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Conceptualizing Information, Technology, and People: Comparing Information Science and Information Systems Literatures

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ABSTRACT
Through this paper we highlight that there are discernibly different patterns among conceptualizations of information, technology and people across information systems and information science literatures. We do this to clarify the differences in these two areas of scholarship and to further encourage the substantial overlap possible, but not yet engaged, in the research pursued in these areas. We engage this by analyzing published literature these areas to frame our discussion of the challenges and opportunities for scholars in information science and information systems disciplines to engage in collaborative work.

INTRODUCTION

Leading scholars, funding agencies and the knowledgeable public are calling for more collaborative and cross-disciplinary research to advance our understanding of the issues, opportunities and roles of information and communications technologies (ICT) in our world. Current academic structures and disciplinary boundaries are often identified as obstacles for pursuing inter-disciplinary knowledge sharing, theory building, and collaborative scholarship (NAS, 2004).

In information science, Ellis, Allen, and Wilson (1999) noted that scholars in information science and information systems have "a considerable potential common research interest" (p.1096). And, they further note that scholars pursue these seemingly shared interests by studying different domains in different ways and publish their work in different venues with little interaction or cross-citation. Here we extend the work of Ellis et al (1999) by providing additional empirical evidence to support our claim that the two areas of scholarship recognize and pursue theories, methods and findings that focus on the importance and nature of people's needs and uses of information and the features and impacts of ICT to meet these.

The premise here is that more collaborative and cross-boundary scholarship will improve and expand current theories and strengthen current findings. We take as inspiration other areas of computing scholarship, such as human-computer interaction (HCI) and computer-supported collaborative work (CSCW), where extensive cross-disciplinary research has been instrumental to our theoretical and empirical understanding (e.g., Hughes, 1992, 1997; Star, 1996; Suchman, 2001). We are further encouraged by some evidence of increased interaction among scholars in

these areas. For example, there is work on information awareness (Gutwin & Greenberg, 1999) and shared information spaces (Bannon & Bødker, 1997) to support communication and coordination.

In knowledge management there is evidence of extensive cross-disciplinary interaction involving learning (Argyris & Schon, 1996), organizational theory (Davenport & Prusak, 1998; Thomas, Kellogg, & Erickson, 2001; Kankanhalli, Tanudidjaja, Sutanto, & Tan, 2003), information access and retrieval (Zhu, Ramsey, Chen, Hauck, & Ng, 1999; Cannataro & Talia, 2003), information system requirements/requirement engineering (Maier, 2002; Chen, Lee, Zhang, & Zhang, 2003), and explicit use of information seeking approaches towards user behavior research in organizations (Detlor, 2003).

Here we seek to encourage this trend via our exploratory analysis and discussion of the literatures of information science and information systems. Our research questions are:

1a. How do information science researchers conceptualize (information and communications) technologies, information, people, level of analysis and research methods?

1b. How do information systems researchers conceptualize (information and communications) technologies, information, people, level of analysis and research methods?

2. Do these conceptualizations differ by academic discipline?

To respond to these questions, we continue with a brief review of information science and information systems scholarship. In section two we provide empirical evidence of the differences in these literatures conceptualizations of information, technology, and people using a comparative analysis of published work (as a representative sample) of both areas. We conclude by discussing the findings and reflect on their implications.

COMPARING INFORMATION SCIENCE AND INFORMATION SYSTEMS RESEARCH

Information science (endnote 1)

Information scientists study the characteristics of information and human information behavior, develop and evaluate information search and retrieval processes and technologies, engage information organization and management, and theorize on information environments and information policy (Johannessen, 1996; Bottle, 1997; Bates, 1999; Webber, 2003). Saracevic (1997, 1999) (endnote 2) has further emphasized that the discipline of information science has three general characteristics: it is interdisciplinary in nature, it has an inexorable connection to ICT, and it has strong social and human dimensions. Summers, Oppenheim, Meadows, McKnight, and Kinnell (1999) argued that relative to other disciplines, the role of information science is to support human information needs, implying that this includes consideration of the user and information storage, search and retrieval tools, systems and processes.

Information systems

Like information science, the information systems discipline is characterized as multidisciplinary and pluralistic in its approaches (Fitzgerald & Adam, 1996; Checkland & Holwell, 1998; Ellis et al., 1999). Davis (2000, p. 67) noted that "… *the information system of an organization consists*

of the information technology infrastructure, application systems, and personnel that employ information technology to deliver information and communication services for transaction processing/operations and administration/ management of an organization." Scholars see this area is relatively new, perhaps multi (or pre-) paradigmatic and often focused on pragmatics (Fitzgerald & Adam, 1996; Checkland & Holwell, 1998; Ellis et al., 1999). (endnote 3)

Comparing Information Science and Information Systems

Comparative research across these two academic disciplines is relatively rare, as the three studies noted below highlight (endnote 19). Tang (2004) has analyzed the citations of library and information science publications to identify cross-disciplinary citing. He found that references to management (where some of the information systems literature is located) and computing (where other information systems material can be found) literatures is growing over time, now accounting for about 15% of all extra-disciplinary referencing in information science.

