in the past.

Experiments are still his passion, and anything that addresses user attitudes, behavior, and performance still seems to be too much fun to be considered work. He still loves planning for and executing new studies. He enjoys walking through a research lab with students busily working on an experimental task. He enjoys Mondays just as much as Saturdays; you will not catch him wishing away any part of his life.

9.3 Na (Lina) Li

NA (LINA) LI has been enjoying reading and writing since her childhood. So as a child, she planned two careers for herself. On the one hand, she wanted to be a librarian so that she would have the opportunity to read a lot of books, for free! On the other hand, she also dreamed about becoming a writer or reporter simply because she loved writing and wanted to present the reality with her pen. (At that time, she didn’t know that she could write with a computer instead of a pen years later.☺)

However, she didn’t major in any of these two areas in college because she was in the science track in high school. Only those in the arts track were allowed to take exams for those majors. She eventually chose to major in Information Science and Technology because she vaguely felt that information was becoming more and more important in the modern society. Her intuition has been proved to be right later. In 1992, she entered the Department of Information Management at Peking University. She took a number of courses in computer, programming, information system analysis, information system design, and database management systems. Interestingly, the department also offered librarian courses. She took them too. As an undergraduate student, therefore, she had been learning about information storage, retrieval, transfer, and management both in the digital world and in the traditional library setting. She also minored in law for her own interests.

Upon receiving her Bachelor degree, Lina was automatically admitted to the masters program in Information Science at Peking University for her academic excellence. But at that time, she had doubt in pursuing a higher degree. So she put off the opportunity and found a reporter/editor position in a newspaper in Dalian, a seaside city. This job earned her some money, a better taste of fashion (Dalian is a fashion city), rich experience in writing, editing, and picking misused characters and typographical errors. Despite those, she found herself missing the free and exciting atmosphere in college so much. One year later, she returned to Peking University to pursue the master degree.

In the masters program, Lina was actively involved in an enterprise competitive intelligence systems project sponsored by the National Natural Science Foundation of China. She coauthored three journal papers and one book in this project. She also taught courses in MIS and Office Automation in Beijing Management Software College and Peking University. These activities along with other research work and graduate courses gained her much deeper understanding of MIS and research in information studies. She realized that she truly enjoyed research and teaching. So she modified her career plan. She wanted to be a professor. Hence getting a doctoral degree was necessary. This time, she decided to go beyond Peking University and China to see how other researchers conduct academic activities in the world. She applied and got admitted to the doctoral program in Information Transfer (the program name has been changed to "Information Science and Technology" now) in the School of Information Studies at Syracuse University.

In her first semester in the doctoral program, Lina took a seminar in Human-Computer Interaction taught by Prof. Ping Zhang. A broad range of HCI issues were explored in the seminar. This opened a window for her to understand information systems from a user's perspective. She realized that no matter how complex or simple an information system (IS) or technology (IT) is, no matter how hard or easy it is to design and implement, it ought to be used for human therefore should satisfy human needs and complement human weaknesses. It is HCI researchers' work to enhance our understanding of the interaction between people and technology so that IT/IS can better serve human. To know more about people, she then took courses in motivations and user behaviors. She also took courses in research methodology (both qualitative and quantitative) and statistics to sharpen her research skills.

In the doctoral program, Lina has been dedicated her research efforts to the broadly defined HCI field in scientific, educational, organizational, and business settings. She has been studying IS evaluation, IS adoption, users' emotional reactions to IS, and cyberinfrastructure-supported distributed groups in various contexts. Some of the outcomes of these studies have been published as referred journal papers, book chapters, and conference proceedings.

Currently Lina is working on her dissertation, "Toward E-Commerce Websites Evaluation and Use: A Balanced View". Rooted in psychological theories, her dissertation proposes a concept named initial perception of affective quality (initial PAQ) to capture a user's immediate affective reaction toward an e-commerce website. A research model is proposed to theorize that initial PAQ can be induced by certain features of a website (affective cues); and that initial PAQ can significantly influence a user's attitude toward and intention of using the website directly or mediated by perceived usefulness, perceived ease of use, and perceived enjoyment. Empirically, a list of website affective cues has been identified through interviews. An instrument to measure initial PAQ is being developed and validated following classical instrument development procedures. The proposed model will be tested in a field study. The dissertation offers a novel angle to understand customer evaluation and use of business to customer e-commerce websites.

