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USING STRUCTURATION THEORY IN IS RESEARCH: OPERATIONALIZING KEY CONSTRUCTS

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Abstract

This paper focuses on the application of structuration theory, seeking to explicate analytical considerations by which key structural constructs may be operationalized so as to guide a detailed empirical analysis. In so doing, the paper offers a methodological contribution in respect of the conduct of structuration-based IS research. Owing to its high level of abstraction, structuration theory raises difficulties at the level of empirical application and leaves the IS researcher with no obvious path to follow. Several key constructs have come from studies of the structural modalities, but the issue of how these constructs may be operationalized remains obscure. An attempt is made here to overcome this deficiency by offering a number of elaborations of some of the central analytical dimensions, contributing to the creation of much needed clarity in terms of where and what to look for and which specifications to lay down at the operational level.

Keywords: Structuration theory, IS research, Research Methods.

Introduction

IS researchers have increasingly been adopting Structuration Theory (ST) (Giddens, 1976; 1979; 1981; 1984; 1991) over the last decade (Jones et al., 2004). Numerous commentators have highlighted the value of structuration as a theoretical lens for studying a variety of IS issues and have sought to increase its relevance for empirical research (Pozzebon, and Pinsonneault, 2005). This paper attempts to contribute further by focusing on analytical considerations arising in empirical applications of ST within IS studies. In particular, this study brings to the fore the use of key constructs associated with the Duality of Structure Model (Giddens, 1984), namely, the three modalities of facility, norms and interpretive schemes. Giddens' formulation sees modalities as the locus of interaction between the knowledgeable capacities of actors and the structural features of social systems. Modalities thus facilitate the inter-linkage between agency and structure which are viewed not as independent and conflicting elements but instead as a mutually interacting duality. Given the methodological focus of this paper, an exposition of ST is not attempted and readers are referred to Giddens' outline of the theory (1984) as well as to concise summaries of its core elements offered by IS researchers (e.g. Walsham, 2002; Jones, 1999; Jones and Karsten, 2003).

This paper is organized as follows. The next section provides a brief overview of the use of ST in IS research. We suggest that although this body of work may be classified with different typologies, the 'duality of action and structure' remains the dominant component being adopted, with its three modalities representing key research constructs. Given the significance of these constructs for current and future structuration IS research, attention should be paid to the intricacies of applying them in empirical analyses. The third section offers an outline of the methodological discourse of structuration IS research. A critical review of this literature reveals a perceptible gap at the operational level in the treatment of data analysis processes and of specification. Attempting to address this gap, the fourth section then provides a systematic discussion of this subject. Elaborations on the key structuration constructs are proposed together with analytical considerations and operational definitions which can be used as guidance for future empirical IS studies using ST.

The Use of Structuration Theory in IS Research

ST is considered one of the most influential contemporary theories in sociology (Bryant and Jary, 2001), one that has triggered and informed considerable research effort in many fields of social science. In the last decade, ST has been increasingly adopted, and adapted, by IS researchers. Several typologies were proposed to depict its range of application. In an early review of the IS literature, Walsham and Han (1991) suggested categories of structuration applications: operational studies, use as meta-theory and use of individual concepts. Operational studies refer to the application of ST in carrying out empirical studies of *IS use* and the ways in which it modifies and is modified by social and organizational structures. Here it is suggested the power of the theory lies in its emphasis on the interlinked nature of action and structure and its provision of operational concepts, mainly the three modalities of facilities, norms and interpretive schemes (Giddens, 1984; p.29).

Using structuration as *meta-theory* implies relating it to and locating it within other theoretical approaches, such as interpretivist sociology and structuralism. From a theoretical standpoint, the main contribution of ST is not in how it conceives of either action or structure, but in their reconciliation in the duality of structure. Thus, the meta-perspective of ST overcomes the biased character of both approaches in IS, such as social constructivism (Pinch and Bijker, 1987; Bijker, 1995), which emphasizes agency (Klein and Kleinman, 2002), and of theories such as institutional analysis (Kling and Iacono, 1987), which emphasize structure. A rather similar type of application, the use of structuration with other theories, was identified by Jones (1999). In particular, attempts have been made to combine ST with Actor Network Theory (ANT) (Callon, 1986; Latour, 1987; Law, 1992). For example, Walsham and Sahay (1999) distinguish between structuration, which they employ as a meta-theory, and ANT, which they employ as a more detailed methodological and analytical device.

The last category: use of individual concepts, taken from the theory of structuration, illustrates the value of particular concepts (e.g. 'structural contradiction' and 'time-space distancing') in studying a range of IS topics such as IS development, IS strategy and resistance to IS (Walsham and Han, 1991). The use of ST concepts as a type of application was identified in another review (Jones and Karsten, 2003), demonstrating explicit selectivity in the

use of structurational concepts in IS research as well as adaptations and developments of concepts from other writings of Giddens, as shown for example in Barrett et al (2001).

