CHAPTER 1

APPLICATIONS OF HUMAN-COMPUTER INTERACTION IN MANAGEMENT INFORMATION SYSTEMS

An Introduction

DENNIS GALLETTA AND PING ZHANG

Abstract: *In this introduction to the second of the two complementary volumes, we provide a general context of applications of HCI research in MIS and then preview all papers in the second volume. This volume represents applications of HCI from the point of view of MIS research. Applications take particular courses that are carved out by researchers; we find that MIS researchers have taken HCI work in the directions of electronic commerce, team collaboration, culture and globalization, user learning and training, user-centered system development, and information technology in health care. Two reflective pieces at the end of this volume provide ample food for thought for researchers in this area.*

Keywords: *WWW, Electronic Commerce, Collaboration, Culture and Globalization, Training and Learning, User-Centered System Development, Health Informatics, Research Methodology*

INTRODUCTION

This book is one of two complementary volumes that present scholarly works from a variety of thought leaders in HCI, especially those who have ties to the field of management information systems (MIS). The first volume (*AMIS* Vol. 5) covers concepts, theories and models, and general issues of human-computer interaction studies relevant to MIS. Addressing perspectives on HCI from different disciplines, the first volume's topics include the nature and evolution of our understanding of who users are; theoretical understanding of how to design systems to support humans; theories and models of cognitive and behavioral aspects of using information technology (IT); and fundamental understanding of the affective, aesthetic, value-sensitive, and social aspects of HCI. This volume (*AMIS* Vol. 6) covers applications, special case studies, and HCI studies in specific contexts. Topics in this volume include HCI studies in electronic commerce and the Web context; HCI studies for collaboration support; culture and globalization issues; specific HCI issues in IT learning and training; theoretical understandings of 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 the first volume, Fred Davis discusses the connection between the technology acceptance model (TAM) and HCI, and Jonathan Grudin provides a historical reflection of the 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.

Application of theories, frameworks, and principles is crucial to the HCI-MIS field. Without theory, research would be haphazard, inconsistent, and inconclusive. Because of that undesirable potential, the MIS field has explicit requirements from editors of all of the major journals to provide adequate theory in performing studies.

Applications of human-computer interaction (HCI) theories, frameworks, and principles to MIS problems can be considered to be an organizationally based "proving ground" of sorts for those tools. Theories, frameworks, and principles provide an understanding of an issue or problem, while applications supply not only some partial evidence of whether or not the principles hold, but also some solutions, additional extensions, and new questions.

Therefore, in some ways, this second volume completes the story that was started in the first volume by complementing the perspectives and theories with those selected application areas that several of our most respected colleagues have chosen to examine. In other ways, this volume should stimulate the emergence of new applications and problem areas as it raises new questions—most papers suggest the need for additional research and even new areas of theory. Thus, this volume provides for tomorrow's conceptual work and applications. Such is the hallmark of a vibrant and progressing field.

RESEARCH CONTEXT

It is important to establish an appropriate disciplinary base for studying HCI issues. In the introduction to the first volume, we assert that HCI is an interdisciplinary research arena. Several papers in this volume underscore the multifaceted and interdisciplinary nature of the field. These papers import theoretical perspectives and tools from a variety of reference disciplines. The astute reader will recognize theories from several areas, including such fields as psychology, sociology, computer science, economics, health science, cultural sciences, and organizational sciences.

There is one interesting benefit to the interdisciplinary nature of HCI. There is a highly publicized and dramatic trend towards outsourcing system development (and many other) tasks to offshore vendors, and hiring is down. At the same time, enrollments in systems-related academic programs have declined sharply. Fortunately, Schwartz (2005) provides a preview of an upcoming government report that indicates that "work that crosses multiple disciplines" and requires creativity, ingenuity, and, most interestingly, "integration of business processes with IT," is less likely to be cast offshore in the foreseeable future. The HCI designer's task fits with all of these notions.