Ellis, Allen, and Wilson's (1999) developed a co-citation analysis of information science and information systems literature and found limited linkages between the two sets of literature. They concluded that while information science and information systems research might be conjunctive in terms of research interests but remained disjunctive in terms of their "disciplinary recognitions" (Ellis et al., 1999, p. 1100). They went on to speculate this disciplinary disjunction might be due to academic politics.

Monarch (2000), building on the Ellis, Allen and Wilson (1999) analysis, compared selected journals from information science, information systems and medical informatics using co-word

analysis. This analysis leads to "leximaps" that reflect the network of relationships among most commonly used words and phrases. Monarch's subsequent discussion (for information science and information systems) "… bear<s> out the story … concluded <by> the Ellis study. <Information Science> is primarily concerned with the information content of systems and retrieval, and <information systems> is concerned with the organizational context of systems and computer based decision support and executive information systems."

A FRAMEWORK TO COMPARE ACADEMIC DISCIPLINES FOCUSED ON ICT

Our approach to illustrating the overlap and common interest among these two disciplines begins with the claim that both are focused on the concepts of information, people and (information and communication) technology (ICT). We see this as an empirical question and assess this claim by analyzing published work drawn from these two literatures (endnote 4).

Conceptualizing information, technology, and people

We are in good company positing that differing conceptualizations of *information*, *technology*, and *people* underlie both information science and information systems. For example, Saracevic (1999) made this the case for information science. Checkland and Holwell (1998, p. 40) argued that anyone who enters the information systems field, no matter which discipline they originally come from, " … *would have to think about the notion of 'information' and 'information system'; they would have to work with some coherent idea of what we mean by organization.…* ." Studies by Orlikowski and Iacono (2001) and by Sawyer and Chen (2002) explicitly theorize about the conceptualizations of the ICT artifact, the meanings of information, and the ways in which people are conceptualized (See Table 1).

<insert Table 1 near here>

Information

Theories and concepts of information are vibrant research concerns in information science (Taylor, 1982, 1986; Losee, 1997; Borgmann, 1999; Saracevic, 1999; Cornelius, 2002; Bates, 2005), philosophy (Floridi, 2002), and communications (Braman, 1989) (endnote 5). In contrast, published papers in information systems often have little text devoted to this concept. However, it appears that two contemporary phenomena are helping bring conception of information more directly to the forefront of information systems research. First, there is the increasing attention being paid to practical and conceptual issues in managing knowledge in extant social organizations (Alavi & Leidner, 2001; Tsoukas & Vladimirou, 2001; McInerney, 2002). Second, there is an increased interest in the roles that information plays in the philosophical and conceptual foundations of information systems research (Callaos & Callaos, 2002; Fonseca & Martin, 2005a, 2005b)

One difficulty with developing a more explicit conceptual definition of information is the ongoing debate over the differences among data, information, knowledge and wisdom (Taylor, 1982; Brown & Duguid, 2000; Callaos & Callaos, 2002). Another part of the difficulty is that there exist multiple interpretations of information in different disciplines and in different contexts (e.g., Cornelius, 2002). Saracevic (1999) suggested viewing information according to a continuum of complexity: as an entity of signal or message in narrow sense; as cognitive processing and understanding in a broader sense; and as embedded within a social context in the

broadest sense.

Reflecting Sarcevic's continuum, we characterize information in three ways: as an object, as embedded in some larger entity, or naïvely. From an *object* view, information is a discrete entity: something that can be passed from sender to receiver with no loss of value, something that can be stored for later retrieval, or something that can exist and be understood on its own (endnote 6). For example, it is assumed that one may be able to understand the directions by simple provided with a manual. A second way to conceptualize information is as *embedded* into a larger entity. In this way information is that which is in someone's head (tacit) (Polyani, 1969; Brown & Duguid, 2000), co-constructed through social interactions (as the development of collective meaning, see Crowston & Kamerer, 1998; Wynn & Katz, 1997), or embedded into the design of IT artifacts (distributed cognition, see Hollan, Hutchins, & Kirsh, 2000) and organizational structures (an organizational information processing perspective: Galbraith, 1974). A third characterization of information is what we term a *naive* view. In the naive view the meaning of information is never made clear. Or, there are multiple inferred meanings (sometimes as "object" and sometimes as "embedded") with no over-arching discussion of the conceptual issues with a pluralist approach to depicting information.

Information and Communication Technologies

We use here the five approaches to conceptualizing ICT identified by Orlikowski and Iacono (2001): feature, proxy, function (or ensemble), proof of concept, and presence/absence.

The *feature* or tool view of ICT: Here ICT is depicted as a tool with one or more features. The

ICT is characterized as operating as it was designed to behave. The roles of the ICT with those features are seen as primarily technical in nature and direct in their effects. These *feature*-based approaches focus on the values, effects and impacts of particular (and identifiable) technical aspects of an ICT. The feature or tool view is the most common view of ICT (Orlikowski & Iacono 2001).

The *proxy* view of ICT: ICT is viewed as some (often quantifiable) surrogate that captures or measures some of the value of ICT. For example, the work by Brynjolfsson and colleagues uses spending on IT as a proxy for ICT (Brynjolfsson, 1994; Brynjolfsson & Hitt, 1998). Three forms of proxy are identified in the contemporary information systems literature. This is a form of capital proxy -- using some surrogate (such as spending on computers) as the definition of ICT. The other proxy form is the perception view of ICT. Here perceptions of human cognition or attitudes become the proxy for what is meant by ICT. The diffusion proxy uses measures availability (or level of penetration) of ICT artifacts. Proxy views of ICT focus on making clear the ways in which the measure highlights the value of the ICT.