With the aim of evaluating the contribution of ST to the IS field, Rose (1998) identifies three categories pertaining to distinct purposes: to theorise, to analyse and to operationalise. ‘Theorising’ represents attempts to re-conceptualize or theorize aspects of the IS domain using ST. Similar efforts were also referred to as the developments of an IS-specific version of ST (Jones and Karsten, 2003). Major contributions include the ‘Duality of Technology’ model (Orlikowski and Robey, 1991; Orlikowski, 1992) Adaptive ST (DeSanctis and Poole, 1994), and more recently, the Practice Lens (Orlikowski, 2000, Schultze and Orlikowski, 2004). ‘Analysing’ involves applying ST as an analytical framework to the retrospective understanding of empirical situations or cases. Barley (1986), usually recognized as the first to address IT from a structurational perspective, applied the theory in studying the introduction of CT scanners and the consequences for social organization in the radiology departments of two hospitals. Applications of structuration for analysis purposes are found in various research areas in IS, such as groupware implementation (Karsten, 1995), CSCW (Lyytinen and Ngwenyama, 1992) and the early work of Macintosh and Scapens on management accounting systems (1990). Finally, ‘Operationalising’ is concerned with providing operational guidelines for IS practitioners, distilled from the theoretical and analytical experience of using ST. An explicit attempt to inform practice is demonstrated in Rose and Scheepers’s (2001) proposal of IS development tools that are based on ST. The main types of ST use within IS research are summarized in table 1.

Table 1: Types of structurational applications in IS research

Main types of ST use in IS	Categories of application proposed in the literature	Examples of structurational IS studies
Application of ST in empirical IS studies	Operational Studies (Walsham and Han (1991)	Barley (1986); Macintosh and Scapens (1990); (Lyytinen and Ngwenyama, 1992); (Walsham, 1993); (Karsten, 1995); Walsham and Sahay (1999); Walsham (2002); Evans and Brooks (2005)
	‘Analyze’ (Rose, 1998)	
	ST applications in IS research (Jones and Karsten, 2003)	
Use of ST with other theoretical approaches	Use as meta –theory (Walsham and Han, 1991)	Walsham and Sahay (1999), Johnston, (2001), Chae and Poole (2005)
	Use of ST with other theories (Jones and Kaesten, 2003)	
Use of ST concepts in IS research	Use of individual concepts (Walsham and Han, 1991)	Nicholson and Sahay, 2001; Barrett et. al (2001);
	Use of ST concepts and related Giddens’ writing (Jones and Kaesten, 2003)	
Theorization of IS domains using ST	‘Theorise’ (Rose, 1998)	Orlikowski (1992); DeSanctis and Pool (1994); Orlikowski (2000); Schultze and Orlikowski (2004)
	Development of an IS specific version of ST (Jones and Kaesten, 2003)	

While a number of distinct uses of ST in IS research may be identified, its application as an analytical framework stands out, whether referred to as ‘Operational Studies’ (Walsham and Han, 1991) or ‘Analysing’ (Rose, 1998). In this context, the duality of structure model (Giddens, 1984, p.29) is adopted as the theoretical core with the three modalities of facilities, norms and interpretive schemes representing key research constructs. Similarly, within the major contributions referred to as the IS-specific version of structuration (Jones and Karsten, 2003) the three modalities are seen to play a crucial role. At the core of the Practice Lens framework, for example, lie these structurational constructs, with particular attention given to the facility construct that is used to conceptualise *technology* in this model (Orlikowski, 2000). Given their significance in current and future structurational IS research, this paper centres on the three modalities. In particular, elaboration and operationalization of these key

constructs is provided so as to facilitate the analysis process of empirical IS research. As shown in the next section, an apparent limitation of the literature concerns how the structurational constructs link the process of data collection and analysis. It is the aim of this study to address this methodological lacuna.

Methodological Discourse on Structurational IS Research

Although ST has been applied in the IS field for nearly 20 years, a focused and systematic discussion of the epistemological and methodological premises of this body of work has only recently emerged. Such a debate seems inevitable since structuration operates at a high level of abstraction, providing limited guidance in specific empirical settings and thereby leaving the IS researcher with no obvious path to follow (Rose and Scheepers, 2001). A brief review of the literature to date is provided below, pointing to a perceptible gap in the treatment of the analysis process that we address in this paper.

In terms of the research approaches that have been applied in structurational IS research, current reviews of the literature reveal the classic opposition of positivism to interpretivism. For example, Pozzebon and Pinsonneault (2001; 2005) identified three types of structurational IS research: adaptive structuration (AST), mutual shaping and actor's organizing perspectives, which are associated with the following paradigmatic assumptions:

The mutual shaping and actor's organising perspectives largely refute the regularities and predictions inherent to positivistic assumptions, whereas the adaptive structuration group largely applies them. The methodological and ontological dimensions are coherent with the epistemological ones. Mutual shaping and social/actor's organising perspectives exhibit ideographic methods and nominalist ontology, whereas the adaptive structuration perspective exhibits a monothetic method coherent with its realist ontological beliefs. (Pozzebon, and Pinsonneault, 2001, p. 207)

