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IS RESEARCH PERSPECTIVES ARTICLE

The Intellectual Development of Human-Computer Interaction Research: A Critical Assessment of the MIS Literature (1990-2002)[1]

Ping Zhang
School of Information Studies
Syracuse University
pzhang@syr.edu

Na (Lina) Li
School of Information Studies
Syracuse University
nli@syr.edu

Abstract

As one of the five research streams of the Management Information Systems (MIS) discipline, Human-Computer Interaction (HCI) was predicted to resurge in the post-millennium era. To date, however, few studies have either synthesized existing studies or drawn an overarching picture of this sub-discipline. This study delineates the intellectual development of HCI research in MIS by a multifaceted assessment of the published HCI articles over a period of 13 years (1990-2002) in seven prime MIS journals: MISQ, ISR, JMIS, Decision Sciences, Management Science, DATA BASE, and JAIS. Twenty-two specific questions are addressed to answer the following five general research questions about the HCI sub-discipline: (1) What constitutes its intellectual substance? (2) What relationships does it have with other disciplines? (3) What are its recent evolutions? (4) What are the patterns of publishing HCI studies in the primary MIS journals? And, (5) Who are its contributing members? We use classification approach to address these questions. Descriptive analyses, including co-occurrence and cross-facet analyses, depict the key relationships. Trend analyses demonstrate recent evolutions. We present a number of areas for future research, along with a discussion of potential future directions for the sub-discipline. This study should be of interest to researchers in this sub-discipline, in the MIS discipline, and in other related disciplines for future research, collaboration, publication, and education. It should also be of interest to doctoral students to identify potential research topics for dissertation research and to

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identify academic institutions for future employment where such research is understood, appreciated, and encouraged.

Keywords: Human-Computer Interaction (HCI), Human Factors in Information Systems (HFIS), scientific fields, intellectual development, literature assessment, subject topics, research methods, study contexts, individual characteristics, levels of analysis, contributing disciplines, IT and service, Management Information Systems (MIS)

Introduction

At the first International Conference on Information Systems (ICIS), Keen (1980) defined MIS or IS (in this paper, we use MIS and IS interchangeably) as “the effective design, delivery and use of information systems in organizations.” The original perspective of MIS centered on either management, information, systems, or a combination of the three (Banville and Landry, 1989). Recently, Laudon and Laudon (2003) defined MIS as “the study of information systems focusing on their use in business and management.” Baskerville and Myers (2002) also broadly defined MIS as ”the development, use and application of information systems by individuals, organizations and society.” MIS has gone through a steady shift from a techno-centric focus to a balanced view of technology, organizational, management, and social focus (Baskerville and Myers, 2002).

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

With the rapid development and deployment of information systems, information and communication technology, and related services (in this paper, we use IT to represent them all), and with IT playing a central role at work and in every part of our lives, HCI issues become even more important and fundamental. Interest in the HCI research stream within the MIS discipline is predicted to be resurgent (Banker and Kauffman, 2004). The recently active HCI-centered tracks, sessions and workshops at major MIS conferences, and special issues in top MIS journals are testimonies to the high interest in HCI among MIS researchers.

It is natural for any scholar interested in this sub-discipline to ask: What research topics are studied? What research methods are used? Do top MIS journals publish HCI papers at all, and if so, what percentage of the published articles is related to HCI? Who are the contributing authors and what institutions house them? And there is an overarching question: What is the intellectual development of the HCI sub-discipline?

This study attempts to address the questions above, as well as some additional questions. It is widely recognized that research that synthesizes existing studies to provide an overview of an emerging field is often scarce but extremely important to advance scholarly understanding of the current state of the field and to suggest future directions (Alavi and Carlson, 1992; Culnan, 1986; Culnan, 1987; Vessey et al., 2002). Several studies have been conducted to systematically assess the intellectual evolution of the IS discipline (Alavi and Carlson, 1992; Cheon et al., 1992; Culnan, 1987; Lending and Wetherbe, 1992; Teng and Galletta, 1991; Vessey et al., 2002). Similar assessments have been performed on several specific sub-disciplines of MIS (Lai, 1996; Pervan, 1998; Romano and Fjermestad, 2001).

However, only a few articles have provided limited overviews of the HCI sub-discipline thus far. Such overviews include a top down perspective on research issues and directions of HCI studies in MIS (Zhang et al., 2002), a call for action for including HCI topics in the MIS curricula (Carey et al., 2004), a proposition for considering MIS as the home of HCI studies (Kutzschan and Webster, 2006), a limited data-driven view based on an assessment of two MIS journals (*MISQ* and *ISR*) on two facets (subject topic and research method) (Zhang and Li, 2004), and a comparison of three highly related disciplines: MIS, Human Factors and Computer-Human Interaction (CHI) (Grudin, 2006). To date, no study has systematically characterized the intellectual state and development of the HCI sub-discipline. Therefore, there is a strong need to understand the present state and foresee the future of this resurgent subfield of MIS.

Before we can address the specifics, we need an organizing framework of scientific inquiry within which we can discuss the HCI sub-discipline with appropriate perspectives and catalog a large number of questions and vast amounts of materials. Banville and Landry (1989) cautioned that “anyone attempting to assess the state of a particular scientific discipline must necessarily proceed with the implicit or explicit help of a model as to what a scientific discipline is and how it should develop” (p. 48). After arguing the limitations of Kuhn’s model of scientific development based on the notion of paradigm and scientific progress (Kuhn, 1970; Kuhn, 1977), Banville and Landry presented a model of the development of scientific fields, which was adapted from Whitley (1984) and that treats intellectual fields as being simultaneously cognitive and social. Realizing that no model is a perfect fit for all purposes or situations, in this study, we use the Banville and Landry model as a high-level guide to develop our research questions, conduct analyses, and present discussions of the intellectual development of the HCI subfield within MIS.

Specifically, in this study, we present a set of high-level research questions that can be decomposed into lower-level or more detailed questions. We then address these questions by using a classification approach to examine a collection of HCI articles from seven prime MIS journals over the recent period of 13 years (1990-2002). Our approach utilizes a multifaceted view to reveal the detailed characteristics of the dynamics and richness of the HCI sub-discipline. Seven facets are used to assess the literature: research contexts, levels of analysis, topics, methods, individual characteristics, technology or service, and contributing disciplines. Co-occurrence and cross-facet analyses can reveal further interesting patterns by answering questions such as “What topics are often studied together?” and “What methods are used to study what topics?” These types of co-occurrence and cross-facet analyses are novel as they have not appeared in other similar literature assessment studies in the IS discipline. Finally, to reveal the social and academic side of the sub-discipline, we examine publication patterns in the seven journals and the most prolific authors and institutions.

The paper is organized as follows. The next section presents the intellectual dimensions of the HCI sub-discipline, including a framework to structure broad HCI issues and concerns, and research questions for this study. The methodology section follows, including the classification schemes used in the study. Next, we present analysis results to answer the research questions. The final section offers further thoughts and points out future directions.

HCI as an Intellectual Sub-Discipline of MIS

MIS-oriented HCI issues have been visited and addressed for as long as the MIS discipline has been in existence. For example, user attitudes, perceptions, acceptance, and use of IT have been long standing issues and major themes of MIS since early days in computing (Lucas, 1975; Swanson, 1974), along with studies on programmer cognitions and end user involvement in systems development. MIS scholars have identified information systems failures as the potential result of the lack of emphasis on the human/social aspects of system use (Bostrom 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 user-factors, usability, and HCI to the systems development life cycle (Hefley et al., 1995; Mantei and Teorey, 1989; Zhang et al., 2005). Culnan (1986) identified nine factors or subfields in early MIS publications (1972-1982); of these nine, three (factors 6, 7, and 8) are related to issues of humans interacting with computers. In a second study of a later period of MIS publications, Culnan (1987) found five factors where the second factor, individual (micro) approaches to MIS design and use, is closely related to human-computer interaction. Yet, the question remains: What are HCI issues?

In order to constitute a field of scientific inquiry, a discipline must have a boundary, either sharp or fuzzy, that outlines its components and intrinsic interests. The MIS discipline has gone through the process of making this boundary clearer. The same occurs within the HCI sub-discipline and other MIS sub-disciplines. Before we start assessing the literature, we first present a framework attempting to draw the boundary of the intrinsic interests for the HCI sub-discipline. Then we present our understanding of what the intellectual development of a discipline is, and what research questions we intend to answer in this study.

Bounding Broad HCI Issues

Figure 1 provides an overview framework of the important players in the broad research area of human-computer interaction. This framework extends that presented in an early work by Zhang and Li (2004). It illustrates the issues and components that are pertinent to human interaction with technologies. Note that such a framework is meant to illustrate the important players or components in the broadly defined HCI area, thus all the topics in Figure 1 are meant to be illustrative, rather than exhaustive or inclusive. In addition, Figure 1 depicts components and their potential relationships, without necessarily indicating causal connections. Depending on the purpose of a study, a particular component or sub-component can be treated as either an independent or dependent variable.

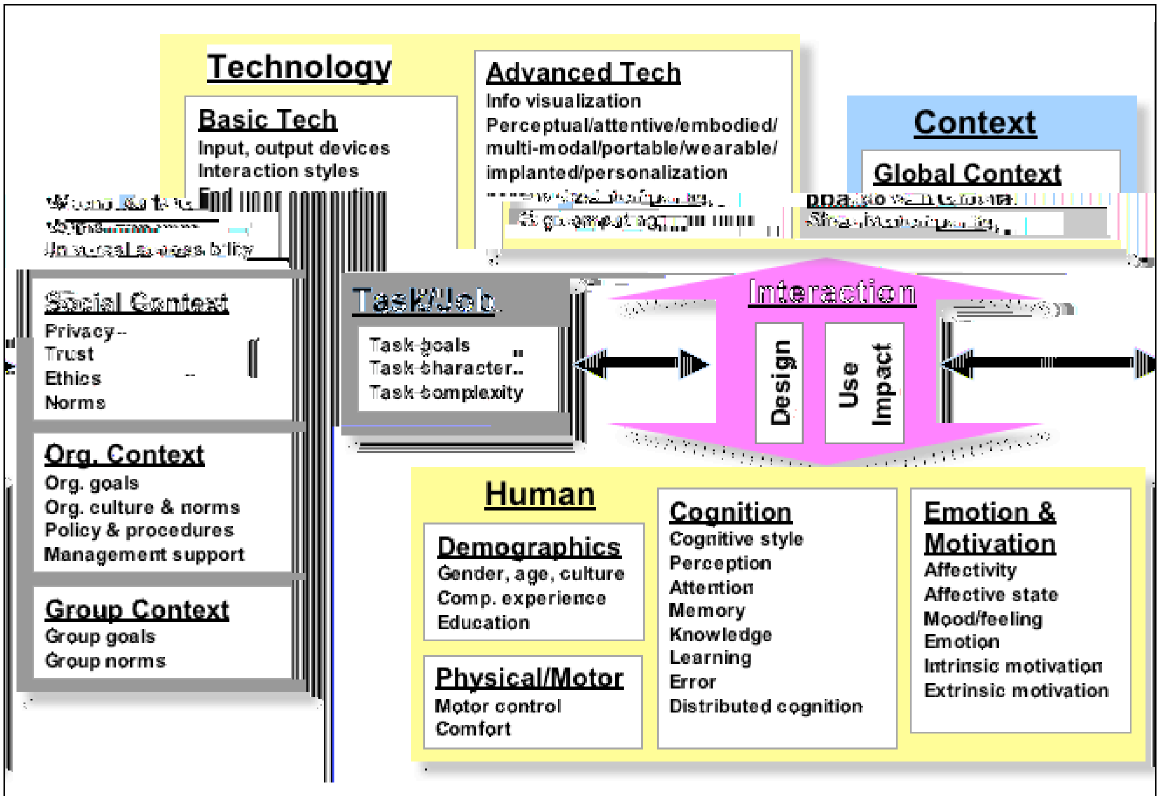


Figure 1. An Overview of Broad HCI Issues

The first basic component is Human. There can be many different ways of understanding humans in general and specific characteristics pertinent to their interaction with IT. In figure 1, we depict one way of studying the human component in HCI, exploring four categories of issues: (1) demographics that are found in many HCI studies; (2) physical or motor aspects, as those investigated in traditional ergonomics; (3) cognitive issues that have been examined by many HCI researchers in a considerable number of disciplines; and (4) emotional/affective and motivational aspects, which have recently begun to gain attention from HCI researchers. Personality traits can be examined within either cognitive or affective categories.

The second basic component is Technology, which can be broadly defined to include hardware, software, applications, data, information, knowledge, services, and procedures. Figure 1 indicates one way of examining technological issues when studying HCI. This is from the perspective of technology types often found in technical fields such as Computer Science or more technically-oriented HCI studies (Shneiderman, 1987; Shneiderman and Plaisant, 2005).

The thick vertical arrow between Human and Technology represents Interaction, the "I" in HCI. It is the core or the center of all the actions in HCI studies. Traditionally, HCI studies, especially research captured by ACM SIGCHI (Special Interest Group on Computer-Human Interaction) conferences and journals, were concerned with designing and implementing interactive systems for specified users, including usability issues. The "Design" box on the left side of the "I" arrow indicates this emphasis. Significant numbers of studies in the CHI literature fit into this box. Its primary focus has been on issues prior to technology release and actual use. Ideally, concerns and understanding from both human and technology should influence design and usability issues. Thus the labeling is bi-directional.

The view of HCI centered on design and usability is narrow and limited. It misses the other half of the system life cycle that has a significant impact on the entire interaction experience. John Carroll and colleagues, more than a decade ago, illustrated the task-artifact cycle: a task sets requirements for the development of artifacts; the use of an artifact often redefines the task for which the artifact was originally developed; and such task redefinitions then affect the future artifacts to be developed (Carroll et al., 1991). This concept of a cycle supports the evolutionary view of examining HCI design, which is represented by the “Use/Impact” box on the right side inside the “I” arrow in Figure 1. This second half of the Interaction is concerned with the actual IT use in real contexts and the impact of such use on users and organizations. It is important to note that design studies should be informed by what we have learned from the use and impact of the same or similar technologies. Thus, the latter has implications for the former. Historically, this use/impact half has been the focal concern for the IS discipline, along with organizational psychology, social psychology, and social science. In the IS discipline, studies on individual reactions to technology (Compeau et al., 1999b), IS evaluation from both individual and organizational levels (Goodhue, 1997; Goodhue, 1995; Goodhue, 1998; Goodhue and Thompson, 1995), and user technology acceptance (Davis, 1989; Venkatesh and Davis, 2000; Venkatesh et al., 2003) all fall in this area.

But the picture that considers Human, Technology, and Interaction alone is still incomplete. Nothing happens in a vacuum. The interaction experience is relevant and important only when humans use technologies to support their primary tasks within certain contexts. Normally, humans use technologies not for the sake of technologies themselves but for supporting their primary tasks, including those that are job or entertainment-related. In addition, tasks are carried out in a certain setting or context that imposes constraints or significance for doing and completing the tasks. Four contexts are identified: group, organizational, social, and global. The task and context boxes add the dynamic and essential meanings to the interaction experience. In this sense, studies on human-computer interaction are moderated by tasks and contexts. The two horizontal arrows connecting Task and Contexts represent this view.

Assessing the Intellectual Dimensions

Overall, there are three dimensions for examining the intellectual development of a scientific field: (1) the field itself in terms of its substance such as topics, methods, etc.; (2) supportive or contributing relationships with other scientific fields; (3) the evolution of the first two dimensions over time and into the future. In this study, we intend to address all three dimensions to some extent.

As mentioned earlier, we take Banville and Landry’s (1989) model of scientific field development (we will refer to it as the B&L model for the rest of the paper) as a high-level guideline for our study. The B&L model has three variables that can be used to describe and classify a discipline. The Strategic Dependency variable is a measure of the political dependence of the members within a field; the Strategic Task Uncertainty variable measures the conceptual coherence within a field; and the Functional Dependence variable is a measure of the technical and procedural coherence within a field. Based on the high or low value of each of these three variables, a field can be classified into one of the seven clusters of fields that share common characteristics. Banville and Landry's key position, inherited from Whitley (1984), is that there are no good or bad fields based on such classification, and all fields should be accepted for what they are (p. 58).

The B&L model is general enough to enable comparisons among different disciplines. It is also a powerful model to depict a field's potential future changes by its internal or external agents in reaction to contextual factors. Thus it is a good tool to examine the third dimension mentioned above and predict future directions. However, for someone who is not familiar with a field, the B&L model does not present the field itself (the first dimension), or the specific relationships with other fields (the second dimension). From this perspective, it is limited but can still support an overview of the HCI sub-discipline.

In the MIS field, several elements are often used to illustrate the field's intellectual development. For example, Culnan (1986) considered four elements: (1) the subfields that constitute MIS research, (2) the reference disciplines of these subfields, (3) the diffusion of the ideas represented by these subfields to other disciplines, and (4) active subfields of current MIS research. In a follow-up study, Culnan (1987) emphasized (1) the intellectual subfields that characterize current MIS research, and (2) the progress MIS has made toward establishing a cumulative research tradition. While focusing on theory building and progress, Webster and Starbuck (1988) utilized two elements: the substance and research methods of scientific fields. Others have used elements such as research variables (Ives et al., 1980) and knowledge utilization (Hamilton and Ives, 1982).

Most of these elements are reflected in our first two dimensions. The second element in Culnan (1987) is related to our third dimension. Together they should provide a reader with a very good understanding of the field itself, as well as its relationships with other fields. We do notice that some of these elements are not at the same abstract level. For example, research variables and knowledge utilization seem more detailed than subfields and can be even subfield-specific. In addition, a researcher may want to know more than just these elements for the first two dimensions, especially if the researcher plans to conduct research in this field and hopes to learn more about the research ingredients. Some of these additional elements can be MIS specific, such as the IT component; some can be HCI-specific, such as the human characteristics being studied.

In this study, we intended to address the three dimensions as three general research questions. Each general question is decomposed further into detailed questions that can be answered directly by the literature assessment. Because of the sensitive difference between the terms "field" and "discipline" in later parts of this paper (see the section on Classification for Contributing Disciplines), starting from this point, we use "discipline" to represent MIS as we have discussed it so far, and "sub-discipline" for the HCI research we are assessing. Table 1 summarizes these general and specific questions. We start the specific questions within the first dimension with "What are the contexts of studies?" as this is one major distinction between HCI studies in MIS and HCI studies with a more technical orientation.

Table 1. Research Questions on the Intellectual Development of the HCI Sub-Discipline	
RQ1	What constitutes the intellectual substance?
	RQ11: What are the contexts of studies? RQ12: What are the research areas or subject topics? RQ13: What topics are often co-studied? RQ14: What are the research methods? RQ15: What methods are often used to study what topics? RQ16: What are the levels of analysis? RQ17: To what extent does the HCI sub-discipline consider IT as a research component? RQ18: To what extent does the HCI sub-discipline consider individual characteristics?*
RQ2	What are the relationships with other disciplines?
	RQ21: What are the disciplines contributing to the HCI studies? RQ22: What contributing disciplines are often co-cited in HCI studies? RQ23: What disciplines are often used to support what subject topics?
RQ3	What are the recent evolutions?
	RQ31: What are the changes in the subject topics over the years? RQ32: What are the changes in the research methods over the years? RQ33: What are the changes in considering IT or service as a research component? RQ34: What are the changes in considering individual characteristics as a research component? RQ35: What are the changes in the contributing disciplines over the years?
RQ4	What are the patterns of publishing HCI studies in the primary MIS journals?
	RQ41: What percentage of published works are HCI studies? What is the trend in such percentage? RQ42: What topics are "preferred" by which journals? RQ43: What methods are "preferred" by which journals? RQ44: Which contributing disciplines are cited more frequently in which journals?
RQ5	Who are the contributing members?
	RQ51: Who are the most prolific authors? RQ52: What are the most prolific institutions housing HCI researchers?
Note: * Not all individuals involved in HCI studies are users. Some of them are developers, designers, or analysts.	

In addition to the three dimensions, a particular interest of this study is to examine the primary MIS journals for their patterns of publication of HCI studies. Journals play an important role in a science discipline and are one of the major reputation-building mechanisms that support the social function of the discipline (Banville and Landry, 1989). As one of the several sub-disciplines of MIS, HCI has been through some ups and downs. For example, Culnan (1986) concluded that only the first four factors out of the nine were active at the time. The non-active factors included those that are close to HCI studies. Yet, in a very recent study, Banker and Kauffman (2004) claimed that HCI was one of the five MIS research streams. These claims were all based on publications. And to a degree, they were constrained by the specific journals. For example, Banker and Kauffman's claim was based on one journal, *Management Science*, for a period of 50 years. It is to this end that we are particularly interested in knowing the current publication patterns of the HCI research in the top MIS journals. We group the related research questions into RQ4.

Finally, one important component of a scientific field is its members or knowledge contributors. This recognition encouraged Culnan to begin her assessment of the intellectual development of the MIS field by using a set of key authors (Culnan, 1986; Culnan, 1987). Therefore, it is very interesting to know who the main contributors of the HCI sub-discipline are. Keep in mind, of course, that such a list is time-dependent (we can only focus on a period of time, 13 years for this study) and journal-dependent (we can only examine a limited number of journals, 7 in this study). Related to the contributing authors is the question of which institutions house these authors. This has implications for many people, including graduating Ph.D. students who are passionate about HCI and seeking academic employment where their research is appreciated, encouraged, and supported. It could also impact choices of prospective doctoral students for the same reason. It has implications for potential collaborators who share similar research interests. In academia, people switch institutions from time to time. Thus we are interested in the authors' academic homes at the time the papers are published. These questions are grouped into RQ5. Hence, RQ1, RQ2, and RQ3 are more about the cognitive side of the sub-discipline, while RQ4 and RQ5 lie more toward the social side. We will revisit this later in the discussion section.

Methodology

There are generally three approaches for empirically assessing the intellectual development or state of the IS discipline or its sub-disciplines. The first is to use classifications to code interesting elements such as topics and methods of published articles in the discipline (Romano and Fjermestad, 2001; Vessey et al., 2002). The second is to use citation analysis to examine the references to cited articles (Culnan, 1986; Culnan, 1987). The third is to use surveys or interviews to collect researchers' perceptions (Lee et al., 2003; Teng and Galletta, 1991; Watson et al., 1999). There are a number of studies that examined both the philosophical issues surrounding progress in academic disciplines such as IS and the existing status of them. For a review of these studies, please see Vessey et al. (2002).

This current study provides an objective and representative overview of the intellectual development of HCI research within the MIS discipline. We considered the first approach discussed above, the classification-based approach, to be appropriate for the study. This section introduces the journal and article selection criteria and processes, the development or adaptation of the classification schemes, the coding procedure, and the reliability test.

