MIS Quarterly

RESEARCH COMMENTARY

THE SOCIOTECHNICAL AXIS OF COHESION FOR THE IS DISCIPLINE: ITS HISTORICAL LEGACY AND ITS CONTINUED RELEVANCE[1]

Suprateek Sarker
McIntire School of Commerce, University of Virginia,
Charlottesville, VA 22903 U.S.A. {sarkers@virginia.edu}

Sutirtha Chatterjee
Lee School of Business, University of Nevada, Las Vegas,
Las Vegas, NV 89154 U.S.A. {sutirtha.chatterjee@unlv.edu}

Xiao Xiao
Department of Digitalization, Copenhagen Business School,
Copenhagen DENMARK {xx.digi@cbs.dk}

Amany Elbanna
Royal Holloway University of London,
Egham, Surrey TW20 0EX UNITED KINGDOM {amany.elbanna@rhul.ac.uk}

The sociotechnical perspective is often seen as one of the foundational viewpoints—or an "axis of cohesion"—for the Information Systems (IS) discipline, contributing to both its distinctiveness and its ability to coherently expand its boundaries. However, our review of papers in the two leading IS journals from 2000 to 2016 suggests that IS research has lost sight of the discipline's sociotechnical character—a character that was widely acknowledged at the discipline's inception. This is a problem because an axis of cohesion can be fundamental to a discipline's long-term vitality. In order to address this issue, we offer ways to renew the sociotechnical perspective so that it can continue to serve as a distinctive and coherent foundation for the discipline. Our hope is that the renewed sociotechnical frame for the IS discipline discussed in the paper holds potential to contribute to the enduring strength of our diverse, distinctive, yet unified discipline. It also prompts members of the discipline to think more deeply about what it means to be an IS scholar.

Keywords: IS discipline, foundations, sociotechnical perspective, IT artifact, instrumental goals, humanistic goals, ethics

[1]Andrew Burton-Jones was the accepting senior editor for this paper. Liette Lapointe served as the associate editor. The first two listed authors contributed equally.

The appendix for this paper is located in the "Online Supplements" section of *MIS Quarterly*'s website (https://misq.org).

Introduction

This paper is a call to action for researchers, journals, and academic units in the Information Systems (IS) discipline. It is a call to revisit our academic roots, reimagine them, and recommit to them. We wrote this paper because we are concerned that the key elements of one of the oldest and firmest roots of our discipline, the sociotechnical perspective, are barely reflected anymore in our top journals. Some might argue that our concern is misplaced. Admittedly, in many countries around the globe, the IS discipline is currently booming with high student enrollments and it is enjoying the patronage of key stakeholders, including deans at many universities, employers, and even funding agencies. New technologies such as those related to analytics and machine learning (e.g., Chen et al. 2012), fintech (Hendershott et al. 2017), and cloud computing (e.g., Guo and Ma 2018) are affecting all walks of life. Such technological advancements provide the IS discipline with an excellent platform for having a meaningful impact on business and society.

However, in attending to the rapidly changing technological landscape, and perhaps lulled by the kaleidoscopic capabilities of these technologies being extolled by vendors and other technology enthusiasts, we appear to be losing the grounding that the sociotechnical perspective has traditionally provided for our research and teaching, leaving the discipline exposed to potential dangers with respect to its *long-term* vitality. Such dangers might include (1) disciplinary erosion due to a lack of uniqueness; (2) disciplinary fragmentation due to the discipline's inability to expand in a coherent fashion, and the resulting absence of a shared understanding of topics among its different subcommunities; and (3) a lack of ethical standing of the discipline in society due to the failure of IS scholars and practitioners to reflect on the consequences of information technology, and to critique and actively oppose initiatives where IT might facilitate the development of a dehumanized and dystopian society. We believe that awareness of these potential pitfalls can help initiate a healthy discourse about how the IS discipline should be positioned with respect to other disciplines, how we might uniquely frame and investigate technology-related phenomena that may be of interest to IS as well as other disciplines, and how we should train our Ph.D. students and inspire our junior scholars so that they can continue to create and disseminate valuable knowledge, and ensure the discipline's continuity and progress.