Besides research activities, Lina has been actively serving the academic community as newsletter editor for the AIS SIGHCI. She organizes, edits, prints, and publishes two issues of the newsletter every year (to read or download the newsletters, please visit http://sigs.aisnet.org/sighci/newsletters/index.html). She is very happy to see that the newsletter has been continuously contributing to the SIG development by recording and forecasting its important events, highlighting achievements and news from members, presenting interesting research essays, teaching cases, book reviews and industry voices, and promoting outreaching.

Lina expects to continue her research on how information and information systems can better serve human as libraries serve readers. She is exciting about discovering, interpreting, and predicting the reality and solving real world problems through her research. Writing is part of her routine work. In this sense, she is expanding her childhood dreams.

9.4 Heshan Sun

HESHAN SUN has been enthusiastic about explorations, ever since his childhood. Still remembering that in the elementary school, when he was asked the question “what do you want to be when you grow up?” he gave a very popular answer: being a scientist, like many others did. But he really meant it! Being a person who can do something interesting and benefiting others via in-depth explorations is always his dream. This dream has led him go through middle school, high school, college, and graduate school to where he is: a PhD candidate who is ready to join the broad community of information systems researchers.

His career story began in college, where he thought about his career very seriously for the first time in his life, although he had been dreaming of being a mathematician, a physicist or an earth scientist. Majoring in International Economy and Trade in college, he was very interested in economics and the application of economic theories to understand human behaviors (mostly purchasing behavior). Thus, he decided to narrow down his interest to e-commerce, an area combining information technology and human behavior in business environments. That was the first time he touched the concept of information technology, although he had been enjoying programming courses for years.

After being admitted to Peking University, the Department of Information Management as a graduate student, he continued his interest in e-commerce under Prof. Jianlong Chen’s supervision and made up his mind to pursue a doctoral degree in US to fulfill his strong curiosity in this area. To get some first-hand experience of e-commerce practice, he joined a China-based e-commerce consulting firm as a part-time consultant, which later became one of the largest and most influential e-commerce consulting firms in China. He learned a lot from that job as an Analyst, followed by a fast promotion to the Executive Analyst and Project Manager. When doing the consulting projects, he understood more and more the importance of human behavior in e-commerce practices. After all, information technologies are designed by people and for people and it is the end users who define the “cold” technologies. That job also brought him stronger English capabilities, better interpersonal skills, and a decent salary, which is still high even in today’s Beijing. However, he quitted that job without any hesitation to pursue his dream of exploring the real world.

After successfully finishing GRE, TOEFL, and the boring and expensive application process, he received offers from three prestigious U.S. universities. He finally chose Syracuse University because the faculty here seemed to have more diverse research interests and thus he could be more flexible in choosing what he wanted to study.

During his first year in the PhD program (2002-2003), Heshan was lucky to know Prof. Ping Zhang, a well-known Human-Computer Interaction researcher. After finishing two research practica with her, Heshan found human-computer interaction (HCI) very interesting. It had all necessary components that attracted him for a long time: human behavior, information technology, and business. His prior interest in e-commerce and economics fell into the broad HCI area very well, at least from his point of view. His first attempt in this area ended up with two conference publications (AMCIS 2003 and HICSS 2004), which later were developed into journal publications. This little “success” was really encouraging at that time and helped him make decision to devote to this area.

Since then, he has been actively participating in the Association for Information Systems (AIS), especially its Special Interest Group on Human-Computer Interaction (SIGHCI). In this “academic home”, he met many wonderful researchers (also good people). Participating in this community helps him continue his research in HCI, e-commerce, and HCI related economics more efficiently and productively and also keeps him on the frontier of HCI research.

Now, he is in the fifth year of his doctoral study and really enjoys what he is doing. Looking backward, Heshan has been very lucky by always having good persons around him. These persons include his family, friends, advisors, colleagues, classmates, and collaborators, without whose help, Heshan could not overcome the difficulties he met and be where he is. Their support, encouragements, and advises are invaluable to Heshan’s still young career. He owns a lot of gratitude to them.

10 APPENDIX B. KEY TERMS

Human-Computer Interaction (HCI) studies in MIS are "concerned with the ways humans interact with information, technologies, and tasks, especially in business, managerial, organizational, and cultural contexts" (Zhang et al. 2002).

Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and other methods to design in order to optimize human well-being and overall system performance. (Provided by International Ergonomics Association, http://www.iea.cc/).