Journal and Article Selections

As mentioned above, this study assesses the HCI studies within the MIS discipline. Therefore, we considered only prime peer-reviewed MIS journals that publish general MIS research. There are several highly regarded journals on HCI, such as *ACM Transaction on Computer-Human Interaction* (ACM TOCHI), *Human Computer Interaction* (HCI), *Behaviour & Information Technology* (BIT), *International Journal of Human-Computer Studies* (IJHCS, formerly *International Journal of Man-Machine Studies*), and *Informational Journal of Human-Computer Interaction* (IJHCI), to name a few. Some MIS researchers do publish their HCI studies in these journals (Finneran and Zhang, 2003; Lim et al., 1996b; Sein et al., 1993; Te'eni, 1990). Yet, in general, these journals are not considered prime MIS journals. For example, none of these journals was considered in studies assessing MIS research (Vessey et al., 2002) or productivity (Chua et al., 2003). In addition, some highly regarded MIS journals were excluded from this study due to their specific topical foci. Examples of such journals include *Decision Support Systems* and the *International Journal of Electronic Commerce*.

In order to have a representative and elucidative understanding of the HCI sub-discipline of MIS, yet maintain a manageable workload, we focused on published research articles from seven prime MIS journals for the period of 1990 to 2002. The time period covered in this study is more than double the period that is normally used in this type of research (Chua et al., 2003). The seven MIS journals are: *Management Information Systems Quarterly* (MISQ), *Information Systems Research* (ISR), *Journal of Management Information Systems* (JMIS), *Management Science* (MS), *Decision Sciences* (DS), *The Data Base for Advances in Information Systems* (DB), and *Journal of the Association for Information Systems* (JAIS). All but one (JAIS) of these seven journals are commonly considered top or outstanding journals in the MIS discipline (Hardgrave and Walstrom, 1997). Although not ranked in many journal assessments due to its recent inception, *JAIS* is included in this study owing to its unique position as the flagship research journal for the Association for Information Systems (AIS), and its perceived high quality and rising stature in recent journal ranking studies (Lowry et al., 2004). Overall, our approach is consistent with other similar studies (e.g., Vessey et al., 2002).

We used a two-stage process for paper selection. First, we formed a pool of all IS research articles published in the seven journals. Among these journals, five are mainly IS journals: MISQ, ISR, JMIS, DB, and JAIS. Thus, we considered all research articles published in these five journals as IS articles. The other two, *Management Science* and *Decision Sciences*, have IS departments within the journals, but also publish research articles in other areas such as management, decision science, and operations research, to name a few. For these two journals, we considered only IS articles, as Vessey et al. did (2002). The pool of candidate articles excludes editorial introductions, editorial notes, executive summaries, book reviews, dissertation abstracts, letters, and announcements. We included Issues and Opinion articles only if they were closely related to research. As a result, we identified 1,419 IS articles to form the first pool.

Second, we identified a pool of HCI articles from the IS article pool. A HCI paper should address one or more human-computer interaction issues, as discussed in the previous section. We excluded a paper if: (1) it was about pure system design or development methods or processes without linking to human considerations; (2) it was concerned with group support systems but did not approach it from a human perspective either at the individual or group level; or (3) it was purely concerned with the personnel or human resource management issues related to IT.

We then coded each paper in the HCI pool according to the classification schemes to be explained below. During the coding process, we evaluated each paper again for its relevance to HCI. As a result, a total of 337 HCI articles were included for the final analysis. The Appendix provides a list of these 337 articles by journals.

A Multifaceted View of the Literature

Owing to its interdisciplinary nature, IS research encompasses an array of rich research ingredients. Past literature assessments in IS have examined research topics (Pervan, 1998; Romano and Fjermestad, 2001; Vessey et al., 2002), methods (Alavi and Carlson, 1992; Pervan, 1998; Romano and Fjermestad, 2001; Vessey et al., 2002), reference disciplines (Vessey et al., 2002), and levels of analysis (Vessey et al., 2002). These are also reflected in our research questions.

In addition to these four facets, we considered three more facets based on the nature of HCI research as discussed above: individual characteristics, technology characteristics, and the immediate context of the studies. Our particular interest in HCI directly suggests an exploration of whether any specific individual characteristics were examined in the studies. IT is another hallmark of the IS discipline (Benbasat and Zmud, 2003; Orlikowski and Iacono, 2001; Weber, 2003; Whinston and Geng, 2004) and the HCI sub-discipline, and is often an ingredient of a study. Finally, studies on the interplay between humans and technologies do not occur in a vacuum but within specific contexts, which is the signature of HCI studies in MIS. Context also plays an important role in any study to ensure the external validity of the study (Cook and Campbell, 1979).

We thus conducted this literature assessment around a multifaceted view to demonstrate the various aspects or ingredients of the IS studies that are concerned with humans' interactions with technologies. In order to answer the research questions, we classified all the selected articles in terms of each of the seven facets. Some facets have existing classification schemes that we used or adapted. We also developed a number of schemes specifically for this study. As in similar studies of this nature (Vessey et al., 2002; Vogel and Wetherbe, 1984), we intended to develop classification schemes that are both comprehensive and parsimonious, and thus easy to use. We discuss each of these seven schemes in detail in the rest of this section.

Existing studies on literature assessment often limit each paper to only one category of a classification (Romano and Fjermestad, 2001; Vessey et al., 2002). We believe that this is a limitation and may prevent the complex nature of the research discipline from being revealed. For example, many IS articles utilize more than one research method as the main methods for their studies. Because IS is interdisciplinary, it is typical for IS studies to build on multiple major contributing disciplines instead of just one. It is also possible for a study to focus on more than one major subject topic. Thus, unlike other similar studies, we allowed a paper to be assigned to multiple categories with respect to a specific facet. We believe this can reveal the true nature of the studies and more interesting patterns. Then co-occurrence analyses will allow us to address research questions such as "What contributing disciplines are often used together?" and "What topics are often studied together?"

We also performed cross-facet analyses to answer questions such as "What methods are often used to study what topics?" and "What contributing disciplines are often used to study which topics?" These examinations can provide interesting insights that otherwise could not be detected. To our knowledge, few existing studies on IS research assessment have addressed such co-occurrence or cross-facet analyses.

Classification for Context

Context refers to the setting or environment where a study is conducted. Although context may have different abstract levels and is relative, that is, a study can have an immediate context C and a broader context D, we only consider the immediate context C where the study is conducted. The following six contexts are identified (Table 2).

Table 2. Context Classification Scheme	
A	Organizational or workplace setting. This also includes colleges or universities if students are subjects and the tasks are related to their studies or schoolwork.
B	Market place, where commerce, banking, and marketing take place
C	Home setting, where issues such as home PC adoption and use behavior are examined
D	Social environment, which differs from the former three categories in that it refers to a general setting in a less organizationally constrained environment. For example, studies on online communities tend to be conducted in a social setting
E	Cultural, national, and geographical context if such are specifically concerned in studies. A good example of this category would be a cross-culture /cross-nation study of IT acceptance or the relationship between email use and Japanese characters input method
F	Other context for those papers whose contexts do not fit in any of the above five

Classification for Level of Analysis

Level of analysis refers to the level at which data are collected and analyzed, or main issues and discussions are addressed. Bariff and Ginzberg (1982) introduced four levels of analysis in behavioral IS research: individual, group, organizational, and inter-organizational (societal). The latter two levels are more concerned with organizational and industry units and less with humans. Thus our assessment on level of analysis includes individual and group.

Examples of analysis at the individual level can be those relevant to cognitive styles, individual reactions toward IT, and individual productivity or performance related to IT. Group performance in decision making and group member conflict/agreement are typical topics for analysis at the group level. Analyses could also be conducted at both individual and group levels.

Classification for Individual Characteristics

Individual characteristics refer to individual differences in various aspects, such as gender, age, cognitive style, and affective trait, to name a few. Although Figure 1 depicts a possible way of examining individual characteristics, not all of them are covered in HCI studies in IS. For example, few IS studies focus on motor control or physical attributes of humans. In addition, MIS studies treat some human factors, such as perception and cognition, differently from those in psychology. MIS studies consider these factors more from the perspective of human interactions with IT, such as perceptions of IT usefulness. Therefore, these seemingly human factors actually belong to the Interaction arrow in Figure 1. According to the ways individual characteristics are used in the IS literature, we classified them into two categories: the predetermined disposition, or personality, and the demographics of individuals. Table 3 details the individual characteristics considered in this study. Typically, if these characteristics are covered in the articles, they are used as independent variables or moderating factors, although there are some situations where personality traits or other individual factors are the targets or dependent variables of the studies (Agarwal and Prasad, 1998; Webster and Martocchio, 1992).

Table 3. Individual Characteristics Classification Scheme		
A	Disposition/personality	Personality, Affective trait, Cognitive style (e.g. visual vs. verbal oriented, field dependent/independent), Locus of control, Learning style
B	Demographics	Age, Gender, Education, Cultural background, Experience, Knowledge, Socialeconomic status

Classification for Topic

IS researchers have made several attempts at devising a classification scheme for topics of studies. Culnan, for example, identified several research streams of IS research by examining IS publication citations during the period of 1972 to 1982, then 1980 to 1985 (Culnan, 1986; Culnan, 1987). Barki and colleagues developed the MIS keyword classification scheme by examining authors' keywords in published IS research literature (Barki et al., 1988; Barki et al., 1993). Despite the influence and wide use of these classifications, we note two limitations of using them for this study. First, they were intended to classify the entire IS discipline, and are not detailed enough to classify a single sub-discipline. Second, they were developed for the specific interests of researchers assessing literature, but not necessarily from an HCI perspective. For example, Vessey et al.'s topic classification (2002) is from the perspective of different abstract levels of technology artifacts rather than from the human technology interaction perspective.

Zhang and Li (2004) presented a preliminary topic classification scheme that was consistent with the broad HCI framework. In this paper, we modified and refined Zhang and Li's classification scheme to reflect the unique interest IS scholars have in HCI. As discussed earlier, IS/HCI researchers are not particularly interested in humans *per se*, which would be the interest of psychologists, and they are not particularly interested in artifacts *per se* either, which would engage computer scientists. IS/HCI researchers apply a unique perspective to study humans interacting with technologies in certain contexts. One way of classifying related research topics would be to consider the human interactions or human interventions during the lifecycle of an IT artifact, as guided by the broad overview of HCI in Figure 1.

The IT artifact lifecycle can be divided into two main stages: *during* IT development and *after* IT development (Whitten et al., 2004). In the MIS literature, issues occurring during IT development include programmer or analyst cognition studies, user participation, user-analyst interaction, information presentation designs, and evaluation, to name a few. This is the *Design* stage, as depicted in the Interaction box in Figure 1. In the topic classification scheme, we use the phase "IT Development" to indicate a broad range of issues related to design. After development, IT is used in real contexts, and has impact on individuals, groups, organizations, and societies. We name this stage the *Use and Impact* stage, as depicted by the box on the right side of Interaction in Figure 1. There are many MIS issues that arise during this stage, such as an individual's reactions toward technology, IT use behavior and attitude, trust, user satisfaction, and group task performance or conflict.

Table 4 represents the topic classification scheme, which reflects the issues *during* and *after* development as discussed above. Within each stage, we further categorized the topics into different aspects. As in several existing literature assessment studies, we defined one broad category to classify articles that are concerned with general research issues such as methodology and measurement. The topic classification scheme in Table 4 was pre-tested, evolved, and refined by several subsets of the HCI papers.

Table 4. Topic Classification Scheme			
ID	Category		Description and Examples
A	IT development		Concerned with issues that occur at the stage of IT development and/or implementation that are relevant to the relationship between human and technology. Focus on the process where IT is developed or implemented. The artifact is being worked on before actual use.
	A1	Development methods and tools	Structured approaches, Object-oriented approaches, CASE tools, Social-cognitive approaches for developing IT that consider users/IT personnel's roles.
	A2	User analyst involvement	User involvement, User participation, User-analyst difference, User-analyst interaction
	A3	Software/hardware development	Programmer/analyst cognition studies, Design and development of specific or general applications or devices that consider some human aspects
	A4	Software/hardware evaluation	System effectiveness, efficiency, quality, reliability, flexibility, and Information quality evaluations that consider people as part of the factors.
	A5	User interface design & development	Interface metaphors, Information presentations, multimedia
	A6	User interface evaluation	Instrumental usability (e.g. ease of use, error rate, ease of learning, retention rate, satisfaction), Accessibility, Information presentation evaluation
	A7	User training	User training issues during IT development (prior 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 in use in real context.
	B1	Cognitive belief and behavior	Self-Efficacy, Perception, Belief, Incentives, Expectation, Intention, Behavior, Acceptance, Adoption, Resistance, Use
	B2	Attitude	Attitude, Satisfaction, Preference
	B3	Learning	Learning models, Learning processes, Training in general (different from user training as part of system development)
	B4	Emotion	Emotion, Affect, Hedonic quality, Flow, Enjoyment, Humor, Intrinsic motivation
	B5	Performance	Performance, Productivity, Effectiveness, Efficiency
	B6	Trust	Trust, Risk, Loyalty, Security, Privacy
	B7	Ethics	Ethical belief, Ethical behavior, Ethics
	B8	Interpersonal relationship	Conflict, Interdependence, Agreement/Disagreement, Interference, Tension, Leadership, Influence
	B9	User support	Issues related to information center, end-user computing support, general user support
C	Generic Research Topics		Concerned with general research issues and concerns

Classification for Method

We used Alavi and Carlson's research type framework (Alavi and Carlson, 1992) as a base in this study owing to its comprehensiveness and wide acceptance in the IS community (Pervan, 1998; Romano and Fjermestad, 2001).

At the highest level, the method framework distinguishes between empirical and non-empirical articles. The empirical articles capture the essence of research relying on observation and are further classified into those that describe objects and those that describe events or processes. Non-empirical articles are those that are primarily based on ideas, frameworks, and speculation rather than on systematic observation. We made several modifications to Alavi and Carlson's original framework: we divided the original "case study" into "positivist case study" and "interpretive case study"; and added individual-based "Interview" and group-based "Focus Group" to the framework; "Delphi" as a special method is also added to the framework. Table 5 provides the descriptions and examples from the paper collection in this study. The methods with no examples mean that they are not utilized in this collection of papers (see Analyses and Results section later).

Table 5. Method Classification Scheme

ID	Category Name and Description	Examples of HCI Papers
1	Non-Empirical	
1.1	Conceptual Orientation	
1.1.1	Frameworks: Proposes a framework for defining the content and scope of HCI in MIS context, and provides directions.	
1.1.2	Conceptual model of a process or structure: presents an integrated, schematic representation of a HCI-related process, structure, behavior, activity, organization, method, etc.	(Orlikowski and Iacono, 2001), (Zigurs and Buckland, 1998)
1.1.3	Conceptual overviews of ideas, theories, concepts, etc.: contains an overview of many concepts or theories in one or more areas, and does not propound or support any individual theory, idea, or approach.	(Gerlach and Kuo, 1991), (Melone, 1990)
1.1.4	Theory from reference disciplines: presents theory or theories drawn from outside the HCI sub-discipline but applied within an HCI context	
1.2	Illustration	
1.2.1	Opinion (pure, or supported by examples): gives advice and guidance for practice, in the form of rules and recommendations, steps or procedures to be followed, hints and warnings, etc. May be supported by examples and applications.	(Silver, 1991), (Hawk and Raju, 1991)
1.2.2	Opinion (supported by personal experiences): as for 1.2.1., but also describes the author's experience in some relevant context.	
1.2.3	Description of a tool, technique, method, model, etc.: usually highly specific and detailed, as well as technically or methodologically precise.	(Tan and Hunter, 2002), (Gordon and Moore, 1999)
1.3	Applied Concepts	
1.3.1	Conceptual frameworks and applications: contains both conceptual and illustrative elements. May present some concept or framework and then describe an application of it.	(Vessey, 1991a), (Te'eni, 2001)
2	Empirical	
2.1	Objects	
2.1.1	Descriptions of types or classes of products, technologies, systems, etc.	
2.1.2	Descriptions of a specific application, system, installation, program, etc.	(Chen, 1995), (Shibata et al., 1997)
2.2	Events/process	
2.2.1	Lab experiment: manipulates independent variable; controls for intervening variables; conducted in controlled settings.	(Zhang, 2000), (Morris et al., 1999)
2.2.2	Field experiment: as for lab experiment, but in a natural setting of the phenomenon under study.	(Hunton, 1996), (Webster and Ho, 1997)

Table 5. Method Classification Scheme

ID	Category Name and Description	Examples of HCI Papers
2.2.3	Field study: No manipulation of independent variables, involves experimental design but no experimental controls, is carried out in the natural settings of the phenomenon of interest.	(Barki and Hartwick, 1994), (Lee et al., 1995)
2.2.4*	Positivist case study: investigates one or a few cases in detail from a positivist perspective, assumes an objective reality existing independent of humans, may involve hypothesis testing to discover the reality.	(Hitt and Frei, 2002), (Lawrence and Low, 1993)
2.2.5*	Interpretive case study: studies one or a few cases from an interpretive perspective, assumes interactions between researchers and the phenomenon under investigation, attempts to understand the phenomenon through assessing meanings.	(Kawalek and Wood-Harper, 2002), (Davidson, 2002)
2.2.6	Survey: Involves large numbers of observations; the research uses an experimental design but no controls.	(Compeau et al., 1999a), (Carr, 2002)
2.2.7	Development of instruments: description of development of instrument/measurement or classification scheme, validation of instruments.	(Gefen, 2002), (McKinney et al., 2002)
2.2.8	Ex-post description of some project or event: interest in reporting the results of the project develops after the project is complete (or is partially complete)	
2.2.9	Secondary data: Uses data from secondary sources, i.e., data collected by sources other than the researchers.	(Dennis et al., 2001), (Beath and Orlikowski, 1994)
2.2.10*	Interview: conducted on an individual basis.	(Srinivasan and Te'eni, 1995), (Geissler et al., 2001)
2.2.11*	Delphi study (evolving and iterative developing surveys)	(Nambisan et al., 1999), (Conrath and Sharma, 1992)
2.2.12*	Focus group	(Geissler et al., 2001), (Kekre et al., 1995)

Note: * indicates modifications and expansions of Alavi and Carlson's original framework.

Classification for Technology or Service

Historically, technology has played an important role in IS research (Orlikowski and Baroudi, 1991). Despite some interesting debates on the value vs. non-value of IT in organizations (Carr, 2003) and concerns that IS researchers have not paid enough attention to IT in their research (Orlikowski and Iacono, 2001; Weber, 2003), it is important to gain an insight into the status of technology coverage through this collection of papers. Due to the already extensive and complex nature of this study, we decided to examine only the types of technologies and services, rather than to go into the significant and sophisticated classifications as did Orlikowski and Iacono (2001). A deeper analysis (similar to Orlikowski and Ianono's) could yield another interesting and insightful research article, but that is beyond the scope of this study.

Technologies can be broadly classified into two groups: end-user computing technologies and organizational computing technologies. The former supports individual needs such as productivity and communication, while the latter supports organizational functions, usually centralized or across organizations and sometimes in group settings. Besides technologies, services have become an interest of inquiry during recent years owing to the shift of IS/IT departments' responsibilities in some organizations. We listed the second-order categories and examples inside the three main categories in Table 6.

Table 6. Classification Scheme for IT and Service		
ID	Category	Description and Example
TA	End User Computing	Mainly supporting individual needs such as communication and productivity
TA1	Individual communication	email, voice mail, instant messaging (IM)
TA2	Individual productivity	MS office suite, word processor, presentation software, spreadsheet, GUI, windows, linux
TA3	Web	General web use
TA4	Other	Digital libraries, personal assistants, or others that belong to EUC
TB	Org Computing	Mainly supporting org functions and reflecting organizatinal characteristics or nature
TB1	Group/org communication	Listserv, BBS, audi/video conferencing, LAN, Intranet, telecommuting
TB2	DSS	DSS, EIS, Intelligent systems, expert systems, knowledge systems and respositories that support employees or managers' producivity
TB3	MIS	ERP, MIS, org database systems to suport organization productivity
TB4	CSCW, GDSS	Mainly for supporing group productivity and performance
TB5	Other	If it does not fit any of the above and it supports organization functions
TC	Service	Internet service, Information center

Classification for Contributing Disciplines

Contributing disciplines refer to the disciplines that support or contribute to the development of research questions, theories, models, and hypotheses. Thus, not all references in a paper should be counted toward contributing disciplines. There are several ways of classifying disciplines for different purposes. For sample disciplines and related references of developing disciplines, see Vessey et al. (2002). We needed one classification that is neutral yet represents all possible disciplines so that we could examine the multi- or inter-disciplinary nature of the HCI studies in IS and to increase the generalizability of reference disciplines across different studies. Such a classification does exist: the Research Fields, Courses and Disciplines Classification (RFCD 2002). It was developed for higher education study programs and sponsored research funding purposes and is sponsored by the Australian Research Council. RFCD has a comprehensive coverage of 24 divisions/fields, 139 disciplines, and 898 subjects. To illustrate the RFCD codes, Table 7 lists the 24 divisions, the disciplines inside the 280000 division, and the subjects inside the 280100 discipline. In our coding, we focused only on the disciplinary level, not the subject level, although we used the subjects to justify a discipline when coding any particular paper.

Table 7. The Research Field, Discipline and Subject Code (RFCD) – Partial List	
Broad Research Fields/Divisions	230000 Mathematical Sciences 240000 Physical Sciences 250000 Chemical Sciences 260000 Earth Sciences 270000 Biological Sciences 280000 Information, Computing And Communication Sciences 290000 Engineering And Technology 300000 Agricultural, Veterinary And Environmental Sciences 310000 Architecture, Urban Environment And Building 320000 Medical And Health Sciences 330000 Education 340000 Economics 350000 Commerce, Management, Tourism And Services

Table 7. The Research Field, Discipline and Subject Code (RFCD) – Partial List	
	360000 Policy And Political Science 370000 Studies In Human Society 380000 Behavioural And Cognitive Sciences 390000 Law, Justice And Law Enforcement 400000 Journalism, Librarianship And Curatorial Studies 410000 The Arts 420000 Language And Culture 430000 History And Archaeology 440000 Philosophy And Religion
Disciplines for INFORMATION, COMPUTING AND COMMUNICATION SCIENCES (280000)	280100 Information Systems 280200 Artificial Intelligence And Signal And Image Processing 280300 Computer Software 280400 Computation Theory And Mathematics 280500 Data Format 289900 Other Information, Computing And Communication Sciences
Subjects for the INFORMATION SYSTEMS discipline (280100)	280101 Information Systems Organisation 280102 Information Systems Management 280103 Information Storage, Retrieval and Management 280104 Computer-Human Interaction 280105 Interfaces and Presentation (excl. Computer-Human Interaction) 280106 Interorganisational Information Systems 280107 Global Information Systems 280108 Database Management 280109 Decision Support and Group Support Systems 280110 Systems Theory 280111 Conceptual Modelling 280112 Information Systems Development Methodologies 280199 Information Systems not elsewhere classified

It is worth noting a distinction between two terms: field and discipline. In many MIS publications, these two terms were used interchangeably without confusion (e.g., Banville and Landry, 1989; Boudreau et al., 2001; Culnan, 1986; Culnan, 1987). In this study, these two terms have different meanings, according to the RFCD classification scheme. A field (same as division in RFCD) is considered a larger concept that encompasses several disciplines. For the rest of the paper, we use these two terms in this way.

In our coding, a discipline D is considered a contributing discipline for article A only if the referenced papers used in A (a subset of the entire set of references of A) support the conceptual and theoretical development of the study in A and address issues rooted in discipline D.