Recognizing the prevalence of both interpretivist and positivist underpinnings in structurational IS studies, with the latter typically linked to the AST stream of research, several writers have sought critically to assess the extent to which different approaches are compatible with ST. As Jones et al. (2004, p. 314) note, ST is not methodologically prescriptive; nevertheless its epistemological and ontological stance does carry some important implications for the conduct of research. Indeed, doubts have been raised regarding the appropriateness of applying structurational perspectives within the positivistic research tradition, since structuration 'comes from a social constructivist stable' (Giddens, 1984) and adopt a post-empiricist and anti-positivist stance (Bryant and Jary, 2001). This denies the existence of universal laws of human activity, seen as 'markedly implausible' (Giddens, 1984, p. 345), if not impossible. Social generalizations can therefore, at best, only be 'historical', i.e. temporally and spatially circumscribed. Giddens emphasizes the centrality of the interpretative endeavour, and describes social science as 'irretrievably hermeneutic' (Giddens, 1976, p. 13), that is, interpretative (Jones and Karsten, 2003). It follows, therefore, that the positivistic theory-testing style of research is inconsistent with Giddens's hermeneutic epistemology and that different forms of deterministic reasoning and programmes of causal modelling, such as Adaptive Structuration Theory (AST), are at odds with ST (Jones, 1999; Rose, 1998; Pozzebon and Pinsonneault, 2001; Jones and Karsten, 2003; Jones et al., 2004). It should be noted, however, that this sustained criticism has been addressed by the developers of AST: Poole and DeSanctis (2004). On the one hand, the authors confirm that 'within Giddens' formulation of ST there is no accommodation for deterministic impacts ... the theory is recursive in its logic, not causal ... therefore, the theory does not explain variance in behavior or predict outcomes' (Poole and DeSanctis, 2004, p. 211). They maintain, however, that causal logic can become embedded within a larger programme of study that is recursive: 'just as positivist and interpretive research though opposing, can be integrated (Lee, 1999), so too can deterministic reasoning be used to decompose and study a recursive model' (2004, p. 211). It appears, however, that in insisting on the value of deterministic reasoning and an anticipatory research agenda, the authors' reply falls short of providing a coherent argument by which the apparent 'quandary' (Poole and DeSanctis, 2004, p. 210) may be convincingly resolved or accommodated.

While many researchers tend to associate ST with the epistemological assumptions of interpretivism, ambiguity remains on related issues concerning research strategy and methods. Because the theory is not intended as a concrete research programme, Giddens '[does] not try to wield a methodological scalpel' and states that 'there is [nothing] in the logic or the substance of ST which would somehow prohibit the use of some specific research

technique, such as survey methods, questionnaires or whatever' (Giddens, 1984, xxx). Thus, Giddens does not reject the potential contribution of 'technically-sophisticated, hard-edged' research, but maintains that 'all social research...no matter how mathematical or quantitative, presumes ethnography' (Giddens, 1991, p.1219). It is therefore unsurprising that a range of research strategies and techniques have been applied in structurational IS studies. In their review, Poole and DeSanctis (2004) divide this entire body of research into four categories: case studies, observational studies, experiments and surveys. They further observe that while early studies largely adopted a single type of methodology, the methodology in more recent work has drawn from all four. The authors provide a comprehensive analysis of each strategy as applied to IS studies using ST. Their conclusion, however, appears rather general:

The different method types have the potential to complement one another since each attends to somewhat different issues and has unique strength and weaknesses. Within each approach there seem to be active efforts to take the results of other similar researchers into account. There is a sense of cumulative tradition. The same accumulation is needed at the field level so that a more complete view of structuration in IS can emerge. (Poole and DeSanctis, 2004 p. 237)

The authors illustrate the use of different strategies and advance the use of a multi-method approach to structurational IS research. Yet, processes of data collection and analysis are barely considered and more specific guidelines at the operational level of structuration seem warranted.

A somewhat similar analysis by Pozzebon and Pinsonneault (2001; 2005) resulted in a repertoire of methodological strategies to apply ST empirically in the IS field. Drawing on Langly's (1999) strategies for theorizing from process data, the authors compare strategies, research purposes and types of results across twenty IS studies that used ST. Two major groups of research purposes were identified, one oriented towards the meaning of the process and another more concerned with predictions. These groups are associated, respectively, with two types of approach, namely the process approach and the variance approach. Regarding the results produced, process studies tend to generate typologies, taxonomies, frameworks, conceptual schemes and narrative explanations, while variance research mostly results in statements about tested hypothesis and causal models. Finally, corresponding research strategies were identified: grounding strategies (grounded theory and alternate templates), organizing strategies (narrative and visual mapping) and replicating strategies (temporal bracketing and comparisons) were used in process studies, whereas laboratory experiments were applied in variance studies. The authors conclude that 'although it is hard to suggest which methodological design is more appropriate, it is possible to recognise the potential and limitation of each one' (2001, p. 215). The value of the process approach and its respective strategy of temporal bracketing are highlighted in particular, as the authors agree with Langley (1999) who proposed temporal bracketing as a direct reference to Giddens' ST. It should be noted, however, that the repertoire of methodological strategies provided remains quite general and may arguably be applicable to IS studies using theories other than structuration. Although processual approaches are brought to the fore, it is not evident how the respective strategies may be linked with the analytical constructs of structuration.