User (of information systems): users of information systems have been traditionally considered as the end-users at the individual level. Recently, researchers tend to consider that there is "an ongoing transformation of computer user from an individual to an interacting group, from a group of people to an entire firm or other organization, and from an organization to a diffuse community with dynamic membership and purpose." (DeSanctis 2006)

User-centered design to describe design based on the needs of the user, leaving aside what he considers to be secondary issues like aesthetics. User-centered design involves simplifying the structure of tasks, making things visible, getting the mapping right, exploiting the powers of constraint, and designing for error (Norman 1988).

Human-centered system development life cycle (HCSDLC): SDLC is "a methodology used to structure the process of develop, maintain, and replace IS." Human-centered systems development includes both basic user-centered systems functionalities and encompassing human-centered human-computer interaction development. It is based on the modern system design life circle (SDLC) but integrates the human factors and addresses individual and organizational needs. The HCSDLC methodology emphasizes the systematic and theory-based application and operationalization of human-centeredness during all stages of SDLC. (Te'eni et al. 2007; Zhang et al. 2005b)

Attitude: Attitude is individual's positive or negative feelings about performing a behavior is comprised of beliefs about the consequences of performing the behavior multiplied by his or her valuation of these consequences (Ajzen et al. 1980; Fishbein et al. 1975).

Perception. Perception is the awareness of the elements of environment through physical sensation. (Merriam-Webster's Dictionary)

Beliefs: a state or habit of mind in which trust or confidence is placed in some person or thing. (Merriam-Webster's Dictionary)

Behavioral belief: A behavioral belief is the subjective probability that the behavior will produce a given outcome. (Ajzen 1991)

Behavior: behavior is the manifest, observable response in a given situation with respect to a given target. (Ajzen 1991)

Trust: Trust refers to "the willingness to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control the other party" (Mayer et al. 1995).

Cognition. The term "cognition" refers to all processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used. It is concerned with these processes even when they operate in the absence of relevant stimulation, as in images and hallucinations. Given such a sweeping definition, it is apparent that cognition is involved in everything a human being might possibly do; that every psychological phenomenon is a cognitive phenomenon. (Neisser 1967)

Cognitive fit theory. The theory proposes that the correspondence between task and information presentation format leads to superior task performance for individual users. According to Vessey (1991) "matching representation to tasks leads to the use of similar ... problem-solving processes, and hence the formulation of a consistent mental representation. There will be no need to transform the mental representation . . . to extract information from the problem representation and to solve the problem. Hence, problem solving with cognitive fit leads to effective and efficient problem-solving performance." (Vessey 1991; Vessey et al. 1991)

Affect: Affect is conceived as an umbrella for a set of more specific mental processes including emotions, moods, and attitudes. (Bagozzi et al. 1999)

Emotion: there is little convergence on emotion's definition. Generally, it is an affective state directed toward a specific object or objects. (Forgas 1995; Russell 2003 p.149).

Motivation refers to the initiation, direction, intensity and persistence of behavior (Cacioppo et al. 1989). Motivation can be intrinsic or extrinsic. Extrinsic motivation refers to "the performance of an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself" (1992). In contrast, "intrinsic motivation refers to the performance of an activity for no apparent reinforcement other than the process of performing the activity per se". (Davis et al. 1992)

AIS SIGHCI: AIS SIGHCI is the Special Interest Group on Human-Computer Interaction that is affiliated with the Association for Information Systems (AIS). Ping Zhang and Fiona Fui-Hoon Nah prepared a proposal that was approved by the AIS council in Spring 2001. SIGHCI then became one of the first six officially sanctioned SIGs announced in ISWORLD in July 2001. (http://sigs.aisnet.org/SIGHCI/)

ACM SIGCHI: the ACM's Special Interest Group on Computer-Human Interaction, brings together people working on the design, evaluation, implementation, and study of interactive computing systems for human use. ACM SIGCHI provides an international, interdisciplinary forum for the exchange of ideas about the field of human-computer interaction (HCI). (provided by ACM SIGHCI, http://sigchi.org/).

Human Factors and Ergonomics Society (HFES): HFES is a society of human factors and ergonomics researchers and professional to "promote the discovery and exchange of knowledge concerning the characteristics of human beings that are applicable to the design of systems and devices of all kinds." HFES was founded in 1957. (http://www.hfes.org)

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