Classification Procedure and Coding Reliability

We two authors independently evaluated and coded an initial subset of the papers to refine all the classification schemes and to get familiar with the coding process. Several iterations occurred during this process. After the learning stage, we finalized all classification schemes and independently coded a small set of papers. Then we held discussion sessions to resolve any disagreements and moved on to the next small set of papers until all papers were finished. We developed coding worksheet in Excel to record coding results and explanations when necessary, and compare and record any disagreements and resolutions.

In our study, each of all seven facets is allowed to have multiple categories assigned to a paper if these multiple codes are all primarily important in the study. That is, we considered only the important and primary (not the trivial) categories for a classification, as did similar research, but we allowed multiple important categories to be assigned to one paper.

Consistent with research of a similar nature (e.g., Boudreau et al., 2001), the coding of these articles required an evaluation of textual material, making the raw agreement and inter-rater reliability appropriate indicators in assessing the reliability of the coding results (Miles and Huberman, 1994). We evaluated inter-rater reliability using Cohen's kappa coefficient (Cohen, 1960), which adjusts the raw agreement by removing those "by chance" agreements. Table 8 summarizes the raw agreements and the results of inter-rater reliability analysis.

The kappa coefficients across all categories are highly significant, indicating that the two raters were independent. The kappa values for all categories range from 0.721 to 0.929, all exceeding the 0.70 standard recommended (Bowers and Courtright, 1984; Landis and Koch, 1977) and utilized by other researchers (Boudreau et al., 2001; Vessey et al., 2002). According to Landis and Koch (1977), kappa coefficients between 0.61 and 0.80 are "substantial," while those over 0.80 are regarded as "almost perfect" (Vessey et al., 2002). The reliabilities of five out of our seven categories are "almost perfect," while the other two are on the higher end of "substantial." Before further analysis, we discussed all disagreements and resolved them.

Table 8. Raw Agreement and Inter-Rater Reliability

	Context	Level	Individual Characteristics	Topic	Method	Technology or Service	Contributing Discipline
Raw agreement	0.973	0.985	0.958	0.798	0.923	0.938	0.834
Kappa	0.924	0.919	0.721	0.791	0.907	0.929	0.816
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Analyses and Results

This section presents analyses and results. We organize the presentation around the research questions (see Table 1). Within each of the five general research questions, we present the answers to the specific questions.

RQ1: What Constitutes the Intellectual Substance?

RQ11: What are the contexts of studies?

Table 9 summarizes the frequencies of various contexts employed in the studies. This table (and similar ones for other facets) reveals the following three types of information in addition to showing the occurrence frequencies during the 13 years for each context:

1. Among the 337 papers, 308 (91.4%) considered one context, nine used two contexts, one used three contexts, and 19 papers had no contexts specified in their studies.

2. As shown in the row for Total and the column for Total, a total of 348 context occurrences existed in the 337 papers, among which 276 were Organizational and Workplace context, 30 Marketplace, 2 Home, 7 Social, 5 Cultural, and 9 Other. The first percentage, "% by # of contexts," demonstrates the breakdown of each context category among all 348 contexts used. It shows that Organization and Workplace accounted for 83.9% of all context occurrences, followed by Marketplace with 9.1%.

3. Since each context occurred, at most, once in a paper, it would be interesting to see what percentage of papers used a specific context. This is represented by "% by # of papers" (the last column) in the table. These numbers demonstrate that about 81.9% of the 337 papers used the Organization and Workplace context, followed by about 8.9% of papers using the Marketplace context.

Table 9. Frequency of Contexts

		90	91	92	93	94	95	96	97	98	99	00	01	02	Total	% by # of contexts	% by # of papers
A	Organization, work place	17	15	15	13	25	30	29	28	24	19	19	25	17	276	83.9%	81.9%
B	Market place		1		2		1	1		3	1	2	4	15	30	9.1%	8.9%
C	Home										1		1		2	0.6%	0.6%
D	Social								2		1	1	2	1	7	2.1%	2.1%
E	Cultural, national, geographical					1				2		2			5	1.5%	1.5%
F	Other										2	2	2	3	9	2.7%	2.7%
	Total	19	21	16	18	26	31	30	33	30	26	26	35	37	348	100%	

Note: 308 (91.4% out of 337) articles considerd 1 context, 9 (2.7%) articles considered two contexts, 1 article considered 3 contexts, 19 (5.6%) articles had no context.

The predominant context over the years was Organizational and Workplace. This is consistent with the nature of most IS studies being situated in the Organizational and Workplace context. The second most dominant setting was Marketplace, which demonstrated an increasing trend in recent years. This coincides with the e-commerce related research in recent years, although one would expect more studies than have been shown in this table. The low frequencies of other settings indicate that IS researchers paid little attention to issues that are relevant to these contexts such as Home, Social Environment, and Cultural/Geographical settings. The frequency of no-context studies (19, or 5.6% articles) ranks third in Table 9, right after Marketplace. It is a bit surprising to see that studies with no particular contexts specified could get published in high quality MIS journals, and there were more such papers than other papers with a specific focus on several important contexts such as Home, Social, and Cultural. A closer examination of the 19 papers without specific contexts revealed that 13 of them covered issues related to IT development, and three covered general research-related issues in HCI. This partially explained why they did not have a context in the study.

RQ12: What are the research areas or subject topics?

Table 10 summarizes the frequencies of topics over the years. In addition to showing the occurrence frequencies for each topic during the 13 years, this table reveals the following types of information.

Table 10. Frequency of Topics

		90	91	92	93	94	95	96	97	98	99	00	01	02	Total	% by # of topics	% by # of papers
A	IT Development	7	7	7	8	11	8	11	12	14	5	3	7	11	111	18.8%	
A1	Development methods and tools					1				1				1	3	0.5%	0.9%
A2	User analyst involvement	2	1		1	6	1	3	4	3			1	3	25	4.2%	7.4%
A3	Software/hardware development	2	2		4		5	5	2	3	3			1	27	4.6%	8.0%
A4	Software/hardware evaluation			1				1	2						4	0.7%	1.2%
A5	User interface design & development	1	3	1		1	1	1		2	1	1	2	2	16	2.7%	4.7%
A6	User interface evaluation	2	1	3	2	2	1		4	5	1	2	4	4	31	5.2%	9.2%
A7	User training			2	1	1		1							5	0.8%	1.5%
B	IT Use & Impact	29	29	22	20	33	40	34	39	32	37	43	57	43	458	77.6%	
B1	Cognitive belief and behavior	8	11	10	9	12	14	13	13	11	11	21	20	16	169	28.6%	50.1%
B2	Attitude	7	10	4	3	10	12	5	8	5	7	3	12	10	96	16.2%	28.5%
B3	Learning	3	1	3		4	2	4	5		3	2	4	4	35	5.9%	10.4%
B4	Emotion	1	1	1			2	2	4	2	2	3	2	4	24	4.1%	7.1%
B5	Performance	7	4	3	7	3	8	6	8	10	7	9	14	2	88	14.9%	26.1%
B6	Trust				1			1		2	1	1	1	5	12	2.0%	3.6%
B7	Ethics							1		1	2		1		5	0.8%	1.5%
B8	Interpersonal relationship	2	1			1	2	1	1	1	2	4	3	1	19	3.2%	5.6%
B9	User support	1	1	1		3		1			2			1	10	1.7%	3.0%
C	Generic Research Topics	1	2		1	1	2	1	3	3	3	1	1	2	21	3.6%	6.2%
	Total	37	38	29	29	45	50	46	54	49	45	47	65	56	590	100%	

Note: 154 (45.7% out of 337) papers cover 1 topic, 126 (37.4%) papers with 2 topics, 45 (13.4%) papers with 3 topics, 10 (3%) papers with 4 topics, and 2 papers with 5 topics.

1. Among the 337 papers, 154 (45.7%) papers covered one topic and 183 papers covered more than one topic. On average, the collection has 1.75 topics per paper (590 divided by 337).

2. Among the 590 times all the 17 topics were studied, the most dominant topics fell within the IT Use & Impact area (77.6% of the overall topics). About 18.8% of the topics fell in the area of IT development. Only 3.6% of the topics addressed general research-related issues. Figure 2 summarizes the topic occurrences over the years.

3. It would be interesting to see what percentage of papers studied a particular topic. This is represented by "% by # of papers" (the last column) in the table. Table 10 shows that 50% of the articles addressed Cognitive belief and behavior (B1, including studies pertaining to perception, belief, intention, behavior, acceptance, adoption, use, resistance to use, and continued use), followed by 28.5% of the papers addressing Attitude (B2, including satisfaction and preference), 26% on Performance and Productivity (B5), and 10% on Learning (B3), all within the IT Use & Impact area. User Interface Evaluation (A6) was the most studied topic in the IT Development area, but only by 9.2% of the papers. The other two relatively well-studied topics within this area were Software/hardware development with Human Considerations (A3), and User Analyst Involvement (A2).

4. Except for Development Methods and Tools (A1), Software/Hardware Evaluation (A4), and User Training (A7), all topics are currently active in the literature,

although some are much more active than others. Several topics, such as Trust (B6) and Ethics (B7) were not studied until a later time.

Figure 2 depicts the topic frequencies of the three areas over the years. Overall, the results indicate that this collection of papers strongly emphasized issues occurring during the after-release stage where IT is in use.

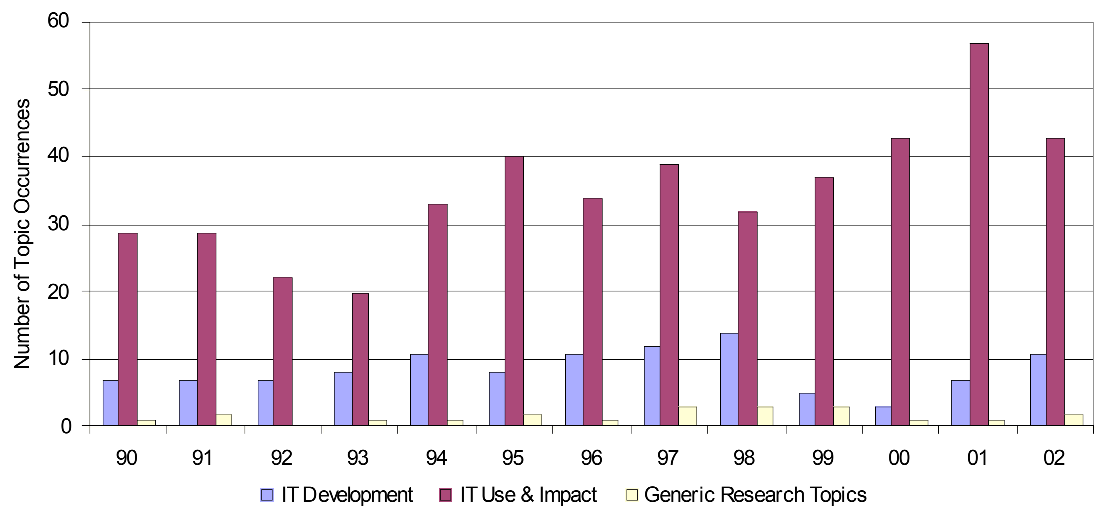


Figure 2. Number of Topic Occurrences in the three Topic Areas over the Years

RQ13: What topics are often co-studied?

Since more than half of the papers covered more than one topic, it would be interesting to see which topics were studied alone and which were studied together. Table 11 shows the frequency of topics that were studied alone, that is, each of them was the only topic in a paper.

Table 11. Frequency of the Topics that were Studied Alone

	Total Number
A1: Dev. methods & tools	1
A2: User analyst involvement	9
A3: Software/Hardware dev.	22
A4: SW/HW evaluation	4
A5: User interface design & dev.	2
A6: User interface evaluation	0
A7: User training	1
B1: Cog. belief & behavior	51
B2: Attitude	7
B3: Learning	17
B4: Emotion	2
B5: Performance	19
B6: Trust	7
B7: Ethics	3
B8: Interpersonal relationship	2
B9: User support	2
C: Research	8

For the co-occurred or co-studied topics, we focused only on pairs of topics owing to the complexity of analysis and interpretation. For example, for those articles that studied three topics, we considered each two-topic combination among the three, thus yielding three pairs of two-topic co-occurrence. Table 12 depicts the results of any pair of co-studied topics. The second row is the total for any topic that is studied with any one of the other 16 topics. The table shows that B1, B2 and B5 were the most paired topics, occurring more than 100 times each. Within A topics, A6 (User interface evaluation) was paired mostly with B topics (versus being studied alone or with other A topics). B topics were mostly co-studied with other B topics; the frequency of such co-studies was 223 (32.4% of the 688 pairs). The co-occurring frequency among A and B topics was 88, about 11% of the total 688 pairs. That is, about 11% of the total co-studied topics encompassed the two stages of the IT life cycle.

Table 12. Frequency of Co-Studied Topics

	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8	B9	C
Total: 688	3	23	7	2	23	51	8	188	135	32	36	113	6	3	37	6	15
A1: Dev. methods & tools		2								1							
A2: User analyst involvement							1	8	9			1			2		
A3: Software/Hardware dev.					1		1	2				3					
A4: SW/HW evaluation						1											1
A5: User interface design & dev.						7		4	3	2		6					
A6: User interface evaluation							1	10	7	2	1	20			2		
A7: User training								1	1	1	1	1					
B1: Cog. belief & behavior									59	10	21	40	3	2	13	1	4
B2: Attitude										5	4	24	3	1	8	5	6
B3: Learning											5	6					
B4: Emotion												2			2		
B5: Performance															9		1
B6: Trust																	
B7: Ethics																	
B8: Interpersonal relationship																	1
B9: User support																	2
C: Research																	

Note: The Total numbers are for frequency of a topic being studied with any other topics. The frequencies of co-studied topics at the high level categories are: (A, A) = 14, (A, B) = 88, (A, C) = 1, (B, B) = 223, and (B, C) = 14.

RQ14: What are the research methods

Table 13 summarizes research methods utilized in the articles. Among the 337 papers, the majority (298 or 88.4%) used one method, 37 papers used two, and two papers used three methods. Among the 378 total methods used, empirical methods (90.5%) dramatically exceeded non-empirical ones (9.5%). From the number of papers perspective, 35.6% of the papers used lab experiment, 25.5% used survey, and 12.5% used field study.

The low frequency of non-empirical studies has been fairly stable over the years. Empirical studies have been conducted almost entirely on events/processes. In particular, lab controlled experiment, survey, and field study were the three most utilized methods, followed by field experiment, instrument development, and others. This indicates that positivist research has been conducted more often than other forms of research.

Table 13. Frequency of Method

		90	91	92	93	94	95	96	97	98	99	00	01	02	Total	% by # of methods	% by total # of papers
1	Non-Empirical	6	6			1	3	2	4	3	4		4	3	36	9.5%	
1.1	Conceptual Orientation	3	1			1		1		2	1		1		10	2.6%	
1.1.1	Framework																
1.1.2	Conceptual model	1				1		1		2	1		1		7	1.9%	2.1%
1.1.3	Conceptual overview	2	1												3	0.8%	0.9%
1.1.4	Theory																
1.2	Illustration	1	2				1		4	1	2		1	1	13	3.4%	
1.2.1	Opinion (pure)	1	2				1		4	1	1		1		11	2.9%	3.3%
1.2.2	Opinion (personal exp)																
1.2.3	Desc. a tool, technique										1			1	2	0.5%	0.6%
1.3	Applied concepts	2	3				2	1			1		2	2	13	3.4%	
1.3.1	Frameworks & appl.	2	3				2	1			1		2	2	13	3.4%	3.9%
2	Empirical	14	18	18	21	28	32	31	30	30	25	26	34	35	342	90.5%	
2.1	Objects				2		1		1	1			1	2	8	2.1%	
2.1.1	Desc. class of systems																
2.1.2	Desc. of a specific				2		1		1	1			1	2	8	2.1%	2.4%
2.2	Events/Process	14	18	18	19	28	31	31	29	29	25	26	33	33	334	88.4%	
2.2.1	Lab experiment	6	4	7	12	6	9	11	8	13	10	14	15	5	120	31.7%	35.6%
2.2.2	Field experiment	2	1	1		4		3	4	1		1	2	2	21	5.6%	6.2%
2.2.3	Field study	4	3	2		3	7	4	7	1	3	3		5	42	11.1%	12.5%
2.2.4	Positivist case study				1		1			2		1		1	6	1.6%	1.8%
2.2.5	Interpretive case study	1		1	1			1		2		2	1	3	12	3.2%	3.6%
2.2.6	Survey		7	4	3	9	8	9	8	7	8	4	10	9	86	22.8%	25.5%
2.2.7	Instrument develop.		2	2		3	1	1	1	3	1		1	4	19	5.0%	5.6%
2.2.8	Ex-post description																
2.2.9	Secondary data	1			1	1	2				2	1	1	2	11	2.9%	3.3%
2.2.10	Interview		1		1	2	2	1	1				2	2	12	3.2%	3.6%
2.2.11	Delphi			1				1			1				3	0.8%	0.9%
2.2.12	Focus group						1						1		2	0.5%	0.6%
	Total	20	24	18	21	29	35	33	34	33	29	26	38	38	378	100%	

Note: 298 (88.4% out of 337) papers used 1 method, 37 papers used two methods, 2 papers used 3 methods.

It is noteworthy that five methods (Framework, Theory from reference disciplines, Opinion with personal experience, Description of types/classes of products, and Ex-post description) were not utilized in this collection of papers. Note that the numbers of papers employing "Theory from reference disciplines" methods might have been underestimated. Some studies did borrow theories from other reference disciplines and applied them in a HCI context. But the authors did not stop at this point. Instead, they continued with empirical methods to test them. Since the focus was empirical, we assigned corresponding empirical method categories to this kind of paper. Nevertheless, the lack of attention to these methods reflects the culture of HCI research in MIS. For example, it is common to find articles in CHI- or computer science-oriented journals and conference proceedings that emphasize method 2.1.1 Description of Class of Systems and 2.1.2 Description of a Specific Application.

RQ15: What methods are often used to study what topics?

The results of cross-facet analysis of method and topic are shown in Table 14. Each pair represents one method and one topic that appeared in one article. We limited our analysis to such pairing. For example, those articles that studied three topics using two methods would yield six method-topic pairs. The last column of the table shows the total frequencies of each method's usage. For example, lab experiment (2.2.1) was used 228 times to study all the topics except A4 (Software/Hardware Evaluation) and B7 (Ethics). Similarly, the last row shows how many times each topic was studied with different methods.

The most frequently occurring pairings were empirical methods and B type topics. In particular, most methods were used to study three topics, Cognitive belief & behavior (B1), Attitude (B2), and Performance (B5); two methods, 2.2.1 and 2.2.6, were used to study almost all topics. Table 14 also shows what methods were utilized for each topic. For example, Performance (B5) was studied mostly by using lab experiments. Given the limitations of lab experiments, this analysis may call for future performance studies that occur in real world settings, thus reflecting the complex and dynamic nature of the phenomena.

Table 14. Pair Frequency of Method and Topic

Method		Topic																	Total
		Dev. methods & tools	User analyst involvement	S/H dev.	S/H evaluation	User interface design & dev.	User interface evaluation	User training	Cog. belief & behavior	Attitude	Learning	Emotion	Performance	Trust	Ethics	Interpersonal relationship	User support	Research	
		A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8	B9	C	
1.1.2	Conc. model			1			1		4	3	1	1	4					1	16
1.1.3	Conc. overview			1		1			1	1								1	5
1.2.1	Opinion (pure)			2					3	1	1	1	2				1	7	18
1.2.3	Desc. a method			1					1									1	3
1.3.1	Framewks & appl.		2	2		4	1		5	4	1	1	1		1	3			25
2.1.2	Desc. of appl.			5		3	2	1		1			2						14
2.2.1	Lab experiment	1	2	17		11	23	2	49	22	17	3	65	1		11	1	3	228
2.2.2	Field experiment		4	1			2	2	10	5	6		7	1		1		1	40
2.2.3	Field study	1	5			1	1		27	19	7	6	3	2		2	1		75
2.2.4	Positivist case		2						4	4			1	1		1		1	14
2.2.5	Interpretive case	1	4						7	3			2	1		2	1	1	22
2.2.6	Survey	1	7		2			1	58	34	3	10	5	5	4	1	5	6	142
2.2.7	Instrument dev.		2		2		3	1	7	9	1	3	2	2			2	4	38
2.2.9	Secondary data						1		3	3	1	1						1	10
2.2.10	Interview	1	2			2	3		6	4	2		1						21
2.2.11	Delphi				1		1		2										4
2.2.12	Focus group					1	1		1	1									4
Total		5	30	30	5	23	39	7	188	114	40	26	95	13	5	21	11	27	680

RQ16: What are the levels of analysis?

As shown in Table 15, 304 studies (or 90%) were conducted at the individual level only, 15 at the group level only, and 6 at both individual and group levels. As shown in the last column, the majority of papers (93.8%) in this collection were concerned with individual-level analysis. This result is consistent with the conventional wisdom that studies concerning human aspects are conducted mostly at the individual level.

Table 15. Frequency of Level of Analysis																
	90	91	92	93	94	95	96	97	98	99	00	01	02	Total	% of # of levels	% by total # of papers
Individual	17	20	16	18	24	30	29	31	26	25	21	29	30	316	92.4%	93.8%
Group	3	1			2	2		1	4	2	4	6	1	26	7.6%	7.7%
Total	20	21	16	18	26	32	29	32	30	27	25	35	31	342	100%	

Note: 304 (90% out of 337) papers considered individual level only, 15 (4.5%) papers group level only, 12 (3.6%) papers both levels, and 6 (1.8%) papers with no levels specified.

RQ17: To what extent does the HCI sub-discipline consider technology or service?

Table 16 summarizes the frequencies of technologies or services being studied. 244 (72.4%) papers studied one type of technology or service, 5% two types, about 1% three types, and 21.7% of the papers did not specify technology/service. Among the 361 times technologies and services were studied, 55.9% were organizational computing tools, 38.2% were end user computing tools, and 5.9% were services. Among the 337 papers, 19.3% of papers studied DSS, followed by 11.6% papers on individual productivity tools. Other types of technologies were studied to some extent. Service was studied in 5% of the papers.

Table 16. Frequency of Technology or Service																	
		90	91	92	93	94	95	96	97	98	99	00	01	02	Total	% by # of tech	% by total # of papers
TA	End User Computing	4	7	9	6	11	3	7	13	6	10	8	9	17	110	38.2%	
TA1	Ind. communication			1	1	3	1	2	4	1	3			1	17	5.9%	5.0%
TA2	Individual productivity	3	1	5	5	3	1	3	4	3	5	3	3		39	13.5%	11.6%
TA3	Web							1	2	2	1	4	4	11	25	8.7%	7.4%
TA4	Other	1	6	3		5	1	1	3		1	1	2	5	29	10.1%	8.6%
TB	Org. Computing	8	8	6	7	11	17	19	9	15	12	14	25	10	161	55.9%	
TB1	Group/org comm.			1				1	1	4		2	5	1	15	5.2%	4.5%
TB2	DSS	4	5	5	3	5	9	7	4	7	5	2	8	1	65	22.6%	19.3%
TB3	MIS	1			3	2	3	7	2	1	3	2	4	4	32	11.1%	9.5%
TB4	CSCW, GDSS	3	1				4	2	2	3	3	6	5	4	33	11.5%	9.8%
TB5	Other		2		1	4	1	2			1	2	3		16	5.6%	4.7%
TC	Service	1	1			3	1	1	3	3	2			2	17	5.9%	5.0%
	Total	20	23	17	18	30	32	33	32	31	29	24	37	35	361	100%	

Note: 244 (72.4% out of 337) papers considered one type of technology or service, 17 (5%) papers 2 types, 3 (0.9%) papers 3 types, and 73 (21.7%) papers did not specify technology or service in the studies.

