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RESEARCH ESSAY

THE NATURE OF THEORY IN INFORMATION SYSTEMS[1]

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Abstract

The aim of this research essay is to examine the structural nature of theory in Information Systems. Despite the importance of theory, questions relating to its form and structure are neglected in comparison with questions relating to epistemology. The essay addresses issues of causality, explanation, prediction, and generalization that underlie an understanding of theory. A taxonomy is proposed that classifies information systems theories with respect to the manner in which four central goals are addressed: analysis, explanation, prediction, and prescription. Five interrelated types of theory are distinguished: (1) theory for analyzing, (2) theory for explaining, (3) theory for predicting, (4) theory for explaining and predicting, and (5) theory for design and action. Examples illustrate the nature of each theory type. The applicability of the taxonomy is demonstrated by classifying a sample of journal articles. The paper contributes by showing that multiple views of theory exist and by exposing the assumptions underlying different viewpoints. In addition, it is suggested that the type of theory under development can influence the choice of an epistemological approach. Support is given for the legitimacy and value of each theory type. The building of integrated bodies of theory that encompass all theory types is advocated.

Keywords: Theory, theory taxonomy, theory structure, information systems discipline, philosophy of science, philosophy of social sciences, interpretivist theory, design theory, design science, explanation, prediction, causality, generalization

Introduction

The aim of this essay is to examine the structural nature of theory in the discipline of Information Systems. There are a number of grounds for believing that this meta-theoretical exploration is both necessary and timely. Calls continue for "good theory" in IS (Watson 2001) and the development of our "own" theory (Weber 2003). Despite the recognition of the need for theory development, however, there is limited discussion in IS forums of what theory means in IS and what form contributions to knowledge can take.

To place this discussion in context, consider the questions that arise about the bodies of knowledge or theories encompassed in a discipline. These questions fall into a number of interrelated classes[2]:

1. *Domain questions.* What phenomena are of interest in the discipline? What are the core problems or topics of interest? What are the boundaries of the discipline?

[1] Allen Lee was the accepting senior editor for this paper. M. Lynne Markus, Michael D. Myers, and Robert W. Zmud served as reviewers.

[2] The last three of these four classes have parallels in the three sets of issues distinguished by Godfrey-Smith (2003) for thinking about the philosophy of science: (1) the logical structure of science, (2) epistemological and methodological issues, and (3) scientific thinking, or the social organization of science. When thinking about one discipline in particular, we need to add the first class to define the range of phenomena of interest in that discipline.

2. *Structural or ontological questions*. What is theory? How is this term understood in the discipline? Of what is theory composed? What forms do contributions to knowledge take? How is theory expressed? What types of claims or statements can be made? What types of questions are addressed?

3. *Epistemological questions*. How is theory constructed? How can scientific knowledge be acquired? How is theory tested? What research methods can be used? What criteria are applied to judge the soundness and rigor of research methods?

4. *Socio-political questions*. How is the disciplinary knowledge understood by stakeholders against the backdrop of human affairs? Where and by whom has theory been developed? What are the history and sociology of theory evolution? Are scholars in the discipline in general agreement about current theories or do profound differences of opinion exist? How is knowledge applied? Is the knowledge expected to be relevant and useful in a practical sense? Are there social, ethical, or political issues associated with the use of the disciplinary knowledge?

Each of these classes of questions has received attention. Examination of each category, however, shows that questions falling into the second category have received limited treatment in the extant literature. Each of these classes of questions is considered in turn, leaving the second category until last.

With respect to the first category, questions about the *domain of interest* of IS research have remained a topic of interest since the inception of the discipline. Argument about the definition of *management information systems* dates back to the 1970s (Benbasat 2001) and many writers have debated aspects of our domain identity since that time. A selection of articles illustrates the range and history of this stream of debate. Weber (1987) was concerned with identifying the unique nature of IS that distinguished it from other disciplines. Orlikowski and Iacono (2001) argued for attention to the information technology artifact as the core subject matter of the IS discipline. Benbasat and Zmud (2003) proposed a core set of phenomena to define the IS field, generating further debate in a series of articles in *Communications of the Association of Information Systems* (2003, Volume 12).

Epistemological questions, in the third category, have also received considerable attention. Numerous articles argue the merits of different paradigms for conducting research in IS. Frequently, debate is framed in terms of distinctions between *positivist* and *interpretivist* paradigms (for example, see Orlikowski and Baroudi 1991) or between qualitative and quantitative methods. Some have argued for pluralism in methods (Mingers 2001) or for integrating approaches (Lee 1991). There has been little or no recognition to date in IS of the view that the research approach adopted could vary with different types of theory in IS, which is a view underlying this essay.

