# Human–computer interaction and management information systems: foundations

CHAPTER 1

# FOUNDATIONS OF HUMAN-COMPUTER INTERACTION IN MANAGEMENT INFORMATION SYSTEMS

## An Introduction

PING ZHANG AND DENNIS GALLETTA

***Abstract:*** *We begin this introduction to this first of two complementary volumes by providing a general context for both volumes and by giving a brief historical view of management information systems (MIS) scholars' interest in human-computer interaction (HCI) research. We then integrate various HCI issues into an overarching framework that can encompass broad HCI concerns from multiple disciplines. After presenting the classification of HCI topics that guides our organization of the collection, we preview the papers collected in this volume, together with a variety of additional ideas, evidence, and insights. Topics in this volume include different disciplines' perspectives on HCI; our evolving understanding of who users are; theoretical understanding of how to design systems to support humans; theories and models of the cognitive and behavioral aspects of information technology (IT) use; and fundamental understanding of the affective, aesthetic, value sensitive, and social aspects of HCI. Overall, this introduction brings together many literatures and highlights key points in the research's evolution; it thus augments the collected papers to provide readers with a rich picture of HCI research's foundations.*

***Keywords:*** *Human-Computer Interaction, MIS, Disciplinary Perspective, Computer Users, Design Theory, Fit, Belief and Behavior, Affect, Aesthetics, Socialization, Technology Acceptance Model (TAM), Computer-Human Interaction (CHI), Human Factors, Ergonomics, MIS History*

### INTRODUCTION

This book is the first of two complementary volumes that present scholarly works from a variety of leading thinkers in HCI, including those who have ties to the field of management information systems (MIS). This volume (*AMIS* Vol. 5) covers concepts, theories, and models, and general issues of human-computer interaction studies relevant to MIS. Topics in this volume include interdisciplinary perspectives on HCI; our evolving understanding of who users are; theoretical understanding of how to design systems to support humans; theories and models of the cognitive and behavioral aspects of information technology (IT) use; and fundamental understanding of the affective, aesthetic, value sensitive, and social aspects of HCI. The second volume (*AMIS* Vol. 6) covers applications, special case studies, and HCI studies in specific contexts. Topics in the second volume include HCI studies in the areas of electronic commerce and the Web; HCI studies for collaboration support; issues relating to culture and globalization; specific HCI issues in IT learning and training; theoretical understandings of the system development processes; HCI issues in health care and health informatics; and, finally, methodological concerns in HCI research. Each volume concludes with thoughtful reflections by well-known authors. In this volume, Fred Davis discusses the connection between the technology acceptance model (TAM) and HCI, and Jonathan Grudin reflects on the historical development of three closely related disciplines. In the second volume, an early, influential, and visible debate on soft versus hard science in HCI studies is revisited and updated from the perspective of one of the original debaters, John Carroll.

We begin this introduction by providing a general context for both volumes, along with a brief historical view of MIS scholars' interest in HCI research. Then we integrate various HCI issues into an overarching framework introduced by Zhang and Li (2005) that can encompass broad HCI concerns from multiple disciplines. We present the classification of HCI topics that guides the organization of this volume; we then preview the papers collected in this volume. We integrate this preview with a variety of additional ideas, evidence, and insights. Overall, we intend this introduction to augment the collected papers in this volume, thus providing readers with a rich picture of the foundations of HCI research.

## A HISTORICAL VIEW OF HCI IN MIS RESEARCH

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 and Myers, 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 and Heinen, 1977), have pointed out the need to attend to user behavior in information technology research (Gerlach and Kuo, 1991), and have attempted to tie human factors, usability, and HCI to the systems development life cycle (Hefley et al., 1995; Mantei and Teorey, 1989; Zhang et al., 2005). Also extensively studied are IS development theories and methodologies (Baskerville and Pries-Heje, 2004; Hirschheim and Klein, 1989), collaborative work and computer-mediated communication (Poole et al., 1991; Reinig et al., 1996; Yoo and Alavi, 2001; Zigurs et al., 1999), representations of information for supporting managerial tasks (Jarvenpaa, 1989; Vessey, 1994; Zhang, 1998), and computer training (Bostrom, 1990; Sein and Bostrom, 1989; Webster and Martocchio, 1995).

Culnan (1986) identified nine factors or subfields in early MIS publications (1972–82). Of these nine, three relate to issues in humans interacting with computers. In a second study of a later period of MIS publications (1980–85), Culnan (1987) found the field to be composed of five areas of study, of which the second, individual (micro) approach to MIS design and use is closely related to human-computer interaction. Vessey and colleagues also considered HCI as a research area when studying the diversity of the MIS discipline, although they considered HCI to be more at the user interface level, and thus placed it within the systems/software concepts category (Vessey et al., 2002). After surveying fifty years of MIS publications in the *Management Science* journal, Banker and Kauffman identified HCI as one of five main research streams in MIS and predicted that interest in HCI research will resurge (Banker and Kauffman, 2004).

These longtime interests in the MIS field have touched upon the fundamental issues of human interaction with technologies, or, even more generally, the broad area of human factors. 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, 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* orientation (Zhang et al., 2004).