In addition to being multidisciplinary, HCI 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). The MIS field's main academic association, the Association for Information Systems (AIS), is participating in the dialog and movement. Other professionals include ergonomists, graphic designers, business analysts, product designers, engineers, and health professionals. There are few fields that escape the task of designing for a user's experience, and the time has come to share important findings among these fields.

While efforts are under way to pool resources, the disciplines will remain distinct. Ergonomists will continue to examine physical impacts in human factors work, graphic designers will retain their skill base on layout and presentation, and mechanical engineers will not yield their ability to

Table 1.1

Framework for Applying Theory

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

analyze materials that will go into a physical product. At the same time, it is striking that all of them need to be concerned with usability and users' experience of their products. All need to ask if people will understand the product with little training, if the product will behave as users expect, and if the product will be appealing. These concerns are indeed also shared by systems designers in the MIS field. What distinguishes MIS researchers is the organizational context.

Both MIS researchers and practitioners are interested in the organizational context. That context provides a notion of an organization's strategic goals and users' tasks. For researchers, the organizational context drives the choice of research problems and suggests methods for learning more. 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.

The rest of this paper is organized as follows: First, the notion of applying theory is described. Then each of the papers in this volume will be described, in order by section.

APPLYING THEORY

Theory is applied in a multitude of ways by researchers and practitioners, and there are important differences in the purpose and the application itself. Each part of the framework in Table 1.1 will now be discussed.

Generalization versus Problem Solving

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.

Academic 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.

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.

The difference between the researcher's and practitioner's purpose is actually unexpectedly 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. Stated another way, MIS needs HCI and HCI needs MIS, as mentioned in the introduction to the first volume. It is worthwhile to examine each part of this assertion in some detail.

HCI Needs MIS

Historically, HCI research has included 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 obvious instructions, it might be difficult to find the key aspect of help needed, or that key aspect might have not been provided.

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.

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. As described by Davis (2006), the former had been called "ease of use" and the latter "usefulness" in the past. In this model, performance expectancy, along with outcomes of these expectancies, provide useful context for effort expectancy. Effort expectancy by itself seems to provide a focus that is incomplete.

As an example, the famous "Ernestine" project (Gray et al., 1992) provided evidence that support calls could be handled more quickly by avoiding purchase of a new system. The new system had touted an "HCI friendly" design (with an easier-to-use interface and faster connection speed), but in reality, several steps that were previously done in parallel (computer and human) would now have to be done sequentially. Broadening the analysis to organizational needs for overall efficiency helped provide the proper decision, and helped save several million dollars. Further, additional analysis of customer satisfaction, company image, and IT strategy might have provided crucial input to the decision as well. The context provided by MIS is valuable and necessary, hence, HCI needs MIS.

MIS Needs HCI

The converse is also true, that MIS needs HCI. We have models that would, and do, benefit from more detailed notions in HCI. Again, using the UTAUT (Venkatesh et al., 2003) example, neither MIS researchers nor practitioners should stop after making an overall assessment of effort expectancy. They should make use of HCI principles and theoretical perspectives for their application work. MIS researchers should drill deeper and specify more elements of usability. For example, some systems

are easy to learn but hard to use (putting everything into deeply nested but understandable menus) while others are hard to learn but easy to use (forcing memorization of shortcuts). While that crucial notion has received broad coverage in the HCI literature, it has not in the MIS literature. Therefore, for similar deepening of issues that might not be explored in the MIS literature, MIS needs HCI.

DEVELOPMENT AND TESTING OF THEORY

Theory is 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. 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 the HCI theories, frameworks, and principles defined in the first volume. 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. Researchers should be concerned with two basic questions: Where (i.e., to what kinds of problems) is theory applied? How is it applied?

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.

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.

Browsing the titles of these two volumes will provide ample testimony of the diversity in the application of theory by researchers and practitioners. The next concern is *how* it is applied.

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.

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 and Ajzen, 1975) from social psychology. Many other models have been imported and adapted in this manner.