Socio-political questions, in the fourth category, address diverse issues. Into this category fall questions concerning the historical development of scientific thought in a disciplinary community (as in Kuhn 1996). An example in Information Systems is the analysis of how the interpretivist paradigm has emerged historically in contrast to positivism (Walsham 1995). There is also discussion of political, power, and prestige issues for the discipline. The benefits and costs of diversity in IS research to the discipline have been considered by Benbasat and Weber (1996) and Robey (1996). Questions of relevance to practice of IS research also fall into this category. Further, what is termed *critical theory* explicitly addresses ethical and moral questions, by seeking to be emancipatory and bring about improvements in the human condition (see Ngwenyama and Lee 1997).

Returning to questions in the second category, discussion of the *structural nature* or *ontological character* of theory in Information Systems is scattered and there is scanty recognition that these questions are even of interest. Here the word *ontology* is used in the sense that it refers to a language for talking about the nature and components of theory (for example, the different types of statements that are incorporated). Many IS researchers who use the word *theory* repeatedly in their work fail to give any explicit definition of their own view of theory. A number of papers that discuss different research paradigms (for example, Klein and Myers 1999; Mingers 2001) offer little in the way of definitions or discussion of the nature of theory or types of knowledge that can be expected to result from different research approaches. Recognition that different types of theory exist can be found in some proponents of constructive or design theory (Iivari 1983; Markus et al. 2002; Walls et al. 1992). A wider view on theory and knowledge types is found in only a handful of papers in IS (Cushing 1990; Gregor 2002a 2002b; Iivari 1983; Markus and Robey 1988).

Table 1 presents examples of theories in IS of different ontological types to demonstrate that multiple views of theory exist. These initial examples are presented briefly. Further delineation of these views and more is the *raison d'etre* of this essay.

Table 1 Some Differing Views of Theory in Information Systems

Theory as statements that say how something should be done in practice:

> An early textbook by Davis and Olson (1985) articulates the way in which MIS should be designed, implemented and managed. This theory provides **prescriptions** to be followed in practice, with the implicit expectation that the prescribed methods will in some sense be "better" than alternatives (Cushing 1990).

Theory as statements providing a lens for viewing or explaining the world:

> Orlikowski and Robey (1991) drew on structuration theory and empirical work to construct a theory in which the organizational consequences of IT are **viewed** as the products of both material and social dimensions. Such theory is seen as a desirable **end product**; formal testing of such a theory is not envisaged (Walsham 1995).

Theory as statements of relationships among constructs that can be tested:

> The technology acceptance model (Davis 1986) posits that two particular beliefs on the part of users, perceived usefulness and perceived ease-of-use, are of primary relevance for computer acceptance behaviors. This theory leads to **testable propositions** that can be investigated empirically (see Davis et al. 1989).

Examination of what is meant by theory occurs in other disciplines. An issue of the *Academy of Management Review* (1989, Volume 14, Number 4), focused on theory and theory development. Similarly, an issue of *Administrative Science Quarterly* (1995, Volume 40, Number 3) contained articles about what theory is, what theory is not, and how theorizing occurs. Descriptions of theory in the social sciences can also be found in Dubin (1978), Freese (1980), Kaplan (1964), Merton (1967), and Weick (1989). More established disciplines have considerable histories of enquiry into the nature of theory. In the philosophy of science there has been discussion of scientific knowledge and the formulation of theory over a very long period (for example, Hume 1748; Locke 1689; Nagel 1979; Popper 1980). Fundamental ideas from this prior work are drawn upon in this essay, but they are adapted for the IS context.

It is important to examine the nature of theory in IS separately from other disciplines as the four classes of questions depicted earlier are interrelated. The domain of interest for a discipline can be expected to influence the nature of its theory. Theory in mathematics and music, for example, means different things and knowledge is developed, specified, and used in different ways. Thus, the nature of theory in IS could differ from that found in other disciplinary areas. A characteristic that distinguishes IS from other fields is that it concerns the use of *artifacts* in human-machine systems. Lee (2001, p iii) uses these words:

> research in the information systems field examines more than just the technological system, or just the social system, or even the two side by side; in addition, it investigates the phenomena that emerge when the two interact.

Thus, we have a discipline that is at the intersection of knowledge of the properties of physical objects (machines) and knowledge of human behavior. IS can be seen to have commonalities with other design disciplines such as architecture or engineering, which also concern both people and artifacts, or with other applied disciplines such as medicine, where the products of scientific knowledge (such as drugs or treatments) are used with people. To understand IS, theory is required that links the natural world, the social world, and the artificial world of human constructions. Thus, the body of knowledge that is needed draws on natural science, social science and what has been termed *design science* (Cross 2001; Hevner et al. 2004; March and Smith 1995; Simon 1996). The attributes of such a body of knowledge are worthy of exploration, which is the aim of this essay.