The *functional* or ensemble view of ICT: Here ICT is a viewed socio-technical package. To understand an ICT requires understanding the both specific artifacts and people are mutually constituted, interdependent, and connected through roles, uses of information and actions. In the functional view there is often explicit attention paid to the ways of using a particular ICT. Such socio-technical arrangements can be called webs of computing, socio-technical IS or socio-technical systems (Kling & Lamb, 1999; Sawyer & Eschenfelder, 2002). The structural ensemble highlights the relationships among ICT, structure and action. Functionally oriented

characterizations of ICT focus on the values, effects and impacts of the uses of particular ICT.

The *proof-of-concept* view of ICT: Here ICT is the computational power or ability of an artifact. These characterizations of ICT highlight the construction of a computational artifact, where that artifact instantiates an idea or theory of information processing (Chandra, Gasser, March, Mukherjee, Pape, Ramesh et al., 2000). In the proof-of-concept view of ICT, the focus is on providing evidence of a concept by developing a *computational* artifact.

The *presence/absence* or nominal view of ICT: The presence/absence or nominal view implies that discussions of ICT do not provide a definition or operational depiction of what is meant. In this approach the characterization of ICT is implicit. Often the particular ICT is named, but its features, functions, model or proxy are not defined. Nominal treatments of ICT are often developed as *presence/ absence* rhetoric: contrasting situations that have ICT to situations that have no ICT, or to situations where there are both more and less of the same ICT.

People

We characterize conceptualizations of people in one of three ways: as individuals, as social, or naively (endnote 7). The first makes use of *individual attributes* or *characteristics*, which view people from a typically psychological perspective. There are, of course, a variety of psychological theories that can be (and have been) used in computing related research. There are also some derivative approaches to theorizing people that draw on psychology (such as the technology acceptance model in information systems) that may not be used by psychologists. This characterization of people, however, follows the general characteristics of a philosophy of

psychology (see Machamer, 1992).

A second characterization of people is *social*: as aggregations, units greater than one, and not individuals. In this view collective attributes and behaviors are the focus and individual variance is not central. Such perspectives are often labeled social theories and they can be found in theories of social organization, institutional economics, and new institutionalism. Again, the issue is not their use in a reference discipline as much as it is that their underlying structure reflects the philosophy of social science (see Salmon, 1992).

A third characterization of people as is what we will call *naive*. A naive view of people as a construct is not grounded in theory. A naïve view does not presume individual differences and/or aggregate/collective characteristics and behaviors. Such an approach often is based on claims of people's actions and behaviors that are independent of a credible theoretical base.

While this three-way characterization of people is quite broad it provides a means to discriminate the ways in which people are depicted in the current information science and information systems literature. Thus, a paper that depicts women as not able to understand ICT solely because of their gender would be seen as using the naive construct of people. The characterization of people (women) in the aggregate is a social level of analysis, but it is disconnected from any conceptual basis and so is naive. Likewise a paper that uses the technology acceptance model (TAM) and depicts people as having individual beliefs and expectations of ICT use (building on two elements of TAM) would be using a theory premised on individual characteristics. In contrast, a paper that explicitly depicts social organizations as

information processing entities (such as done by Ackoff, 1996) would be seen as developing people as an aggregate social construct.

Level of Analysis

We depict four levels of analysis: *artifact*, *individual*, *group* and *institution*. The *artifact* level engages development of a particular ICT artifact. The *individual* level of analysis is characterized by attention to individual differences in cognition, perceptions, attitudes and beliefs. The *group* level of analysis focuses on small groups of people: often work groups or teams. Here we treat groups as a special form of a social unit, even though they could be (and often are) treated as either an aggregation of individual characteristics *or* as a specific form of social aggregation. We use the term *institution* to represent the levels of analysis encompassing social aggregations larger than a group or team. These aggregations can take the form of organizations, departments, communities, social groups, industries, and societies.

Research Methods

We characterize all survey and laboratory, field, or quasi-experiments as *experimental* research methods. Case studies, fieldwork and ethnographies, deconstruction and hermeneutics are classified as *intensive* approaches to research. The development of an artifact, such as a model or an algorithm, is classified as *theory/model* approaches to research. And, we classify reviews, archival and historical study, or drawing on secondary data (e.g., using web logs) as "*other*" research approaches.

The use of such broad categories masks some of the rich variety of research methods. However,

the purpose of this paper is to explore general trends in disciplinary progress. Despite the granularity, these four categorizations are sufficient to help represent trends in contemporary information science and information systems research.

In coding papers that focused on multiple levels of analysis or employed multiple research approaches the text of the paper had to make clear the multiple levels and define how they were crossing levels of analysis. Thus, a paper in which the authors claim to study organizational decision-making, but focus solely on individual differences of certain decision-makers, would be classified as research at the individual level of analysis. Conversely, a paper in which the authors articulated several working groups using ICT to coordinate and collaborate to achieve organizational goals as research being done at both group and institutional levels of analysis would be classified as doing both. In similar fashion, a study using surveys and fieldwork (such as Kaplan & Duchon, 1988) would be coded as both experimental and intensive (endnote 17).