By contrast, an example of a theoretical development that originated in the field is the theory of cognitive fit (Vessey, 1991; Vessey and Galletta, 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 demonstrates her formidable research and writing instincts in the first volume, and her expertise and leadership provided a sensible framework and name for the theory. As the experiments were under way, 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.

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 in the first volume, 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.

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 (1990) point out the trial-and-error process that led to its design and final placement. Alternative solutions—such as integrating the pointing stick with the "J" key, or placing it below the space bar or above the function keys—were explored.

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.

Such events are not relegated to hardware design. Practitioners have also benefited from analysis of design alternatives by applying Fitts' Law. Callahan et al. (Callahan et al., 1988) designed a "Pie Menu," which does not require users to move to the top of the screen as in a pull-down menu. 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.

OVERVIEW OF THE VOLUME

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.

Several applications of theory are described in this volume. The areas are diverse, interesting, and important, and have either direct or indirect relevance to researchers and practitioners alike.

This volume contains monographs that cover several specific areas of HCI and MIS. The topics included 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. Following these papers are two highly appropriate pieces to conclude the two volumes. One provides strong methodological advice for HCI/MIS researchers, and the other revisits, and perhaps settles, a famous debate in the HCI field over "hard" science and "soft" science.

Each section of the book is introduced below, and each paper within each section is described.

Electronic Commerce and the Web

The Web and electronic commerce have become important areas in HCI MIS. The MIS researchers' interest in studying hypertext or the Web has expanded from the early days of building decision support systems (Minch, 1990) to a much broader range of research interests. According to 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, an unprecedented number of regular citizens are Internet users: Statistics from February 2005 show that about two-thirds of Americans have Internet access (Internet World Stats, 2005).

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 three papers in this session examine complementary and important aspects of electronic commerce and HCI.

The first, by Izak Benbasat, outlines several studies on various difficulties imposed by the physical decoupling of retail stores from their customers. Benbasat first explores types of communication, and then describes 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.

The second, by Dennis F. Galletta, Raymond M. Henry, Scott McCoy, and Peter Polak, focuses on the phenomenon of Web delay. Delay is examined 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. 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.

The third electronic commerce study, by Ping Zhang, addresses animation in pop-up advertising, and describes eight years of research in that area. Three studies during that period 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.

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.[1] Due to the large number of tasks that are too large or complex for a single individual to perform, this area is quite important.

The first collaboration paper, by Judy and Gary Olson, examines 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. The paper focuses 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" are used to construct conceptual technical and social "bridges" to solve the difficulties.

The second paper on collaboration, by Starr Roxanne Hiltz, Jerry Fjermestad, Rosalie Ocker, and Murray Turoff, focuses on groups that are separated by time and distance (also known as asynchronous teams). Results from several field and laboratory experiments are described, and the results push in a variety of directions. Future research needs are outlined to help uncover a model for understanding this area better.

Ilze Zigurs and Bjørn Erik Munkvold contributed the third collaboration paper, which examines collaboration technologies, tasks, and contexts, and provides an analysis of how these three elements have been addressed in MIS research. They review several typologies, as well as the evolving nature of these concepts. They also thoroughly review the literature, which should help researchers who are interested in this area.

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.

Two studies focus on culture and globalization. The first, by Jinwoo Kim, Inseong Lee, Boreum Choi, Se-Joon Hong, Kar Yan Tam, and Kazuaki Naruse, represents a collaboration of researchers in three Asian countries on the subject of the mobile Internet. Specifically, metrics for examining cultural aspects of technology are proposed and tested. Rather than force-fit the established dimensions of culture, the authors develop a layered approach that assumes that most elements of culture exist in deeper layers that cannot easily be observed. The metrics are 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 is provided.

The second cultural study was contributed by Geoffrey S. Hubona, Duane Truex III, Jijie Wang, and Detmar Straub. The group collected data that are complementary to the Asian mobile Internet study. The paper focuses on organizational use, and includes several countries throughout the world. Hubona et al. demonstrate that North American models of technology acceptance are not necessarily applicable in other countries. They examine sociocultural 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.