Another way of examining IT or service coverage is to conduct a cross-facet analysis on topic and IT/service. The corresponding question would be: What topics often consider IT or service?

Table 17 shows the frequencies of topic-technology pairings (a particular topic appearing in the same paper with a particular technology/service). All three topic groups (A - IT development, B - IT use and impact, and C - Research) and all three technology groups (TA - End user computing, TB - Organizational computing, and TC - Service) were co-studied. There seems no obvious “favorite” technology for a particular group of topics, and vice versa. The three most studied topics, Cognitive belief & behavior (B1), Attitude (B2), and Performance (B5), were studied with almost all types of technologies and services.

Because a large number of studies did not specify a technology/service, we included this information to gain more insight. It is shown as "Blank" in Table 17, which indicates that the frequency for topics with no technology/service (which is 127) was the highest compared to other studies with any type of technology/service.

Table 17. Pair Frequency of Topic and Technology/Service

		Topic																Total
		Dev. methods & tools	User analyst involvement	S/H dev.	S/H evaluation	User interface design & dev.	User interface evaluation	User training	Cog. belief & behavior	Attitude	Learning	Emotion	Performance	Trust	Ethics	Interpersonal relationship	User support	Research	
Tech/Service		A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8	B9	C	
TA1	Indi. comm.								12	4	4		1			2		1	24
TA2	Indi. productivity		1	4		1	7	4	20	7	7	2	10			1		1	65
TA3	Web					1	4		20	9		5	3	6		1			49
TA4	Other	1		2		2	3	1	18	11	4	4	1			1	1	4	53
TB1	Group/org comm.								8	5	2		5	2		2			24
TB2	DSS		1	7	1	4	9		29	12	8	1	34			1		3	110
TB3	MIS		8	3	1	1	1		16	11	2	1	7		1			1	53
TB4	CSCW, GDSS					3	3		14	7	4	4	16			10		1	62
TB5	Other	1	3						9	7		1	4			2		2	29
TC	Service		1						4	8							9	6	28
Blank		2	11	11	1	4	4		32	23	6	6	11	4	4	3		5	127
Total		4	25	27	3	16	31	5	182	104	37	24	92	12	5	23	10	24	624

Further, Table 18 depicts the frequency and percentage of each topic being studied without specified technology/service. Almost all topics at times were researched with no particular technology or service involved. Overall, 22% of the articles did not specify any technology/service. This co-relates with Table 16, which shows that about 21.7% of articles did not cover a particular technology/service.

Table 18. Frequency and Percentage of Topics with no Technology

Topic	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8	B9	C	Total
# of this topic being studied w/ no tech	2	11	11	1	4	4		32	23	6	6	11	4	4	3		5	127
# of this topic being studied	3	25	27	4	16	31	5	169	96	35	24	88	12	5	19	10	21	590
% of this topic being studied w/ no tech	67 %	44 %	41 %	25 %	25 %	13 %	0%	19 %	24 %	17 %	25 %	13 %	33 %	80 %	16 %	0%	24%	22%

RQ18: To what extent does the HCI sub-discipline consider individual characteristics?

Table 19 summarizes the frequencies of individual characteristics. Among the 337 articles, only 50, or 14.8% of articles, considered explicitly individual characteristics. Table 19 also includes a row, Blank, to indicate the number of articles that did not consider individual characteristics at all in their studies. These papers constituted more than 85% of the 337 papers. From the total number of papers perspective (last column of Table 19), 19 papers (8%) considered personality, 27 (9.2%) considered demographics, and eight papers considered both.

Table 19. Frequency of Individual Characteristics

	90	91	92	93	94	95	96	97	98	99	00	01	02	Total	% by total # of ind. factors	% by total # of papers
Personality	2	2	3		1	1	2	2	6	2	2	2	2	27	46.6%	8.0%
Demographics	2	2	1	1	2	3	1	6	3	2	5	1	2	31	53.4%	9.2%
Sub Total	4	4	4	1	3	4	3	8	9	4	7	3	4	58	100%	
(Blank)	16	18	13	17	23	28	27	25	21	23	17	31	28	287		85.2%

Note: among the 50 (14.8% out of 337) papers covering individual factors, 19 papers considered Personality only, 23 papers considered Demographics only, and 8 papers considered both .

Summary for RQ1

Several main observations can be drawn from the above analyses. (1) IS scholars are mainly interested in HCI issues that are concerned with IT use and impact at the individual level in organizational and work contexts. (2) A broad range of research methods are utilized, although the predominant ones are lab experiment, survey method and field study. Different methods are used to explore the same topics, and the same method for different topics. (3) Individual characteristics do not gain the level of attention one would anticipate for studies on humans interacting with technologies. Only a small portion of the studies (less than 15%) considers individual characteristics. (4) IT artifacts and services, although considered more frequently than individual characteristics in the studies, are not always clearly specified in the studies. The large number of studies that do not specify IT seems consistent with some researchers' observation and calls for more attention to the IT artifact in MIS research (Benbasat and Zmud, 2003; Orlikowski and Iacono, 2001; Weber, 2003).

Additional observations on topic coverage reveal that there is an imbalance of topical coverage as demonstrated by this collection of papers. Within the IT Use/Impact category, which is the core interest of HCI studies in MIS, much emphasis is accorded to Cognitive beliefs and behavior (50%), Performance/production (26%), and Attitude and satisfaction with IT (28.5%). Several other pertinent topics do not gain much attention: Emotion/affective (7%), Trust (3.6%), Ethics (1.5%) and Interpersonal relationships (5.6%). These topics are more concerned with the holistic and social aspects of HCI. With the focus of HCI moving from individual-based productivity to communication, collaboration, socialization, and holistic human experiences (Zhang et al., 2002), these topics may and should receive more attention in the future.

RQ2: What Are The Relationships With Other Disciplines?

RQ21: What are the contributing disciplines?

Table 20 summarizes the frequencies of the 23 disciplines that contributed to the 337 articles. Out of the 337 articles, only 38 (11.3%) articles relied on just one discipline, 119 (35.3%) articles drew upon two disciplines, 122 (36.2%) built on three, 49 (14.5%) on four, and nine (2.7%) on five disciplines. Together, these 23 disciplines were referenced 903 times, averaging 2.68 disciplines per paper. Among the 903 references for the 23 disciplines, the three most referenced disciplines were Information Systems (D2801, 36%), Psychology (D3801, 24%), and Business and Management (D3502, 17%). One caution is that D2801 is more than just MIS, as indicated in Table 7. The last column of Table 20 demonstrates which disciplines were referenced by how many papers. More than 96% of the 337 papers used Information Systems as the contributing discipline, 65% built on Psychology, and 47% relied on Business and Management.

Table 20. Frequency of Contributing Disciplines

	Discipline	90	91	92	93	94	95	96	97	98	99	00	01	02	Total	% by # of referring	% by total # of papers
D2301	Mathematics		1				1				1				3	0.3%	0.9%
D2302	Statistics	1	3		1		1		2						8	0.9%	2.4%
D2801	Information Systems	19	21	16	17	25	31	28	31	27	26	23	31	30	325	36.0%	96.4%
D2802	AI, Signal and Image Processing	2	1		1	2	3	1	2		1	2	2	1	18	2.0%	5.3%
D2803	Computer Software	1		2	2	1	5	5	6	3	2	1	2	3	33	3.7%	9.8%
D2805	Data Format							1			1				2	0.2%	0.6%
D2912	Maritime Engineering				1								1		2	0.2%	0.6%
D3201	Medicine - General										1		1	1	3	0.3%	0.9%
D3212	Public Health & Health Services													1	1	0.1%	0.3%
D3301	Education Studies	1		2		3		2		1		3	2	2	16	1.8%	4.7%
D3401	Economic Theory									1			1		2	0.2%	0.6%
D3402	Applied Economics													3	3	0.3%	0.9%
D3501	Accounting/Auditing			1				1							2	0.2%	0.6%
D3502	Business and Management	10	9	6	7	10	14	18	14	15	9	6	17	22	157	17.4%	46.6%
D3504	Transportation										1				1	0.1%	0.3%
D3701	Sociology	3	1	1		1	1	1	2	2		2	8	4	26	2.9%	7.7%
D3801	Psychology	12	11	12	10	15	22	20	25	17	17	19	23	16	219	24.3%	65.0%
D3802	Linguistics							1	1		1	1	1		5	0.6%	1.5%
D3803	Cognitive Science	2	1	2	2	2			1	1		3	1		15	1.7%	4.5%
D3901	Law				1			2							3	0.3%	0.9%
D4001	Journalism/Commu./Media	2	1			2	2	1	2	4	1	2	8	3	28	3.1%	8.3%
D4203	Cultural Studies								2			1	2		5	0.6%	1.5%
D4401	Philosophy					1		2		1	2	6	9	5	26	2.9%	7.7%
	Total	53	49	42	42	62	80	83	88	72	63	69	10 9	91	903	100%	

Note: 38 (11.3% out of 337) papers were built on one discipline, 119 (35.3%) papers on 2 disciplines, 122 (36.2%) papers on 3 disciplines, 49 (14.5%) papers on 4 disciplines, and 9 (2.7%) papers on 5 disciplines. The disciplines that were used alone are: 2801 (35 times), 3502 (once), and 3802 (twice).

Figure 3 depicts the frequencies of the contributing disciplines that were referenced more than 10 times by the 337 papers. Table 21 shows the broad fields (one level higher than disciplines as shown in Table 7) that supported this set of 337 papers. Information, Computing, & Communication Sciences (2800), Behavioral & Cognitive Sciences (3800), and Commerce, Management, Tourism & Services (3500) were the most frequently referenced fields that supported theoretical or conceptual development in HCI studies. This is fairly consistent with the top global IS supporting disciplines identified by Lowry et al. (2004), though the disciplines are classified slightly differently.

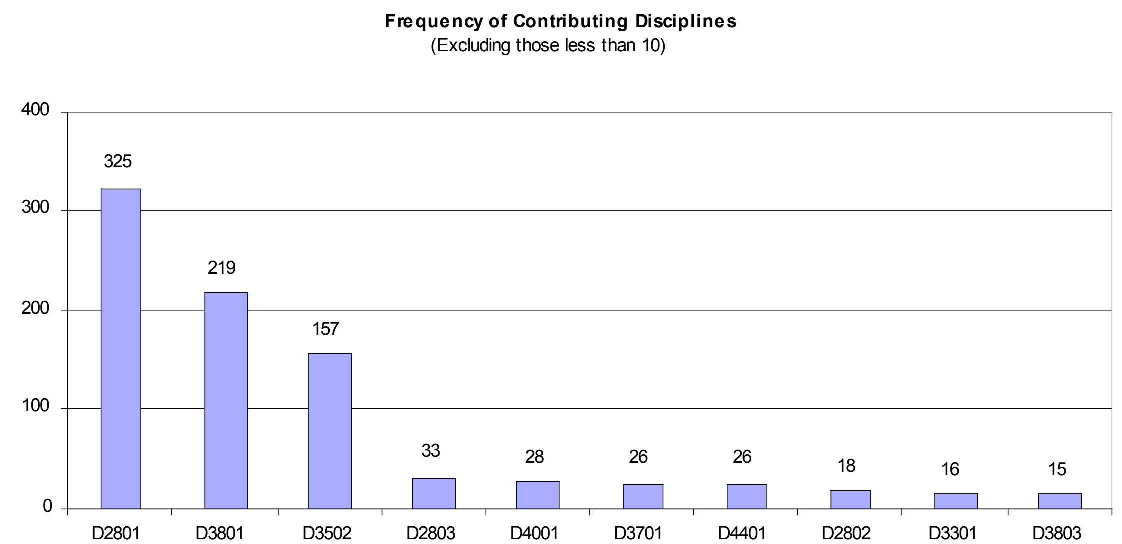


Figure 3. The Frequency of the Contributing Disciplines being Referenced More Than 10 Times

Table 21. Frequency of Fields that Contribute to the Studies

	Field	90	91	92	93	94	95	96	97	98	99	00	01	02	Total	%
F2800	Information, Computing, & Communi. Sciences	22	22	18	20	28	39	35	39	30	30	26	35	34	378	42%
F3500	Commerce, Management, Tourism & Services	10	9	7	7	10	14	19	14	15	10	6	17	22	160	18%
F3800	Behavioral & Cognitive Sciences	14	12	14	12	17	22	21	27	18	18	23	25	16	239	26%
	Other	7	6	3	3	7	5	8	8	9	5	14	32	19	126	14%
	Total	53	49	42	42	62	80	83	88	72	63	69	109	91	903	100%

RQ22: What contributing disciplines are often co-cited in HCI studies?

Table 20, earlier, shows that only 38 papers (11.3%) were built on just one discipline. The majority (299 or 88.7%) of papers relied on more than one supporting discipline. It would be interesting to ask "What disciplines are often used together to support conceptual and theoretical development in this set of research?"

Similar to the co-occurrences analysis for topics, we focused on co-occurrence of two disciplines. For those articles that built on three disciplines, we considered combinations of two-discipline pairs. Table 22 summarizes the frequencies of co-occurring disciplines.

The "Total" column of the table shows the frequency of each discipline paired with another discipline. For example, Artificial Intelligence, Signal and Image Processing (2802) paired up with other disciplines 49 times.

The most often co-occurring discipline pairs were among the three most frequently cited disciplines: (2801 Information Systems, 3801 Psychology) appeared most frequently, followed by (2801 Information Systems, 3502 Business and Management), and (3502 Business and Management, 3801 Psychology). These three disciplines (2801, 3502, & 3801) also co-occurred with other disciplines. This indicates that these three disciplines were often combined together or with other disciplines to support theoretical and conceptual development in HCI studies. Overall, the use of multiple disciplines in single studies and the number of different disciplines cited confirm the multidisciplinary nature of the HCI sub-discipline.

Table 22. Frequency of Co-occurring Disciplines

		Total	2302	2801	2802	2803	2805	2912	3201	3212	3301	3401	3402	3501	3502	3701	3801	3802	4001
2301	Math	8		3		1									2		2		
2302	Statistics	16																	
2801	IS	534	8																
2802	AI	49		17															
2803	Software	71	1	29	5														
2805	Data Format	3		2															
2912	Maritime	7		2	2	1													
3201	Medicine.	8		3															
3212	Health	5		1					1										
3301	Edu.	40		16	1														
3401	Economics	5		2															
3402	Applied Econo.	7		3															
3501	Accounting	5		2							1								
3502	Busi. & Mgt.	324	1	151	6	5		1	2	1	4	2	3	1			1		
3504	Transportation	2		1											1				
3701	Sociology	59		19									1		16		1		
3801	Psychology	431	5	215	12	21			2	1	13	1		1	101	15			
3802	Linguistics	14		5			1				1				2		3		
3803	Cog. Science	39	1	15	4	4					2						12	1	
3901	Law	9		3											3		3		
4001	Journ./Comm	74		26	2	2		1			2				15	7	18		
4203	Cultural	9		4											2		1	1	1
4401	Philosophy	18		7		2									4		5		

RQ23: What contributing disciplines are often used to support what topics?

Table 23 shows the frequencies of a particular topic appearing in the same paper with a particular discipline. The total in the last column for each discipline shows how many times the discipline appeared with all topics. For example, discipline 2302 (Statistics) appeared 16 times with various topics in the 337 articles. The last row shows the total frequency of each topic co-occurring with all contributing disciplines.

Table 23. Pair Frequency of Topics and Contributing Disciplines

Discipline		Topic																Total
		Dev. methods & tools A1	User analyst involvement A2	S/H dev. A3	S/H evaluation A4	User interface design & dev. A5	User interface evaluation A6	User training A7	Cog. belief & behavior B1	Attitude B2	Learning B3	Emotion B4	Performance B5	Trust B6	Ethics B7	Interpersonal relationship B8	User support B9	Research C	
2301	Math			1						1			1						3
2302	Statistics					2	3		2	2		1	4					2	16
2801	IS	4	24	26	3	15	29	5	163	93	35	24	82	10	5	17	10	21	567
2802	AI			5		2	3		8	5	3		6			1		1	34
2803	Software	2	2	12	1	5	8	1	4	4	2		10			1		1	53
2805	Data Format					1					1			1					3
2912	Maritime						1		1	1			1			1			5
3201	Medicine.								3	3									6
3212	Health								1	1									2
3301	Edu.						1	1	4	2	11	1	7						27
3401	Economics								2										2
3402	Applied Econo.								1	1				1					3
3501	Accounting						1		1		1								3
3502	Busi. & Mgt.	2	15	6		5	9	1	85	47	8	11	37	10	3	9	6	13	268
3504	Transportation												1						1
3701	Sociology		4			1			15	7		2	3	2		6		2	42
3801	Psychology	1	16	20		10	17	5	119	56	28	22	67	7	4	14	2	9	398
3802	Linguistics			1		2			2		1		1						7
3803	Cog. Science			5		3	3	3	5	1	1		7						28
3901	Law								1	2			1	1	1				6
4001	Journ./Comm		1			1	4		15	10	2	3	10	2		10			58
4203	Cultural								4	1		1	1			1		1	9
4401	Philosophy	1	1	1					2	1				1	4				11
Total		10	63	78	4	47	79	16	438	238	93	65	240	35	17	60	18	50	1552

The IT Development topics (A topics) seemed to be built primarily on the fields of 2800 Information, Computing, & Communication Sciences, 3500 Commerce, Management, Tourism & Services, and 3800 Behavioral & Cognitive Sciences. The overall IT use and impact topics (B topics) were built on much broader fields and disciplines.

The three most frequently cited disciplines, 2801 Information Systems, 3502 Business and Management, and 3801 Psychology, contributed to almost all the topics that were studied. The pairings of the most studied topics, Cognitive belief & behavior (B1), Attitude (B2), and Performance (B5), and the most cited contributing disciplines, Information Systems, Business and Management, and Psychology, were the most frequent topic-discipline pairs.

Summary for RQ2

HCI studies in IS are truly multi- and interdisciplinary. The majority of studies cite more than one discipline as main supporting disciplines. A large number of disciplines have contributed to the conceptual and theoretical development of the HCI sub-discipline as a whole, while the most influential disciplines are Information Systems, Business and Management, and Psychology. The fact that more than 96% of the articles relied on the IS discipline (with the realization that it embraces more than just MIS although the majority of cited works were within MIS) may be another indication that MIS is refining and growing into a mature discipline now and may function as a reference discipline to studies in other fields (Baskerville and Myers, 2002; Nambisan, 2003).

RQ3: What are the Recent Evolutions?

In order to demonstrate the recent evolutions as indicated by the collected papers, we conducted a series of linear regression analyses to examine the trends of several relevant facets and detailed categories. A regression analysis can show the impact of an independent variable (in our case, the years) on the dependent variable. A significant value of p means that the regression result fits the data well, or there is an obvious linear trend for the dependent variable through the years. A standardized coefficient, beta, expresses the impact of the independent variable on the dependent variable in terms of standard deviation unit. That is, it tells us the number of standard deviations the dependent variable increases (when beta is a positive number) or decreases (when beta is negative) with a one standard deviation increase in the independent variable.

RQ31: What are the changes in the subject topics over the years?

The regression analyses of the frequency of studies on the three topical categories showed that Category A (IT development, beta = 0.063, p = 0.839) and Category C (Research Issues, beta = 0.356, p = 0.232) did not reveal an obvious linear trend. Category B (IT Use and Impacts, beta = 0.783, p = 0.002) has gained increasing attention from researchers.

Since the overall number of articles increased over the years (see Figure 6 in RQ 41 later), it is possible that the number of articles in each category increased as well. To see if the division of overall research efforts has changed, we conducted regression analyses on the percentage of studies that cover each category out of total HCI papers published each year. None yielded significant results (A: beta = -.492, p = .087; B: beta = .130, p = .671; C: beta = .157, p = .607), indicating there is no obvious linear trend for these percentages.

Within Categories A (IT development) and B (IT Use & Impact), we examined the topics that have accounted for 2% or higher of the total number of topics studied (see Table 10). Both frequency and percentage are considered. We present the results in Table 24. None of the A category topics show any obvious trend over the years. Within Category B, three topics attracted increasing numbers of studies over the years: Cognitive belief and behavior (B1), Emotion (B4), and Trust (B6). From the percentage perspective, B1 did not evidence an obvious trend, yet Emotion and Trust increased.

We conducted one final analysis to see if covering more topics in one study was an emerging trend over the years. As presented in the answer to RQ12, the average number of topics per paper is 1.75. Figure 4 shows the number of articles with multiple topics during 1990-2002. Regression analyses revealed that the number of multi-topic articles (the top line in Figure 4) increased fairly rapidly (beta = .678, p = .011). The percentage of multi-topic papers out of all HCI papers published in the seven journals each year did not show an obvious trend (beta = -.344, p = .249). An examination of the average number of topics studied per paper showed no significant trend over the 13 years (beta = .062, p = .840)

Table 24. Regression Analyses Results for Topic Trends

Topic		Frequency		% out of HCI Papers for Each Year	
		Beta	p	Beta	p
A2	User analyst involvement	.000	1.000	-.158	.606
A3	Software/hardware development	-.185	.544	-.326	.277
A5	User interface design & development	.129	.675	-.176	.564
A6	User interface evaluation	.413	.161	.049	.873
B1	Cognitive belief and behavior	.761	.003**	.226	.458
B2	Attitude	.146	.635	-.339	.258
B3	Learning	.421	.173	-.050	.872
B4	Emotion	.718	.006**	.615	.025*
B5	Performance	.377	.205	.028	.928
B6	Trust	.666	.013*	.643	.018*
B8	Interpersonal relationship	.475	.101	.289	.339

Note: * significant at .05; ** significant at .01; *** significant at .001.