RESEARCH APPROACH

We pursue this research via a comparative analysis of journals drawn from information science and information systems. To structure the comparison, we use a framework outlined in Table 1 and discussed below. Like others, we use as evidence a sample of publications drawn from a key journal in each of these academic disciplines (e.g., Tang, 2004; Vessey, Ramesh, & Glass, 2002; Glass, Ramesh, & Vessey, 2004; Grudin, 2004; Ellis et al., 1999). In the rest of this section we lay out the reasoning for our selection of two journals: the *Journal of the American Society of Information Science and Technology (endnote 8)* (*JASIST*) as a representative journal of information science and *Information Systems Research* (*ISR*) as a representative journal of

information systems.

JASIST as a representative journal of information science scholarship

The roots of *JASIST* can be traced to 1950 when *American Documentation* was first published. (endnote 9) Since then, *JASIST* has both evolved and become a leading journal in information science. Nisonger (1999) noted *JASIST* had a high impact factor and was an oft-studied journal within information science. As additional evidence, we note that *JASIST* has published a series of articles using itself as a source to explore the disciplinary characteristics of information science discipline (White & McCain, 1998; Bates, 1999). From this we deduce that *JASIST* is a representative information science journal.

***ISR* as a representative journal of information systems research**

Information Systems Research (endnote 10) was first published in 1990 and since has become a leading international journal focusing on information systems in organization and other institutional contexts. *Information Systems Research* is consistently ranked as a premier journal in the information systems field, and was placed among the top three journals (along with *Management Information Systems Quarterly* and *Communications of the ACM*) in recent summaries of IS publications (Mylonopoulos & Theoharakis, 2001; Romano, 2004). Recently, *ISR* has been used as a source of evidence for studies of the disciplinary structure of information systems (Lee, Gosain, & Im, 1999; Farhoomand & Drury, 1999; Vessey et al., 2002; Mingers 2003; Chen & Hirschheim, 2004). This bolsters our claim that *ISR* can be viewed as a representative journal of the information systems research discipline (endnote 11).

Coding the *JASIST* and *ISR* Articles

We coded articles published in *ISR* and *JASIST* between 1990 until 2003. We began with 1990 because that is when *ISR* began publishing and we used the same time frame for JASIST for comparison. We included all research articles, research commentaries and notes from *ISR*. In *JASIST*, we did not include the book reviews and the brief communication articles or research on bibliometrics and studies of information seeking that had no direct or explicit engagement with ICT (e.g. Cronin, Shaw, & LaBarre, 2003). Thus, this analysis includes 672 articles: 217 from *ISR* (endnote 12) and 455 from *JASIST* (endnote 18) published between 1990 and 2003.

The coding scheme was developed *a priori* and refined through initial coding of journal articles (see Table 1) (endnote 13). Initial article coding was done by one of the authors. This was compared to the coding done by others. Disputes on differences in coding 43 articles (6.4%) were resolved via discussion.

Two empirical issues hampered coding. First, the research published in both *ISR* and *JASIST* is not written in a way that makes it easy to assess how information, technology and people are conceptualized (and the levels of analysis and research methods were often difficult to ascertain). This is to be expected given our argument that these are often implicit. Second, several papers have multiple perspectives on the three constructs (and occasionally use multiple methods or levels of analysis). In the cases where there were multiple methods or levels of analysis, we coded all of them.

6. Findings and Discussion

We summarize the findings of our analysis of the *JASIST* literature in Table 2 and of the *ISR* literature in Table 3. In Tables 4A to 4E we compare *JASIST* and *ISR* and literature relative to characterizations of ICT, information, people, level of analysis, and research. We report a finding, noting the tentative nature of this position, if one of the following criteria is met:

1. More than 50% of the articles are coded in the same way relative to the construct.
2. No one perspective of a construct is dominant but two of the codes account for at least 75% of the representations in the collection of IS research articles.
3. One coding category is at least 40% of the total number of coded articles; and, no other form of coding is more than 20% of the total number of coded articles.

<**Insert** Tables 2: *JASIST* literature summary>

<**Insert** Tables 3: *ISR* literature summary>

Findings from *JASIST* literature analysis

We identify and discuss three findings from our analysis of the *JASIST* literature:

1. Characterizing ICT, Information, and People: In the *JASIST* literature there exist dominant conceptualizations of information and people and a diverse range of conceptualizations regarding ICT. Our analysis of the JASIST literature finds that 66.2% of the articles do not have a well-developed (or at least well-documented) conceptualization of people (endnotes 14, 15).

2. Common level of analysis but diverse uses of research methods: We find that the *JASIST* literature is oriented towards the artifactual level of analysis (28%), followed by the individual

level of analysis (23.3%). We further observe that there is no one dominant research method in the JASIST literature, although *theory/model* development and *intensive* approaches are more prevalent that are *experimental* and '*other'* research methods.

3a. Patterns when ICT is conceptualized as set of *features*: In 29% of articles published in *JASIST* ICT as collections of *features* account. In these papers the dominant characterization of information is as an *object*. People are characterized as either *individuals* or *naively*. The dominant level of analysis is *artifactual* and the dominant research method is *intensive*. It seems that information science literature depicts ICT as a set of features that are often presented in some form of design criteria regarding technological frame for these features are to be used.

