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A COMMENT ON THE INTELLECTUAL STRUCTURES OF INFORMATION SYSTEMS DEVELOPMENT

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INTRODUCTION

Hirschheim, Klein, and Lyytinen's (henceforth HKL) "Intellectual structures of information systems development" is a very rich and suggestive paper. They developed a taxonomy that integrates and makes sense of the fragmented domains of intellectual knowledge in ISD. The paper significantly contributes to knowledge in both the process and outcome: the process by means of a methodology for developing taxonomies, and outcome by means of a theory-based framework for classifying ISD research.

Classification is fundamental in scientific development. However, researchers seldom explain how they create taxonomies and frameworks. As observed by Bailey (1994), constructing taxonomies as a conceptual exercise is so ubiquitous and so well-ingrained in research that we often fail to question, analyze or reflect on the process systematically. HKL's paper offers a rare exemplar. The paper is valuable to any social scientist, whether or not he or she studies information system development. The authors employed a methodology that was justified on strong principles of social action theories. They offered deliberate and careful organization of disparate bodies of knowledge into groups or classes based on epistemological and ontological similarities and differences. Works of Habermas and Etzioni aided as conceptual tools in deciding which dimensions, concepts, frames, and orientation fitted existing research and yielded insights into ISD and implementation. The methodology could be usefully employed to synthesize other realms of information system research or organization research.

The most important task in creating taxonomies involves comparison, taking one object as the focus of attention and something else with which it can be compared to highlight differences and similarities. The persistent comparison among the studies as to their objects, development strategies, and outcomes along the dimensions of domain objects and orientations, informs and enriches our understanding of each study. In particular, locating prior ISD studies in the taxonomy highlights the implicit theories-in-use and philosophical inclinations of each.

The dramatic spread among ISD studies across the framework calls into question the hegemony of the positivist approach to ISD research that is based on technical and deterministic rationality. Paradigms alternative to the positivist empiricist approach differ in their assumptions about the nature of reality and knowledge. While the traditional technological, control and deterministic approaches underestimate constraints and overestimate response alternatives, the post-positivist paradigms emphasize critical interpretations of reality over functional interpretations, and communicative interactions and relationships over formal hierarchies.

From a multiparadigimatic standpoint, the taxonomy gives IS researchers the opportunity to reflect on how ISD is researched. It opens up different ways of seeing, telling different stories of ISD depending on the standpoints of different paradigms. It also forces one to self-examine: in the way one does research, the sources of one's thinking and more importantly, the language, embedded values, and implicit beliefs that shape one's own research agenda. As a model for theoretically integrating research on IS development, this analysis has a number of implications for future work. In particular, what captures my interest and draws me back to the paper is its silence on the evolution or growth in the disparate discourses in ISD research, and the relevance of the taxonomy to accommodate future ISD research. The following section will elaborate on these two issues.

SOURCES OF DIFFERENTIATION AND HISTORICAL EVOLUTION IN INTELLECTUAL DISCOURSE OF ISD RESEARCH

Figure 7 of the paper presents a snapshot of ISD literature classified in the taxonomy. Existing ISD literature populated all nine cells of the framework, suggesting the diversity in underlying orientations and domains of interest. Although the populated cells in the framework show dramatic divergence of ISD research, we are not sure about the pattern of diffusion or growth of knowledge in ISD. A future extension of the study could examine the historical evolution of the body of knowledge of ISD, and the factors that influence such growth.

The primary question about the growth of ISD research is: How did knowledge in ISD develop, and what factors influenced the growth in diverging orientations of ISD studies? Corollary questions include:

1. Who are (and were) the core ISD knowledge producers? And what factors influence their orientations or domains of interest?
2. How do knowledge producers interact (if any) to shape the development or perceptions of the phenomenon?
3. Do IS practitioners and academics influence (if any) each other's interpretation and orientations?

The importance of answering the above questions is that the answers provide a basis for systematically understanding and extrapolating the growth of ISD as a specialized (albeit disparate) body of knowledge.