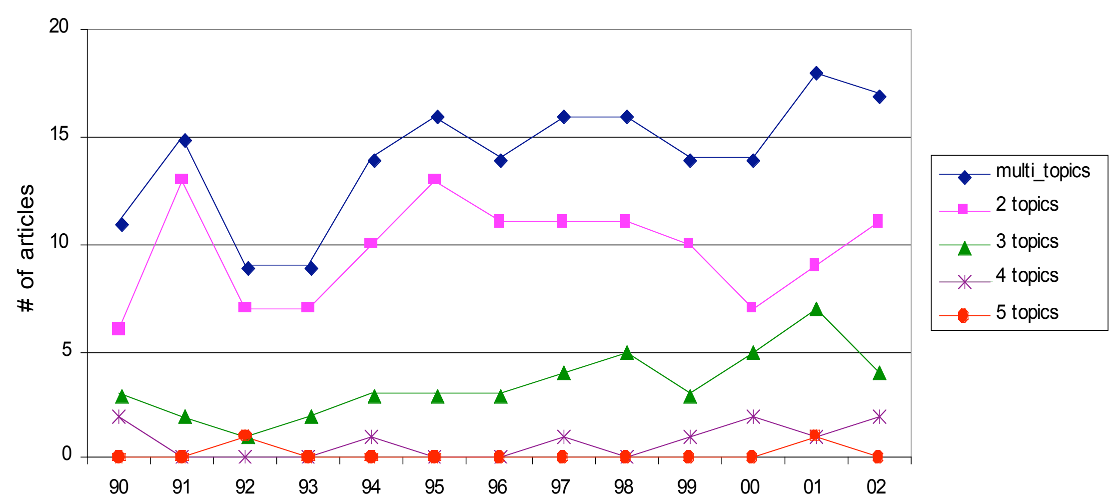


Figure 4. The Trend of Multiple Topics per Paper over the Years among all 7 Journals

RQ32: What are the changes in the research methods over the years?

Regression analyses at the higher category level indicated that the frequency of empirical method usage increased greatly over the years (beta = 0.805, p = 0.001). The frequency for non-empirical methods does not show a linear trend (beta = -0.113, p = 0.714). Regression analyses on percentages of empirical and non-empirical methods used in each year revealed insignificant results (empirical, beta = 0.348, p = 0.244; non-empirical, beta = -0.348, p = 0.244).

For the three most frequently used research methods - lab experiment, survey, and field study - regression analyses on the frequencies showed that the usage of survey (beta = .578, p = .038) increased, while no trend was found for lab experiment (beta = .501, p =

.081) or field study (beta = .000, p = 1.000). Regression analyses did not reveal significant results for the percentages of each of the three methods out of the total HCI articles each year (lab: beta = .057, p = .853; survey: beta = .321, p = .285; field study: beta = -.231, p = .447).

Neither the number of multi-method papers (beta = .428, p = .095) nor the percentage of multi-method papers out of all HCI papers published in the seven journals each year (beta = .045, p = .885) revealed any obvious linear trend.

RQ33: What are the changes in considering IT or service as a research component?

Regression analyses showed that the frequency of HCI articles covering technology or service factors increased over the 13 years (beta = .881, p = .000), while the number of papers not specifying technology/service did not show an obvious trend (beta = -.229, p = .321). When we checked the percentages of these two types of papers out of HCI articles published each year, we found that the percentage of studies specifying technology/service increased (beta = .682, p = .010), while the percentage of articles without specified technology/service decreased (beta = -.682, p = .010).

RQ34: What are the changes in considering individual characteristics as a research component?

Since only 14.8% of papers covered individual characteristics (see RQ18 analysis), we wondered if there had been any changes over the years. Regression analyses showed that the frequency of HCI articles not covering individual characteristics increased over the 13 years (beta = .630, p = .021); and the number of papers covering individual factors did not show an obvious trend (beta = .449, p = .124). No significant trend was found for the percentages of papers covering (beta = .158, p = .606) and not covering (beta = -.160, p = .603) individual factors.

RQ35: What are the changes in the contributing disciplines over the years?

Table 25 shows the results of regression analyses on contributing disciplines that accounted for 2% or higher of the total citing/referring to these disciplines (see Table 20 in RQ 21). The results for frequency are based on the frequency counts during the 13 years for each discipline in Table 20. Table 25 shows that five disciplines (2801 Information Systems, 3502 Business and Management, 3801 Psychology, 4001 Journalism/Communication, and 4401 Philosophy) have been increasingly cited as contributing disciplines to HCI research. It is worth noting that the three most cited contributing disciplines, 2801 Information Systems, 3502 Business and Management, and 3801 Psychology, are among the five, indicating that reliance on them has increased over the years.

Because the total number of HCI studies increased over the years, the total citation to contributing disciplines should increase as well, as shown in the Frequency column of Table 25. We wondered if the proportion of HCI studies citing a particular discipline had changed over the years. To answer this, for each year, we obtained the percentage by using the number of articles citing a discipline divided by the total number of HCI studies in that year. The analyses indicated that the reliance on Philosophy (4401) was increasing, while that on Information Systems (2801) was decreasing. A further analysis showed that 2801 was cited by 100% of HCI papers in the early years, thus causing a decreasing trend in the percentage of papers citing it. Table 26 shows the percentage of the papers citing 2801.

Table 25. Regression Analyses Results for Contributing Disciplines

Contributing Discipline		Frequency		% of HCI Papers Citing a Discipline	
		Beta	p	Beta	p
2801	Information Systems	.695	.008**	-.590	.034*
2802	AI and signal/image processing	.049	.873	-.194	.525
2803	Computer software	.272	.368	.104	.736
3502	Business and Management	.547	.053*	.183	.550
3701	Sociology	.484	.094	.296	.326
3801	Psychology	.623	.023*	.127	.678
4001	Journalism/Communication	.577	.039*	.459	.086
4401	Philosophy	.778	.002**	.782	.002**

Note: * significant or marginally significant at .05; ** significant at .01; *** significant at .001.

Table 26. Percentage of HCI Papers Citing 2801 (Information Systems)

	90	91	92	93	94	95	96	97	98	99	00	01	02
Number of papers citing 2801	19	21	16	17	25	31	28	31	27	26	23	31	30
Total number of HCI papers	19	21	16	18	26	31	30	32	28	26	24	34	32
% of HCI papers citing 2801	100%	100%	100%	94%	96%	100%	93%	97%	96%	100%	96%	91%	94%

In addition, we wanted to see if the number of different contributing disciplines in each paper changed over the years. Regression analyses did not show an obvious trend for the percentage of papers referring to one (beta = -0.355, p = 0.234) or more than one discipline (beta = 0.356, p = 0.232). The average number of contributing disciplines per paper showed an increasing trend (beta = 0.617, p = 0.025), indicating that over the years, HCI studies tend to be built on bigger sets of contributing disciplines.

Summary for RQ3

The number of studies on research topics in Category B (IT Use and Impact) increased over the years. Within Category B, three topics attracted increasing numbers of studies: Cognitive Beliefs and Behavior (B1), Emotion (B4), and Trust (B6). Among the three, Emotion and Trust gained an increasing percentage of studies among all the selected papers. The number of studies using empirical methods increased over the years. There was also an increase in the use of survey methods.

IT and service has gained more attention over the years, as both the frequency and percentage of papers specifying IT/service in the studies increased and the percentage of papers not specifying IT/service decreased. On the other hand, the number of papers not specifying individual characteristics increased over the years.

Finally, there was an increasing trend in considering more than one topic per study and relying on more contributing disciplines per study.

RQ4: What Are The Patterns Of Publishing HCI Studies In The Seven Primary MIS Journals?

RQ41: What percentage of published works are HCI studies? And what is the trend in such percentages?

Table 27 summarizes the number of IS articles, the number of HCI articles, and the percentage of HCI articles within the IS articles in each journal for each year. About 29% of the IS articles focused on HCI issues in the most recent year studied (2002).

Figure 5 depicts the percentages of HCI articles published in each journal over the 13-year period (except JAIS, which was only three years old as of 2002). These percentages range from 15% to 41%, with 24% as a whole. That is, among the seven journals for the entire 1990-2002 period, 24% of the IS articles focused on HCI issues.

Figure 6 presents the publication pattern of HCI articles in all seven journals over the 13 years. Regression analysis revealed that the number of HCI articles published in the seven journals increased as shown in Figure 6a. Similarly, the total percentage of HCI articles out of all IS papers also increased (Figure 6b).

Table 27. Number and Percentage of IS and HCI Articles Assessed in the 7 Journals

IS Articles	90	91	92	93	94	95	96	97	98	99	00	01	02	Total
DB	13	11	15	11	13	12	12	12	16	18	14	13	13	173
DS	7	17	15	15	12	8	7	17	8	17	7	10	6	146
ISR	20	12	16	13	20	16	26	21	21	20	24	21	27	257
JAIS											10	8	7	25
JMIS	27	27	31	34	33	34	35	35	30	36	35	34	36	427
MISQ	27	30	31	26	23	23	20	17	18	21	23	16	16	291
MS	5	4	4	1	10	15	11	17	12	3	10	4	4	100
Overall	99	101	112	100	111	108	111	119	105	115	123	106	109	1419
HCI Articles	90	91	92	93	94	95	96	97	98	99	00	01	02	Total
DB	2	2	3	1	3	3	1	7	5	1	2	4	6	40
DS	2	7	5	2	8	2	3	9	4	7	1	8	2	60
ISR	5	4	3	1	5	6	6	3	5	7	7	8	11	71
JAIS											3	4	2	9
JMIS	4	3	1	5	3	7	12	4	8	4	4	3	5	63
MISQ	3	4	4	8	6	7	6	8	5	7	6	7	5	76
MS	3	1		1	1	6	2	1	1		1		1	18
Overall	19	21	16	18	26	31	30	32	28	26	24	34	32	337
% of HCI in IS	90	91	92	93	94	95	96	97	98	99	00	01	02	Total
DB	15%	18%	20%	9%	23%	25%	8%	58%	31%	6%	14%	31%	46%	23%
DS	29%	41%	33%	13%	67%	25%	43%	53%	50%	41%	14%	80%	33%	41%
ISR	25%	33%	19%	8%	25%	38%	23%	14%	24%	35%	29%	38%	41%	28%
JAIS											30%	50%	29%	36%
JMIS	15%	11%	3%	15%	9%	21%	34%	11%	27%	11%	11%	9%	14%	15%
MISQ	11%	13%	13%	31%	26%	30%	30%	47%	28%	33%	26%	44%	31%	26%
MS	60%	25%	0%	100%	10%	40%	18%	6%	8%	0%	10%	0%	25%	18%
Overall	19%	21%	14%	18%	23%	29%	27%	27%	27%	23%	20%	32%	29%	24%

Note: DB: Data Base; DS: Decision Science; ISR: Information Systems Research; JAIS: Journal of Association for Information Systems; JMIS: Journal of Management Information Systems; MISQ: MIS Quarterly; MS: Management Science.

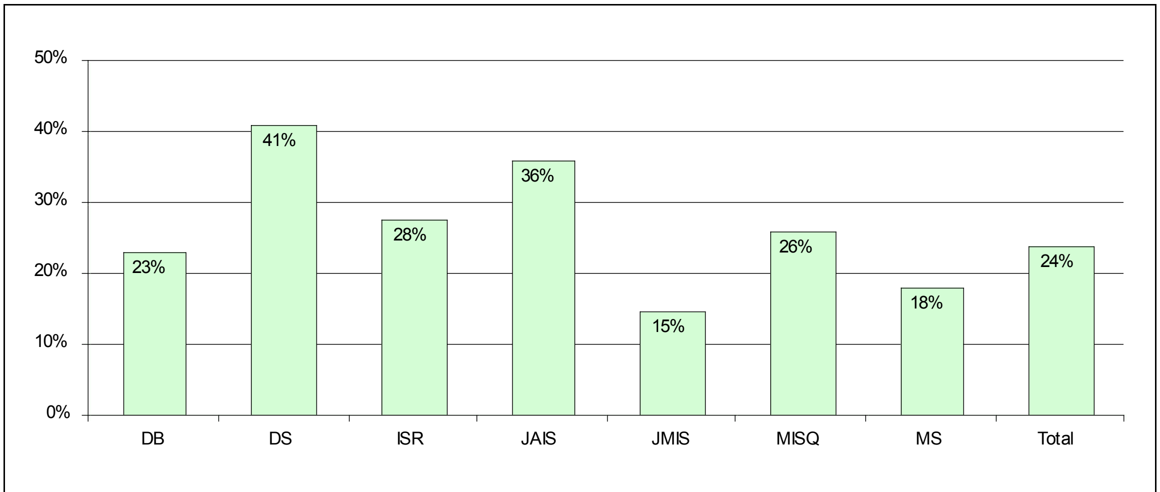
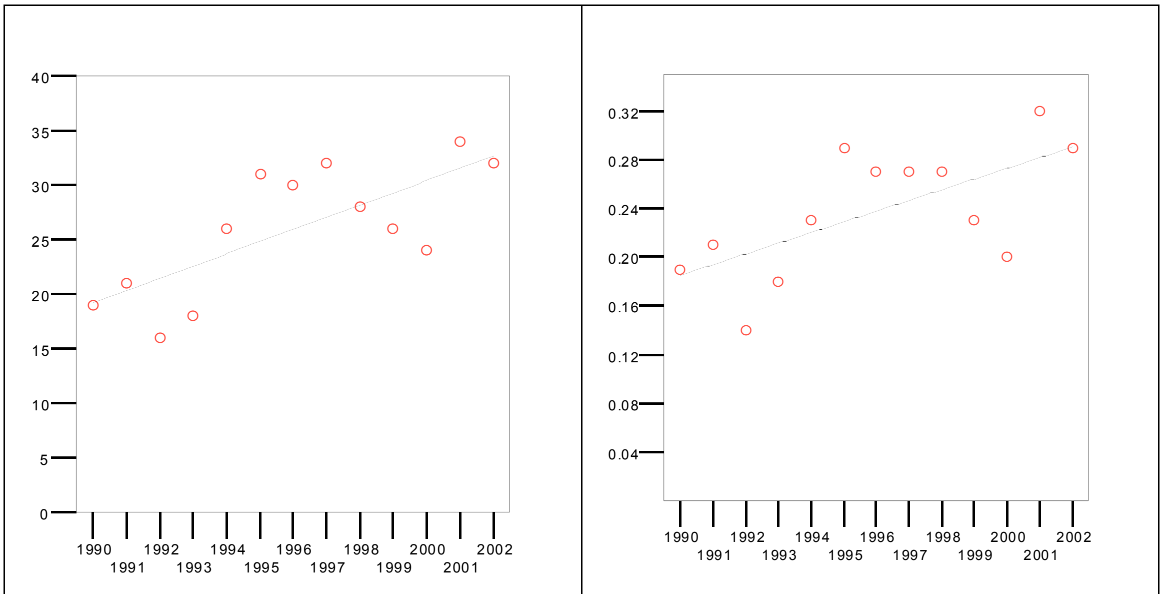


Figure 5. The Percentage of the HCI Articles in Each Journal and as a Whole



a. Frequency of HCI Articles beta = 0.735, p = 0.004	b. Percentage of HCI Articles in IS Journals beta = 0.655, p = 0.015

Figure 6. Publication Pattern of HCI Articles in the 7 Journals

RQ42: What topics are "preferred" by which journal?

Table 28 shows the percentage of topics published within each of the seven journals. In each journal, the percentages of IT Development (A), IT Use & Impact (B), and Research (C) topical categories add up to 100%. The table also demonstrates the total HCI topics and the average number of topics per HCI article in a journal.

Cognitive belief and behavior (B1) was the predominant topic, with Attitude (B2) and Performance (B5) tied as the second in all seven journals. No other topics were covered by all seven journals. The ratios between topic categories A and B ranged from 13%:87% (for JAIS and MS) to 31%:67% (for DB). DB and JMIS had a higher percentage of coverage of IT development than the other five journals. JAIS is the youngest, and thus has the fewest total number of HCI articles. MS also has a relatively small number of papers. These two journals had less topical coverage than the other five journals.

Interestingly, articles in the youngest journal, JAIS, had a much higher average number (2.6) of topics per paper, while the other journals ranged from 1.6 to 1.9 topics per article over the 13 years.

Table 28. Percentage of Topics within Journals

Topic		Journal						
		DB	DS	ISR	JAIS	JMIS	MISQ	MS
A1	Development methods and tools	3%		1%		1%		
A2	User analyst involvement	6%	3%	3%		3%	6%	6%
A3	Software/hardware development	5%	1%	6%		11%	2%	6%
A4	Software/hardware evaluation	5%						
A5	User interface design & development	2%	2%	3%	4%	5%	2%	
A6	User interface evaluation	11%	10%	3%	9%	6%	1%	
A7	User training			1%			3%	
	Subtotal	31%	15%	17%	13%	26%	14%	13%
B1	Cognitive belief and behavior	25%	24%	33%	30%	26%	31%	29%
B2	Attitude	14%	17%	14%	26%	15%	16%	23%
B3	Learning	9%	7%	7%		8%	3%	
B4	Emotion	8%	1%	5%		1%	7%	3%
B5	Performance	8%	21%	16%	13%	12%	13%	23%
B6	Trust	2%		2%	9%	2%	3%	
B7	Ethics			1%	4%		2%	
B8	Interpersonal relationship		3%	3%	4%	4%	3%	10%
B9	User support	2%	4%			3%	1%	
	Subtotal	67%	77%	81%	87%	72%	80%	87%
C	Research	2%	8%	2%		1%	6%	
Total % of topics within journal		100%	100%	100%	100%	100%	100%	100%
Total # of topics within journal		64	104	125	23	99	145	31
Total # of HCI papers in the journal		40	60	71	9	63	76	18
Average # of topics per paper in the journal		1.6	1.7	1.8	2.6	1.6	1.9	1.7

Note: DB: Data Base; DS: Decision Science; ISR: Information Systems Research; JAIS: Journal of Association for Information Systems; JMIS: Journal of Management Information Systems; MISQ: MIS Quarterly; MS: Management Science.

RQ43: What methods are "preferred" by which journal?

Table 29 summarizes the percentage of the various methods used within each of the seven journals. Within each journal, the percentages of all methods used in HCI papers add up to 100%. The table also demonstrates the total number of methods and the average number of methods per HCI article in the journal.

Table 29 shows that among this collection, the seven journals demonstrated slightly different emphases on research methods. For example, Lab Experiment (2.2.1) was the predominant method in all journals but MISQ, in which Survey (2.2.6) was predominant. In fact, Lab Experiment comprised around 40% of methods utilized in DS, ISR, JMIS, and MS. MISQ was the journal with the most diverse methods, utilizing both non-empirical and empirical (18%:81%), and within empirical, almost all methods. Survey (2.2.6) accounted for 29% of all methods employed in HCI articles in MISQ during the 1990-2002 period. ISR was the next most diverse journal in terms of methods, including 13% non-empirical methods. JMIS seemed primarily dominated by three empirical methods: Lab Experiment (2.2.1), Field Study (2.2.3), and Survey (2.2.6).

In general, three empirical methods, Lab Experiment (2.2.1), Field Study (2.2.3), and Survey (2.2.6), were popular in all seven journals. No other methods were employed by HCI papers in all seven. It is interesting to note some patterns for particular methods. For example, Conceptual-oriented papers (non-empirical) were mostly welcome in MISQ and ISR. Instrument Development (2.2.7) primarily appeared in DB, DS, ISR, and MISQ. Field Study (2.2.3) was more often “preferred” by JMIS and MS than by MISQ. Interestingly, articles in the youngest journal. JAIS also had a slightly higher average number (1.3) of methods per paper compared to 1.1 in the other six journals. Since only 39 papers used multiple methods (see Table 13), the number is too small to conduct a supplemental analysis similar to that of multiple topics in order to look for trends in recent years.

Finally, readers are cautioned against over-generalizing these results due to the relatively small number of studies within some journals and the policy changes enacted by journals.

Table 29. Percentage of Methods within Journals

Method	Journal						
	DB	DS	ISR	JAIS	JMIS	MISQ	MS
1.1.2 Conceptual model	2%		4%			4%	
1.1.3 Conceptual overview					1%	1%	5%
1.2.1 Opinion (pure)	2%	3%	3%			7%	
1.2.3 Desc. a tool, technique			1%			1%	
1.3.1 Frameworks & application		3%	5%		4%	5%	
Subtotal	4%	6%	13%		5%	18%	5%
2.1.2 Desc. of a specific application	4%				6%	1%	5%
2.2.1 Lab experiment	29%	44%	39%	33%	41%	16%	40%
2.2.2 Field experiment	4%	9%	3%	8%	3%	8%	5%
2.2.3 Field study	13%	3%	13%		20%	6%	25%
2.2.4 Positivist case study						6%	5%
2.2.5 Interpretive case study	7%		1%		1%	8%	
2.2.6 Survey	24%	25%	18%	25%	20%	29%	10%
2.2.7 Instrument development	11%	9%	6%			4%	
2.2.9 Secondary data		3%	3%	8%			
2.2.10 Interview		1%	5%	17%	1%	2%	
2.2.11 Delphi	2%				1%	1%	
2.2.12 Focus group				8%			5%
Subtotal	94%	94%	88%	99%	93%	81%	95%
Total % within journal	100%	100%	100%	100%	100%	100%	100%
Total # of methods used by HCI articles within journal	45	68	79	12	69	85	20
Total # of HCI papers in the journal	40	60	71	9	63	76	18
Average # of method per paper in the journal	1.1	1.1	1.1	1.3	1.1	1.1	1.1

Note: DB: Data Base; DS: Decision Science; ISR: Information Systems Research; JAIS: Journal of Association for Information Systems; JMIS: Journal of Management Information Systems; MISQ: MIS Quarterly; MS: Management Science.

RQ44: Which contributing disciplines are cited more frequently in which journals?

Table 30 shows the percentages of contributing disciplines within the journals. The table shows that the Information Systems (2801) discipline was most cited in all seven journals, followed by Psychology (3801) and Business and Management (3502). No other disciplines were cited by HCI studies in all seven journals. Among the seven journals, the HCI papers in JMIS and DS were built upon more different disciplines than those in other journals. Finally, articles in all seven journals were built on at least two disciplines on average, with articles in MS, MISQ and ISR slightly more multi-disciplinary than those in the other four journals.

Table 30. Percentage of Contributing Disciplines within Journals

Discipline		Journal						
		DB	DS	ISR	JAIS	JMIS	MISQ	MS
2301	Mathematics		1%			1%		2%
2302	Statistics	1%	3%	1%				
2801	Information Systems	46%	38%	34%	40%	37%	35%	33%
2802	AI, Signal and Image Processing		3%	1%		3%	2%	2%
2803	Computer Software	4%	3%	3%		8%		4%
2805	Data Format					1%		
2912	Maritime Engineering		1%					
3201	Medicine - General		1%			1%		
3212	Public Health & Health Services					1%		
3301	Education Studies	1%	3%	3%		1%	2%	
3401	Economic Theory	1%	1%					
3402	Applied Economics			1%				
3501	Accounting/Auditing/Accountability		1%			1%		
3502	Business and Management	18%	18%	17%	25%	12%	20%	27%
3504	Transportation		1%					
3701	Sociology		1%	4%		2%	3%	2%
3801	Psychology	25%	24%	26%	30%	24%	28%	23%
3802	Linguistics			1%		1%		
3803	Cognitive Science		1%	5%		1%	2%	
3901	Law						1%	
4001	Journalism/Communication/Media	1%	2%	4%		6%	1%	8%
4203	Cultural Studies	2%					1%	
4401	Philosophy			2%	5%		1%	
Total % within journal		100%	100%	100%	100%	100%	100%	100%
Total # of disciplines supporting HCI studies within journal		84	156	196	20	165	209	52
Total # of HCI papers in the journal		40	60	71	9	63	76	18
Average # of discipline per HCI paper in the journal		2.1	2.6	2.8	2.2	2.6	2.8	2.9

Note: DB: Data Base; DS: Decision Science; ISR: Information Systems Research; JAIS: Journal of Association for Information Systems; JMIS: Journal of Management Information Systems; MISQ: MIS Quarterly; MS: Management Science.