In conclusion, while the methodological discourse on structurational IS research addresses epistemological approaches and the level of generic strategy and research design, little attention has been paid hitherto to the operational level of the data collection and analysis processes. The present study essays a first step in redressing this shortcoming, seeking to explicate analytical considerations and processes by which key structurational constructs may be operationalized so as to guide a detailed empirical analysis. A systematic discussion of this subject is provided in the next sections.

Operationalizing the Modalities of Structuration

The discussion that follows focuses on key structurational constructs, namely, the three modalities of facility, norms and interpretive schemes. We recall that in Giddens' formulation, modalities are seen as the locus of interaction between the knowledgeable capacities of actors and the structural features of social systems. Modalities thus facilitate the inter-linkage between agency and structure which are viewed not as independent and conflicting elements but as a mutually interacting duality.

The present discussion aims to demonstrate the ways in which the modalities as research constructs may be linked *directly* to data analysis. We note, however, that interpretations of ST and thus application of its constructs may differ significantly between single pieces of research. This is evident in the IS field in the striking difference between the numerous AST-based studies on the one hand, and the interpretivist studies on the other. The interpretation underpinning the present discussion follows the interpretivist tradition and relies predominantly on Orlikowski's Practice Lens (2000) as the conceptual starting point. In particular, the conceptualization of technology in terms of *facility* is adopted and further elaborated. The research focus, or object of study, is another factor with potential bearing on the use of structural constructs in empirical analyses. The current discussion focuses on *technology-in-use* because it represents an IS topic for which structuration appears especially relevant: the theory is inherently dynamic and grounded in human action.

Finally, the empirical study on which we draw upon for demonstration involves the use of learning technology in the institutional context of Higher Education. In this research, a structural framework was applied to study how learning practices emerge and evolve through ongoing use of learning technology (Halperin, 2005). The technology investigated is a Learning Management System (LMS) called WebCT.

Having introduced the conceptual and empirical context, in the following sections we explore the three structuration modalities in turn. Before doing so, we note first the question of *sequence* in the analysis process: Where should the analysis begin? How should it progress? Is there an appropriate 'order of play'? In considering a course of action for the analysis phase, the interdependency of the conceptual constituents needs to be taken into account. Within the formulation of ST, the duality of action and structure is neither sequential nor linear; rather, structure and agency are mutually dependent and the modalities of structuration are intrinsically interlinked and only distinct analytically. Therefore, *iteration* is a second key question for the data analysis process, and the modalities must be jointly analyzed. This may be achieved by traversing back and forth across the modalities during the analysis process. A point of departure for analysis needs to be determined. Within an IS research on technology in use, the starting point of the analysis involves mapping out the technological conditions as illustrated in the next section. In the following stages, analysis derives the identification and patterns of use and relates them to the respective norms and interpretive schemes elicited in recursive decompositions, as discussed below.

The Modality of Facility

A major contribution of Orlikowski's Practice Lens (2000) is the re-conceptualization of technology within a structural framework. Reframing the problematic notion of technology embodying structure (Jones, 1999), the Practice Lens instead locates technology within the modality of *facility* and suggests structures of technology are not embodied and appropriated but, on the contrary, emergent and enacted (Orlikowski, 2000). Viewing the IT artifact in terms of *facility* provides a solid starting point for IS research. It clarifies a place for technology within the structural model both conceptually – coherent with ST, and analytically – by allowing for technology to be treated as a research construct, namely, as facility. Yet, further breakdown of this construct seems necessary in order to pursue an empirical analysis. Although the fine details of such analysis should be determined by the characteristics of the technology investigated in any given piece of research, general principles may be suggested and illustrated.

Structural analysis places human action at the centre of its attention. As Giddens puts it: 'technology does nothing, except as implicated in the actions of human beings' (Giddens and Pierson, 1998 p. 82). Thus, structuration draws attention to analyses of *technology-in-use* rather than the IT artifact per se (Orlikowski, 2000). The first step, however, involves *mapping out the technological properties* available for use in a particular empirical setting. This prepares the ground for the subsequent analysis of *action* (the actual use of that technology) that identifies those technological elements that become implicated in structuration. Those technological properties neglected by users cannot be seen, in structural terms, as facility and should therefore be relegated from the analysis of social structures. Nonetheless, data about non-use becomes documented as a result and may well be accounted for, in conjunction with findings derived from subsequent analysis of the interlinked modalities of norms and interpretive schemes. In the first instance, however, the task of mapping out technological properties draws on the researcher's knowledge of the system being studied, which can be enhanced by a combination of hands-on experience and relevant product documents, such as user manuals and white papers. However, a structural study of technology-in-use requires *continual* analysis of the technological modality. This is particularly relevant in the case of

contemporary technology packages whose hallmark is flexibility and open-endedness, thus providing for a technology amenable to a wide variety of uses and modifications over time (Orlikowski, 2000; Ciborra, 2000; Cornford, 2003). A crucial element in the analysis, therefore, involves documenting *changes* to the technology through ongoing use. Documentation of configurations and reconfigurations, as well as continual observation of users, figure as key sources for such a data collection process.