As MIS scholars' interest in HCI has increased in recent years, HCI has gained great importance in the MIS discipline. There is evidence to support these assertions. For example, a large number of MIS scholars report their interest in researching HCI-related issues and in teaching HCI-related topics (Zhang et al., 2002). HCI courses are offered in many MIS programs (Carey et al., 2004; Chan et al., 2003; Kutzschan and Webster, 2005). HCI is considered an important topic in the most recent model curriculum for masters in information systems majors (Gorgone et al., 2005). Both the total number and the percentage of HCI studies published in primary MIS journals have increased over the recent years (Zhang and Li, 2005). Major MIS conferences—such as the International Conference on Information Systems (ICIS), the Hawaii International Conference on System Science (HICSS), the Americas Conferences on Information Systems (AMCIS), the Pacific Asia Conference on Information Systems (PACIS), and the European Conference on Information Systems (ECIS)—have been publishing HCI studies. Most of them have recently included specific HCI tracks (ICIS started in 2004, AMCIS in 2002, and PACIS in 2005; ECIS in 2006, and HICSS in 2007). A workshop devoted to HCI research in the MIS discipline, the pre-ICIS Annual Workshop on HCI Research in MIS, started in 2002. Several special issues on HCI research in MIS have appeared or are appearing in top MIS and HCI journals since 2003. Finally, an official organization of HCI in MIS, the AIS Special Interest Group on HCI (SIGHCI), was established in 2001 (Zhang, 2004).

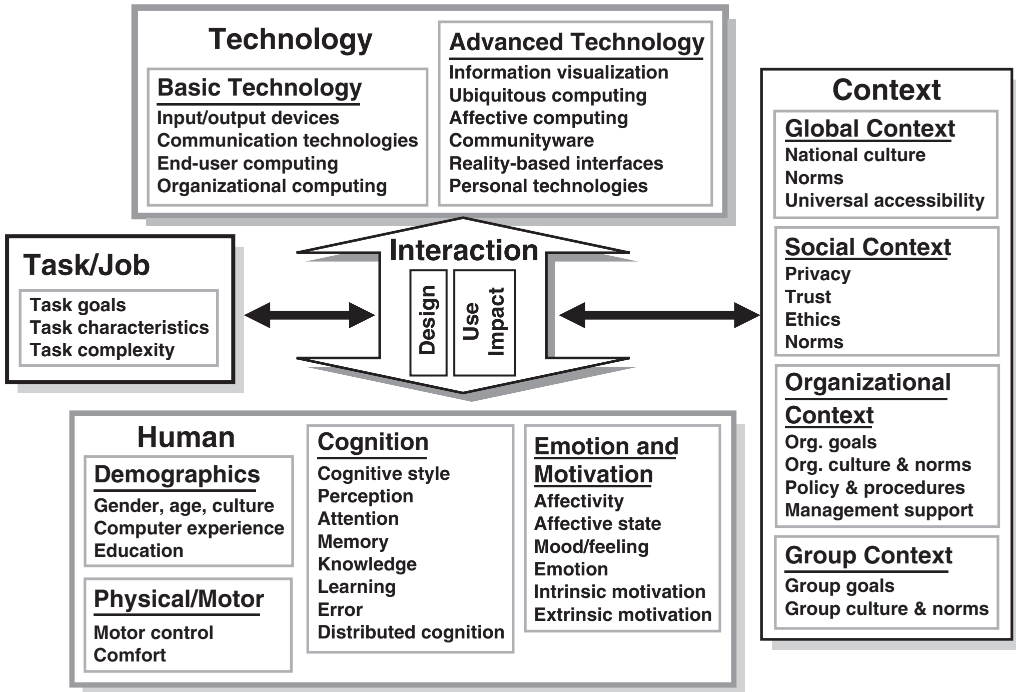
## BOUNDING HCI

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. Over many years, the MIS discipline has gone through the process of clarifying its boundary. The same process has been occurring in the HCI sub-discipline (Zhang and Li, 2005). Based on the definition of HCI research in MIS given above (Zhang et al., 2002), Figure 1.1 represents a 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.

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 1.1 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 1.1 indicates one way of examining technological

Figure 1.1 **An Overview of Broad HCI Issues**




*Source:* Adapted and expanded from Zhang and Li (2005).

issues when studying HCI. Many of these technological issues have interested researchers in the HCI field for a long time (Shneiderman, 1987; Shneiderman and Plaisant, 2005). The figure was developed from the perspective of technology types often found in technical fields such as computer science or studies associated with the computer-human interaction (CHI) community.

The Interaction 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 Interaction in Figure 1.1 is concerned with actual IT use in real contexts and its impact on users, organizations, and societies. Design studies can be 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 other 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; Goodhue, 1998; Goodhue, 1995; Goodhue and Thompson, 1995), and user technology acceptance (e.g., Davis, 1989; Venkatesh and Davis, 2000; Venkatesh et al., 2003) all fall into 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 goals. 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.

Based on a literature assessment of HCI studies in seven prime MIS journals between 1990 and 2002, Zhang and Li (2005) further provided a classification of the HCI subject topics. Table 1.1 adapts this classification, adding descriptions and examples.

The organization of the collected papers for this volume is guided by the classification in Table 1.1. Although the papers in this volume do not cover all the topics listed in Table 1.1, due to limited space and the unavailability of prospective researchers, the scholars who contribute to this collection do provide a rich understanding of state-of-the-art HCI issues. Next, we discuss the topical themes covered in this volume and preview the collected papers within the broad HCI framework provided in Figure 1.1. Readers interested in discussions of other topics can read (Zhang and Li 2005) to find out what is demonstrated by the MIS literature on those topics.