Based on our understanding of the IS discipline and its ecology, we believe that there is a need to revisit the sociotechnical perspective as a foundation for the discipline, and to develop recommendations for researchers, journals, and academic units on how they can recommit to it. Our arguments are informed, in part, by the seminal work of Andrew Abbott (2001, 2002, 2014) on the progress of academic disciplines. One of the influential ideas in Abbott's work that we draw upon pertains to the concept of *axis of cohesion* for a discipline. An axis of cohesion is a shared frame that provides the discipline with common language, broadly accepted research orientation(s), and/or communal knowledge in the form of shared assumptions and interests (Abbott 2002). For example, in political science, the axis of cohesion is a "central allegiance to the phenomenon of power," and in anthropology, it is the ethnographic method (Abbott 2002, p. 216). The axis of cohesion helps members of a discipline conceptualize phenomena-of-interest in ways specific to that discipline, and thereby generate knowledge that is unique in comparison to knowledge generated by its closely related disciplines about the same phenomenon-of-interest (Purao et al. 2008).

We believe that, at least implicitly, the axis of cohesion (even though the term was not used earlier) for the IS discipline has, for long, been the *sociotechnical perspective.* For many scholars, the sociotechnical perspective captures the very essence of the IS discipline (Avgerou et al. 2004; Bostrom et al. 2009; Chiasson and Davidson 2005; Lee 2004; Sawyer and Jarrahi 2014). Broadly speaking, the sociotechnical perspective considers the technical artifacts *as well as* the individuals/collectives that develop and use the artifacts in social (e.g., psychological, cultural, and economic) contexts (Briggs et al. 2010). This perspective privileges neither the technical nor the social, and sees outcomes as emerging from the interaction between the two. Further, it espouses a focus on instrumental outcomes such as efficiency and productivity *as well as* on humanistic outcomes, such as well-being, equality, and freedom (Beath et al. 2013; Mumford 2006).

Despite the undeniable legacy of the sociotechnical perspective in shaping IS scholarship, a theme upon which we further elaborate in the next section, not all researchers appreciate and/or acknowledge its significance. Forman et al. (2014), for example, criticized the sociotechnical perspective for being associated with ideas rooted in trade unions and empowerment of workers' movements, characterizing it as an "anachronism" developed in and for another place and time. Alter (2015) has likewise questioned whether *every* IS phenomenon must be framed using this perspective since the study of technology alone could be a worthwhile undertaking in some contexts. Other scholars have taken a pragmatic approach and urged IS scholars to focus on solving novel problems (Agarwal 2016) and on claiming new territory that comes with the new opportunities of IT applications (Goes 2014a). Additionally, some scholars have recently expressed skepticism as to whether IS research has a sociotechnical future:

> Whether the scholarly Information Systems (IS) field could, or even if it should, engage in research focused on sociotechnical futures is less clear (Chiasson et al. 2018, p. 367).

The stark contrast between such emerging views of the IS discipline that are seemingly disconnected from, indifferent to, skeptical regarding, or critical of the sociotechnical perspective, and our own understanding of the IS discipline and its unique sociotechnical legacy, prompted us to engage in this discourse. We are aware that some scholars in IS have critiqued and contributed to further development of sociotechnical theory (e.g., Winter et al. 2014). Our focus is different: we are concerned that many colleagues in the IS discipline do not find the sociotechnical perspective meaningful for the work they do, as researchers, as teachers, or as representatives of the discipline. This paper is written out of this concern, and it seeks to present to the IS community the signicance of the sociotechnical perspective to the discipline's past and, more importantly, to its future.

To dig deeper into the issues that we have surfaced thus far, we first seek to *understand to what extent, and how, the sociotechnical perspective has been actually enacted in IS research* (RQ1). As we will show, we found that contemporary IS research studies, at least those featured in the two leading IS journals since 2000, have not been consistent with the sociotechnical perspective as traditionally espoused in the discipline. This finding led to our subsequent aim that we address in the second half of the paper: *to propose how the sociotechnical perspective can be adapted, and how the IS community can adapt to it, so that it can continue to serve as an effective axis of cohesion for the IS discipline* (RQ2).

The Sociotechnical Perspective and IS

Origins of the Sociotechnical Perspective and its Adoption in IS

The ideas underlying the sociotechnical perspective have appeared in various forms: as sociotechnical systems, sociotechnical theory, sociotechnical approach, and sociotechnical systems theory (with and without hyphenation between the "socio" and the "technical"). While there is some agreement with respect to the essence of the sociotechnical perspective, scholars are divided regarding its specific elements and principles (Olerup 1989).