Notwithstanding the potential flexibility of any given technological system, Kallinikos (2002; 2004) points to the constraints brought about by technology that can heavily condition its amenability and the possibilities for in-use reshaping. It follows that in order to balance and complement a situated account, attention should be paid to core properties that may *restrict* the local shaping of the technology. In studying the use of an LMS, we proposed that since the systemic character of the technology is encapsulated in its modular architecture, the system's *modules* may be thought of as a basis for the analysis. Tools and procedures attached to particular modules can then be considered as potential means for accomplishing tasks. In our analysis of the WebCT case study the modular structure of the LMS suggested the following core properties: Content Representation Modules (Content Module, Student Presentations Module, Assignments Submission Module) Communication Modules (Discussion Module, Mail, Chat, Whiteboard), Evaluation Modules (Quizzes/surveys, Self-testing) and Administrative Modules (Calendar). In the following section we focus on modules in-use, the core properties that are implicated in structuration. For each module adopted, further analysis of the technological properties reviews the related *tools* used, the *data* which became available and the *set-up* of features in use. With a focus on the discussion module of the system as an empirical example, the application of the related units of analysis is demonstrated in table 2 and further explained below.

Table 2: Analyzing technological properties in the WebCT case study

Units of Analysis	Empirical Illustration
Module (core property) in-use	Communication Module: A-synchronous Discussion Module
Tools attached	Text-authoring ; Uploading; Downloading
Data made available	Original posting (textual); Link; Event; News article; Lecture material; Admin announcement; Course reading; Reference; Academic paper
Technical set-up of features in use	Dedicated forums; General forum; Private groups; Public groups

In the case of WebCT, tools attached to the a-synchronous discussion module include text-authoring, uploading and downloading mechanisms. Through the use of these tools, the types of data that became available included, e.g., original postings (texts) on course content, news articles, academic articles, and administrative announcements which were exchanged in either technical set-up within the discussion board: dedicated forums (thematic), general forum, private groups, public groups. Describing the technological conditions in this way supports the subsequent analysis, which seeks to identify patterns of use, and non-use, of the available technological properties. It does so whilst also taking account of the constraining impact of the technology (e.g. proscribing communication other than text-based) as well as its enabling characteristics (e.g. configuring different set-ups to accommodate local needs). A detailed account of the technological conditions and of the technological properties drawn on in recurrent action derives from continual analysis of the structuration modality of facility. As facility is intrinsically interlinked with the modalities of norms and of interpretive schemes, the structuration account requires these constructs to be analyzed jointly; it requires the identification and analysis of respective norms and interpretive schemes instantiated in the technology-mediated practices.

The Modality of Norms

Having explored the structural construct of *facility*, we move on to discuss the way in which the interlinked modality of *norms* may be operationalized for studying technology-in-use. Critical reading of the Practice Lens (Orlikowski, 2000) reveals that the analysis of norms offered by Orlikowski portrays a rather limited picture of normative conditions involved in technology use. In particular, the analysis overlooks the possible tension arising from the ambiguity associated with the enactment of social norms. Going back to Giddens' (1984) discussion on social rules, further distinctions are invoked, between informal or formal norms and between different levels of sanction associated with them, namely, weak or strong. Starting from the definition of social norms as conventions of accepted behavior, their status (formal or informal) and degree of sanction (weak or strong) may be identified in the following manner.

Formal norms enacted by users represent those official conventions and guidelines that are made public in a written form. Formal norms may therefore be identified in various documents collected in fieldwork. In the case of students in higher education institutions, for example, the behavior expected and the requirements in terms of students' *participation* in and *contribution* to different learning activities are specified and communicated through course documents (e.g. programme handbook, course syllabus and official messages sent by instructors). Take participation norms as an illustration: in the case study these refer to conventions of involvement in a practice, and to the extent to which online participation is voluntary or mandatory. The analysis revealed a type of technology-mediated practice associated with using discussion boards, which relied on a *formal* compulsory participation norm. Course documents set out an explicit requirement specifying the number of contributions expected from each student over a given period of time. As for contribution norms – the conventions associated with the input to online discussions (the qualitative features of the contribution) – the practice instead drew upon *informal* norms (see below). Although a set of official guidelines was made available in the form of an assessment framework, no evidence was found of its manifestation in any actions we observed thus leaving it outside the structuring process of the practice.

