Task in HCI Research in the Management Information Systems (MIS) Literature: A Critical Survey

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Abstract

Tasks and task analysis play an important role in broad Human-Computer Interaction (HCI) research, based on the view that users utilize technologies to support their primary tasks. Several models and heuristics are developed for task analysis for HCI design. Yet tasks and task analysis have received relatively little attention in the MIS literature that primarily considers IT use and impact on individuals, groups, and organizations. This can be a problem considering the task-artifact cycle, where the use and impact of IT on tasks should feed back into the next round of IT design. This study examines MIS studies that focus on humans interacting with IT at individual and group levels where tasks are part of the research interest. Our objective is to gain a better understanding of the types, the characteristics, and the roles of tasks in the MIS literature.

1 Introduction

The Management Information Systems (MIS), or Information Systems (IS), discipline is a community of scholars interested in the development, use, and impact of information technologies in broadly defined social and organizational settings (Zhang & Dillon, 2003). User attitudes, perceptions, acceptance, and use of IT have been long-standing issues and comprise a major theme of MIS research since the early days in computing (Lucas, 1975; Swanson, 1974). These topics continue to occupy a major portion of HCI studies in the MIS literature (Zhang & Li, 2004), and they nicely complement several technically oriented HCI research streams that focus primarily on the design stage of technologies. Together, the design, and use/impact emphases of HCI research have grown significantly in the past and have greatly advanced our understanding of human interaction with technologies in a significant manner (Zhang & Li, 2004).

Among different reasons for technology use, a prevalent reason is to support users in their primary tasks. Technologies are regarded as tools to help users achieve goals that are significant to their work, jobs, or lives. Many research efforts in HCI design take this view and emphasize the value of understanding users' goals, tasks, and activities in order to design better HCI support. Vessey and Galletta (1991) suggest that providing decision support systems to satisfy individual managers' desires will not have a large effect on either the efficiency or the effectiveness of problem solving. Designers should, instead, concentrate on determining the characteristics of the tasks that problem solvers must address, and on supporting those tasks with the appropriate problem representations and support tools (Vessey & Galletta, 1991).

Task analyses can better support effective HCI design efforts if such analyses are situated in real contexts that consist of IT use by real users. To ensure effective support of tasks by technologies,

researchers need to examine what really happens when users employ the technologies, and the impact of technology use on users' task performance, as well as on the formation and change of their attitudes. These issues naturally fall into the MIS research realm. Yet tasks and the match of tasks with supporting technologies have not been taken as a main focus in the MIS literature (Goodhue, 2005), despite the existence of several important research efforts on tasks and their role in MIS research (Goodhue & Thompson, 1995; Vessey, 1991; Zigurs & Buckland, 1998).

The objective of this paper is to examine the existing MIS literature to gain an understanding of the types and the roles of tasks being studied in HCI research within the MIS discipline. This can help point out potential research directions for future research in this important stream.

2 Research Method

As a first attempt to investigate the types and roles of tasks in the MIS literature, this study utilizes a critical literature survey method. In order to have a comprehensive understanding of the status of this research stream, published articles are selected from four prime MIS journals during the period of 1990 to 2002. These four journals are: MIS Quarterly, Information Systems Research (ISR), Journal of Management Information Systems (JMIS), and Management Science (MS). In this study, MIS journals are used instead of the ones oriented towards HCI, because the focus of the study is to understand the role of the tasks in the MIS literature. Each of the published research articles in these journals during the 13 year period is screened based on the following criteria: First, the article focuses on individuals or groups interacting with technology, thus is an HCI article. We define HCI broadly as being concerned with the ways in which humans interact with information, technologies, and tasks, especially in business, managerial, organizational, and cultural contexts (Zhang, Benbasat, Carey, Davis, Galletta & Strong, 2002). Second, the article considers task as a non-trivial factor in the theoretical and conceptual reasoning or in its research questions. This is to distinguish the cases where a paper may have no tasks in the research model, but then utilizes a lab controlled experiment which has a task for subjects to complete during the experiment. In these cases, tasks are used as a means to achieve some other goals in the research question, but are not the central focus of the research question. Third, the article also includes empirical treatment of tasks. This is to make sure that when tasks are conceptually discussed, they are also empirically studied in the same paper. In summary, the articles selected from the target MIS literature are HCI studies that examine tasks conceptually and empirically as significant factors in answering research questions.