3b. Patterns when ICT is conceptualized via some *proxy*: Using surrogate measures to denote ICT accounts for 16.3% of *JASIST* articles. In these papers information is most often conceptualized *naively*. People are depicted as *individuals* or *naively* in 92% of the papers. The dominant research approach is some form of *intensive* method and the level of analysis is either *artifact* or *individual* (which together account for 84% of the articles with this view of ICT). The most common proxy is how different types of users perceive a particular or generic ICT.

3c. Patterns when ICT is conceptualized as some *function* or *ensemble*: Research that depicts ICT as *functions* or ensembles account for 12.1% of *JASIST* articles. In 93% of these papers information is depicted either *naively* or as *embedded*. People are framed *naively* in 62% of the papers. While 84% of the papers focus on either the *artifact* or the *institution* level of analysis, there are no discernable trends relative to research methods. When ICT is characterized

functionally, the research often focuses on how the social and work contexts shape the design or uses of ICT.

3d. Patterns when ICT is conceptualized as *proof-of-concept*: Those depicting ICT as proof-of-concept account for 21.8% of *JASIST* articles. In 73% of papers information is treated as an *object* and in 94% people are viewed *naively*. In 96% of the papers the level of analysis is the *artifact*. The computational approach to theory/model development is taken in 83.8% of the papers. This type of JASIST literature often focuses on either information analysis of a particular domain or on information retrieval techniques and algorithms.

3e. Patterns when ICT is conceptualized by its *presence/absence*: For those studies in which ICT is mentioned but not described or theorized, there is a range of levels of analysis and no dominant approach to the research methods used. However, in 80% of the papers information is depicted naively, as are people in 70%.

Findings from the *ISR* literature analysis

We identify and discuss below four findings from our analysis of the *ISR* literature:

1. No dominant view of ICT: The ISR literature is diverse relative to conceptualizations of ICT. This reflects our and other's assessment that this area is a diverse research community (Banville & Landry, 1989; Benbasat & Weber, 1996; Robey, 1996; Vessey et al., 2002).

2. No dominant view of information or level of analysis: The literature published in ISR reflects a range of approaches to conceptualizing information, with no one approach dominating. Likewise, there is no common level of analysis across the *ISR* literature.

3. Individualistic or naïve view of people: In 82% of the *ISR* papers people are conceptualized as either some collection of *individual attributes* or *naïvely*. As we note below there are patterns of relations among the constructs that highlight different views of people. However, these two approaches to conceptualizing people reflect a clear trend in the current literature.

4a. Patterns when ICT conceptualized as a set of *features*: Research that depicts ICT as collections of features account for 19.4% of *ISR* articles. In these papers, the *object* and *embedded* views of information predominate (accounting together for 85.7% of this work). People are characterized as *individuals* and the level of analysis is focused on the *individual*. Feature-based ICT research is most often conducted as some form of *experiment*.

4b. Patterns when ICT conceptualized via a *proxy*: Research that uses a surrogate measure accounts for 28% of *ISR* articles. In 54% of these papers information is depicted *naively*, in 87% of the papers people are conceptualized *naively* or as *individuals.* In 82% of these papers, the level of analysis is either *individual* or *institutional*. However, there is no one dominant research method in proxy-based approaches to studying ICT.

4c. Patterns when ICT conceptualized as *functions* or *ensembles*: Research depicting ICT as functions or ensembles account for 23% of *ISR* articles. In these papers information is depicted

as *embedded* in some discourse or larger context. People are treated as either *individual* or *social* entities (together they account for 74% of the articles with functional views of ICT). The social entities are often characterized as behaviors of institutions and other organizations. In 82% of these papers, the dominant research approach is a form of *intensive* methods or *theory/model* development. When ICT is characterized functionally, the research typically focuses on the *institutional* level of analysis (e.g., an organization, some community, groups, etc.). Findings of this form of information systems scholarship seem to be represented as process models or models of social structures. The ICT is often depicted in terms of the broad functionality that it provides.

4d. Patterns when ICT conceptualized as a *proof of concept*: Characterizations of ICT as a proof of concept account for 20% of ISR articles. In 81% of these papers information is conceptualized as an *object* and in 72% of these papers, people are conceptualized *naïvely*. In 79% of these papers, the *artifact* is the level of analysis. For 79% of these papers research method is always a computational type of *theory/model* development (endnote 16).

Comparing *JASIST* and *ISR* literature

We highlight five findings drawn from comparing information science research as published in *JASIST* with information systems research as published in *ISR*:

Variations regarding conceptualizations of information (Table 4A): In the *JASIST* literature, 85% of the papers conceptualize information as either object or naive. The *ISR* literature is more diverse.

< **Insert near here** Table 4A: Comparing *JASIST* and *ISR* – Conceptualizing Information>

Multiple and diverse conceptualizations of ICT (Table 4B): All five conceptualizations of ICT can be found in both the *JASIST* and *ISR* literatures. Both literatures have similar percentages of papers reflecting the computational perspective of ICT. The *JASIST* literature treats ICT from a naïve perspective more than twice as often as does the *ISR* literature. The reverse holds for proxy-based and ensemble views of ICT. The *JASIST* literature treats ICT from a feature/tool perspective about 40% more than does the published literature in *ISR*.