## FOUNDATIONS OF HCI RESEARCH

### Disciplinary Perspectives and the Users

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” (in this volume). 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” (in the second volume). The key to success is to keep an open-minded attitude and to facilitate dialogues among various related disciplines, thus making the best of each discipline’s unique perspectives and strengths. With this in mind, we collected papers from well-known authors that reflect several HCI-related disciplines and their relationships with each other. The contributors reveal different disciplinary views across the entirety of the two volumes. In this section, we highlight two specific papers on this subject.

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 share this strong interest in information; these include MIS, HCI, and information science. 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 potential for collaboration. Dillon provides just this perspective. He examines how different disciplines treat

Table 1.1

**HCI Topic Classification**

| ID | | Category | Description and Examples |
|---|---|---|---|
| A | | IT development | Concerned with issues that occur during 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 roles of users and IT personnel |
| | A2 | User-analyst interaction | User involvement in analysis, user participation, user-analyst differences, 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 mix |
| | A5 | User interface design and development | Interface metaphors, information presentations, multimedia |
| | A6 | User interface evaluation | Instrumental usability (e.g., ease of use, low error rate, ease of learning, retention rate, satisfaction), accessibility, information presentation evaluation |
| | A7 | User training | User training issues or studies 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, eBelief, 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 |

*Source:* Adapted from Zhang and Li (2005).

information in order to identify the similarities and differences between MIS and HCI. 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.

MIS scholars have built their HCI research on a large number of diverse disciplines, including information systems, business and management, psychology, philosophy, and communications, among others (Zhang and Li, 2005). Accordingly, HCI issues have been examined from the different analytical perspectives inherited from these disciplines. Kutzschan and Webster argue 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 the natural home of HCI research.

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 and Li, 2005). 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.[1] Tables 1.2 and 1.3 list some of the MIS research topics that explicitly consider humans as individuals or groups during the IT life cycle. 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:

- Users with individual differences such as general traits, IT-specific traits, cognitive styles, and personalities (e.g., Agarwal and Prasad, 1998; Benbasat and Taylor, 1978; Huber, 1983; Webster and Martocchio, 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 and Kling, 2003). Lamb and Kling argued that most people who use ICT applications use 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 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. In this volume, 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. This inevitable evolution challenges the design and research issues MIS scholars face, but also provides opportunities to advance their understanding of broad HCI issues.

Table 1.2

**Some MIS Studies on Individuals During the IT Life Cycle**

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

## IT Development: Theories of Individual and Group Work

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

- Technology-driven design: a technology was proposed before anyone fully understood the problem or the best way to solve it;
- Rational design: design by prescription, in that a system is designed to change the way people behave;
- Intuitive design: a designer builds something because it seems intuitive that it will work well;
- Analogical design: systems are built to resemble people's present use of similar objects; and
- Evolutionary design: systems are built to expand the capabilities of current systems already in use.

Table 1.3

**MIS Studies on Groups During the IT Life Cycle**

| | IT Development | IT Use and Impact |
|---|---|---|
| Developers, Designers, Analysts | • User-centered design of collaborative technology (Olson and Olson, 1991)<br>• Global software team coordination (Espinosa and Carmel, 2005) | |
| Users, End Users | • The user interface design issues for GDSS (Gray and Olfman, 1989) | • Group performance and productivity (Dennis and Garfield, 2003; Dennis et al., 2001)<br>• Collaborative telelearning (Alavi et al., 1995)<br>• Cognitive feedback (Sengupta and Te'eni, 1993)<br>• Behavior in group process (Massey and Clapper, 1995; Zigurs et al., 1988)<br>• The effect of group memory on individual creativity (Satzinger et al., 1999)<br>• On the development of shared mental models (Swaab et al., 2002)<br>• Satisfaction with teamwork (Reinig, 2003) |
| Managers, Stockholders | • Developing Systems for Management of Organizational Knowledge (Markus et al., 2002)<br>• 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.

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 and Olson, 1991).

As we can see, several of these approaches still exist today; they can be applied to designing individual-based technologies as well as to collaborative work. Design is more than art. Theoretically informed design goes a long way to advance research and practice. As Baecker and colleagues pointed out, "Many empirical studies of interactive computer use have no theoretical orientation. Data is collected, but no underlying model or theory of the process exists to be confirmed or refuted. Such a theory would be very helpful because with many design decisions there are too many alternative proposals to test by trail and error. A strong theory or performance model could reduce the set of plausible alternatives to a manageable number of testing" (Baecker et al., 1995, p. 573). In the MIS literature, much theoretical work guides designers on developing information systems that support individuals and groups. In this section, we introduce three streams of such work to demonstrate the importance of such design theories.

Two papers cover research on designing systems for individual support. 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 present an extension of the 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. In a related paper, Silver broadens the original 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. The broadened theoretical work can be used to study not only DSS but a variety of other interactive information systems.

In a group setting, coordination becomes an important activity to ensure group success. Coordination activities relate to organizing and coordinating group activities, both during the course and over the course of a project. They include such activities as goal stating, agenda setting, history keeping, floor control, activity tracking, and project management (Olson and Olson, 1991). Coordination theory (Malone and Crowston, 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. In this volume, Crowston and his colleagues provide a ten-year retrospective on the development, use, and impact of coordination theory.

## IT Development: Theories of Fit

The theoretical works in this section continue to shed light on developing effective information systems that can benefit individuals, groups, and organizations. The section comprises three papers on fit that, taken together, cover a broad range of aspects important in designing information systems.