Informal norms, on the other hand, are seen as conventions reflected in common behavior that lack any formal documentation. Hypothetically, informal norms may complement formal norms, that is, when they supply conventions to areas of activity that are not addressed by the formal norm. Yet, formal norms might also compete with informal norms, i.e. when suggesting alternative or contradictory conventions compared with their formal counterpart. In light of these distinctions, the analysis of norms ought to be sensitive to potential ambiguity between competing or incongruent conventions of action. Given their tacit nature, analysis of informal norms should rely on a variety of data types, ranging from interview transcripts and conversation notes to protocols of meetings/interactions obtained through observations. A hermeneutic process within and across these texts should lead the researcher to tentative interpretations, which can then be iteratively validated against the observed behavior. Informal norms can also reveal themselves through direct interaction analysis. For example, in studying students' use of the LMS, online conference transcripts indicated the enactment of specific *moderation* norms i.e. whether and how online discussions are being moderated, and by whom. Analysis revealed that a teacher-led convention was enacted when formal guidelines were absent. In a later stage however, a normative change was attempted by teachers in order to facilitate a student-moderated discussion. Students were divided into small groups, and separate discussion forums were created on the LMS. Two student moderators were assigned to each group. Although formal documents specified arrangements and guidelines, here again informal norms held sway. Analysis of the discussion forums showed that instead of being student-moderated, as suggested by the formal instructions, or teacher-moderated, as in the previous case, emerging practice fashioned a convention of leaderless discussions. The online discussion board became a non-moderated space and this shaped the online learning practice. Likewise, informal communication conventions, such as the appropriateness of using certain social expressions (Oren et al., 2002) or the standards associated with writing styles and the use of language (Lapadat, 2002), became apparent through systematic content analysis of discussion board messages.

Identifying the **degree of sanction** associated with different norms might appear fairly obvious and straightforward, as may well be the case when sanctions are explicit and concrete. In the context of higher education, for example, certain deviations from normative behavior might entail the sanction of expelling a student, or lead to the

institution's refusal to award a degree. Less extreme and more common is the role played by assessment and grading as a sanction and reward mechanism (cf. Mason and Bacsich, 1998). In many cases, however, the level of sanction can only be deduced through interpretation of nonverbal information. It may be so in the case of informal norms, when the sanction is implicit and silent. This may be exemplified by revisiting the notion of moderation as mentioned above. If the moderation norm of an online discussion board suggests a didactic, teacher-led interaction – then students are unlikely unilaterally to take up a leading role as moderators. Although such behavior should not necessarily lead to a sanction, the student might risk facing an embarrassing reaction or reprimand. Hence, certain sanctions, although not fixed and wholly predictable, are nevertheless acknowledged by the social actors concerned, and can be sensed and inferred *in situ*. Whether explicit or implicit, norms may be interpreted as **strongly sanctioned**, when they appeared to be taken for granted, when understood 'as is' and when deviations seem unlikely. **Weakly sanctioned** norms, on the other hand, characterize cases in which ambiguity prevails. For example, formal requirements or guidelines would at times be communicated, although lack of clarity regarding both the norm and its sanction resulted in mixed interpretations which became evident in diverse actions. In other cases, however, weakly sanctioned norms were observed when certain behaviors were informally encouraged. Even though messages were made clear, the nature of the sanction attached to them was less evident. Different actors could thus interpret and assess the likelihood of sanction and act accordingly.

To conclude, we suggest that a nuanced treatment of institutional norms as demonstrated above not only accords with Giddens' formulation of social rules, but more importantly it allows us to recognize the relative impact of specific norms and identify tensions and ambiguity within normative conditions. Further, that in the case of new technology-based practices, the likelihood of ambiguous normative conditions may increase. Since practices have not yet been consolidated and stabilized, norms still need to be negotiated and agreed. The significance of these distinctions becomes apparent when attempting to account for diversity in the use of technology as well as for non-use. Both phenomena are highly relevant for IS research.

The Modality of Interpretive Schemes

Interpretive schemes, the third modality of structuration, encompass the actors' 'stocks of knowledge' (Giddens, 1984), assumptions and beliefs drawn upon in the technology-supported practice. Despite this rather broad conception, the analysis of interpretive schemes offered in Orlikowski's Practice Lens is ultimately restricted to the level of technical knowledge held by the user. While this distinction may be considered relevant in certain cases, it seems to provide a rather limited view which underplays the richness of interpretive schemes and overlooks their practice-specific nature. In addition, it may be argued that in certain contexts of computer literacy and self-efficacy (cf. Piccoli et al., 2001) the significance of such a distinction, between levels of technical knowledge, decreases considerably. Alternatively, we propose a more elaborate yet focused investigation into relevant personal properties that may become associated with the structuring of certain technology-based practices. Before demonstrating the framework that we applied for studying technology-mediated learning practices in higher education, we outline briefly some general clarifications associated with the analysis process of interpretive schemes.