Summary for RQ4

Publication numbers and percentages of HCI studies have been steadily increasing over the years. This is a sure sign that HCI studies are attracting more interest from MIS scholars and becoming more important in MIS. The seven journals are all encouraging multi-disciplinary work, although they exhibit some differences in topics, methods, and contributing disciplines.

RQ5: Who are the Contributing Members?

RQ51: Who are the most prolific authors?

A total of 494 different authors contributed to the 337 articles. These authors came from 232 institutions (at the time of publication). Research identifying prolific authors and institutions has used three methods: normal rank, adjusted rank, and straight rank (Chua et al., 2003; Romano and Fjermestad, 2001). Normal rank is based on the assumption that all authors perform equal-value work, thus every co-author of an article receives one point. Adjusted rank assumes that the marginal contribution of an author is greater for works with fewer authors, thus each co-author of an article receives only a fraction of a point determined by the number of co-authors. For example, each of the two coauthors of a paper receives half a point, and each of the three co-authors of a paper receives one third point. Finally, straight rank is based on the belief that the first author is solely responsible for idea creation, thus is the only person receiving credit. It should be noted that the straight rank method is limited in representing the fact that many co-authors agree to be listed alphabetically in their publications. Thus all three ranking methods together should provide a clearer picture. Since not all authors can be displayed within the limited space in this paper, we only present the most prolific authors. Table 31 lists the three ranks for these authors.

Table 31. The Most Prolific Authors

Normal Rank	Author	Normal Count	Adjusted Rank	Author	Adjusted Count	Straight Rank	Author	Straight Count
1	Benbasat, I.	12	1	Benbasat, I.	5.50	1*	Agarwal, R.	7
2*	Agarwal, R.	8	2	Venkatesh, V.	4.83	1*	Venkatesh, V.	7
2*	Venkatesh, V.	8	3*	Agarwal, R.	3.50	2	Gefen, D.	5
3*	Guimaraes, T.	7	3*	Gefen, D.	3.50	3*	Alavi, M.	4
3*	Todd, P.	7	4*	Alavi, M.	3.33	3*	Doll, W.	4
4*	Cronan, T.	6	4*	Vessey, I.	3.33	3*	Kettinger, W.	4
4*	Dennis, A.	6	4*	Todd, P.	3.33	4*	Barki, H.	3
4*	Higgins, C.	6	5	Bhattacherjee, A.	3.00	4*	Chau, P.	3
4*	Igbaria, M.	6	6	Straub, D.	2.92	4*	Chin, Wynne W.	3
4*	Straub, D.	6	7*	Goodhue, D.	2.83	4*	Compeau, D.	3
4*	Vessey, I.	6	7*	Guimaraes, T.	2.83	4*	Dennis, A.	3
5*	Alavi, M.	5	8	Higgins, C.	2.67	4*	Galletta, D.	3
5*	Chin, W.	5	9*	Cronan, T.	2.50	4*	Goodhue, D.	3
5*	Davis, F.	5	9*	Davis, F.	2.50	4*	Hunton, J.	3
5*	Doll, W.	5	9*	Szajna, B.	2.50	4*	Igbaria, M.	3
5*	Galletta, D.	5	10*	Chin, W.	2.33	4*	Lim, Kai H.	3
5*	Gefen, D.	5	10*	Dennis, A.	2.33	4*	Mathieson, K.	3
5*	Satzinger, J.	5	11	Chau, P.	2.25	4*	Satzinger, J.	3
5*	Watson, R.	5	12	Igbaria, M.	2.08	4*	Shaft, T.	3
5*	Wei, KK	5	13	Barki, H.	2.00	4*	Szajna, B.	3
6	Barki, H.	4	13	George, J.	2.00	4*	Todd, P.	3
6	Bhattacherjee, A.	4	13	Hartwick, J.	2.00	4*	Vessey, I.	3
6	Chau, P.	4	13	Hunton, J.	2.00	4*	Webster, J.	3
6	Cheney, P.	4	13	Kettinger, W.	2.00			
6	Compeau, D..	4	13	Lerch, F. J.	2.00			
6	Goodhue, D.	4	13	Shaft, T.	2.00			
6	Grover, V.	4	13	Te'eni, D.	2.00			
6	Hartwick, J.	4	13	Webster, J.	2.00			
6	Kappelman, L.	4						
6	Kettinger, W.	4						
6	Lerch, F. J.	4						
6	Olfman, L.	4						
6	Speier, C.	4						

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

RQ52: What are the most prolific institutions housing HCI researchers?

The same formulas used for authors was applied to institutions, thus yielding Table 32 for three ranks among the most prolific institutions.

Table 32. The Most Prolific Institutions

Normal Rank	Institute	Normal Count	Adjusted Rank	Institute	Adjusted Count	Straight Rank	Institute	Straight Count
1*	U. British Columbia	22	1	University of Maryland	12.17	1	University of Maryland	15
1*	U. of Maryland	22	2	U. of British Columbia	10.00	2	Florida State University	9
2*	University of Georgia	18	3*	Indiana University	8.17	3	University of Calgary	8
2*	U. of Pittsburgh	18	4*	U. of Pittsburgh	7.67	4*	Drexel University	7
2*	U. of South Carolina	18	5	University of Georgia	7.47	4*	Univ. of South Carolina	7
2*	Indiana University	18	6	U. of South Carolina	6.92	5*	Carnegie-Mellon Univ.	6
3	University of Arizona	16	7	U. of Minnesota	6.42	5*	Case Western Reserve U	6
4*	Carnegie-Mellon U.	15	8*	Carnegie-Mellon U.	6.17	5*	Natl. U. of Singapore	6
4*	U. of Arkansas	15	8*	Florida State U.	6.17	5*	Queen's University	6
4*	U. of Minnesota	15	9	U. of Arkansas	6.00	5*	Southwest Missouri State U	6
5	Florida State U.	14	10	U. of Calgary	5.58	5*	University of Arizona	6
6	U. of Calgary	13	11	Queen's U.	5.17	5*	University of Pittsburgh	6
7	U. Western Ontario	12	11*	U. of South Florida	5.17	5*	University of South Florida	6
8*	Natl. U. Singapore	11	12*	Drexel University	5.00	6*	Indiana University	5
8*	Queen's University	11	12*	U. of Western Ontario	5.00	6*	Texas Christian University	5
8*	Univ. of North Texas	11	13	Natl. U of Singapore	4.75	6*	University of Georgia	5
						6*	University of Toledo	5

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

Summary for RQ5

HCI research has attracted a great number of researchers from a great number of institutions. This indicates good opportunities for collaboration and employment. The top four institutions have large overlaps among the ranks shown in Table 32: University of Maryland, University of British Columbia, Indiana University, and University of Pittsburgh. The institutions consist of scholar, whose works are in this collection of publications. An examination of the collection indicates that the following researchers were hosted by these institutions at the time of publications. The authors are listed in the order of productivity (adjusted score) within the institution. For example, Agarwal had three papers published when she was in Florida State U. and five papers when in U. of Maryland. Since we are listing authors in U. of Maryland, we only count her publication while she was with U. of Maryland.

- Maryland: V. Venkatesh, R. Agarwal, M. Alavi, J. Palmer, F. Davis, T. Asahi, R.

Johnson, V. Sambamurthy, B. Shneiderman, and D. Turo.

- UBC: I. Benbasat, J. Tan, J. Tillquist, K. Siau, L. Ward, C. Lovato, and A. Dexter
- Indiana: I. Vessey, G. Marakas, A. Dennis, M. Swink, S. Brown, L. Jessup, T. Ryan, C. Schwenk, J. Valacich, A. Massey, and N. Taylor.
- Pittsburgh: D. Galletta, W. King, B. Butler, C. Carr, W. Xia, R. Heckman, R. King, K. Hartzel, S. Johnson, J. Joseph, and S. Rustagi.

In Table 31, the top four researchers, I. Benbasat, V. Venkatesh, R. Agarwal, and D. Gefen, also overlap with each other to a large degree among the different ranks. In Table 31, all papers by a particular author are considered. For example, Agarwal has a total of eight papers in the collection.

We wondered what specific roles these top researchers and top institutions played in the HCI sub-discipline besides being the most prolific. Thus we performed additional examination of the publications by these four researchers and those from the four top institutions to see what types of work they did. The results are presented in Table 33. All the numbers in the table represent the number of papers that cover a certain aspect. For example, 15 papers from the University of Maryland covered IT Use & Impact issues. Among them, 15 papers covered Cognitive belief & behavior, two papers covered Attitude, three covered Learning, seven covered Emotion, and three covered Performance. Since one paper may cover more than one topic, the total number of papers covering each topic (15+2+3+7+3 = 30) may not equal to the number of papers covering the corresponding category (15). The same rule applies to Method, Context, Individual characteristics, and IT & Service.

Table 33. Research Characteristics of the Most Prolific Institutions & Authors

			Maryland	UBC	Indiana	Pittsburgh	Benbasat	Viswanath	Agarwal	Gefen
# of papers			17	16	16	12	12	8	8	5
Topic	A	IT Development	4	4	3	4	3	1	2	1
	A1	Dev. methods & tools				1				
	A2	User analyst involvement				2				1
	A3	S/Hardware development	1		3				1	
	A4	S/Hardware evaluation								
	A5	User interface design/dev	1	2		1	2			
	A6	User interface eval.	3	3		1	2	1	1	
	A7	User training								
	B	IT Use & Impact	15	15	13	10	11	7	7	5
	B1	Cog. belief & behavior	15	12	5	4	9	8	7	3
	B2	Attitude	2	2	2	3	2		1	
	B3	Learning	3	3	2	1	2	2		
	B4	Emotion	7		3			5	3	
	B5	Performance	3	7	10	3	5			
	B6	Trust								2
	B7	Ethics								
	B8	Interpersonal relationship				1				
	B9	User support				2				
	C	Research			1	1				
Method	1	Non-Empirical	2	2	1	1	2			
	1.1.1	Framework								
	1.1.2	Conceptual model	1	1	1		1			
	1.1.3	Conceptual overview								
	1.1.4	Theory								
	1.2.1	Opinion (pure)								
	1.2.2	Opinion (personal exp)								

Table 33. Research Characteristics of the Most Prolific Institutions & Authors

			Maryland	UBC	Indiana	Pittsburgh	Benbasat	Viswanath	Agarwal	Gefen
# of papers			17	16	16	12	12	8	8	5
	1.2.3	Desc. a tool, technique								
	1.3.1	Frameworks & appl.	1	1		1	1			
	2	Empirical	16	14	15	11	10	8	8	5
	2.1.1	Desc. class of systems								
	2.1.2	Desc. of a specific appl.								
	2.2.1	Lab experiment	3	10	11	4	8	2	1	
	2.2.2	Field experiment	1		1	1				1
	2.2.3	Field study	5	1			1	3	2	
	2.2.4	Positivist case study			1					
	2.2.5	Interpretive case study		1	1					
	2.2.6	Survey	4	2	1	5	1	2	3	3
	2.2.7	Instrument develop.	2	1		1	1	1	2	1
	2.2.8	Ex-post description								
	2.2.9	Secondary data	1		1			1		
	2.2.1	Interview	1							
	2.2.1	Delphi	1						1	
	2.2.1	Focus group								
Context	A	Organization, work place	12	10	13	11	6	6	6	2
	B	Market place	2	3		1	3	1	2	3
	C	Home	1		1			1		
	D	Social				1				
	E	Cultural, natl.,								
	F	Other	1	1			1		1	
	blank		1	2	2		2			
Individual		Personality	4		3				4	
		Demographics	3	1	3	2	1	1	1	1
IT & Service	TA	End User Computing	9	5	3	3	3	3	7	4
	TB	Org Computing	7	10	11	6	8	4	1	1
	TC	Service				3				
	blank		2	2	3	2	2	1	1	

We found that papers from the four universities and four authors share the facts that 1) most studies were conducted at the individual level; and 2) Most papers were built on multi- and interdisciplinary foundations. However, these papers do show some diversity in several aspects, as shown in Table 33. In general, however, they are consistent with the most active studies in this collection. Thus, these scholars and the institutions can be regarded as centers of excellence that help to lead, shape, and promote important HCI research in the MIS discipline.

Discussion

Before we further discuss the potential directions for the HCI sub-discipline as a whole, and the significance and implications of this study, it is important to point out its limitations.

Limitations

This paper is one of the first attempts to draw a multifaceted overview of HCI studies in the IS discipline based on the evidence of published articles. As such, it is limited in scope due to the time-consuming nature of such studies. First, it has the limitation of using a journal “basket” (Chua et al., 2003; Lowry et al., 2004) that is constrained by the selected journals and time period. Only the recent 13 years of the seven prime MIS journals were considered as paper sources in this study. While this is very reasonable, and compatible with other studies of a similar nature (Romano and Fjermestad, 2001; Vessey et al., 2002), the 13-year time period and the seven journals may have had a strong influence on the assessment results. This includes the potential biases of the seven journals’ emphases on publishable works, and the characteristics of the research that may be salient only for this period of time.

Second, we realize that some classifications are not detailed enough. For example, the RFCD classification scheme for disciplines does not distinguish different types of Information Systems in the 2801 discipline. Rather, it treats several areas that are normally regarded as different disciplines as different subjects within 2801. Psychology (3801) is similar. It would be interesting to see what type of psychology, such as cognitive psychology, organizational psychology, social psychology, or consumer psychology, etc., is most influential in some of the studies. Despite this limitation, we consider RFCD to be superior to some other classifications for disciplines due to its comprehensive coverage. Future study can be focused on levels beyond discipline to capture the specific subjects in Information Systems and Psychology.

Last, due to its inherent complexity, we did not address the three dimensions of scientific development to the fullest extent. For example, for Dimension 1, one plausible aspect is task analysis, which was omitted in the current study but presented in the broad HCI framework in Figure 1. As indicated in Figure 1, task plays an important role in HCI studies. Our literature search failed to find appropriate task taxonomies to use. In our attempt to develop our own classification scheme, we realized that it would be too complex on its own to be included in this study, thus we decided to exclude it. For Dimension 2, we only considered the disciplines contributing to the HCI sub-discipline, not the diffusion of HCI works to other disciplines (Culnan, 1986). Our methodology used in this study did not permit us to address this latter aspect of Dimension 2. Yet, we are aware of the importance and value of assessing this aspect to fully understand how other disciplines regard and value HCI research in the MIS discipline, thus experiencing the impact of the HCI sub-discipline.

Where the HCI Sub-Discipline Stands

At the beginning of this paper, we raised two questions: (1) Where is the HCI sub-discipline now? (2) Where can it go in the future? Here we come back to address the first question. (The next section addresses the future directions.)

The early detailed analyses emphasized primarily the specifics or intellectual content of the HCI sub-discipline. But they did not address the scientific development question at a level that is positioned by the B&L model (Banville and Landry, 1989), which considers a scientific discipline to be simultaneously cognitive and social. Specifically, although our early analyses did touch upon both cognitive (RQs 1-3) and social aspects (RQs 4-5) of the sub-discipline, they were not based on the three variables of the B&L model: strategic dependence, strategic task uncertainty, and functional dependence. One advantage of the B&L model is its ability to position a discipline and its potential changes along these three variables, free from its content. For this reason, the B&L model can provide a context to discuss where the HCI sub-discipline stands and where it may go.

As a sub-discipline of MIS, HCI can be argued to be qualified for application of the B&L model of analysis. There are HCI courses offered in MIS programs (Carey et al., 2004; Chan et al., 2003; Kutzschan and Webster, 2005). We have already seen in this paper that primary MIS journals publish HCI research. Prestigious conferences of MIS, such as the International Conference on Information Systems (ICIS) and the pre-ICIS Annual Workshop on HCI Research in MIS publish HCI studies. Finally, there is an official organization of HCI in MIS, the AIS Special Interest Group on HCI (SIGHCI), which members of MIS (and other disciplines) join at their discretion (Zhang, 2004). Therefore, the B&L model can be used to analyze the HCI sub-discipline.

Utilizing a similar analysis of Banville and Landry's (1989, p56), and using the results of early analyses in this paper along with other evidence, we found that the HCI sub-discipline of MIS is a Fragmented Adhocracy with low degrees of strategic and functional dependences and a high degree of strategic task uncertainty. According to Whitley (1984), the characteristics of Fragmented Adhocracy include (we use the term "field" below as it was used in the original reference):

> Research is rather personal and weakly coordinated in the field as a whole; a researcher can gain a reputation by contributing in a way that is largely specific to a group of colleagues or a research site. The field is largely open to an educated public and amateurs can affect the field's standards; barriers to entry in the field are weak and going from one fragment to another is quite easy. Reputations are fairly fluid, control of resources is unstable, coalitions are likely to be ephemeral and leadership is often of charismatic nature; common-sense languages dominate the communication system. (from Banville and Landry, 1989, p. 56)

There is sufficient evidence to argue that the HCI sub-discipline fits these characteristics and the definition of Fragmented Adhocracy. The following present just some of the evidence. During informal conversations with colleagues, the first author of this paper sensed that not all members of the HCI sub-discipline have the same understanding of what HCI in MIS is about. This is a typical situation in the MIS discipline as well, as indicated by recent discussions (e.g., Baskerville and Myers, 2002; Benbasat and Zmud, 2003; Straub and Watson, 2001). Even in formal communications such as published writings, the term HCI can be the abbreviation of different phrases such as Human-Computer Interaction (Banker and Kauffman, 2004; Zhang et al., 2002), Human-Computer Interface, User Interface, Human Factors (Carey, 1988; Carey, 1991; Carey, 1995; Carey, 1997; Culnan, 1986), and Individual (Micro) Approaches to MIS Design and Use (Culnan, 1987), among others. And more often, the term HCI may have different scopes of topical coverage in members' perceptions. This is evidenced by reviewers' uncertainty of the suitability of submissions to the HCI workshops, tracks, and MIS journal special issues on HCI. In addition, researchers' contributions are driven more by new research ideas and new technological opportunities or research fads than by concern over their colleagues' contributions, evaluation and judgment (Banville and Landry, 1989). These are all indications of low strategic dependence and functional dependence, and high strategic task uncertainty.

Answers to two research topic related questions, RQ12 ("What are the research areas or subject topics?") and RQ13 ("What topics are often co-studied?"), indicate that in general, research efforts spread out among the topics, although some topics (e.g. B1 Cognitive belief and behavior, B2 Attitude, and B5 Performance) gained more attention than others. For each particular topic, there has been little consensus yet (except the well studied user technology acceptance research, which covers topics B1 Cognitive belief and behavior, and B2 Attitude). From the research method perspective, RQ14 ("What are the research methods?") and RQ15 ("What methods are often used to study what topics?") indicate methodological pluralism and a true "blooming of many flowers" (Banville and Landry, 1989, p56). These are additional indications of a high level of strategic task uncertainty.

We agree with Banville and Landry's key position that any field should be accepted for what it is and there are no good or bad fields. The most interesting question is: Where might a field go? And if it can develop in various directions, what situations and what agents or forces will move it? In the case of the HCI sub-discipline, we wonder about its potential future directions and potential change agents.

Potential Future Directions for the HCI sub-discipline

It is beyond the scope of this study to analyze where the MIS discipline stands now according to the B&L model (B&L classified it as Fragmented Adhocracy in 1989). However, one thing HCI researchers should be aware of is that the HCI sub-discipline inherits many of the MIS discipline's characteristics and constraints. This is not, however, to say that we cannot predict where this sub-discipline could go and what might happen to it. In this section, we attempt to point out several possible directions and the potential change agents provoking movement in these directions. Keep in mind that we do not intend to qualify any direction as being better or worse than others.

Ad hoc opportunistic research vs. long term, theoretically-oriented research

Banville and Landry predicted that MIS as a whole is unlikely to have long term, theoretically oriented research due to its "vocational school" nature (Banville and Landry, 1989, p57). MIS is to be closely linked to practice and consulting (Banville and Landry, 1989). This makes opportunistic research a necessity for being on the cutting edge, competitive and reputation-enhancing for the researchers. The implication of this option is the possible maintenance of low functional dependence and high strategic task uncertainty for the HCI sub-discipline. It is noteworthy that Banville and Landry did suggest other possibilities for having linkage with practitioners yet moving the fields toward a more Partitioned Bureaucracy that has a high degree of strategic dependence and low degrees of strategic task uncertainty and functional dependence. Some of these may apply to the HCI sub-discipline as well.

On the other hand, researchers in the HCI sub-discipline have an option to actually focus on long term theoretical works. HCI research is inherently inclined toward human characteristics and human cognitive, affective, motivational, and behavioral factors. These human characteristics and factors do not change as frequently or quickly as technology or contexts, and some of them are transferable across contexts or IT artifacts. This gives HCI researchers the advantage of emphasizing the fundamental theoretical understandings of humans and their interaction with IT, and to apply or test such understandings in new IT development and IT use contexts to further enhance or enrich such understandings. In the history of HCI studies in MIS, we have seen tremendous efforts around Group Decision Support systems in the 1980s and 1990s. What did we learn from those studies that can be applied or tested in today's virtual environments for decision making or other tasks?

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

Related to long term theoretical work is the development of conceptual frameworks to understand the HCI sub-discipline as a whole. Currently, there are few studies focusing on providing frameworks and high-level overviews (See RQ14, “What are the research methods?”). This may have to do with what Teng and Galletta discovered more than a decade ago (Teng and Galletta, 1991), that few MIS researchers appear to rely on research frameworks. Frameworks and models may have failed to gain sufficient attention in guiding and structuring research findings. However, good frameworks and models do enhance our understanding at a higher level, and thus advance the sub-discipline. With the increased importance of HCI in IT development and use, and more needs for guiding practice, informative and parsimonious frameworks and models are much needed. Thus, we predict potential future growth in this area.

Theoretical work should also emphasize making informed design possible. That is, theoretical understandings of human interaction with technology should feed back to design of new and improved technologies. This should be done consciously both within the MIS discipline and between MIS and other design-oriented disciplines such as Computer Science, Engineering, and Design. Within the MIS discipline and the HCI sub-discipline, we have seen less interest in the design side of the interaction box in Figure 1 (Refer to the analysis results for RQ12, Table 10). This can become a concern because theoretical understandings that do not feed design can eventually lose their relevance. MIS researchers realize this, and some efforts are in the wings to rejuvenate the interest in this important area, as evidenced by recent calls for a conference and an MISQ special issue on design science (Chatterjee, 2005; Saunders, 2005). Effort should be put into making HCI research in MIS known to other design disciplines, and into making the work of other disciplines known to MIS researchers, because each side has a great deal to contribute to ultimate IT products. Only a strong collaborative spirit and environment can enable informed designs to produce better IT that is aware of human, organizational, and societal needs. The AIS SIGHCI has done a number of activities to make this happen. But more efforts are needed.

Emphasizing long-term theoretical research will help build functional dependence and reduce strategic task uncertainty. This will change the HCI sub-discipline classification in the B&L model toward Technologically Integrated Bureaucracy.