<**Insert near here** Table 4B: Comparing JASIST and *ISR* – Conceptualization of Technology>

Variations in conceptualizations of people (Table 4C): In the *JASIST* literature, 66% of the papers conceptualize people naively. In 39% of the *ISR* papers, people are conceptualized naively. In 46% of the papers in *ISR* people are conceptualized as individuals. In both sets of literature the social characterization of people is the least-common, although it is more than three times more likely to appear in *ISR* than in *JASIST*.

< **Insert near here** Table 4C: Comparing *JASIST* and *ISR* – Conceptualizing People>

Variations by levels of analysis (Table 4D): In 58% of the papers published in *JASIST* the artifact is the level of analysis. In 23% of the papers the level of analysis is the individual and in 14% of the papers the level of analysis is institutional. By contrast, in 40% of *ISR* papers the

institution is the focus. The artifact is the level of analysis in 26% of *ISR* papers as is the individual level of analysis. The group-level of analysis is proportionally the least common in both literatures, but four times more likely to appear in *ISR* than in *JASIST*.

< **Insert near here** Table 4D: Comparing *JASIST* and *ISR* – Levels of Analysis>

Differences in research methods (Table 4E): Both sets of literature have nearly similar percentages of papers taking intensive or theory/model-building approaches to conducting research. The *ISR* literature contains about 40% more papers that rely on some form of experimental or quasi-experimental methods than are seen in *JASIST*. The *JASIST* literature contains nearly twice as many papers (as percent of total) that reflect a wide range of research methods. This suggests an openness to research methods innovation in *JASIST*: something that is far less prevalent in the published work in *ISR.*

< **Insert near here** Table 4E: Comparing *JASIST* and *ISR* – Research Methods>

IMPLICATIONS AND CONCLUSIONS

In this comparative analysis of research published in information science and information systems, we have identified differences and patterns relative to conceptualizations of ICT, information, people, the level of analysis and research methods. This analysis was premised on two beliefs. First, these two areas of research share three common concepts – a focus on ICT, information, and people. Second, that a more explicit recognition of the patterns of relationships relative to the five conceptualizations of ICT can also help researchers to better position their

work and maximize its value for others by being more explicit about the ways in which their research addresses these core concepts and characteristics. We further note that our findings can be seen best as reflecting patterns and acknowledge that there are many papers in both literatures that do not reflect the tendencies we are focusing on in this discussion.

That said, one implication of this work is there is value in making more explicit the conceptualizations of information, people and ICT. Being more explicit allows for other scholars to more quickly engage and make sense of work that does not reflect their own conceptualizations or research traditions. A second outcome of increased clarity of core constructs is the development of cumulative findings; and, third, the likely engagement in what these differences and clarifications mean for pursuing scholarship.

The disciplinary structures of information science and information systems

The work of information science, based on findings reported here, suggests this area of scholarship has dominant conceptualizations of information and people, common levels of analysis, diverse conceptualizations of ICT and is done using a broad range of research methods. Information systems research reflects a diversity of views and approaches across the five constructs, with no dominant or dominating theme.

One implication of this analysis is that scholars adhering to the dominant approach to research in information science (at least relative to the constructs we highlighted) will find a small percentage of scholars in information systems taking the same approach. And, it may be that researchers interested in computing who are outside of information science may be attracted to

the pluralistic approaches to doing research that seem to be embraced in this community. At the same time it may be very difficult for scholars who are not in the information systems research community to consume or synthesize the findings of current research efforts in that area given the disparity of approaches to getting these findings.

A second implication from our analysis is that these two areas of scholarship have overlapping, but substantively different, research foci. Information science scholars most commonly focus on information and ICT, with explicit attention to the artifact. In doing this, information scientists approach their research in diverse ways, yet seem to maintain a naïve (or at least not well-documented) conceptualization of people. In contrast, information systems research seems to focus attention on the roles of information and people relative to technology. And, information systems scholars most often take a quasi-experimental approach to this work and focus on research that spans individual and institutional levels of analysis.

We noted earlier that Ellis et al., (1999) concluded in their co-citation analysis that information science and information systems seem conjunctive but are disjunctive. They reflect that perhaps this is because of the different research foci and institutional pressures. We speculate that information science research is expanding its focus beyond informational imperatives and may need to relax (not reify) current disciplinary boundaries.

Information systems research is, by our analysis, a more diverse community. We speculate that scholars in this area may need to be more explicit about its basic constructs (even to the simple

level of articulating the range of possible ways to characterize these basic constructs) in order to more easily connect to, and to be understood by, other disciplines.

Like Ellis et al. (1999) we see opportunities for increased cross-disciplinary research among information science and information systems. To encourage this we make broad-scale suggestions for both information science and information systems research. In doing this we know that interpreting and taking action relative to these suggestions is the more difficult issue. That said, our intent is as much to focus attention as to suggest action.