The first two papers built and expanded on two important MIS models by their original creators: cognitive fit by Iris Vessey and task-technology fit by Dale Goodhue. Cognitive fit (CF) theory (Vessey, 1991; Vessey and Galletta, 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. In this volume, Vessey surveys the broad applications of CF, discusses the fundamental theoretical framework of CF theory, and points out future directions (Vessey, 2005).

Task-technology fit (TTF) (Goodhue and Thompson, 1995) studies the causal chain connecting information technology with its performance impact. The key idea of TTF is that a technology can have a positive performance impact only if it fits the task that is being supported. In this regard, TTF may sound very similar to cognitive fit theory. Yet, the granularity of analysis and the scope of considerations taken by these two models are different: Cognitive fit focuses more on the cognitive processes during individual problem solving, while TTF emphasizes the relationships among the various factors that influence the fit of the technology under analysis. 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 and Buckland, 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 argues that it is often neglected in major MIS models on information systems and performance.

An organizational information system does more than simply supporting 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, Dov Te'eni presents a well-rounded and much broader concept of fit that has to do with physical, cognitive, and affective fit between human and computer. All three authors conclude that there is much to do to advance studies on fit in HCI and MIS disciplines. This further confirms the call for research in this area (Zhang et al., 2002).

## IT 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 constitutes two main questions: what causes users to use technology, and why the use of technology is different (Zhang et al., 2005). 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 and Fishbein, 1980; Fishbein and Ajzen, 1975), a significant amount of IS research has been conducted in identifying relevant cognitive beliefs that lead to certain behavior.

One important belief that is related to computer use is computer self-efficacy (CSE) (Compeau and Higgins, 1995). CSE is defined as "an individual judgment of one's capability to use a computer" (Compeau and Higgins, 1995, p. 192). CSE has been found to influence user acceptance of technology and user learning about technology. Through a thorough review of MIS literature on CSE, Compeau and colleagues find that the formation of CSE, along with its careful conceptualization and measurement, is much less studied. Therefore, their paper focuses on these issues. Specifically, they present the state of the research on CSE, including its conceptualization, influence, and formation. Then they introduce a number of ongoing research programs in addressing the gaps and opportunities in this area. Finally, they conclude with an agenda for future research on CSE.

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 define behavioral information security as the human actions that influence the availability, confidentiality, and integrity of information systems. They note that despite the multibillion dollars spent on information security by commercial, nonprofit, and governmental organizations around the world, the success of security appears to depend upon the behavior of the individuals involved. 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 use social, organizational, and behavioral theories and approaches, and conduct a series of empirical investigations in developing a taxonomy of security behaviors and identifying the motivational predictors of such behaviors.

Information security is also heavily engineering and technology oriented, because 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 use a semiotic framework to illustrate the holistic nature of information security issues. 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 argue that when HCI or IS research considers only some layers when studying and designing information security, the results can be dysfunctional and dissatisfactory. 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 places more emphasis on the pragmatic and social layers of the semiotic framework.

## IT Use and Impact: Affect, Aesthetics, Value, and Socialization

Other researchers investigate why people use technology and examine aspects of technology use that lie beyond cognitive reasoning. These include affect and emotion, aesthetics, human values, and social influence, which are covered by four papers in this volume.

Affect (mood, emotion, feeling) has been found to influence reflex, perception, cognition, and behavior (Norman, 2002; Russell, 2003; Zhang and Li, 2005) 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 examine 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.

A specific aspect of affect is the pleasantness or unpleasantness that may be generated by visual attractiveness, or aesthetics, as Tractinsky puts it. Tractinsky makes a strong argument that aesthetics has become a major differentiating factor between IT products in 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. Perceived aesthetics (Tractinsky et al., 2000), perceived visual attractiveness (van der Heijden, 2003), and first impressions (Schenkman and Jonsson, 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 long-standing interest in designing information and computational systems should be to support enduring human values. 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 give detailed descriptions of the approach and some examples in their paper.

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 and Nass, 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? In this volume, Nass and colleagues present abundant investigations to explore social consistency issues that are at the center of the more socially demanding interfaces of today's technology. The studied social responses to computers include personality, gender, emotion, and the use of "I."

## Reflections

To conclude the first volume, we include two reflective pieces. In the first, Fred Davis, the creator of the technology acceptance model (TAM), deals with the relationship between TAM and HCI. In the second, Jonathan Grudin offers a historical cross-examination of three related disciplines.

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 and Doll, 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 and Davis, 2000; Venkatesh and Davis, 1996), or compare it with other models (Davis et al., 1989; Dishaw and Strong, 1999; Mathieson, 1991; Taylor and Todd, 1995; Venkatesh and Davis, 2000). In this volume, Fred Davis discusses how early HCI research inspired him during his dissertation work on TAM. He also discusses the evolution and current status of TAM research.

A historical view can be informative, enlightening, and intriguing. Because historical interpretations depend on the views taken by a researcher, they may yield unique results. Taking a historical perspective, Grudin compares 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). He examines a rich set of historical events for each discipline. One frustration Grudin mentions is the terminologies used by MIS and CHI. On the surface, the different uses of the same terms do seem overwhelmingly confusing, as noted by Grudin repeatedly (Grudin, 1993). Yet, if we examine these differences more deeply, we can actually identify some fundamental differences among the different disciplines, such as 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. For example, Grudin mentions that "task analysis" has different meanings in MIS and in CHI: the word "task" in CHI would mean "move text" or "select-copy-paste," while the word "task" in MIS would usually refer to an organizational task. We think this difference arises because of the different levels of analysis these two disciplines take. "Moving text" or "selecting an object in GUI" is less meaningful in an organizational context than "finding a new location for the new branch of the business." To support the latter, IS designers need to go through the user's cognitive processes—i.e., they must conduct a cognitive task analysis by understanding how an organizational-level task can be supported by "tool-level" tasks that are, in turn, more directly supported by a computer system (such as a Decision Support System). Organizational-level tasks contextualize the interaction the user has with the computer when he or she is carrying out tool-level tasks. Therefore, although both studies in CHI and MIS may seem to be conducted at the level of the individual user, the tasks involved take place at different levels of abstraction (Zhang et al., 2005).