There are a total of 1,075 MIS articles in the four journals between 1990 and 2002. Among them, 228 are HCI articles, and 43 of the 228 meet our selection criteria. Table 1 summarizes the total number of articles and the screening results. Due to limited space, the complete list of the 43 articles is omitted in this paper and is available from the authors upon request

Table 1: Summary of Article Selection Process (1990-2002)

Journal	Total Number of MIS Articles	Total Number of HCI Articles	Total Number of Task Articles	% of Task Articles over all MIS Articles
ISR	257	71	15	5.8%
JMIS	427	63	15	3.5%
MISQ	291	76	8	2.7%
MS	100	18	5	5.0%
Total	1075	228	43	4.0%

Sections 3 and 4 below report the survey results. Section 3 primarily emphasizes the task itself, and contexts where tasks, task types and characteristics are studied. Section 4 focuses on the relationships tasks have with other key factors in the MIS literature. Together, these two sections provide insights into the roles of tasks in the HCI research in MIS. These results can be compared to the studies in related fields, such as more design-oriented HCI studies. Section 5 concludes the study.

3 Characteristics of Tasks in the MIS Literature

3.1 Task Definition and Hierarchy

There are two aspects of task that deserve mentioning. First, task is one of those concepts that are inherently clear to readers, thus most authors usually do not feel the need to give formal definitions in a study. For discussion purposes, we define task based on Merriam-Webster Online: Task is a usually assigned piece of work to be finished within a certain time. Its synonyms include duty, job, chore, stint, assignment, chare, and devoir. Among the collected articles, few studies give formal definitions for tasks. Some articles define tasks based on their specific characteristics, such intellective versus preference tasks, near-transfer versus far-transfer tasks, analyzable versus less-analyzable tasks, well-structured versus ill-structured tasks.

Second, task normally faces a granularity or level of analysis issue. For example, a consulting firm executive needs to select a site for a new office. This task may have several subtasks, such as identifying selection criteria (e.g., cost, traffic), evaluating the cost of several potential sites, assessing the potential client base, comparing several alternatives, and finalizing the selection. Each of these subtasks can be used in a study. However it should be realized that although the site selection task seems to be the highest level of task within this context, it may be a subtask of a higher level task or goal such as expanding or competing with other consulting firms. Thus in general, a task is never an isolated unit but rather, it is either made up of hierarchies or is part of a hierarchy.

Few of the articles consider the different granularities or hierarchies of tasks. Tasks are normally treated at a particular granularity level in the collected articles. Most tasks are at a higher level than the tasks that occur at the computer interface level, although different task types may differ on this regard (see Section 3.3 below for different task types). The lack of attention to task hierarchy may be due to the fact that only few of these studies focus primarily on task analysis per se; their focus is on some phenomenon of which tasks are a part. Section 4 provides further details on this.

3.2 Task Context

Context refers to the setting or environment where a study is conducted. Context plays an important role during a scientific inquiry (Cook & Campbell, 1979). In this study, we consider the immediate context where a study is conducted. Table 2 is the result of categorizing task contexts in the collected articles. It shows that the majority of the studies are conducted in organizational and work contexts. This of course has implications for the types and nature of tasks being studied.

Table 2: Contexts of Studies

Context	Professionals as Participants		Students as Participants	
	# Articles	%	# Articles	%
Organizational or work setting, where IT is for work or job related tasks	9	21%	28	65%
Marketplace, where commerce, banking, or marketing take place	1	2%	2	5%
Cultural or geographic setting if it is specifically concerned in the study.			1	2%
No context explicitly listed in the study			2	5%

3.3 Task Type and Characteristics

Among the selected studies, few identify task characteristics that would fit all types of tasks. In contrast, certain characteristics of tasks are found as related to only certain task types. For example, in end-user learning and training tasks, the near versus far-transfer nature of tasks is commonly studied. Yet this characteristic is not found in the collection of articles to describe end-user decision making tasks. Therefore, we first classify tasks into different types. Then within each type, the commonly studied characteristics are discussed. Examining the tasks being studied in the selected articles results in a classification of four task types. Table 3 lists these types, the examples for each type, and the number of articles in which each type is studied. End-user decision making and problem solving tasks are studied at both individual and group levels, while the other three types of tasks are studied at the individual level. Detailed discussion of each type follows.

Table 3: Classification of Task Types

Type	Examples	Frequency
DM – End-user decision making and problem solving	Individual level: Site selection, apartment selection, queuing and resource allocation, business plan development, pension benefit calculation	11
	Group level: Consumer preferential choice problem, alternative selection, idea organization and generation, student admission decisions, desert survival problem	12
TL – End-User Training/ Learning	Learning how to set up meeting date using a computer system, move and modify messages in an email system, learning to use the whole computer system or specific functionalities of it	8
ISD - IS Development related tasks	Writing database queries, writing new programs, reusing old programs, identifying information elements for systems analysis, developing object-oriented models or process models, determining system requirements	10
GO - General office tasks	Browsing Web sites, using different input devices such as mouse, pen, or keyboard	2