The origin of sociotechnical thinking can be traced to the multiple post-World War II field studies undertaken in the British coal-mining industry by the Tavistock Institute (Rice and Trist 1952; Trist and Bamforth 1951). It emerged as a new way of thinking, which challenged the prevailing worldview on technologies as being external antecedents to organizational and social structure and behavior (Beath et al. 2013), and paved the way for establishing what could be considered among the earliest IS programs (*Management Science* 1967). Such programs sought to bridge the divide between the socially oriented approaches to solving organizational problems advocated by psychological/organizational disciplines and the technically oriented approaches advocated by disciplines such as computer science and operations research (Davis and Olson 1985).

Building on these early developments, the IS discipline further drew upon ideas from the sociotechnical tradition for uniquely studying information technology and its relationship with individuals and social collectives (Bostrom and Heinen 1977a, 1977b). According to this view, the social and the technical should be *apportioned comparable emphases*, with scholars noting that "neither technology nor human activity deserves a privileged position [with respect to the other] in shaping ongoing practice: it is the interplay between the two that matters" (Beath et al. 2013, p. iii). Along similar lines, Lee (2004) highlighted *the idea of interaction between the two components*, the social and the technical, as a distinctive character of IS research, stating that studies that

> do not account for the mutually and iteratively transformational interactions between the social system and the technological system … [and] are not information systems research at all (p. 14).

Notably, Lee, the then editor-in-chief of *MIS Quarterly,* emphasized that neither the social nor the technical should have an "incidental" or nominal role in this interaction:

> Manuscripts focusing on information technology generally need to examine a phenomenon in which the behavioral, the managerial, and/or the organizational also play a substantive and **not just incidental role**. Similarly, manuscripts focusing on the behavioral, the managerial, and/or the organizational generally need to examine a phenomenon in which information technology also plays a substantive and **not just incidental** role (2001, p. iii, emphases added).

The IS vision of the sociotechnical perspective consisted of yet another important observation. This view "argued that the … desired end product is to be a *humanized, efficient* … workplace" (Mumford 2006, p. 339, emphases added) and issued a call to "counter tendencies to subjugate man [social]

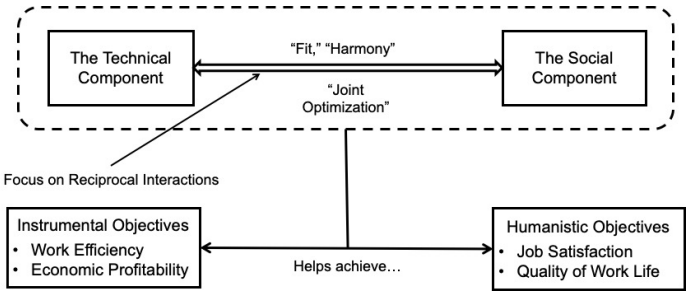

Figure 1. A Representation of the Sociotechnical Perspective in IS

to the machine [technical]"(Bjørn-Andersen et al. 1982, p. xiv). The above characterizations of the sociotechnical perspective appear to be consistent with, though not identical to, the views expressed in many studies/commentaries within and outside the IS discipline (e.g., Bansler 1989; Bjørn-Andersen et al. 1986; Cherns 1976; Lamb and Kling 2003; Ropohl 1999). Figure 1 captures the essence of this perspective and provides analytic clarity for our subsequent literature review.

To elaborate, the sociotechnical perspective in IS, as depicted in Figure 1, conceptualizes the social and the technical as two mutually interacting components (Alter 2013). The technical component is "primarily a human-created tool whose raison d'être is to be used to solve a problem, achieve a goal or serve a purpose that is human defined, human perceived or human felt" (Lee et al. 2015, p. 8). It consists of hardware and software, by some accounts, data sources, and associated techniques necessary to carry out organizational work (Ryan et al. 2002). The social component can be defined as consisting of individuals or collectives, as well as "relationships or interactions between or among individuals [or collectives] through which an individual [or collective] attempts to solve one of his or her [or their] problems, achieve one of his or her [or their] goals or serve one of his or her [or their] purposes" (Lee et al. 2015, p. 9). The social component thus includes humans (as individuals or social collectives) and their relationships and attributes such as social capital, structures, cultures, economic systems, and best practices (Ryan et al. 2002).