## SUMMARY

HCI research in the MIS discipline has a long and an extensive history. Many different disciplines contribute to the development and enrichment of HCI research within the MIS discipline. There are also shared concerns and commonalities among MIS and other disciplines that have an interest in humans interacting with technologies. By the time a reader reads all the papers in this volume, it may become 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. The collected papers may also demonstrate the richness of HCI research topics in the MIS discipline. This can be further complemented by the collection on specific research topics in the second volume, *HCI and MIS: Applications.*

It may also become evident that the interest in HCI research in MIS will continue, just as Banker and Kauffman (2004) predicted. 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). Because users are diverse and use technology in many different ways, the need for universally accessible IT (Shneiderman, 2000) affects more than just challenged people. Overall, human-centeredness has become more critical than ever before (Zhang et al., 2005). We hope HCI research in MIS will continue to grow. Together with other aspects of MIS research and with other disciplines related to HCI, we hope to make human experiences with technologies more pleasant, interesting, rewarding, and fulfilling, thus generating more business value for organizations and more social value for societies (Zhang and Li, 2005).

## ACKNOWLEDGMENTS

We thank Drs. Alan Dennis and Joe Valacich for providing insight and pointers on some materials. Drs. Izak Benbasat, Gerry DeSanctis, Andrew Dillon, Jonathan Grudin, Ben Shneiderman, and Vladimir Zwass commented on early drafts, which enhanced the final paper considerably. We are responsible for any omissions, errors, or biases in this paper.

## NOTE

1. In the MIS discipline, there are many studies on the management of IT where managers, CIOs, stakeholders, and other people play important roles that can be in both IT development and IT use stages in an organizational context. Their interaction with IT is most often at a higher level rather than at a direct hands-on level, so there are few sample studies of behavioral, cognitive, or affective impacts. Most often, managers deal with user resistance, raise intrinsic motivation of users, or "reengineer" a task to raise user productivity with IT support.

## REFERENCES

Adams, D.A.; Nelson, R.R.; and Todd, P.A. Perceived usefulness, ease of use, and usage of information technology: a replication. *MIS Quarterly*, 16, 2 (1992), 227–247.

Agarwal, R., and Prasad, J. A conceptual and operational definition of personal innovativeness in the domain of information technology. *Information Systems Research*, 9, 2 (1998), 204–215.

Ajzen, I. The theory of planned behavior. *Organizational Behavior & Human Decision Processes*, 50, 2 (1991), 179–211.

Ajzen, I., and Fishbein, M. *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, NJ: Prentice-Hall, 1980.

Alavi, M.; Wheeler, B.C.; and Valacich, J. Using IT to reengineer business education: an exploratory investigation of collaborative telelearning. *MIS Quarterly*, 19, 3 (1995), 293–312.

Argyris, C. Management information systems: the challenge to rationality and emotionality. *Management Science*, 17, 6 (1971), B275–B292.

Baecker, R.; Grudin, J.; Buxton, W.; and Greenberg, S. *Readings in Human-Computer Interaction: Toward the Year 2000*. San Francisco: Morgan Kaufmann Publishers, 1995.

Banker, R.D., and Kauffman, R.J. The evolution of research on information systems: a fiftieth-year survey of the literature in management science. *Management Science*, 50, 3 (2004), 281–298.

Banville, C., and Landry, M. Can the field of MIS be disciplined? *Communications of the ACM*, 32, 1 (1989), 48–60.

Bapna, R.; Goes, P.; and Gupta, A. User heterogeneity and its impact on electronic auction market design: an empirical exploration. *MIS Quarterly*, 28, 1 (2004), 21–43.

Barki, H., and Hartwick, J. Measuring user participation, use involvement, and user attitude. *MIS Quarterly*, 18, 1 (1994), 59–82.

Barki, H., and Hartwick, J. Rethinking the concept of user involvement. *MIS Quarterly*, 13, 1 (1989), 53–63.

Baskerville, R., and Pries-Heje, J. Short cycle time systems development. *Information Systems Journal*, 14 (2004), 237–264.

Baskerville, R.L., and Myers, M.D. Information systems as a reference discipline. *MIS Quarterly*, 26, 1 (2002), 1–14.

Benbasat, I., and Taylor, R.N. The impact of cognitive styles on information systems design. *MIS Quarterly*, 2, 2 (1978), 43–54.

Bostrom, R.P., and Heinen, J.S. MIS problems and failures: a socio-technical perspective. Part I: The causes. *MIS Quarterly*, 1, 3 (1977), 17–32.

Bostrom, R.P.; Olfman, L.; and Sein, M.K. The importance of learning style in end-user training. *MIS Quarterly*, 14, 1 (1990), 101–119.

Carey, J.; Galletta, D.; Kim, J.; Te'eni, D.; Wildermuth, B.; and Zhang, P. The role of HCI in IS curricula: a call to action. *Communications of the AIS*, 13, 23 (2004), 357–379.