Thinking clearly about the nature of theory in Information Systems has significance for research and practice. Our leading journals expect that published research articles will have a strong grounding in theory (MISQ 2004). Developing theory is what we are meant to do as academic researchers and it sets us apart from practitioners and consultants. In addition, there is the view that "nothing is so practical as a good theory" (Lewin 1945). Theories are practical because they allow knowledge to be accumulated in a systematic manner and this accumulated knowledge enlightens professional practice.

Personal experience with doctoral students in particular suggests that they often have limited understanding of what is meant by theory. Exposure to conflicting or simplistic descriptions of different research paradigms (for example, interpretivism versus positivism) sometimes leads to confusion. The distinction made earlier among the different classes of questions about research suggests that pieces of the puzzle these novice researchers are facing are missing. The discussion of differences among paradigms is frequently framed around epistemology and the practice of doing research in a community and the possibility that there may be different types of theory appropriate in different circumstance is not explored. An initial premise for the paper is that different types of theory exist in Information Systems and that all can be valuable. The exploration of theory that follows has been framed to be inclusive and does not depend on the adoption of a specific epistemological commitment (that is, how knowledge is acquired and justified). The paper is intended to be of interest to a range of scholars with different personal preferences for research approaches.

The remainder of this paper proceeds as follows. First, it considers general notions of theory in more detail, including different conceptions of causality, explanation, and generalization, which are central to different ways of developing and expressing knowledge. An argument is made that an appropriate taxonomy for IS depends on classifying theories with respect to the degree and manner in which they address four central goals of theory: analysis, explanation, prediction and prescription. The five different types of IS theory distinguished are labeled: (1) theory for analyzing, (2) theory for explaining, (3) theory for predicting, (4) theory for explaining and predicting (EP theory), and (5) theory for design and action. The different types of theory are interrelated and some comprehensive, well-developed bodies of theory could include components from all the types of theory discussed. Illustrations of relevant work in IS are provided under each heading, as are related research methods (briefly), and the form a contribution to knowledge could take. The applicability of the taxonomy is demonstrated by classifying a sample of articles from recent journal issues. The paper concludes with a discussion of questions that arise from consideration of these different views of Information Systems theory and suggestions for further work.

About Theory

This section presents underlying ideas relevant to theory to preface the subsequent discussion of theory in Information Systems. It is necessary to express these ideas to show the underlying philosophical positions on which the essay relies. Issues discussed include the nature of theory in general, the need for generalization, the nature of causality and the core goals of explanation and prediction. It is impossible in a single paper to condense the extensive discussion of these topics over many hundreds of years into a meaningful representation of all that has been said. The approach adopted is to give an outline of the perspectives considered and to highlight those differences in thought that are intimately connected with different approaches to theory, as well as some important commonalities.

A wide rather than a narrow view of theory is taken so that the subject matter of the essay is not restricted. Dictionary definitions show that the word *theory* can take on many meanings, including "a mental view" or "contemplation," a "conception or mental scheme of something to be done, or the method of doing it; a systematic statement of rules or principles to be followed," a "system of ideas or statements held as an explanation or account of a group of facts or phenomena; a hypothesis that has been confirmed or established by observation or experiment, and is propounded or accepted as accounting for the known facts; statements of what are held to be the general laws, principles, or causes of something known or observed," a "mere hypothesis, speculation, conjecture" (OED 2004). Thus, the word theory will be used here rather broadly to encompass what might be termed elsewhere conjectures, models, frameworks, or body of knowledge.

Different Perspectives on Theory

Differences in views of theory depend to some degree on philosophical and disciplinary orientations, yet there are also commonalities. This essay draws upon writings from the philosophy of the natural sciences, the social sciences, from the interpretivist tradition, and from the sciences of the artificial, all of which are relevant to Information Systems.

In general, philosophers of science writing in the tradition of the physical or natural sciences are likely to see theory as providing **explanations** and **predictions** and as being **testable**. For example, Popper[3] (1980) held that theorizing, in part, involves the specification of universal statements in a form that enables them to be tested against observations of

[3]Popper was an effective critic of Marxism and Freud's psychoanalytic theories and was the first insightful critic of logical positivism. Popper's contributions to the philosophy of science continue to be significant. Godfrey-Smith (2003) saw that he had an appeal to many working scientists and was regarded as a hero by many. Magee (1998, p. 256) places Popper among the leading philosophers of the 20th century, along with Russell, Wittgenstein, and Heidegger, and believes that there will be continued discovery and development of his positive views in comparison with his critiques.