End-User Decision Making and Problem Solving Tasks. This type involves the decision making and problem solving by end-users of Information Technologies rather than programmers. Making decisions or solving problems normally require the end users to have the domain knowledge and clear task goals in addition to computing knowledge and skills. These tasks are identified as analyzable tasks (predetermined responses to potential problems with well known procedures available and useful) and less-analyzable tasks (lack of predefined responses, procedures and/or knowledge of what is needed to solve the problem or to perform the task) (Lim & Benbasat, 2000). Tasks are also examined based on their spatial versus symbolic nature (Dennis & Carte, 1998; Mennecke, Crossland & Killingsworth, 2000; Vessey & Galletta, 1991). A choice

or selection problem is a popular problem and such problems have multiple attributes or alternatives for the task doers to select. Thus problem size, complexity, and degree of structure are often considered in the studies (Bell & O'Keefe, 1995; Burgoon, Bonito, Bengtsson, Ramirez, Dunbar & Miczo, 2000; Mackay & Elam, 1992; Poole, Holmes & Desanctis, 1991; Todd & Benbasat, 1991; Todd & Benbasat, 1992). Preference tasks, where subjective answers are often established on normative information and personal preferences, are contrasted with intellective tasks, where objective answers can be established on factual information and rational reasoning (Huang & Wei, 2000; Smith & Vanecek, 1990; Tan, Wei, Watson & Walczuch, 1998).

End-User Training and Learning Tasks. These tasks are related to learning to use a computer system or training users to use a system. Near-transfer tasks (for which trainees have been specifically trained or are very similar to training tasks) and far-transfer tasks (novel tasks for which trainees have not been specifically trained) are often studied task characteristics (Santhanam & Sein, 1994; Sein & Santhanam, 1999; Simon, Grover, Teng & Whitcomb, 1996). Different methods for conducting learning tasks are explored. For example, Lim and Benbasat (1997) find that self-exploring and co-exploring lead to different mental models of a computer system, and in turn yield different task performance. Conceptual complexity is a task characteristic for studying learning to use computer systems (Satzinger & Olfman, 1998). Compared to the other three types of tasks, end-user training and learning tasks have a relatively lower level of abstraction that is closer to the computer system or user interface level operations. The goal of these tasks is to learn a feature of, a part of, or the whole computer system.

IS Development Tasks. They are related to the IS development processes. Programmer study, user involvement and end user computing related IS development issues, as well as problem solving by developers for IS development purposes fall into this category. This type can be further divided into (1) database design and database queries (Ahrens & Sankar, 1993; Chan, Wei & Siau, 1993; Leitheiser & March, 1996; Srinivasan & Te'eni, 1995; Suh & Jenkins, 1992), (2) information systems analysis tasks such as requirements specification (Agarwal, Sinha & Tanniru, 1996; Money, 1996; Schenk, Vitalari & Davis, 1998; Zmud, Anthony & Stair, 1993), and (3) programming (Kim & Lerch, 1997). In an attempt to match design principles with different tasks in database designs, Ahrens et al. (1993) identify a list of end-user computing tasks including comprehending data analysis concepts and technology, creating the conceptual schema, converting the conceptual schema into files, discriminating among decision rules, and integrating and applying previous skills. For systems requirements tasks, studied characteristics include novel or ill structured task context (Zmud et al., 1993), task ambiguity (absence of information and of a framework for interpreting that information), uncertainty (absence of information, but presence of a framework for interpreting when the information is available), and equivocality (multiple interpretations for the information and/or the framework, and potential disagreement among the interpretations) (Money, 1996).

General Office Tasks. These tasks are for general personal productivity or leisure purposes that often occur in office settings and do not require users to have domain specific knowledge. This category includes clerical and other white-collar tasks. This is the least studied task type, appearing in only two of the 43 articles. For the study on Web use (Agarwal & Venkatesh, 2002), tasks are implied by the roles the participants assume: customer or investor. In the pen-based interface study (Briggs, Dennis, Beck & Nunamaker, 1993), the tasks are editing text in existing documents, creating graphics, and building spreadsheet formulas.

It is noteworthy that this collection of articles does not present tasks at the group level for T/L, ISD, and GO task types. Yet it is quite likely that people use group systems to conduct various

tasks. For example, a group of authors could collaborate on writing a paper together using a groupware word processor, or set up a meeting time using group calendar software. A team of developers work together on an ISD project, or learn together about a computer system. Thus, in principle, tasks can be studied at the group level for all four task types.

4 The Relationships between Tasks and Other Factors

Few of the collected studies focus on task alone. Typically task is co-studied with a number of other factors. The examination of the selected articles showed that tasks are found to have relationships with several other factors that reflect users' IT related beliefs, attitudes, behaviors, performance, and others factors. Due to limited space, we discuss three main relationships: task with doer, task with technology, and task with user performance.