Pluralistic methods, dominating methods, and multi-methods

RQ14 (“What are the research methods?”) and RQ15 (“What methods are often used to study what topics?”) show that many methods are accepted in this sub-discipline and different methods can address the same research topics. This pluralism of methodologies seems highly desirable among MIS researchers in general (e.g., Baskerville and Wood-Harper, 1996; Mingers, 2001) and garners more support than adverse criticism. For example, Mingers (2001) argued that research results will be richer and more reliable if different research methods are routinely combined. If this is the direction for the HCI sub-discipline as well, then the current literature shows a need to utilize more interpretive and qualitative research methods in HCI studies. The advantage of such pluralism is obvious. Due to the dynamic nature of HCI for supporting tasks and within contexts, and to be more social and communicative, research methods such as action research, case study, ethnography, etc. are better suited for addressing the complexity and dynamics of the HCI phenomena in real and normal settings.

There seems to be a trend in which certain methods are gaining more popularity in this sub-discipline (See RQ32, “What are the changes in research methods over the years?”). Extending this trend, we predict that the application and resulting explanation of these methods will generate a common language in the community and high demand for rigor in research. This seems also in line with the MIS discipline (See Boudreau et al. 2001 for the state of and a call for validation in IS research). This direction has an impact on increasing functional dependence of the HCI sub-discipline.

Finally, utilizing multiple methods in one study is on the horizon, although not a common practice yet (RQ14 shows only less than 12% of the 337 papers used more than one method, and RQ32 shows no trend of gaining popularity).

General MIS journals, specific HCI in MIS journals, and general HCI journals

According to Banville and Landry (1989), the creation of prestigious MIS journals would have the effect of increasing the degree of functional and strategic dependencies, since authors could refer more easily to other MIS publications (in the MIS journals) and less to management theory for publication in other disciplines (e.g., Management journals in which MIS research was initially published). Authors need to reference what has been published in a discipline in order to publish in that discipline, even if the referenced work is less relevant. With the same line of argument, specific HCI journals targeted to the HCI research in MIS would have similar effects on the HCI sub-discipline. Currently there is no such journal, although several major MIS journals do publish a significant percentage in the HCI area (See RQ41, “What percentage of published works are HCI studies?”). Thus, creating specific journals could be one direction for the HCI sub-discipline.

It is noteworthy that creating specific HCI journals will not necessarily or automatically make them prestigious and, thus, likely to enhance the author’s reputation. The prestige of a journal is built over a rather long period of time and is affected by many factors. One can also argue the many advantages of utilizing the well-established prestigious MIS journals as the primary outlets for HCI research. One major advantage is the immediate impact of these reputable MIS journals on researchers’ tenure and promotion evaluations. Thus, staying with the prestigious MIS journals for the HCI sub-discipline is a viable direction. In fact, several initiatives have been conducted to increase the publication of HCI research in top MIS journals. For example, with the strong support from the journals’ editors-in-chief, AIS SIGHCI has sponsored four special issues so far: three with Journal of Association for Information Systems (January and March, 2004 and forthcoming in 2006 and 2007) and one with Journal of Management Information Systems (forthcoming in 2005). A panel on “Publishing HCI Research in MIS Journals” was held at the third pre-ICIS Annual Workshop on HCI Research in MIS, where editors-in-chief from MISQ, ISR, and JMIS showed their strong support and provided constructive suggestions for publishing more HCI works in these journals.

Another direction is to extend publication efforts in general top HCI journals. Although this study did not address the diffusion of the HCI sub-discipline to other disciplines, we do realize the fact that many general HCI journals welcome the type of work this sub-discipline produces. For example, so far, with the purpose of increasing dialogues and synergies with scholars outside MIS, AIS SIGHCI has sponsored four special issues in general HCI journals with prestigious stature: two with the International Journal of Human-Computer Studies (Volume 59, Issue 4, October 2003; and forthcoming in 2006), one in Behaviour & Information Technology (Volume 23, Issue 3, May-June, 2004), and one in the International Journal of Human Computer Interaction (Volume 19, No. 1, September, 2005). MIS scholars do frequently publish in these and other general HCI journals including ACM Transactions on Computer-Human Interaction (e.g., Lim et al., 1996a), Human Computer Interaction (e.g., Sein and Bostrom, 1989), Interacting with Computers (e.g., Tractinsky et al., 2000), and Computer in Human Behavior (e.g., Webster et al., 1993), to name a few. Thus our authors are relatively familiar with these general HCI journals, as are the broad audience of these journals with our work. Expanding existing effort is, thus, feasible and plausible. Extending the effort increase the recognition of the prestige of these general HCI journals in the MIS institutions where the HCI scholars are housed. Consequently, this will help with tenure and promotion evaluations of our scholars and, overall, will strengthen the HCI sub-discipline within MIS. Extending the effort will also make HCI research in MIS known to scholars outside MIS, especially those in design-oriented disciplines, thus facilitating the process of feeding MIS research back to the IT design stage.

Of course, these directions do not have to be mutually exclusive.

Implications for Research, Education, and Practice

Besides some of the research directions pointed out earlier, this study has several additional research implications. By demonstrating the multifaceted view of the sub-discipline, this study outlines the ingredients of a typical research study. In addition to being used to assess a literature, the seven facets may be used by a scholar to design a research study, including dissertation research. Results from this literature assessment may trigger some interesting explorations. For instance, Table 14 shows the co-occurrence pattern of research topics and methods. This may give scholars a clue to which methods have been proven to be effective (or ineffective) in examining a certain phenomenon and which methods might lead to a fresh viewpoint and thus be worth exploring. For topical components to be included in a study, Figure 1 gives a high level overview and illustrates the potential relationships of the components. Finally, this study provides a number of very useful classification schemes that can guide future studies. For example, the classification of the HCI research topics is very comprehensive and allows dialogues with other related disciplines such as design-oriented disciplines. Each of the topics in the scheme can be further examined in terms of its current status and future directions. An existing classification framework for methods (Alavi and Carlson, 1992) is expanded to reflect the current research methods. The classification of contexts depicts the rich environments where MIS-oriented HCI studies are conducted.

This literature assessment has implications for IS teaching and education, especially in preparing our doctoral students who are interested in broad HCI issues. In addition to studying the IS discipline, students might well familiarize themselves with knowledge and issues from several other disciplines, especially psychology and business, and be able to conduct research with a variety of research methods. The recent trend toward multiple topics within a study challenges our future scholars to prepare themselves accordingly. Frequently used methods should be taken into consideration when doctoral program directors or curricula committees decide what methodological courses should be offered.

This study has practical implications as well. While designing IT, in general, and user interations in particular, practitioners are strongly encouraged to examine what happens after previous or similar products have been released and put into use in real contexts, as depicted by the two-stage Interaction arrow in Figure 1. Such an examination should provide abundant insight for the design of new products. As demonstrated by this study, the majority of HCI studies in the MIS discipline are particularly interested in issues that occur in the use and impact stage, thus its research results are worth referencing by the practitioners. The topic classification scheme (Table 4) lists a variety of issues and concerns that can provide a HCI designer with broad perspectives pertinent to human interaction with technologies in various contexts.

Conclusions

HCI research in MIS has as long a history as the MIS discipline. The importance of HCI research is elevated by the continued expansion of IT capabilities yet limited realization of IT values because of human users' cognitive qualities, information processing capabilities, and use of IT (Banker and Kauffman, 2004). Understanding the current state, evolutions, and possible future directions is important to the HCI sub-discipline, to MIS as a whole, and to other closely related disciplines.

To our knowledge, this study is one of the few that systematically assesses the IS literature to depict the status of the research considering humans and their interaction with technologies. The study is informative in providing the state of the art of research issues and concerns, research emphases and gaps, potential research directions, and publication and employment opportunities. Thus, it can play an important role in the identification and promotion of this sub-discipline, and suggest directions for guiding future efforts in research, collaboration, publication, practice, and education. It can also help interested doctoral students to identify potential research topics for dissertation research, and even suggest academic institutions for future employment. Overall, this study contributes to the literature in a unique way.

The rapid development and pervasive use of technology prompt a need to re-examine broad HCI issues in light of IT development, actual use, and impact on all aspects of our lives. The framework in Figure 1 emphasizes the entire interaction cycle between human and technology, rather than a stage or part of it. It also includes tasks and contextual factors. This view is intended to show the dynamic as well as the evolutional aspect of issues and concerns regarding the interactions between humans and technology.

Within the broad HCI framework, this paper reports a MIS literature assessment to demonstrate the intellectual substance of the HCI sub-discipline. This assessment uses seven classification schemes to assess HCI articles that appeared in seven prime MIS journals during a 13-year period (1990-2002) and in doing so, extended the classification-based approach. Our study allows multiple categories of a particular facet to be assigned to a paper. This multiplicity captures a more accurate picture of the nature of HCI research, allowing us to reveal more realistic and interesting patterns by conducting co-occurrence and cross-facet analyses.

There are many findings in this study. The salient ones are that HCI studies in MIS are conducted largely at the individual level in the organizational and workplace context. Although HCI researchers show interest in a variety of topics, three topics, all of which have to do with IT use and impact, are dominant: Cognitive beliefs and behavior, Attitude, and Performance. Among a broad range of methods used in the HCI studies, three, all empirical methods, are used most frequently: lab experiment, survey, and field study. Despite the potential interest in human and technology interaction in HCI studies, individual characteristics and IT artifacts and service are not paid as much attention as we might have expected from this collection of papers. The HCI sub-discipline is truly interdisciplinary and builds on a number of other disciplines, among which three contribute significantly to the conceptual and theoretical development of HCI studies: Information Systems, Psychology, and Business and Management.

Like any other possible discipline, the HCI sub-discipline has evolved over the years. Since 1990, there have been some obvious changes. For example, there have been more studies focused on research topics in IT Use and Impact. In particular, three topics gained increasing attention: Cognitive Beliefs and Behavior, Emotion and Affect, and Trust. It is noteworthy that Emotion and Trust attracted not only an increasing number of studies but also increasing percentages among all the selected papers. Similarly, IT/service is more and more specified in the HCI studies. On the other hand, individual characteristics have not gained a comparable increase in explicit coverage in the studies. Empirical methods continue to be favored, and the survey method in particular enjoys an increasing popularity. Finally, there is an increase in the complexity of research studies, indicated by an increasing trend in considering more than one topic per study and relying on an increasing number of contributing disciplines per study.

HCI research occupies a gratifying percentage of primary MIS journal studies, showing an increase in both number and percentage. This indicates that HCI studies have gained more importance over the years. HCI research is attractive to a great number of MIS scholars. Equally encouraging is the existence of a large number of institutions where such scholars are employed and appreciated, thus forming the centers of excellence in HCI research.

Evolving from its current state of a Fragmented Adhocracy, there can be a number of future directions for the sub-discipline. We discussed these directions along three aspects: research interests, methods, and journals. Understanding that a field cannot be created and evolve according to precisely pre-defined plans (Banville and Landry, 1989), we hope that our discussions will inspire and trigger additional discussions, initiatives, and actions of the community members, so that together, the community as a whole can advance an understanding of humans interacting with technologies in various contexts for various purposes. Together with other MIS sub-disciplines and other related disciplines, we can make human experiences with technologies more pleasant, interesting, rewarding, and fulfilling, thus generating more human value for the users, more business value for organizations, and more social value for societies.

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References

Agarwal, R. and J. Prasad (1998) "A conceptual and operational definition of Personal Innovativeness in the domain of information technology," *Information Systems Research* (9)2, pp 204-215.

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

Banker, R.D. and R.J. Kauffman (2004) "The evolution of research on Information Systems: A fiftieth-year survey of the literature in management science," *Management Science* (50)3, pp 281-298.

Banville, C. and M. Landry (1989) "Can the Field of MIS be Disciplined?" *Communications of the ACM* (32)1, pp 48-60.

Bariff, M.L. and M.J. Ginzberg (1982) "MIS and the behavioral sciences: Research patterns and prescriptions," *The Data Base for Advances in Information Systems* (14)1, pp 19-26.

Barki, H. and J. Hartwick (1994) "User Participation, Conflict, and Conflict Resolution: The Mediating Roles of Influence," *Information Systems Research* (5)4, pp 422-438.

Barki, H., S. Rivard, and J. Talbot (1988) "An Information Systems Keyword Classification Scheme," *MIS Quarterly* (12)2, pp 299-322.

Barki, H., S. Rivard, and J. Talbot (1993) "A Keyword Classification Scheme for IS Research Literature: An Update," *MIS Quarterly* (17)2, pp 209-266.

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

Baskerville, R.L. and A.T. Wood-Harper (1996) "A critical perspective on action research as a method for information systems research," *Journal of Information Technology* (11)3, pp 235-246.

Beath, C.M. and W.J. Orlikowski (1994) "The Contradictory Structure of Systems Development Methodologies: Deconstructing the IS-user Relationship in Information Engineering," *Information Systems Research* (5)4, pp 350-377.

Benbasat, I. and R.W. Zmud (2003) "The Identity Crisis within the IS Discipline: Defining and Communicating the Discipline's Core Properties," *MIS Quarterly* (27)2, pp 183-194.

Bostrom, R.P. and J.S. Heinen (1977) "MIS Problems and Failures: A Socio-Technical Perspective. Part I: The causes," *MIS Quarterly* (1)3, pp 17-32.

Boudreau, M., D. Gefen, and D. Straub (2001) "Validation in IS Research: A State-of-the-Art Assessment," *MIS Quarterly* (25)1, pp 1-24.

Bowers, J.W. and J.A. Courtright (1984) *Communication Research Methods*, Foresman, Glenview, IL: Scott.

Carey, J. (1988) *Human Factors in Management Information Systems*, Greenwich, CT: Ablex Publishing Corporation.

Carey, J. (1991) *Human Factors in Information Systems: An Organizational Perspective*, Greenwich, CT: Ablex Publishing Corporation.

Carey, J. (1995) *Human Factors in Information Systems: Emerging Theoretical Bases*, Greenwich, CT: Ablex Publishing Corporation.

Carey, J. (1997) *Human Factors in Information Systems: The Relationship Between User Interface Design and Human Performance*, Greenwich, CT: Ablex Publishing Corporation.

Carey, J., D. Galletta, J. Kim, D. Te'eni, B. Wildermuth, and P. Zhang (2004) "The Role of HCI in IS Curricula: A Call to Action," *Communication of the AIS* (13)23, pp 357-379.

Carr, C.L. (2002) "A psychometric evaluation of the expectations, perceptions, and difference-scores generated by the IS-adapted SERVQUAL instrument," *Decision Sciences* (33)2, p 281.

Carr, N. (2003) "IT Doesn't Matter," *Harvard Business Review* (81)5, p 41.

Carroll, J., W. Kellogg, and M.B. Rosson (1991) "The task-artifact cycle," in Carroll, J. (ed.), *Designing Interaction* Cambridge University Press, pp. 74-102.

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

Chatterjee, S. (2005) "Call for Papers - 1st Design Science Conference DESRIST2006," *ISWORLD*, September 6.

Chen, M. (1995) "A model-driven approach to accessing managerial information: The development of a repository-based executive information system," *Journal of Management Information Systems* (11)4, pp 33-63.

Cheon, M.J., C.L. Choong, and V. Grover (1992) "Research in MIS Points of Work and Reference: A Replication and Extension of the Culnan and Swanson Study," *Data Base* (23)2, pp 21-29.

Chua, C., L. Cao, K. Cousins, and D.W. Straub (2003) "Measuring Researcher-Production in Information Systems," *Journal of Association for Information Systems* (3)6, pp 145-215.

Cohen, J. (1960) "A coefficient of agreement for nominal scales," *Educational and Psychological Measurement* (20)1, pp 37-46.

Compeau, D.R., C.A. Higgins, and S. Huff (1999a) "Social Cognitive Theory and Individual Reactions to Computing Technology: A Longitudinal Study," *MIS Quarterly* (23)2, pp 145-158.

Compeau, D.R., C.A. Higgins, and S.L. Huff (1999b) "Social Cognitive Theory and Individual Reactions to Computing Technology: A Longitudinal Study," *MIS Quarterly* (23)2, pp 145-158.

Conrath, D.W. and R.S. Sharma (1992) "Toward a Diagnostic Instrument for Assessing the Quality of Expert Systems," *The Data Base for Advances in Information Systems* (23)1, pp 37-43.

Cook, T.D. and D.T. Campbell (1979) *Quasi-Experimentation: Design and Analysis Issues for Field Settings*, Boston: Houghton Mifflin Company.

Culnan, M.J. (1986) "The intellectual development of Management Information Systems, 1972-1982: A co-citation analysis," *Management Science* (32)2, pp 156-172.

Culnan, M.J. (1987) "Mapping the Intellectual Structure of MIS 1980-1985: A Co-citation Analysis," *MIS Quarterly* (11)3, pp 341-353.

Davidson, E.J. (2002) "Technology frames and framing: A socio-cognitive investigation of requirements determination," *MIS Quarterly* (26)4, pp 329-358.

Davis, F. (1989) "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly* (13)3, pp 319-340.
Dennis, A.R., B.H. Wixom, and R.J. Vandenberg (2001) "Understanding Fit and Appropriation Effects in Group Support Systems via Meta-Analysis," *MIS Quarterly* (25)2, pp 167-193.
DeSanctis, G. (1984) "Computer graphics as decision aids: Directions for research," *Decision Sciences* (15)4, pp 463-487.
Finneran, C.M. and P. Zhang (2003) "A person-artefact-task (PAT) model of flow antecedents in computer-mediated environments," *International Journal of Human-Computer Studies* (59)4, pp 475-496.
Gefen, D. (2002) "Reflections on the dimensions of trust and trustworthiness among online consumers," *The Data Base for Advances in Information Systems* (33)3, p 38.
Geissler, G., G. Zinkhan, and R.T. Watson (2001) "Web Home Page Complexity and Communication Effectiveness," *Journal of Association for Information Systems* (2)2.
Gerlach, J. and F.-Y. Kuo (1991) "Understanding Human Computer Interaction for Information Systems Design," *MIS Quarterly* (15)4, pp 257-274.
Goodhue, D. (1997) "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, pp 449-453.
Goodhue, D.L. (1995) "Understanding User Evaluations of Information Systems," *Management Science* (41)12, pp 1827-1844.
Goodhue, D.L. (1998) "Development and measurement validity of a task-technology fit instrument for user evaluations of information systems," *Decision Sciences* (29)1, pp 105-137.
Goodhue, D.L. and R.L. Thompson (1995) "Task-Technology Fit and Individual Performance," *MIS Quarterly* (19)2, pp 213-236.
Gordon, M.D. and S.A. Moore (1999) "Depicting the Use and Purpose of Documents to Improve Information Retrieval," *Information Systems Research* (10)1, pp 23-37.
Grudin, J. (2006) "Human Factors, CHI and MIS," in Zhang, P. and D. Galletta (eds.), *Human-Computer Interaction and Management Information Systems: Foundations,* Armonk, NY: M.E. Sharpe, p. this volume.
Hamilton, S. and B. Ives (1982) "Knowledge utilization of among MIS researchers," *MIS Quarterly* (6)4, pp 61-77.
Hardgrave, B.C. and K.A. Walstrom (1997) "Forums for MIS scholars," *Communications of the ACM* (40)11, pp 119 - 124.
Hawk, S.R. and N.S. Raju (1991) "Test-Retest Reliability of User Information Satisfaction: A Comment on Galletta and Lederer's Paper," *Decision Sciences* (22)5, p 1165.
Hefley, W.E., E.A. Buie, G.F. Lynch, M.J. Muller, D.G. Hoecker, J. Carter, and J.T. Roth (1995) "Integrating human factors with software engineering practices," in Perlman, G., 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, pp. 359-363.
Hitt, L.M. and F.X. Frei (2002) "Do better customers utilize electronic distribution channels? The case of PC banking," *Management Science* (48)6, pp 732-749.
Hong, W., J.Y.L. Thong, and K.Y. Tam (2004) "The Effects of Information Format and Shopping Task on Consumers' Online Shopping Behavior: A Cognitive Fit Perspective," *Journal of Management Information Systems* (21)3, pp 149 - 184.

Hunton, J.E. (1996) "Involving information system users in defining system requirements: The influence of procedural justice perceptions on user attitudes and performance," *Decision Sciences* (27)4, p 647.

Ives, B., S. Hamilton, and G. Davis (1980) "A framework for research in computer-based management information systems," *Management Science* (26)9, pp 910-934.

Jarvenpaa, S.L. (1989) "The Effect of Task Demands and Graphical Format on Information Processing Strategies," *Management Science* (35)3, pp 285-303.

Kawalek, P. and T. Wood-Harper (2002) "The finding of thorns: User participation in enterprise system implementation," *The Data Base for Advances in Information Systems* (33)1, p 13.

Keen, P.G.W. (1980) "MIS research: reference disciplines and a cumulative tradition," The First International Conference on Information Systems, pp. 9-18.

Kekre, S., M.S. Krishnan, and K. Srinivasan (1995) "Drivers of Customer Satisfaction for Software Products: Implications for Design and Service Support," *Management Science* (41)9, pp 1456-1470.

Kuhn, T.S. (1970) *The Structure of Scientific Revolutions*, Chicago, IL: The University of Chicago Press.

Kuhn, T.S. (1977) *The Essential Tension*, Chicago, IL: The University of Chicago Press.

Kutzschan, A.O. and J. Webster (2005) "HCI as MIS," in Zhang, P. and D. Galletta (eds.), *Human-Computer Interaction and Management Information Systems: Foundations* M.E. Sharpe.

Kutzschan, A.O. and J. Webster (2006) "HCI as MIS," in Zhang, P. and D. Galletta (eds.), *Human-Computer Interaction and Management Information Systems: Foundations,* Armonk, NY: M.E. Sharpe, p. this volume.

Lai, V.S. (1996) "An assessment of database research interest in MIS," *The Data Base Advances in Information Systems* (27)2, pp 37-43.

Landis, J.R. and G.G. Koch (1977) "The measurement of observer agreement for categorical data," *Biometrics* (33)1, pp 159-174.

Laudon, K.C. and J.P. Laudon (2003) *Management Information Systems: Managing the Digital Firm*, Upper Saddle River, NJ: Prentice Hall.

Lawrence, M. and G. Low (1993) "Exploring Individual User Satisfaction Within User-Led Development," *MIS Quarterly* (17)2, pp 195-208.

Lee, S.M., Y.R. Kim, and J. Lee (1995) "An empirical study of the relationships among end-user information systems acceptance, training, and effectiveness," *Journal of Management Information Systems* (12)2, pp 189-202.

Lee, Y., K.A. Kozar, and K.R.T. Larsen (2003) "The technology acceptance model: Past, present, and future," *Communication of the AIS* (12)50, pp 752-780.

Lending, D. and J.C. Wetherbe (1992) "Update on MIS Research: A Profile of Leading Journals and U.S. Universities," *The Data Base for Advances in Information Systems* (23)3, pp 5-11.

Lim, K.H., I. Benbasat, and P. Todd (1996a) "An Experimental Investigation of the Cognitive Processing Effort Involved in Direct Manipulation and Menu Interfaces," *ACM Transactions on Computer-Human Interaction* (3)1, pp 1-37.