This view of the sociotechnical perspective ascribes comparable importance to both the technical component and the social component, explicitly acknowledges the interdependence between them (Bostrom et al. 2009), and focuses on the fit/harmony/joint optimization between the technical and social components (Pava 1983; Wallace et al. 2004). A fit/harmony/joint optimization between the technical and the social is expected to result in better instrumental outcomes (e.g., higher productivity) as well as humanistic outcomes (e.g., greater job satisfaction) (Wallace et al. 2004). Obviously, the sociotechnical tradition has many strands with different ideas, but the above figure represents the most relevant ideas in defining the essence of the IS discipline. Also, irrespective of what the original formulation(s) intended, the sociotechnical perspective can be applied across different IS problem domains, levels of analyses, and contexts.

The Salience of the Sociotechnical Perspective to the IS Discipline

The sociotechnical perspective has historically been at the heart of the IS discipline. Indeed, it has contributed to some of the seminal works that inspired the IS discipline in its formative years (e.g., Emery 1959; Perrow 1967; Thompson 1967; Trist and Bamforth 1951). Later, it provided grounds for further consolidation of the IS discipline (Beath et al. 2013; Land 2000; Mumford 2006). Other seminal sociotechnical works that contributed to the IS discipline include methodologies such as ETHICS for designing computer-assisted work (e.g., Mumford and Weir 1979), or the soft systems methodology (SSM) for designing IS (e.g., Checkland and Scholes 1990). In this context, it is worth noting that the very first volume of *MIS Quarterly* celebrated the sociotechnical perspective by including two seminal papers by Bostrom and Heinen (1977a, 1977b) that highlighted the sociotechnical perspective and its relevance to understanding IS failures. Most IS scholars consider the launching of *MIS Quarterly* as an epochal moment in the evolution of the IS discipline, and it is worthwhile to observe that the sociotechnical perspective had an important presence in the emerging IS discourse then. Even going beyond the historical evolution and consolidation of the IS discipline, prominent strands in contemporary IS research owe a great deal to the sociotechnical perspective. For example, Cecez-Kecmanovic et al. (2014, p. 814) explain how the body of sociomaterial scholarship emerged from sociotechnical thinking:

> By drawing attention to, and encouraging deeper insights into, the intertwining and interpenetration among technological and human processes, the sociotechnical systems approach paved the way for sociomaterial thinking.

Indeed, one of the streams of sociomaterial research (e.g., Leonardi 2011, 2013), is often seen as "a reinterpretation and continuation of the sociotechnical tradition" (Cecez-Kecmanovic et al. 2014, p. 814). Others see "sociomateriality as a natural extension of S/T [sociotechnical] research" (Bjørn-Andersen and Clemmensen 2017, p. 32). Moreover, almost all major topics of interest in the IS discipline, such as IS development (Luna-Reyes et al. 2005), IS induced organizational change (Lyytinen and Newman 2008), IS innovation (Avgerou and McGrath 2007), knowledge management (Pan and Scarbrough 1998), human–computer interaction (Alter 2010), mobile work (Sawyer et al. 2003), and group processes and interactions (Jensen et al. 2010) have been studied using a sociotechnical perspective. These are but some of the reasons why we believe that the IS discipline needs to continue to engage with and draw inspiration from this perspective.

Beyond pointing to these works that broadly utilize the sociotechnical perspective, a better understanding of our position—*that the sociotechnical perspective can be a fundamental way to grasp the essence of IS*—can be attained by reviewing some of the key ideas in Abbott's work on the nature and progress of academic disciplines. This discussion, presented below, suggests why the IS discipline needs an axis of cohesion, and then seeks to demonstrate how the sociotechnical perspective can serve in this role.

Disciplinary Coherence and Growth: The Need for an Axis of Cohesion

A basic question for many of us is: *What is a discipline?* According to Fabian (2000, p. 351), "a discipline refers to the common focus of a set of researchers who might perform research in varied paradigms and/or theoretical perspectives." A discipline presents a coherent account of the "tools, methods, procedures, exempla, concepts, theories … for a set of objects or subjects" (Strober 2010, p. 13; see also Davison and Tarafder 2018, p. 524). A discipline not only demands a coherent tradition, but also necessitates a unique perspective in order to identify, support, and/or legitimize research within that discipline (Fabian 2000).

This ideal conception of a discipline with a coherent and unique perspective can be contrasted with the reality that Abbott observes in his work on disciplinary evolution. Specifically, Abbott (2001, 2002) observes that disciplinary evolution, rather than being smooth, is particularly unwieldy in nature. In any growing discipline, some degree of fragmentation is inevitable (Preece and Rombach 1994) and happens as subgroups of scholars within a discipline create distinctive clusters for their respective needs, thus distancing themselves from other subgroups within that discipline. These subgroups could subdivide into even smaller fragments over time, leading to disciplines resembling "fragmented adhocracies," a term that has been used to describe the IS discipline (Banville and Landry 1989; Hirschheim et al. 1996).