Carmel, E.; Whitaker, R.; and George, J.F. Participatory design and joint application design: a transatlantic comparison. *Communications of the ACM*, 36, 6 (1993), 40–48.

Chan, S.S.; Wolfe, R.J.; and Fang, X. Issues and strategies for integrating HCI in masters level MIS and e-commerce programs. *International Journal of Human-Computer Studies*, 59, 4 (2003), 497–520.

Compeau, D.R., and Higgins, C. Application of social cognitive theory to training for computer skills. *Information Systems Research*, 6, 2 (1995), 118–143.

Compeau, D.R., and Higgins, C.A. Computer self efficacy: development of a measure and initial test. *MIS Quarterly*, 19, 2 (1995), 189–211.

Compeau, D.R.; Higgins, C.A.; and Huff, S.L. Social sognitive theory and individual reactions to computing technology: a longitudinal study. *MIS Quarterly*, 23, 2 (1999), 145–158.

Culnan, M.J. The intellectual development of management information systems, 1972–1982: a co-citation analysis. *Management Science*, 32, 2 (1986), 156–172.

Culnan, M.J. Mapping the intellectual structure of MIS 1980–1985: a co-citation analysis. *MIS Quarterly*, 11, 3 (1987), 341–353.

Davis, F.D. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13, 3 (1989), 319–342.

Davis, F.D. User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, 38, 3 (1993), 475–487.

Davis, F.D.; Bagozzi, R.P.; and Warshaw, P.R. User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35, 8 (1989), 982–1003.

Dennis, A., and Garfield, M. The adoption and use of GSS in project teams: toward more participative processes and outcomes. *MIS Quarterly*, 27, 2 (2003), 289–323.

Dennis, A.R.; Wixom, B.H.; and Vandenberg, R.J. Understanding fit and appropriation effects in group support systems via meta-analysis. *MIS Quarterly*, 25, 2 (2001), 167–193.

Dickson, G.W., and Simmons, J.K. The behavioral side of MIS. *Business Horizons*, 13, 4 (1970), 59–71.

Dishaw, M.T., and Strong, D.M. Extending the technology acceptance model with task-technology fit constructs. *Information & Management*, 36, 1 (1999), 9–21.

Espinosa, A., and Carmel, E. The impact of time separation on coordination in global software teams: a conceptual foundation. *Journal of Software Process Improvement and Practice*, 8, 4 (2005), 249–266.

Fishbein, M., and Ajzen, I. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Reading, MA.: Addison-Wesley, 1975.

Gerlach, J., and Kuo, F.-Y. Understanding human computer interaction for information systems design. *MIS Quarterly*, 15, 4 (1991), 257–274.

Goodhue, D. The model underlying the measurement of the impacts of the IIC on the end-users. *Journal of the American Society for Information Science*, 48, 5 (1997), 449–453.
Goodhue, D.L. Development and measurement validity of a task-technology fit instrument for user evaluations of information systems. *Decision Sciences*, 29, 1 (1998), 105–137.
Goodhue, D.L. Understanding user evaluations of information systems. *Management Science*, 41, 12 (1995), 1827–1844.
Goodhue, D.L., and Thompson, R.L. Task-technology fit and individual performance. *MIS Quarterly*, 19, 2 (1995), 213–236.
Gorgone, J.T.; Gray, P.; Stohr, E.A.; Valacich, J.S.; and Wigand, R.T. MSIS 2006 curriculum review. *Communications of the AIS*, 15 (2005), 544–554.
Gray, P., and Olfman, L. The user interface in group decision support systems. *Decision Support Systems*, 5, 2 (1989), 119–137.
Grudin, J. Interface: an evolving concept. *Communications of the ACM*, 36, 4 (1993), 110–119.
Hackbarth, G.; Grover, V.; and Yi, M.Y. Computer playfulness and anxiety: positive and negative mediators of the system experience effect on perceived ease of use. *Information & Management*, 40, 3 (2003), 221.
Hardgrave, B.C.; Davis, F.; and Riemenschneider, C.K. Investigating determinants of software developers' intentions to follow methodologies. *Journal of Management Information Systems*, 20, 1 (2003), 123–151.
Harrison, A.W., and Rainer, R.K. The influence of individual differences on skill in end-user computing. *Journal of Management Information Systems*, 9, 1 (1992), 93–112.
Hefley, W.E.; Buie, E.A.; Lynch, G.F.; Muller, M.J.; Hoecker, D.G.; Carter, J.; and Roth, J.T. Integrating human factors with software engineering practices. In G. Perlman, G.K. Green, and M.S. Wogalter (eds.), *Human Factors Perspectives on Human-Computer Interaction: Selections from the Human Factors & Ergonomics Society Annual Meetings 1983–1994*. (Santa Monica, CA: Human Factors and Ergonomics Society, 1995), 359–363.
Hirschheim, R., and Klein, H.K. Four paradigms of information systems development. *Communication of the ACM*, 32, 10 (1989), 1199–1216.
Huber, G. Cognitive style as a basis for MIS and DSS designs: much ado about nothing? *Management Science*, 29, 5 (1983), 367–379.
Huber, G. Issues in the design of group decision support system. *MIS Quarterly*, 8, 8 (1984), 195–204.
Igbaria, M.; Zinatelli, N.; Cragg, P.; and Cavaye, A.L.M. Personal computing acceptance factors in small firms: a structural equation model. *MIS Quarterly*, 21, 3 (1997), 279–305.
Jarvenpaa, S.L. The effect of task demands and graphical format on information processing strategies. *Management Science*, 35, 3 (1989), 285–303.
Keil, M., and Carmel, E. Customer-developer links in software development. *Communications of the ACM*, 38, 5 (1995), 33–44.
Kim, J.; Hahn, J.; and Hahn, H. How do we understand a system with (so) many diagrams? Cognitive integration processes in diagrammatic reasoning. *Information Systems Research*, 11, 3 (2000), 284–303.
Lamb, R., and Kling, R. Reconceptualizing users as social actors in information systems research. *MIS Quarterly*, 27, 2 (2003), 197–235.
Lucas, H.C. Performance and the use of an information system. *Management Science*, 21, 8 (1975), 908–919.
Lyytinen, K. Expectation failure concept and systems analysts' view of information system failures: results of an exploratory study. *Information & Management*, 14 (1988), 45–56.
Lyytinen, K.; Yoo, Y.; Varshney, U.; Ackerman, M.; Davis, G.; Avital, M.; Robey, D.; Sawyer, S.; and Sorensen, C. Surfing the next wave: design and implementation challenges of ubiquitous computing environments. *Communication of the AIS*, 13, 40 (2004), 697–716.
Malhotra, Y., and Galletta, D.F. A multidimensional commitment model of volitional systems adoption and usage behavior. *Journal of Management Information Systems*, 22, 1 (Summer 2005), 117–151.
Malone, T.W., and Crowston, K. The interdisciplinary study of coordination. *Computing Surveys*, 26, 1 (1994), 87–119.
Mantei, M., and Teorey, T. Incorporating behavioral techniques into the system development life cycle. *MIS Quarterly*, 13, 3 (1989), 257–274.
Markus, L.M., and Björn-Andersen, N. Power over users: its exercise by system professionals. *Communication of the ACM*, 30, 6 (1987), 498–504.
Markus, M.L., and Keil, M. If we build IT, they will come: designing information systems that people want to use. *Sloan Management Review*, 35, 4 (1994), 11–25.