Lim, K.H., I. Benbasat, and P.A. Todd (1996b) "An Experimental Investigation of the Interactive Effects of Interface Style, Instructions, and Task Familiarity on User Performance," *ACM Transactions on Computer-Human Interaction* (3)1, pp 1-37.

Lowry, P.B., D. Romans, and A. Curtis (2004) "Global Journal Prestige and Supporting Disciplines: A Scientometric Study of Information Systems Journals," *Journal of Association for Information Systems* (5)2, pp 29-77.

Lucas, H.C. (1975) "Performance and the Use of an Information System," *Management Science* (21)8, pp 908-919.

Mantei, M. and T. Teorey (1989) "Incorporating Behavioral Techniques into the System Development Life Cycle," *MIS Quarterly* (13)3, pp 257-274.
McKinney, V., K. Yoon, and F. Zahedi (2002) "The measurement of Web-customer satisfaction: An expectation and disconfirmation approach," *Information Systems Research* (13)3, pp 296-315.
Melone, N.P. (1990) "A Theoretical Assessment of the User-Satisfaction Construct in Information Systems Research," *Management Science* (36)1, pp 76-91.
Miles, M.B. and A.M. Huberman (1994) *Qualitative Data Analysis: An Expanded Sourcebook*, Thousand Oaks, CA: Sage Publications.
Mingers, J. (2001) "Combining IS Research Methods: Towards a Pluralist Methodology," *Information Systems Research* (12)3, pp 240-259.
Morris, M.G., C. Speier, and J.A. Hoffer (1999) "An examination of procedural and object-oriented systems analysis methods: Does prior experience help or hinder performance?" *Decision Sciences* (30)1, p 107.
Nambisan, S. (2003) "Information Systems as a Reference Discipline for New Product Development," *MIS Quarterly* (27)1, pp 1-18.
Nambisan, S., R. Agarwal, and M. Tanniru (1999) "Organizational Mechanisms for Enhancing User Innovation in Information Technology," *MIS Quarterly* (23)3, pp 365-395.
Orlikowski, W.J. and J.J. Baroudi (1991) "Studying Information Technology in Organizations: Research Approaches and Assumptions," *Information Systems Research* (2)1, pp 1-.
Orlikowski, W.J. and C.S. Iacono (2001) "Desperately Seeking the "IT" in IT Research - A Call to Theorizing the IT Artifact," *Information Systems Research* (12)2, pp 121-134.
Pervan, G.P. (1998) "A review of research in Group Support Systems: leaders, approaches and directions," *Decision Support Systems* (23), pp 149-159.
Romano, N.C. and J. Fjermestad (2001) "Electronic commerce customer relationship management: An assessment of research,"*International Journal of Electronic Commerce* (6)2, pp 61-113.
Saunders, C. (2005) "CFP - MISQ Special Issue on Design Science Research," *ISWORLD*, September 2.
Sein, M.K. and R. Bostrom (1989) "The Influence of Individual Differences in Determining the Effectiveness of Conceptual Models in Training Novice Users," *Human-Computer Interaction* (4), pp 197-229.
Sein, M.K., L. Olfman, R.P. Bostrom, and S.A. Davis (1993) "Visualization ability as a predictor of user learning success," *International Journal of Man-Machine Studies* (39)4, pp 599-620.
Shibata, Y., M. Fukuda, and M. Katsumoto (1997) "A hypermedia-based design image database system using a perceptional link method," *Journal of Management Information Systems* (13)3, pp 25-44.
Shneiderman, B. (1987) *Designing the user interface: Strategies for effective human-computer interaction*, Reading, MA: Addison-Wesley.
Shneiderman, B. and C. Plaisant (2005) *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, New York: Addison-Wesley.
Silver, M.S. (1991) "Decisional Guidance for Computer-Based Decision Support," *MIS Quarterly* (15)1, pp 105-122.
Srinivasan, A. and D. Te'eni (1995) "Modeling as Constrained Problem Solving: An Empirical Study of the Data Modeling Process," *Management Science* (41)3, pp 419-434.

Straub, D. and R.T. Watson (2001) "Research commentary: Transformational issues in researching IS and net-enabled organizations," *Information Systems Research* (12)4, pp 337-345.

Swanson, E.B. (1974) "Management Information Systems: Appreciation and Involvement," *Management Science* (21)2, pp 178-188.

Tan, F.B. and G.M. Hunter (2002) "The Repertory Grid technique: A Method For The Study of Cognition in Information Systems," *MIS Quarterly* (26)1, pp 39-57.

Te'eni, D. (1990) "Perceived costs and benefits as determinants of user behavior: A matchmaking experiment," *Behaviour & Information Technology* (9), pp 31-45.

Te'eni, D. (2001) "Review: A Cognitive-Affective Model of Organizational Communication for Designing IT," *MIS Quarterly* (25)2, pp 251-312.

Teng, J.T.C. and D.F. Galletta (1991) "MIS research directions: a survey of researchers' views," *Data Base* (21) Winter/Spring, pp 53-62.

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

Venkatesh, V. and F. Davis (2000) "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies," *Management Science* (46)2, pp 186-204.

Venkatesh, V., M.G. Morris, G.B. Davis, and F.D. Davis (2003) "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly* (27)3, pp 425-478.

Vessey, I. (1991a) "Cognitive Fit: A Theory-Based Analysis of the Graphs Versus Tables Literature," *Decision Sciences* (22)2, p 219.

Vessey, I. (1991b) "Cognitive Fit: A Theory-Based Analysis of the Graphs Versus Tables Literature,"*Decision Sciences* (22), pp 219-240.

Vessey, I. (2005) "The Theory of Cognitive Fit: “One Aspect of a General Theory of Problem Solving?”" in Zhang, P. and D. Galletta (eds.), *Human-Computer Interaction and Management Information Systems: Foundations* M.E. Sharpe.

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

Vogel, D.R. and J.C. Wetherbe (1984) "A profile of leading journals and universities," *The Data Base for Advances in Information Systems* (16)1, pp 3-14.

Watson, H.J., K.P. Taylor, G. Higgins, C. Kadlec, and M. Meeks (1999) "Leaders assess the current state of the IS academic discipline," *Communication of the AIS* (2)2, pp 2-27.

Weber, R. (2003) "Still desperately seeking the IT artifact," *MIS Quarterly* (27)2, pp iii-xi.

Webster, J. and H. Ho (1997) "Audience engagement in multimedia presentations," *The Data Base for Advances in Information Systems* (28)2, pp 63 - 77.

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

Webster, J., L.K. Trevino, and L. Ryan (1993) "The dimensionality and correlates of flow in human-computer interactions," *Computers in Human Behavior* (9)4, pp 411-426.

Whinston, A.B. and X. Geng (2004) "Operationalizing the essential role of the Information Technology artifact in Information Systems research: Gray area, pitfalls, and the importance of strategic ambiguity," *MIS Quarterly* (28)2, pp 149-159.

Whitley, R. (1984) *the Intellectual and Social Organization of the Sciences*, Oxford: Clarendon press.

Whitten, J., L. Bentley, and K. Dittman (2004) *Systems Analysis and Design Methods*, (6th ed.), Boston: McGraw-Hill Irwin.

Zhang, P. (2000) "The Effect of Animation on Information Seeking Performance on the World Wide Web: Securing Attention or Interfering with Primary Tasks," *Journal of Association for Information Systems* (1)1.

Zhang, P. (2004) "AIS SIGHCI Three-Year Report," *AIS SIGHCI Newsletter (http://sigs.aisnet.org/sighci/)* (3), July.

Zhang, P., I. Benbasat, J. Carey, F. Davis, D. Galletta, and D. Strong (2002) "Human-Computer Interaction Research in the MIS Discipline," *Communications of the AIS* (9)20, pp 334-355.

Zhang, P., J. Carey, D. Te'eni, and M. Tremaine (2005) "Integrating Human-Computer Interaction Development into the Systems Development Life Cycle: A Methodology," *Communications of the AIS* (15), pp 512-543.

Zhang, P. and N. Li (2004) "An assessment of human-computer interaction research in management information systems: topics and methods," *Computers in Human Behavior* (20)2, pp 125-147.

Zigurs, I. and B.K. Buckland (1998) "A Theory of Task/Technology Fit and Group Support Systems Effectiveness," *MIS Quarterly* (22)3, pp 313-334.

APPENDIX. LIST OF THE 337 HCI ARTICLES IN THE SEVEN MIS JOURNALS DURING 1990-2002

DATA BASE

ID	Article
1.	Alavi, 1990
2.	Amoroso and Cheney, 1992
3.	Antony and Batra, 2002
4.	Atkinson and Kydd, 1997
5.	Chan et al., 1998
6.	Chiasson and Lovato, 2001
7.	Chin and Gopal, 1995
8.	Conrath and Sharma, 1992
9.	Cooper and Bhattacherjee, 2001
10.	Curl et al., 1998
11.	Dekleva, 1994
12.	Ein-Dor and Segev, 1991
13.	Galletta et al., 1993
14.	Gefen, 2002b
15.	Gefen and Keil, 1998
16.	George, 1991
17.	Henfridsson and Holmstrom, 2002
18.	Higa and Wijayanayake, 2000
19.	Hong and Lerch, 2002
20.	Hwang and Wu, 1990
21.	Jiang and Klein, 1996
22.	Ju and Wagner, 1997
23.	Kappelman, 1995
24.	Kawalek and Wood-Harper, 2002
25.	Kendall, 1997
26.	Khalifa, 1998
27.	Louadi et al., 1998
28.	Mathieson et al., 2001
29.	Mathieson and Ryan, 1994
30.	Napier et al., 1992
31.	Perry and Ballou, 1997
32.	Rivard et al., 1997
33.	Ryan et al., 2000
34.	Shaft, 1995
35.	Shaw et al., 2002
36.	Shirani et al., 1994
37.	Simon, 2001
38.	Webster and Ho, 1997
39.	Yager et al., 1997
40.	Zigurs et al., 1999

DECISION SCIENCES

ID	Article
41.	Agarwal and Prasad, 1997
42.	Agarwal and Prasad, 1999
43.	Bhattacherjee, 1998
44.	Bolt et al., 2001
45.	Carr, 2002
46.	Chau and Hu, 2001
47.	Chu and Spires, 2000
48.	Cook, 1993
49.	Davis and Kottemann, 1994
50.	Doll et al., 1998
51.	Doll and Torkzadeh, 1991
52.	Dunn and Grabski, 2001
53.	Fedorowicz et al., 1992
54.	Gal and Steinbart, 1992
55.	Gonzalez and Kasper, 1997
56.	Goodhue, 1998
57.	Grabowski and Sanborn, 2001
58.	Guimaraes and Igbaria, 1997
59.	Guimaraes et al., 1992
60.	Hawk and Raju, 1991
61.	Hendrickson et al., 1994
62.	Howard and Mendelow, 1991
63.	Hunton, 1996
64.	Jackson et al., 1997
65.	Kettinger and Grover, 1997
66.	Kettinger and Lee, 1994
67.	Kettinger and Lee, 1999
68.	King and Xia, 1997
69.	King et al., 1990
70.	Kottemann and Davis, 1991
71.	Loy, 1991
72.	Lucas and Spitler, 1999
73.	Mackay et al., 1992
74.	McHaney and Cronan, 1998
75.	Mirani and King, 1994a
76.	Moffitt, 1994
77.	Morris et al., 1999
78.	Parikh et al., 2001
79.	Ramarapu et al., 1997
80.	Reneau and Blanthorne, 2001
81.	Sambamurthy and Chin, 1994

82.	Schmidt et al., 2001
83.	Smelcer and Carmel, 1997
84.	Snead and Harrell, 1994
85.	Speier et al., 1999
86.	Subramanian, 1994
87.	Sulek and Marucheck, 1992
88.	Swink, 1995
89.	Swink and Speier, 1999
90.	Tan and Benbasat, 1993
91.	Teng and Calhoun, 1996
92.	Torkzadeh and Doll, 1991
93.	Umanath et al., 1990
94.	Valacich and Schwenk, 1995
95.	Van Dyke et al., 1999
96.	Venkatesh and Davis, 1996
97.	Venkatesh et al., 2002
98.	Vessey, 1991
99.	Warkentin et al., 1997
100.	Yi and Davis, 2001

ISR

ID	Article
101.	Agarwal and Prasad, 1998
102.	Agarwal et al., 2000
103.	Agarwal and Venkatesh, 2002
104.	Alavi and Leidner, 2001
105.	Alavi et al., 2002
106.	Ang et al., 1993
107.	Asahi et al., 1995
108.	Barki and Hartwick, 1994b
109.	Beath and Orlikowski, 1994
110.	Belanger et al., 2001
111.	Brancheau and Wetherbe, 1990
112.	Butler, 2001
113.	Chen and Hitt, 2002
114.	Chin and Newsted, 1995
115.	Chwelos et al., 2001
116.	Compear and Higgins, 1995
117.	Constant et al., 1994
118.	Dennis and Carte, 1998
119.	Dennis and Kinney, 1998
120.	Devaraj et al., 2002
121.	Doll et al., 1995
122.	Elam and Mead, 1990
123.	Galletta and Heckman, 1990
124.	Garfield et al., 2001
125.	Gattiker and Kelley, 1999
126.	Gordon and Moore, 1999
127.	Harrison et al., 1997
128.	Johnson and Marakas, 2000
129.	Kasper, 1996
130.	Kim et al., 2000
131.	Kim and Lerch, 1997
132.	Koufaris, 2002
133.	Kraut et al., 1999
134.	Lerch and Harter, 2001
135.	Lim et al., 2000
136.	Lim et al., 1997
137.	Limayem and DeSanctis, 2000
138.	Mackay and Elam, 1992
139.	Marakas et al., 1998
140.	Marcolin et al., 2000
141.	Mathieson, 1991
142.	McKinney et al., 2002
143.	McKnight et al., 2002
144.	Moore and Benbasat, 1991
145.	Morris et al., 1992
146.	Newman and Noble, 1990
147.	Orlikowski and Iacono, 2001
148.	Palmer, 2002
149.	Parthasarathy and Bhattacherjee, 1998
150.	Plouffe et al., 2001
151.	Rai et al., 2002
152.	Roy and Lerch, 1996
153.	Santhanam and Sein, 1994
154.	Sein and Santhanam, 1999
155.	Sethi and King, 1999
156.	Shaft and Vessey, 1995
157.	Sharda and Steriger, 1996
158.	Sia et al., 2002
159.	Simon et al., 1996
160.	Stewart and Segars, 2002
161.	Straub, 1994
162.	Suh and Jenkins, 1992
163.	Sussman and Sproull, 1999
164.	Tan and Benbasat, 1990
165.	Taylor and Todd, 1995b
166.	Todd and Benbasat, 1991
167.	Todd and Benbasat, 1999
168.	Vandenbosch and Higgins, 1996
169.	Venkatesh, 2000
170.	Vessey and Galletta, 1991
171.	Weber, 1996

JAIS

ID	Article
172.	Gefen, 2002a

173.	Gefen and Straub, 2000
174.	Geissler et al., 2001
175.	Leonard and Cronan, 2001
176.	Panko and Halverson, 2001
177.	Shim et al., 2002
178.	Tan and Teo, 2000
179.	Te'eni and Feldman, 2001
180.	Zhang, 2000

JMIS

ID	Article
181.	Agarwal et al., 1996
182.	Ahituv et al., 1998
183.	Amoroso and Cheney, 1991
184.	Bargeron et al., 2002
185.	Briggs et al., 1993
186.	Burgoon et al., 2000
187.	Burton et al., 1993
188.	Chau, 1996
189.	Chau and Hu, 2002
190.	Chen, 1995
191.	Choe, 1996
192.	Coppola et al., 2002
193.	Cronan and Douglas, 1990
194.	Davis and Davis, 1990
195.	Edberg and Bowman, 1996
196.	Essex et al., 1998
197.	Galletta et al., 1997
198.	Gogan, 1991
199.	Grise and Gallupe, 2000
200.	Harrison and Rainer, 1992
201.	Hillmer and Dennis, 2001
202.	Hong et al., 2002
203.	Hu et al., 1999
204.	Huang and Wei, 2000
205.	Igbaria et al., 1995
206.	Igbaria et al., 1996
207.	Jarvenpaa et al., 1998
208.	Lee et al., 1995
209.	Leitheiser and March, 1996
210.	Levine and Rossmoore, 1993
211.	Magal, 1991
212.	Mao and Benbasat, 2000
213.	Markus, 2001
214.	Massey and Clapper, 1995
215.	McKeen and Guimaraes, 1997
216.	Minch, 1990
217.	Mirani and King, 1994b
218.	Money, 1996
219.	Montazemi et al., 1996
220.	Moody et al., 1998
221.	Panko, 1999
222.	Reinig et al., 1996
223.	Sack, 2001
224.	Saleem, 1996
225.	Satzinger et al., 1999
226.	Satzinger and Olfman, 1995
227.	Satzinger and Olfman, 1998
228.	Schenk et al., 1998
229.	Shaft and Vessey, 1998
230.	Sheetz et al., 1997
231.	Shibata et al., 1997
232.	Smith and Vanecek, 1990
233.	Sniezek et al., 2002
234.	Steiger, 1995
235.	Tan et al., 1998
236.	Tan, 1994
237.	Thompson and Higgins, 1994
238.	Tillquist, 1996
239.	Vessey and Conger, 1993
240.	Wang and Strong, 1996
241.	Yoon and Guimaraes, 1995
242.	Zmud et al., 1993
243.	Zviran and Haga, 1999

MANAGEMENT SCIENCE

ID	Article
244.	Anson et al., 1995
245.	Bell and O'Keefe, 1995
246.	Connolly et al., 1990
247.	Goodhue, 1995
248.	Grabowski and Wallace, 1993
249.	Hartwick and Barki, 1994
250.	Hiltz and Johnson, 1990
251.	Hitt and Frei, 2002
252.	Hoch and Schkade, 1996
253.	Hunton and Price, 1997
254.	Kekre et al., 1995
255.	Melone, 1990
256.	Poole et al., 1991
257.	Srinivasan and Te'eni, 1995
258.	Straub et al., 1995
259.	Szajna, 1996
260.	van Bruggen et al., 1998
261.	Venkatesh and Davis, 2000

MIS QUARTERLY

ID	Article

262.	Adams et al., 1992
263.	Agarwal and Karahanna, 2000
264.	Ahrens and Sankar, 1993
265.	Alavi, 1994
266.	Ba and Pavlou, 2002
267.	Banerjee et al., 1998
268.	Barki and Hartwick, 1994a
269.	Barki and Hartwick, 2001
270.	Bergeron et al., 1990
271.	Bhattacherjee, 2001
272.	Chan et al., 1993
273.	Chin and Todd, 1995
274.	Compeau and Higgins, 1995
275.	Compeau et al., 1999
276.	Culnan, 1993
277.	Davidson, 2002
278.	Dennis et al., 2001
279.	Doll et al., 1994
280.	Gefen and Straub, 1997
281.	George, 1996
282.	Gerlach and Kuo, 1991
283.	Gill, 1996
284.	Goodhue and Thompson, 1995
285.	Gopal and Prasad, 2000
286.	Gregor and Benbasat, 1999
287.	Griffith and Northcraft, 1996
288.	Harrington, 1996
289.	Hendrickson et al., 1993
290.	Hunton and Beeler, 1997
291.	Igbaria et al., 1997
292.	Joshi, 1991
293.	Karahanna et al., 1999
294.	Kettinger and Lee, 1997
295.	Klein et al., 1997
296.	Kraemer et al., 1993
297.	Lamberti and Wallace, 1990
298.	Lawrence and Low, 1993
299.	Lim and Benbasat, 2000
300.	Massetti, 1996

301.	McKeen et al., 1994
302.	Mennecke et al., 2000
303.	Nambisan et al., 1999
304.	Nelson, 1990
305.	Olfman and Mandviwalla, 1994
306.	Piccoli et al., 2001
307.	Pitt et al., 1995
308.	Pitt et al., 1997
309.	Segars and Grover, 1993
310.	Silver, 1991
311.	Smith and Hasnas, 1999
312.	Smith et al., 1996
313.	Szajna, 1994
314.	Szajna and Scamell, 1993
315.	Tan and Hunter, 2002
316.	Taylor and Todd, 1995a
317.	Te'eni, 2001
318.	Thatcher and Perrewe, 2002
319.	Thompson et al., 1991
320.	Todd and Benbasat, 1992
321.	Tractinsky and Meyer, 1999
322.	Trauth and Cole, 1992
323.	Trauth and Jessup, 2000
324.	Van Dyke et al., 1997
325.	Vandenbosch and Huff, 1997
326.	Venkatesh, 1999
327.	Venkatesh and Brown, 2001
328.	Venkatesh and Morris, 2000
329.	Walsham, 2002
330.	Watson and Pitt, 1998
331.	Webster, 1998
332.	Webster and Martocchio, 1992
333.	Wierenga and Bruggen, 1998
334.	Ye and Johnson, 1995
335.	Yoo and Alavi, 2001
336.	Yoon et al., 1995
337.	Zigurs and Buckland, 1998

About the authors

Ping Zhang is Associate Professor at School of Information Studies, Syracuse University. She has published in both MIS and HCI journals. She is co-editor (with Dennis Galletta) of two volumes on HCI and MIS of the *Advances in MIS* series (M. E. Sharpe, 2006), and is co-author (with Dov Te'eni and Jane Carey) of the first HCI textbook for MIS and other non-Computer Science students (John Wiley, 2006). Dr. Zhang has received three Best Paper awards, an excellent teaching award, and an outstanding service award. She is Associate Editor for *International Journal of Human-Computer Studies* and *Communications of Association for Information Systems*, and a guest editor for *Journal of Association for Information Systems (2004 and 2007)*, *Journal of Management Information Systems (2005)*, *International Journal of Human-Computer Studies (2003 and 2006)*, *International Journal of Human Computer Interaction (2005)*, and *Behavior & Information Technology (2004)*. Dr. Zhang is a co-founder and the first chair (2001-2004) of AIS SIGHCI. She received her PhD in Information Systems from The University of Texas at Austin, and M.Sc. and B.Sc. in Computer Science from Peking University, Beijing, China.

Na (Lina) Li is a PhD candidate at School of Information Studies, Syracuse University. She has published in *Communications of the ACM (CACM)* and *Computers in Human Behavior (CHB)*. She is co-author of a book chapter in *Customer Relationship Management: Advances and Issues* in the *Advances in MIS* series. She also published in the proceedings of the *International Conference on Information Systems (ICIS),* the *Hawaii International Conference on System Sciences (HICSS),* and the *Americas Conference on Information Systems (AMCIS)*. Li attended the OCIS Doctoral Consortium in the Academy of Management (AOM) 2005 Annual Meeting. She is the editor of the *AIS SIGHCI Newsletter*. In addition, she served as an ad hoc reviewer for *Behaviour & Information Technology, International Journal of Human-Computer Studies, International Journal of Human-Computer Interaction*, and *AMCIS*. Li received her Masters degree in Information Science and B.Sc. in Information Science & Technology (minor in Law) from Peking University, Beijing, China. She is expected to receive her PhD in School of Information Studies at Syracuse University in 2006.

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