If continued indefinitely, fragmentation presents two obvious dangers to disciplines. One, it impedes the coherent tradition demanded by a discipline to progress. Second, it creates conditions for interdisciplinary conflict and domination, where neighboring disciplines try to usurp fragments, especially those increasingly disconnected from the focal discipline. Abbott (2001, p. 137) highlights this danger succinctly, stating that "bodies of academic work are perpetually being redefined, reshaped, and recast by the activities of disciplines trying to take work from one another or to dominate one another." He also warns that a discipline that allows indefinite fragmentation "would eventually lose any distinction from other disciplines and be unable to defend itself before crucial audience" (Abbott 2001, p. 149).

Abbott thus paints a stark picture of intra-disciplinary fragmentation and interdisciplinary conflict. However, he also points out that disciplines often have an axis of cohesion which represents the "central principles" of the discipline (Abbott 2001, p. 140); the axis of cohesion can dampen the fragmentation process and stave off attempts at domination by neighboring disciplines. He adds that, for disciplines not belonging to the natural sciences, the axes of cohesion are often not easily aligned, and this can create further complexities in maintaining disciplinary progress and unity.

We must acknowledge that Abbott's ideas are primarily descriptive in that he offers observations regarding the nature and evolution of disciplines. However, his depictions of continued fragmentation within disciplines, of interdisciplinary conflict, competition and attempts at domination by rival disciplines, and of existing yet often misaligned axes of cohesion form the basis of our views regarding what the community of scholars within a discipline should do to guard against such dangers. The axis of cohesion, in creating an umbrella of convergence of scholarly work within the community, protects the discipline from internal fragmentation, and helps prevent attempts at domination from rival disciplines. This, in turn, can help safeguard disciplines and maintain their vitality. Abbott's work on the axis of cohesion, coupled with Fabian's understanding of a discipline, lead us to propose that a widely shared and well-aligned axis of cohesion helps a

discipline to remain robust over the *long run,* by maintaining a distinctive, identifiable orientation with respect to disciplines with which it is associated. We emphasize that by disciplinary distinctiveness we do not mean that the discipline is concerned with phenomena that are not of interest to other disciplines; rather, distinctiveness relates to how a discipline might investigate a phenomenon of interest, and to the knowledge that would result from the discipline's engagement with the phenomenon, using its unique perspective. For example, poverty eradication may be a topic of interest in economics, sociology, and information systems; yet each discipline frames the problem uniquely and seeks to offer different (and hopefully complementary) theories and practical solutions to address the problem. In addition to distinctiveness, the discipline must have the ability to expand in a unified and coherent manner, allowing for the exploration of, and engagement with, problems and approaches outside of its current boundaries. Such expansion, where there is broad agreement regarding the essence of the discipline, helps guard against disciplinary fragmentation (Hirschheim and Klein 2003) that tends to have a weakening effect on disciplines. Interestingly, disciplinary cohesion can add to its distinctiveness, in that it can "present an opportunity … to formalize a shared body of knowledge that distinguishes … [a discipline] from other reference fields" (Grover et al. 2016, p. 450).

The axis of cohesion also facilitates the formulation of problem-portable knowledge that can address *different* substantive problems pertinent to the discipline. In contrast to problem-based knowledge, where the knowledge gained can be applied only to the associated problem, problem-portable knowledge is comprised of abstractions or theories that can be applied to a class of problems or to a variety of disciplinary-relevant phenomena. One possible example of problem-portable knowledge is the task–technology fit theory or TTF (Goodhue and Thompson 1995) that has been applied to many IS phenomena over the years. The ability of a discipline to generate problem-portable knowledge is crucial, because it allows the discipline to "redefine its problems and tasks, defend them from interlopers, and seize new problems" (Abbott 2014, p. 9), which, in turn, contributes to the discipline's long-term survival and competitiveness (Becher and Trowler 2001).