The challenge for information science research: bring people back to the core

Our findings suggest that the people construct is underdeveloped in much of the literature published in *JASIST*. We note that 66% of papers published in JASIST do not provide a conceptually-grounded view of users. In 58% of this work, the analytic focus is the artifact. Saracevic (1999) worried that "providing the effective computer applications pervades the field (of information science)" and "the greater danger that information science faces is losing the sight of users". In his acceptance speech for the 1997 ACM SIGIR Gerald Salton Award, Saracevic (1997) reflected on the origin, development, and current issues of information science, and his own professional life in the field and argued that "the greatest danger that information science faces is losing sight of users" and information science needs to "… integrate systems and users research" (p. 26). We concur.

The challenge facing information science is to better conceptualize people relative to both ICT and information. In developing better theories of people relative to ICT and information,

information science scholars can move beyond the current state of theoretically unreflective research regarding the roles of people relative to information and ICT.

The challenge for information systems research: balancing diversity with divergence

Our findings suggest that information systems research is vibrant, diverse, but perhaps confusing. Jane Webster, writing in Lee (2001, p. xii), argued that IS literature (albeit, referring at least implicitly to the literature published in *MIS Quarterly*, another leading information systems journal), has come "a long way in terms of conducting empirical research", and information systems research has come to some sort of paradigmatic maturity. Our findings suggest that if this is so it seems to embrace a multi-paradigmatic perspective on ICT.

This attribute of information systems research is seemingly well known, and there are sharp debates surrounding how the disciplinary future should proceed. One group of scholars argues for a strong disciplinary core. Others argue that maintaining the diversity of approaches is more central than pursuing a core paradigm (Lyttinen & Kling, 2004). Banville and Landry (1989) classified the IS discipline as a "fragmented adhocracy" and argued that it might be inappropriate to use Kuhn's (1970) view of how scientific disciplines progress (through paradigmatic shifts) to understand the information systems discipline. Benbasat and Weber (1996) emphasized on the importance of both the paradigmatic core and the diversity by saying that the former would provide coherence to the discipline and the later will contribute to build a broad knowledge base. Robey (1996) acknowledged the dangers of both sides and suggested that it is the researchers' responsibility to sustain and extend such diverse contribution without compromising identity or monistic view by clearly justifying their research aims, theories and methods.

However, if information systems scholarship becomes too diverse, the collective value is lost. Should this become the case then the potential contribution of information systems research for researchers outside this community might be incoherent and trivial. Given this, we agree with Robey's (1996) and Ellis et al.'s (1999) calls for clarifying the range of approaches to basic research constructs and committing to collaborative work.

The challenge for cross-disciplinary collaboration: clarifying the discourses

We see opportunities for information science and information systems scholars to pursue collaborative work in both existing and emerging research domains. Our premise is that the discourse to bridge these research communities needs some common structure. Our approach to enabling this discourse has been to, first, highlight that there are common, core concepts in both literatures. Moreover, beyond common conceptualizations of technology, information and people we further note that these constructs are connected to both the levels of analysis and the research approaches engaged. Comparing these patterns of arrangements in a sample of information science and information systems literature suggests to us that cross-disciplinary collaboration is possible, but may be hard to do without more explicit efforts to bridge these two academic spaces. It seems that this translational, or boundary-spanning, research needs to become a focus (or a companion element) of cross-disciplinary scholarship.

Table 1: The Analytic Framework and Coding Scheme

Construct	Description
Information	
Object	Discrete, identifiable and transmittable unit
Embedded	Enmeshed in discourse, structure or process
Naive	No developed or used in multiple ways
Technology (ICT)	
Feature (tool)	Used as intended, technical features with direct effects
Function (ensemble)	Socio-technical collection of artifacts, roles, rules and norms
Proxy	Substitute measure
Proof of concept (computational)	Artifact, model or algorithm
Presence/absence	Not defined or developed, just mentioned (or not).
People	
Individual	Theories of individuals (behaviors, cognition, attitude)
Social	Theories of collective characteristics and behaviors
Naive	No theory of people developed or defined
Level of Analysis	
Artifact	The computational effort
Individual	People's perceptions, attitudes and behaviors
Group	Small collections of people (often teams and work groups)
Institution	Larger social units (organizations, industries, communities)
Research Method	
Experimental (all forms)	Laboratory and field experiments, quasi-experimental designs
Intensive/field-based	Case studies, ethnographies, deconstruction/text analysis
Theory/model	Theory/model/ programs
Other	Literature review, historical study, archive ……

Table 2: *JASIST* literature summary

View of ICT	Feature/Tool	Proxy	Ensemble	Proof-of-concept	Presence/Absence
N (of 455)	132 (29.0%)	74 (16.3%)	55 (12.1%)	99 (21.8%)	95 (20.9%)
Information	Object	Naive	Naïve Embedded	Object	Naïve
People	Individual Naive	Individual Naive	Naive	Naïve	Naïve
Level of analysis	Artifact	Artifact Individual	Artifact Institution	Artifact	Not clear
Method	Intensive	Intensive	Not clear	Theory/model	Not Clear

Table 3: *ISR* literature summary

View of ICT	Feature/Tool	Proxy	Ensemble	Proof-of-concept	Presence/Absence
N (of 217)	42 (19.4%)	61 (28.1%)	50 (23.0%)	43 (19.8%)	21 (9.7%)
Information	Object Embedded	Naive	Embedded	Object	Naïve
People	Individual	Individual Naive	Individual Social	Naïve	Individual Naive
Level of analysis	Individual	Individual Institution	Institution	Artifact	Not clear
Method	Experiment	Not clear	Intensive Theory/model	Theory/model	Not Clear