Markus, M.L.; Majchrzak, A.; and Gasser, L. A design theory for systems that support emergent knowledge processes. *MIS Quarterly*, 26, 3 (2002), 179–212.

Massey, A.P., and Clapper, D.L. Element finding: the impact of a group support system on a crucial phase of sense making. *Journal of Management Information Systems*, 11, 4 (1995), 150–176.

Mathieson, K. Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. *Information Systems Research*, 2, 3 (1991), 173–191.

Norman, D.A. Emotion and design: attractive things work better. *Interactions: New Visions of Human-Computer Interaction*, IX, 4 (2002), 36–42.

Norman, D.A. *Emotional Design: Why We Love (Or Hate) Everyday Things*. Cambridge, MA: Basic Books, 2004.

Olson, G., and Olson, J. User-centered design of collaboration technology. *Journal of Organizational Computing*, 1, 1 (1991), 41–60.

Orlikowski, W.J. The duality of technology: rethinking the concept of technology in organizations. *Organization Science*, 3, 3 (1992), 398–427.

Pitts, M.G., and Browne, G.J. Stopping behavior of system analysts during information requirements elicitation. *Journal of Management Information Systems*, 21, 1 (2004), 203–226.

Poole, M.S.; Holmes, M.; and DeSanctis, G. Conflict management in a computer-supported meeting environment. *Management Science*, 37, 8 (1991), 926–953.

Reeves, B., and Nass, C.I. *The Media Equation: How People Treat Computers, Televisions, and New Media as Real People and Places*. New York: Cambridge University Press, 1996.

Reinig, B.A. Toward an understanding of satisfaction with the process and outcomes of teamwork. *Journal of Management Information Systems*, 19, 4 (2003), 65–83.

Reinig, B.A.; Briggs, R.O.; Shepherd, M.M.; Yen, J.; and Nunamaker, J.F., Jr. Affective reward and the adoption of group support systems: productivity is not always enough. *Journal of Management Information Systems*, 12, 3 (1996), 171–185

Rivard, S., and Huff, S.L. User developed applications: evaluation of success from the DP department perspective. *MIS Quarterly* (1984), 39–50.

Russell, J.A. Core affect and the psychological construction of emotion. *Psychological Review*, 110, 1 (2003), 145–172.

Saleem, N. An empirical test of the contingency approach to user participation in information systems development. *Journal of Management Information Systems*, 13, 1 (1996), 145–167.

Satzinger, J.W.; Garfield, M.J.; and Nagasundaram, M. The creative process: the effects of group memory on individual idea generation. *Journal of Management Information Systems*, 15, 4 (1999), 143–160.

Schenk, K.D.; Vitalari, N.P.; and Davis, K.S. Differences between novice and expert systems analysts: what do we know and what do we do. *Journal of Management Information Systems*, 15, 1 (1998), 9–50.

Schenkman, B.N., and Jonsson, F.U. Aesthetics and preferences of web pages. *Behaviour & Information Technology*, 19, 5 (2000), 367–377.

Sein, M.K., and Bostrom, R. The influence of individual differences in determining the effectiveness of conceptual models in training novice users. *Human-Computer Interaction*, 4 (1989), 197–229.

Senge, P. *The Fifth Discipline: The Art & Practice of the Learning Organization*. New York: Doubleday, 1990.