MIS is a young discipline that emerged in the 1960s. As discussed in HKL's paper, Dickson (1981) had observed that the origin of the MIS concept was anchored primarily in the cybernetic control metaphor of the organization. Earlier ISD research therefore reflected the traditional orientations of control, particularly instrumental control. Yet other orientations have made inroads into ISD intellectual discourse in the past three decades. Why was the origin of the MIS concept anchored on control? Are the present shifting orientations sustainable? Or do they embody the "rubber band approach to theorizing" (Enz, 1992) where new ideas, ontological views, and philosophical paradigms may stretch and challenge conventional thinking, but ultimately bounce back to the traditional control orientation?

Methodologies from other research traditions are well suited to answer the above questions. I will discuss two. One is the use of linguistic analysis of ISD discourse as exemplified by Barley, Meyer and Gash's (1988) study on organizational culture; and the other is the use of bibliometrics and tracing analysis as exemplified by Reid's (1996) research on terrorism literature.

Regarded as one of seven exemplary research studies in the organization sciences (see Frost & Stablein, 1992), Barley *et al.* (1988) adopted semiotics and linguistic analysis to explore the conceptual orientations of two groups of knowledge producers of organizational culture. Specifically, the researchers developed and traced contextual markers as evident in the pragmatics of discourse from academic-oriented and practitioner-oriented texts. The primary objective of the study was to determine the influence of ideas from the academic and practitioner subcultures on the concept of organizational culture. Results from analyzing linguistic indicators showed that early academic-oriented texts relied on an anthropological orientation of culture. Culture was regarded as a form of normative control beyond the volition of any individual. In contrast, early practitioner-oriented texts suggested that individuals might be able to manipulate culture. Over time, while practitioner-oriented texts remained consistently control-oriented, patterns of discourse in academic-oriented texts changed to resemble practitioner-oriented texts and placed more emphasis on controlling culture.

Barley's method of linguistic analysis may be applied to ISD research in a variety of ways. First, it may be used to categorize explicitly and systematically ISD research into the framework proposed by HKL. HKL's existing process of categorizing the representative literature into the framework is implicit. One is unsure how they interpreted and classified each paper into the cells in the taxonomy. Future research can adopt and modify from Barley's linguistic strategy to develop contextual markers for ISD literature. By using linguistic indicators, researchers can analyze and interpret each paper for its dominant orientation and domain object(s).

Second, Barley's method can be used to trace the evolution of ideas of different groups of knowledge producers. Knowledge producers from different traditions often vary in their orientation and foci on domain objects. Accordingly, a way to understand the evolution of the intellectual structures in ISD is to trace the shifting nature of the underlying phenomenon of interests—software development, as it migrates across different generations of computers: from mainframe to minicomputers, to personal computers and to network technologies.

In a paper tracing the history of software development since the early 1960s, Grudin (1994) observed three streams of research in software development conducted by relatively disparate groups of researchers: (1) competitively-bid contract development (typically for government applications), which is the main focus of researchers in software engineering; (2) in-house development in business organizations, which is the primary focus of researchers in MIS; and (3) software product development for highly interactive systems, which is the major focus of researchers in human–computer interaction.

The fundamental difference among the three streams of software development research is the level of interaction between the user and the developer. In competitively-bid contract development, users identified their requirements at the start of the project with minimal interaction with developers. After requirements were fully specified, developers were then selected via a competitive bidding process to design and develop the system based on that set of requirements. In in-house development, users and developers were identified right at the start of the project with users and developers working together to evolve the requirements and develop the system. Finally, in product development, developers typically developed systems with no specific users in mind. Developers designed and developed the software, and potential users were brought in to test and comment on the software or product.