The concept of interpretive schemes, when discussed in the context of IS research, may be associated with similar constructs such as 'user perceptions', designed to capture *personal properties* as they relate to the use of technology. Interviews or surveys are used typically as data collection tools for studying these variables. From a ST perspective however, studying user perceptions as a standalone construct, detached from *action*, would be a pointless exercise. Rather than simply portraying a set of attitudes, assumptions or opinions as reported by users, a structural analysis attempts to identify *enacted* properties, i.e. the sets of assumptions and beliefs drawn on in the technology-based practices. To this end, a twofold mode of analysis may be iteratively applied: on the one hand *eliciting* classes of relevant interpretive schemes relying predominantly on interview transcriptions while, on the other, *tracing* their impact and manifestations within observed activities.

The empirical grounding for relating perceptions and actions should support the explanatory efforts of the research and serve to disentangle situations of inconsistency between perceptions and behavior. Such discrepancies could be accounted for through the interlinked modalities of the norms or the facility-technology. For example, users might act in ways incompatible with their own assumptions should these be at odds with the behavior implied by a strongly sanctioned institutional norm. Even if not necessarily agreeing with the content of a norm, actors may still agree to follow it. Likewise, disapproving or unenthusiastic perceptions regarding certain technological properties do not of themselves determine how or whether they are used. At the same time, the analysis of interpretive schemes will enable the researcher to account for limited use and non-use when observed. Certain normative conditions, coupled with assumptions incompatible with those underlying the technology-based practice could, in some cases, allow actors to opt out altogether or to enact a 'structure of limited use' (Orlikowski, 2000, p. 415).

To complete the methodological discussion on interpretive schemes, we suggest a framework that can be used to analyze their content. As mentioned earlier, a guiding principle for defining the scope and content of interpretive schemes is that relevant assumptions and beliefs are practice-specific rather than generic. To capture these personal properties as they relate to the use of technology in a specific practice domain, a three-layered framework is proposed so as to identify: a) underlying beliefs about the practice; b) practical assumptions about effectiveness in the practice; c) perceived role of the technology in accomplishing the practice. This analytical framework may well be adopted and applied to explore interpretive schemes in any given technology-based practice. To further illustrate its use as an operational tool, we draw on our study of technology-based learning practices in the context of higher education.

For the first dimension of underlying beliefs about the practice of learning, we relied on the conceptual framework of Personal Epistemological Theories (Hofer & Pintrich, 1997). This framework refers to individual's personal theories of how they come to know and what theories and beliefs they hold about knowledge and knowing. According to this stream of research, epistemological premises are both part of, and an influence on, the processes and practices of learning. For example, if one believes that knowledge is simple, then there is no reason to attempt to use deeper processing strategies, such as elaboration, because simple memorization will suffice. Starting from the Personal Epistemologies framework, the dimensions of *knowledge* and *knowing* and their respective categories as specified by Hofer & Pintrich (1997) were applied in a flexible manner, allowing for grounded refinements to the analytical scheme. The original framework served to inform the analysis but was nevertheless supplemented by data-driven categories. The application of the first dimension in the analysis of interpretive schemes is illustrated in table 3 below:

Table 3: Underlying beliefs about learning practice ('Personal Epistemologies' analysis illustrated)

Nature of knowledge	Certainty of knowledge	Absolute; certain, right/ wrong
		Contextual; uncertain; tentative and evolving
		Relativist; evaluated on relative merits
	Simplicity of knowledge	Simple; isolated unambiguous elements
		Complex; interrelated concepts
Nature of knowing	Source of knowledge	Resides in /handed down from Authorities; received
		Derived from reason; self-constructed; experts critically evaluated
	Justification for knowing	Received or mastery; knowledge requires no justification; acceptance of facts unexamined expertise
		Evidence judges in context; knowledge is constructed and judgments are critically evaluated; evaluation of expertise
Nature of Learning	Constructivist	Connecting existing knowledge with new knowledge; relating concepts
	Knowing and doing	Relating knowledge to action; performing tasks
	Transmission	Digesting; absorbing knowledge

While the Personal Epistemologies Framework served to reveal students' underlying beliefs about their learning practice, a complementary *activity-oriented* dimension seemed warranted. Therefore, a general dimension, focusing on students' assumptions about the character of effective learning activities was incorporated into the analysis scheme. Emerging categories related to this dimension illustrated the ways in which underlying epistemological beliefs are associated with, or translated into, more practical assumptions concerning potential activities and courses of action in learning. For example, a major category in the analysis represented the assumption that interaction with people (others) facilitates effective learning. This assumption could be associated with a social constructivist epistemology, however, its practical manifestation revealed variations in terms of, for example, the nature of interaction (structured vs. spontaneous) and the preferred setting or mode for social interaction in learning (synchronous vs. a-synchronous). The second dimension in the analysis of interpretive schemes is illustrated in table 4 below:

Table 4: Practical assumptions about effectiveness in learning

Interaction with others (peers/colleagues) underlies effective learning	Variations in the nature of interaction	Spontaneous and casual
		Structured, well- organized
		Condensed, focused
	Variations in the role of others	Expression/articulation of thoughts; 'explaining' to others triggers further thought and helps validate own knowledge (others passive)
		Exposure to multiple perspectives; other peoples' understandings enhance own understanding and allow validation of knowledge (others active)
		Negotiation of ideas (reciprocal)
	Preferred setting for social interaction in learning	Small groups (need for familiarity)
		Face-to-face, real time, temporary (vs. permanent. documented)
		Mediated, asynchronous (allow for reflection, re-thinking, re-writing)
Interaction with resources underlies effective learning	Social interaction with people is marginal/ insignificant	
	Information exchange expands and enrich learning resources	