4.1 Task and Doer Relationship

Task motivation, task involvement, task importance, and task/job relevance are about the relationships between the task and its doer. They are found to influence task related beliefs and outcomes such as performance and satisfaction. Among the 43 articles, 5 explicitly emphasize such a relationship between tasks and task doers. Klein et al. (1997) find that performance-contingent incentives increase commitment to task goals and affect task performance in both laboratory and field settings. Elam and Mead (1990) discover that task motivation is the connection between task and the individuals performing it. Freedom from extrinsic constraints enhances creativity. Intrinsic task motivation is prompted when individuals perceive themselves to be in control of their own task engagement. Retained control means individuals are free to undertake the task in whatever way they choose. This freedom nurtures the deep involvement and playfulness that many theorists believes is critical to creativity (Elam & Mead, 1990). Task credibility and attraction are found to mediate task outcomes and task processes (Burgoon et al., 2000). Relevance of a computer system to support job related tasks has a positive impact on users' perceived usefulness of the system, which in turn affects their intention to use and actual use of the system (Venkatesh & Davis, 2000). Finally, in the Information Systems Development (ISD) context, Hunton and Price (1997) find that increased task meaningfulness increases procedural justice, decision control, task commitment, and task performance responses.

4.2 Task and Technology Relationship

Taking the view that IT provides tools to support tasks, it is of great interest to see whether and how the studies consider both tasks and IT features together, and to examine the technology support to the tasks at hand. This links directly to existing research such as that concerning cognitive fit (Vessey, 1991) and task technology fit (Goodhue, 2005; Goodhue & Thompson, 1995). Among the 43 articles, 20 consider both the task and technology features in the studies. The tasks in these articles include individual end-user decision making (7 studies), group decision making (7), general office tasks (1), and IS development tasks (5). Although task characteristics are described in the studies, not all studies treat them as independent variables. For example, 7 out of the 20 studies use constant tasks to test research models and hypotheses, instead of varying task characteristics for exploration. When considering the potential match or fit between technology and tasks, the majority of these studies treat tasks as one unit of undertaking and do not consider different steps or subtasks (Goodhue, 2005), with some exceptions (Elam & Mead, 1990; Money, 1996; Poole et al., 1991; Srinivasan & Te'eni, 1995). Among the seven articles that truly examine the fit between technology and tasks, three studies of ISD tasks (Agarwal et al., 1996; Srinivasan

& Te'eni, 1995; Suh & Jenkins, 1992) and two studies of DM tasks (Dennis & Carte, 1998; Vessey & Galletta, 1991) are built on the cognitive fit theory; one study of a DM task uses media richness theory to imply the match between technology and tasks; and one study of a GO task does not have a theoretical base (Briggs et al., 1993).

4.3 Task and User Performance

Task characteristics and relationships with doers are among the determinants of user behavior, task performance, and satisfaction. In general, task performance is a measure of the degree or the extent of user behavior to perform the tasks using IT support, and is normally measured by time, quality, or accuracy of task completion. Among the 43 articles, 30 consider task performance as either a dependent variable or a measure of other factors. The specific relationship between task characteristics and performance is complex and dependent on several other factors.

5 Conclusions

In the MIS literature, HCI studies with a task focus are scarce, accounting for 4% of all MIS articles and 18.9% of all HCI articles in the four prime MIS journals during the 13 years surveyed. This indicates a lack of attention to the importance of considering tasks to fully understand the entire interaction cycle users have with IT. Our results show that most tasks are studied in the organizational and work context. Four task types can be identified, while each has some distinctive characteristics. Tasks are not clearly or explicitly defined in general, and researchers assume that they are well understood by readers. Tasks are found to relate to a number of other factors in the MIS literature, including task doers' motivation or involvement with the tasks, technology features, and task performance.

The findings of this study have the limitation of using a publication "basket" (Lowry, Romans & Curtis, 2004) that includes a limited number of journals and across a limited time period of publication. Although our study is comparable to similar studies of this nature, the results are influenced by the publication basket and shouldn't be over-generalized.

The objective of this paper is to use a publication-driven approach to draw a picture of the MIS literature concerning tasks in HCI research. To maintain the focus of this paper, we did not provide a systematic comparison of task studies in the MIS literature or in the design oriented HCI literature. Such a comparison can be very insightful in applying task studies to HCI design processes, and can be built on this study.

This study has research and practical implications. A number of dimensions of studying tasks are identified, such as task hierarchy, task contexts, task types and their characteristics, and relationships with several other factors. These dimensions function as the potential ingredient of a study, and thus have implications for designing research to further study tasks for the sake of better HCI support. They can also be used as a framework for future task literature review and assessment in different disciplines. Practically, most tasks studied in this collection of papers have strong ties to the context and users' higher level goals that are beyond the interaction at the computer interface level. When designing HCI that normally concerns the interaction at the interface level, it is important to focus on the relatively high abstract level of tasks, and to ensure that low level user interactions with a computer system support such high level tasks and goals.

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