Learning and Training

Over the years, a small but dedicated community has examined user learning and training (e.g., Cronan and Douglas, 1990; Davis and Davis, 1990; Kang and Santhanam, 2004; Sein and Bostrom, 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.

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.

A paper by Sharath Sasidharan and Radhika Santhanam reviews the literature on technology-based training. 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.

The second learning paper is offered by Lorne Olfman, Bob Bostrom, and Maung Sein, who examine how to develop a training strategy from an HCI perspective. 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 present their original model from several years ago, and describe several studies related to that model. They take the unusual step of providing a detailed critique of their own work. Finally, after discussing the framework and industry best practices, they provide an agenda for future researchers.

Conrad Shayo and Lorne Olfman provide the final paper on learning and training, offering a perspective on "learning objects," small chunks of digitized instructional content that can be delivered online. The authors review the literature in this area, focus on the benefits and difficulties of such a technology, and suggest what needs to be done in this area from a "Value Chain" perspective.

User-Centered Information Systems Development

Most 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.

Glenn Browne supplies us with 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. 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 points out additional research needed to better understand cognitive, emotional, communication, experience, environmental, organizational, task, and individual issues in requirements determination.

John Carroll and Mary Beth Rosson survey 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. The framework provides 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.

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. This section provides a paper about each of those areas.

The first paper in this section, by Ritu Agarwal and Corey M. Angst, defines and discusses health information technology and illustrates opportunities for MIS research in this area. Focusing on adoption decisions on an electronic personal health record (PHR), Agarwal and Angst report 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.

The second health-care paper, by Adriane B. Randolph and Geoffrey S. Hubona, reports on significant cutting-edge efforts for developing assistive technologies for people with disabilities. Randolph and Hubona examine 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 are presented. The first case study addresses 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.

Methodological Issues and Reflections

The last two papers in the book provide useful advice for researchers interested in HCI/MIS applications. Researchers are often interested in making sure they are examining appropriate problems, and are examining those problems in the correct manner.

MIS scholars have utilized a large number of different research methods. A recent survey of published HCI studies in seven top MIS journals from 1990–2002 (Zhang and Li, 2005) revealed that almost all of the methods in Alavi and Carlson's research type framework (Alavi and Carlson, 1992) have been used. The most commonly utilized method, however, is the controlled lab experiment (used by 35.6 percent of the HCI papers in the period), followed by surveys (by 25.5 percent of the HCI papers) and field studies (by 12.5 percent of the HCI papers) (Zhang and Li, 2005). In this volume, Alan Dennis, Monica Garfield, Heikki Topi, and Joseph Valacich provide a paper on conducting lab experiments, from initial conception of a study to publication, that should be on every experimenter's desk. 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.

John M. Carroll provides the paper that wraps up the two-volume set. He provides a unique retrospective of his and Robert Campbell's famous "soft versus hard science" debate with Allen Newell and Stuart Card from twenty years ago. Although Allen Newell has since passed on and Stuart Card was not available for a similar retrospective, Carroll's account and analysis helps us to think more thoroughly about the prospect that predictive mathematical or technical studies could drive out social and behavioral approaches. This paper serves as the missing final rebuttal by Carroll, with whom Campbell decided many years ago not to debate the matter further.

Carroll refers to the debate as an "essential tension," and two key questions are 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 demonstrates 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 notes that some less confident researchers will, even today, shy away from "soft" studies and pass up interesting opportunities because of this debate, and closes 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.

CONCLUSION

It is our hope that with these two volumes, researchers in MIS 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. We are proud to have edited these volumes and hope that they inform and energize you as much as they have informed and energized us.

NOTE

1. See Grudin (1994) for a detailed history of the CSCW (computer-supported cooperative work) conference.

REFERENCES

Alavi, M., and Carlson, P. A review of MIS research and disciplinary development. *Journal of Management Information Systems*, 8, 4 (1992), 45–62.