Finally, a third dimension was incorporated into the analytical scheme so as to depict student assumptions about the role of technology in learning. Rather than framing student's views in terms of positive versus negative attitudes towards technology-mediated learning or through predefined satisfaction variables (cf. Lewis et al., 2003), the analysis relied on interview transcripts and attempted to elicit student assumptions about the ways in which technology facilitates or hinders the practice and process of learning. Grounded analysis techniques yielded categories which are illustrated in table 5 below. By comparing and relating these assumptions with the beliefs and assertions pertaining to other dimensions, i.e. personal epistemologies and learning activities, a detailed picture of the students' interpretive schemes emerged.

Table 5: Perceived role of the technology in learning practice

Technology enhances effective learning	Providing a well-structured comprehensive repository, especially for revision activities
	Written interaction enabled by technology raises the level of discussion
	Technology supports knowledge sharing (better than other traditional tools)
Technology improves efficiency in learning	Technology saves time and avoids frustration in accomplishing learning-related tasks
	Technology supports information dissemination (better than other traditional tools)
Technology facilitates flexibility in learning	Availability of learning resources anytime, anywhere
	Possibility for learning interaction anytime, anywhere
Technology provides a sense of orientation in the learning process	Stability; focal point (through continuous availability)
	Control (through accessibility)
	Keeping up to date (never miss out on anything)

The analysis framework as described and illustrated above provides for the process referred to earlier as eliciting classes of relevant interpretive schemes, and is followed by tracing their manifestations and impacts within observed activities. The structuring role of specific beliefs and assumptions represented by interpretive schemes is then analyzed jointly, as an interdependent construct, with the other modalities of facility and norms.

Conclusion

In the methodological discourse on structurational IS research, the literature offers insight into the relevance of different research approaches (Jones et al., 2004) designs (Poole and DeSanctis, 2004) and strategies (Pozzebon and Pinsonneault, 2005) but treatment of the processes of data collection and analysis involved in structurational IS research has been strikingly absent. Some redress has been attempted in this paper through explication of analytical considerations and processes that may link structurational constructs *directly* to data analysis. This analytical process yields several implications that may be applicable in future research. In particular, a set of operational definitions of the constructs and their subsets was offered with pointers for the data analysis process. Key methodological guidelines are integrated into a preliminary framework in table 6 below.

Table 6: Research Framework for Structuration Modalities

Interlinked Modalities of Structuration	Related categories of analysis (subsets)	Data collection tools and data types	Guidelines for analysis process
Facility (Technology)	Modules (core properties, systemic characteristics) Tools and procedures for accomplishing tasks Data/information made available through use Technical set up of features in-use	Technical Documents (e.g., user manuals, white papers) Hands on with system studied Observation of the technological environment in-use (preferably records generated from the system e.g., log files, tracking reports - history)	Track and document the structure and design of the system in-use; identify core technological properties and potentially restricting properties Map technological properties available for use in the particular empirical setting Distinguish available properties from those being used - identify and characterize recurrent interaction with the technology and patterns of use
Norms	Status (formal or informal) Types of norms – e.g. participation, contribution Degree of sanction (weak or strong)	Institutional documents (formal rules and conventions manifested officially and made public in a written form) Observations (e.g. transcripts of CMC discussion messages) Informal conversations	Identify relative impact of different norms Identify ambiguity /tension between norms; competing norms Identify those sensed and inferred <i>in situ</i> through e.g., direct interaction analysis
Interpretive Schemes	Underlying beliefs about the practice Practical assumptions about effectiveness in the practice Perceived role of the technology in accomplishing the practice	In-depth interviews Observations	Elicit classes of relevant interpretive schemes relying predominantly on interview transcriptions Trace manifestations of personal beliefs and assumptions in observed activities.

Table 6 (Research Framework for Structuration Modalities) brings together methodological guidelines suggested by this paper as they relate to each of the three structuration modalities as research constructs. It is offered as much needed clarification in terms of where and what to look for and which specifications to set down at the operational level. While attention is given to the specificities of each modality, the interrelated nature of these constructs and thus the need to analyse them jointly, was underscored throughout this paper. The relative role played by technological and material properties, as well to normative and personal/perceptual properties must be recognised and accounted for by traversing back and forth across the modalities during the analysis process. Furthermore, the continual dimension of the structurational analysis, represented in a longitudinal research design and aimed at tracking changes, is highlighted as another general principle pertaining to all three modalities and their mutual analysis.

This preliminary framework does not specify an analytical itinerary but specifies what tasks need attention in order to operationalize all three modalities. Researchers will determine, according to the particular exigencies of the research study, their own best path through the framework. We intend to develop this framework further in later studies.

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