Table 4A: Comparing *JASIST* and *ISR*: Conceptualizations of Information

Information	Object	Embedded	Naive
ISR (N=217)	34.1	32.7	33.2
JASIST (N=455)	46.2	14.9	38.9

Table 4B: Comparing *JASIST* and *ISR*: Conceptualizations of Technology

Technology	Feature/Tool	Proxy	Ensemble	Computation	Naïve
ISR (N=217)	19.4%	28.1%	23.0%	19.8%	9.7%
JASIST (N=455)	29.0%	16.3%	12.1%	21.8%	20.9%

Table 4C: Comparing *JASIST* and *ISR* Conceptualization of People

People	Individual	Social	Naïve
ISR (N=217)	37.3	18.0	44.7
JASIST (N=455)	28.8	5.1	66.2

Table 4D: Comparing *JASIST* and *ISR*: Levels of analysis

Level of analysis	Artifact	Individual	Group	Institution
ISR (N=217)	26.3	25.8	8.3	39.6
JASIST (N=455)	58.0	23.3	2.2	14.3

Table 4E: Comparing *JASIST* and *ISR*: Research Methods

Research method	Experiment	Intensive	Theory/model	Others
ISR (N=217)	26.3	30.0	36.0	7.8
JASIST (N=455)	16.7	33.0	35.4	14.9

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Endnote 1: The conceptualization of what is a research discipline, and criteria for deciding this, is a matter of scholarly debate. Here we simply note that the boundaries of these two areas of scholarship have been identified by others and that they overlap.

Endnote 2: This now includes the study of ICTs in social and organizational contexts (Kling, Rosenbaum, & Hert, 1998).

Endnote 3: This is an active area of debate within information systems. Some worry that the trend of information systems research is towards divergence instead of convergence which will endanger the future of the IS discipline as a whole (Benbasat & Weber, 1996, Benbasat & Zmud, 2003). Others worry that this concern is unwarranted and may be self-destructive in that boundaries are social constructions and not fixed or fixable (Fitzgerald & Adam, 1996; Lyttinen & King, 2004).

Endnote 4: In grappling with these three issues, researchers must also wrestle with the epistemology or the philosophical view of the research, particularly given the broadened nature of information science and the always-been-broad nature of information systems. This analysis is also worth pursuing, but is more than can be done in this article and is likely to need a different analytical approach from the one we pursue.

Endnote 5: One speculation that arises from this summary is that as information systems scholars more directly address information, the information science literature is likely to be increasingly seen as a resource.

Endnote 6: See: Buckland's "Information as thing," http://sims.berkeley.edu/~buckland/thing.html.

Endnote 7: While conceptualizations of people are central to both information science and information systems, the particular theories and models through which people are depicted vary greatly.

Endnote 8: JASIST was known as JASIS – the Journal of the American Society for Information Science -- from 1970 to 2001. JASIST was known as American Documentation before 1970.

Endnote 9: For more information on JASIST, see http://www.asist.org/jasist/.

Endnote 10: For more information on ISR, see http://www.informs.org/Pubs/.

Endnote 11: In addition, ISR served as the empirical basis for Orlikowski and Iacono's (2001) paper on the categorization of ICT, and we follow on that tradition here.

Endnote 12: Orlikowski and Iacono (2001) based their work on an analysis of work published in ISR from 1990-1999.

Endnote 13: This approach has at least two limitations. First, the analysis is confined to the research published in two journals we choose for this study. It may be that additional (or

different) journals should be included to achieve a more comprehensive view. Second, the framework is clearly pre-theoretical (if not a theoretical) and the coding scheme's empirical support may be belied by future conceptual developments on the nature and roles of computing.

Endnote 14: In doing this we aver that users are people.

Endnote 15: Perhaps this is an historical artifact? Saracevic (1997) noted that as information science developed in the years following World War II, the focus of the discipline was on the "technological fix." This focus on the technological elements of information science means that conceptualizations of people are too-often absent (or under-developed) in the works published in *JASIST*.

Endnote 16: A commonly noted contribution of this type of information systems research is the current limitation(s) of the computational artifact. In addition, there seem to be claims made about the utility of the model for people (such as decision-makers) or its value to people for using the developed ICT. However, these papers rarely include a test (or evaluation) of such claims.

Endnote 17: For more information on classifying and coding articles, contact the first author directly.

Endnote 18: 53 articles, editorials and position papers were not included.

Endnote 19: There is other comparative work from overlapping fields. For example, Glass, Ramesh, and Vessey (2004) contrasted Computer Science, Software Engineering, and Information Systems (IS) by studying each discipline's leading journals from the perspectives of research topic, reference discipline, unit of analysis, research approach, and research method. They noted that while these three disciplines have developed their own domain knowledge separately, it may be the time to create "some impetus for amalgamation" (Glass, et. al., 2004, p. 89). They found that each discipline has its own set of research topics, approaches, and methods. In addition, leading journals are typically focused on their own disciplinary borders and there is little communication and recognition across boundaries.