Briggs, R.O.; Dennis, A.R.; Beck, B.S.; and Nunamaker, J.F. Whither the pen-based interface? *Journal of Management Information Systems*, 9, 3 (1993), 71–90.

Callahan, J.; Hopkins, D.; Weiser, M.; and Shneiderman, B. An empirical comparison of pie vs linear menus. In *Proceedings of the Conference on Human Factors in Computing Systems (CH)*, Washington, DC: Association for Computing Machinery, 1988, pp. 95–100.

Card, S.; Moran, T.P.; and Newell, A. *The Psychology of Human-Computer Interaction.* Hillsdale, NJ: Lawrence Erlbaum Associates, 1983.

Cronan, T.P., and Douglas, D.E. End-user training and computing effectiveness in public agencies: an empirical study. *Journal of Management Information Systems*, 6, 4 (1990), 21–39.

Davis, D.L., and Davis, D.F. The effect of training techniques and personal characteristics on training end users of information systems. *Journal of Management Information Systems*, 7, 2 (1990), 93–110.

Davis, F. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13, 3 (1989), 319–340.

DevCon, CHI Development Consortium. 2005 (available at http://uxnet.org/devcon/, accessed on December 15, 2005).

Dickson, G.W.; Senn, J.A.; and Chervany, N.L. Research in management information systems: the Minnesota experiments. *Management Science*, 23, 9 (1977), 913–923.

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

Fitts, P.M. The information capacity of the human motor system in controlling the amplitude of movement. *Journal of Experimental Psychology*, 47 (1954), 381–391.

Galletta, D.; Zhang, P.; and Nah, F.F.-H. AIS HCI position paper. In *Proceedings of the ACM Conference on Human Factors in Computing Systems.* Portland, OR: Association for Computing Machinery, 2005, pp. 1080–1082.

Galletta, D.F. Human factors and e-commerce. In M. Shaw (ed.), *Electronic Commerce and the Digital Economy.* Armonk, NY: M.E. Sharpe, 2006.

Gould, J.D., and Lewis, C. Designing for usability: key principles and what designers think. *Communications of the ACM*, 28, 3 (1985), 300–311.

Gray, W.D.; John, B.E.; and Atwood, M.C. The precis of Project Ernestine or an overview of a validation of GOMS. In *Proceedings of the ACM CHI.* Monterey, CA: Association for Computing Machinery, 1992, pp. 307–312.

Grudin, J., CSCW: History and Focus. 1994 (available at http://www.ics.uci.edu/~grudin/Papers/IEEE94/IEEEComplastsub.html, accessed on June 6, 2005).

Hu, P.J.; Chau, P.Y.K.; Sheng, O.R.L.; and Tam, K.Y. Examining the technology acceptance model using physician acceptance of telemedicine technology. *Journal of Management Information Systems*, 16, 2 (1999), 91–112.

Instone, K. User experience: an umbrella topic. In *Proceedings of the ACM Conference on Human Factors in Computing Systems*, Portland, OR: Association for Computing Machinery, 2005, pp. 1087–1088.

Internet World Stats. 2005 (available at http://www.internetworldstats.com/am/us.htm, accessed on June 6, 2005).

Kang, D., and Santhanam, R. A longitudinal field study of training practices in a collaborative application environment. *Journal of Management Information Systems*, 20, 3 (2004), 257–281.

Minch, R.P. Application and research areas for hypertext in decision support systems. *Journal of Management Information Systems*, 6, 3 (1990), 119–138.

Rutledge, J., and Selker, T. In-keyboard analog pointing device: a case for the pointing stick. *Technical Video Program of the CHI '90 Conference*, *SIGGRAPH Video Review*, 55, 1 (1990).

Schwartz, E. Dire Forecast for IT jobs. *Infoworld*. 2005 (available at http://www.infoworld.com/article/05/05/17/21OPreality_1.html, accessed on December 15, 2005).

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.

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

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