According to Grudin (1994), each community of knowledge producers advocate different development strategies. Developed by software engineering researchers, the waterfall model was best suited for the earliest form of software development because it addressed the problems associated with the contract development on non-interactive, batch systems. When waterfall models in software engineering were applied to in-house development, the model suffered from

lack of sustained user involvement, and hence, social-technical approaches were proposed. For highly interactive systems, researchers in human computer interaction introduced prototyping and iteration, which later evolved into the software engineering spiral models.

Given the historical context of software development, we can speculate that tracing orientations and domain objects of ISD research with Barley's semiotics and linguistic analysis of texts from these three communities of knowledge producers would systematically reveal their similarities and differences. For example, with Grudin's (1994) historical analysis as a backdrop, we can explain why earlier studies in ISD within organizations adopted an instrumental control orientation (i.e. primarily the top left hand corner labeled "Software Engineering" in Figure 7) as the orientation befitted the non-interactive, batch systems context. However, the waterfall model failed in business organizations as systems became online and highly interactive. These systems called for greater user-IS interaction, and suggested that we pay closer attention to the process of sense-making, argumentation, and language use in organizations. Barley's methodology for developing contextual markers for orientation and domain objects may be employed to detect the underlying changes in the ISD discourse over time and validate Grudin's observations.

Methodologies developed from the library and information sciences are also very fitting for tracing changes in knowledge and ideas over time because they are designed specifically to identify, categorize, and track emerging specialized bodies of knowledge. A comprehensive and direct assessment of how knowledge in specialized communities evolves is offered by Reid (1996) in her case study of terrorism research. Reid's methodology integrates both quantitative and qualitative research strategies. Reid (1996) analyzed the growth of the literature, influences on knowledge producers, and dispersion of ideas in the realm of terrorism research. Several research techniques such as bibliometrics, content analysis, on-line bibliometrics, study of networks of citations, interviewing authors, and idea tracing were used to surface the invisible colleges working within a specialty. The model, based on a triangulation of data sources, offers a fitting strategy for analyzing evolution of knowledge for ISD and answering questions such as:

1. Who are the major members of the ISD community?
2. What are the dispersion patterns of their works and associated ideas?
3. How do some specific ideas, beliefs, assumptions, and theories become dominant and widely disseminated while others fall on the wayside?
4. Where are the forums or marketplace exchanges of ISD ideas?
5. What are the trends and growth of knowledge in ISD?

Answers to the above questions will enable us to understand better the factors that influences the growth and change of direction in knowledge in ISD.

SHIFTING SOFTWARE DEVELOPMENT PARADIGM

In a thought-provoking paper, Welke (1994) predicted that ISD will change from craft to assembly. In craft, IS professionals develop custom solutions. Such was the case in competitively-bid contract and traditional MIS development. In contrast, the emerging new age: an end-user development era is characterized by a market-generated, product-based approach. No longer will IS professionals develop custom solutions. Users themselves will select, acquire, arrange and assemble software objects and components as unique solutions to their requirements.

The attention of IS professionals will be increasingly directed at the production of object components for general and niche market applications. In-house software development will focus on building up object inventories, with the object developers as "chauffeurs" to end users to assisting them with assembly.

The fundamental shift in ISD paradigm from craft to assembly has a number of implications for the framework proposed in HKL's paper. First, their taxonomy is fitting for classifying ISD research that is primarily craft-based. However, when ISD research increasingly reflects a product–market understanding of software, the taxonomy may need to be revised, trimmed, or grown to reflect fundamental differences in the nature of interdepencence of, and co-operative work amongst, end-users and ISD professionals.

Second, even if the taxonomy as proposed is sufficiently stable in its dimensions so that a fundamental shift in ISD will not change the domain objects or orientations, the shift is ISD to assembly-based may still place different emphases on various orientations. For example, an instrumental control orientation may re-emerge as the dominant orientation as ISD moves from craft to assembly, while strategic control, sense-making and argumentation orientations may be less emphasized given a reduced interdependence between end-users and IS professionals. Further theorizing is warranted to assess if their taxonomy does accommodate the new research questions and opportunities that will arise with such a shift in the ISD paradigm.

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