Sengupta, K., and Te'eni, D. Cognitive feedback in GDSS: improving control and convergence. *MIS Quarterly*, 17, 1 (1993), 87–113.

Shneiderman, B. *Designing the User Interface: Strategies for Effective Human-Computer Interaction*. Reading, MA: Addison-Wesley, 1987.

Shneiderman, B. *Leonardo's Laptop: Human Needs and the New Computing Technologies*. Cambridge, MA: MIT Press, 2002.

Shneiderman, B. Universal Usability. *Communications of the ACM*, 43, 5 (2000), 84–91.

Shneiderman, B., and Plaisant, C. *Designing the User Interface: Strategies for Effective Human-Computer Interaction*. New York: Addison-Wesley, 2005.

Swaab, R.I.; Postmes, T.; Neijens, P.; Kiers, M.H.; and Dumay, A.C.M. Multiparty negotiation support: the role of visualization's influence on the development of shared mental models. *Journal of Management Information Systems*, 19, 1 (2002), 129–150.

Swanson, E.B. Management information systems: appreciation and involvement. *Management Science*, 21, 2 (1974), 178–188.

Taylor, S., and Todd, P.A. Understanding information technology usage: a test of competing models. *Information Systems Research*, 6, 2 (1995), 144–176.

Te'eni, D. A cognitive-affective model of organizational communication for designing IT. *MIS Quarterly*, 25, 2 (2001), 251–312.

Torkzadeh, G., and Doll, W.J. The development of a tool for measuring the perceived impact of information technology on work. *Omega-International Journal of Management Science*, 27, 3 (1999), 327–339.

Tractinsky, N.; Katz, A.S.; and Ikar, D. What is beautiful is usable. *Interacting with Computers*, 13 (2000), 127–145.

van der Heijden, H. Factors influencing the usage of websites—the case of a generic portal in the Netherlands. *Information & Management*, 40, 6 (2003), 541–549.

Venkatesh, V. Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research*, 11, 4 (2000), 342–365.

Venkatesh, V., and Davis, F. A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science*, 46, 2 (2000), 186–204.

Venkatesh, V., and Davis, F.D. A model of the antecedents of perceived ease of use: development and test. *Decision Science*, 27, 3 (1996), 451–481.

Venkatesh, V.; Morris, M.G.; Davis, G.B.; and Davis, F.D. User acceptance of information technology: toward a unified view. *MIS Quarterly*, 27, 3 (2003), 425–478.

Vessey, I. Cognitive fit: a theory-based analysis of the graphs versus tables literature. *Decision Sciences*, 22 (1991), 219–240.

Vessey, I. The effect of information presentation on decision making: A cost-benefit analysis. *Information & Management*, 27, 2 (1994), 103–119.

Vessey, I., and Galletta, D.F. Cognitive fit: an empirical study of information acquisition. *Information Systems Research*, 2, 1 (1991), 63–84.

Vessey, I.; Ramesh, V.; and Glass, R.L. Research in information systems: An empirical study of diversity in the discipline and its journals. *Journal of Management Information Systems*, 19, 2 (2002), 129–174.

Webster, J., and Martocchio, J.J. The differential effects of software training previews on training outcomes. *Journal of Management*, 21, 4 (1995), 757–787.

Webster, J., and Martocchio, J.J. Microcomputer playfulness: development of a measure with workplace implications. *MIS Quarterly*, 16, 1 (1992),

Yoo, Y., and Alavi, M. Media and group cohesion: relative influences on social presence, task participation, and group consensus. *MIS Quarterly*, 25, 3 (2001), 371–390.

Zhang, P. AIS SIGHCI three-year report. *AIS SIGHCI Newsletter*, 3, 1 (2004), 2–6.

Zhang, P. An image construction method for visualizing managerial data. *Decision Support Systems*, 23, 4 (1998), 371–387.

Zhang, P.; Benbasat, I.; Carey, J.; Davis, F.; Galletta, D.; and Strong, D. Human-computer interaction research in the MIS discipline. *Communications of the AIS*, 9, 20 (2002), 334–355.

Zhang, P.; Carey, J.; Te'eni, D.; and Tremaine, M. Integrating human-computer interaction development into the systems development life cycle: a methodology. *Communications of the AIS*, 15 (2005), 512–543.

Zhang, P., and Li, N. The importance of affective quality. *Communications of the ACM*, 48, 9 (2005), 105–108.

Zhang, P., and Li, N. The intellectual development of human-computer interaction research in MIS: a critical assessment of the MIS literature (1990–2002). *Journal of the Association for Information Systems*, 6, 11 (2005), 227–292.

Zhang, P.; Nah, F.H.F.; and Preece, J. HCI Studies in MIS. *Behaviour & Information Technology*, 23, 3 (2004), 147–151.

Zigurs, I., and Buckland, B.K. A theory of task/technology fit and group support systems effectiveness. *MIS Quarterly*, 22, 3 (1998), 313–334.

Zigurs, I.; Buckland, B.K.; Connolly, J.R.; and Wilson, E.V. A test of task-technology fit theory for group support systems. *Database for Advances in Information Systems*, 30, 3/4 (1999), 34.

Zigurs, I.; Poole, S.; and DeSanctis, G. A study of influence behavior in computer-mediated group decision making. *MIS Quarterly*, 12, 4 (1988), 625–644.

Zmud, R.W.; Anthony, W.P.; and Stair, R.M. The use of mental imagery to facilitate information identification in requirements analysis. *Journal of Management Information Systems*, 9, 4 (1993), 175–191.