The importance of the axis of cohesion leads us, first, to attempt to identify one that is suitable for the IS discipline, and second, to prescribe ways in which this identified axis of cohesion can be retained and strengthened. Given that the sociotechnical perspective has often provided IS with its uniqueness, identifiable orientation, and an avenue for coherent expansion—for reasons discussed below—we are of the opinion that the sociotechnical view *has been* the axis of cohesion for IS, and, at the very least, *is a strong candidate* for being considered so in the future.

Positioning the Sociotechnical Perspective as an Axis of Cohesion in IS

The distinctiveness afforded to the IS discipline by the sociotechnical perspective, or some subset of its elements, is evident. Reflecting on the history of the discipline, prominent commentators have noted that the sociotechnical perspective engenders "a unique perspective to the application of computers within organizations" (Hirschheim and Klein 2012, p. 193). Such uniqueness has allowed the IS discipline to be "decades ahead of computer science and software engineering in … [its] attention to the context of systems" (Beath et al. 2013, p. iii). The sociotechnical perspective has also been seen to convey "the spirit of what an information system is" (Lee 2004, p. 19). The sociotechnical perspective, as the axis of cohesion for the discipline, can be credited with the development of a common and cumulative body of problem-portable knowledge encompassing the diverse areas within the IS discipline (Briggs et al. 2010; Constantinides et al. 2012; Hirschheim and Klein 2012). This common orientation, when actively espoused, has helped in conveying to external stakeholders such as future students and employing organizations what the IS discipline is about, and how it differs from closely related reference disciplines such as computer science, organization studies, psychology, and so on.

The perspective, implicitly or explicitly, has also helped the IS scholarly community expand using this coherent orientation, by allowing intellectual engagement with many emerging topics and perspectives from reference disciplines (Cecez-Kecmanovic et al. 2014; Rai 2017b; Weber 2004). For instance, the sociotechnical perspective has implicitly allowed us to import problems (traditionally studied in other disciplines) such as poverty (Jha et al. 2016) and infant mortality (Venkatesh et al. 2016) and to reframe them for the IS discipline. Furthermore, it has allowed IS researchers, with an understanding of IT-mediation (the technical), to engage with "group research" (the social) in reference disciplines to spawn research on and theorize about group support systems (GSS) and virtual teams (Dennis et al. 2008; Valacich et al. 1994). Similarly, IS researchers, having an understanding of the many facets of digitization (the technical), are currently engaging with literature on "innovation" and "organizational transformation" (the social) to develop the area of digital transformation (Agarwal et al. 2010; Matt et al. 2016). Likewise, the action design research (ADR) methodology blends elements of action research with elements of technical design to offer a new approach suitable for IS design researchers (Sein et al. 2011). Not only has the sociotechnical perspective expanded the scope and boundaries of IS, but it has also enabled IS to make unique contributions to other disciplines such as computer science (King 2013), strategy (Osterwalder and Pigneur 2013), innovation (Nambisan 2013; Yoo 2013),

and management (Beane and Orlikowski 2015). In short, it is not unreasonable to argue that the sociotechnical perspective has been crucial to the emergence of IS as a competitive discipline among related disciplines (Baskerville and Myers 2002).

Embracing the sociotechnical perspective has traditionally allowed IS scholars to converge on a common frame of reference and avoid focusing *solely* on *problem-oriented* (or problem-based) empirical knowledge—in contrast to *problem-portable* knowledge—which some of the recent calls (e.g., those oriented toward addressing novel problems) within the IS discipline seem to favor. We contend that pursuing such problem-oriented directions in the IS discipline, however appealing, could work against the IS discipline's long-term interest: "There is ample evidence that problem-oriented empirical work does *not* create *enduring*, self-reproducing communities like disciplines" (Abbott 2001, p. 134, emphasis added).

Abbott argues that problem-oriented knowledge creation is "insufficiently abstract to survive" (2001, p. 135). In contrast to a problem-oriented perspective, Abbott argues that robust disciplines create problem-portable knowledge "that can be used to address many different substantive problems" (2001, p. 135). The axis of cohesion of a discipline allows the creation of problem-portable knowledge and its transfer across problems within a discipline. Such knowledge cannot be easily packaged and "commodified" by other disciplines, which enables it to retain the distinctive flavor of the focal discipline. Referring to our earlier TTF example, we can argue that TTF allows us to maintain a unique IS flavor to analyze human performance using technology, quite different from, say, usability studies in computer science or management.

Interestingly, in the many vigorous debates about whether an IS discipline should have a core or not, scholars have not sought to define the core in terms of the sociotechnical perspective. Generally, the arguments have been offered in favor of, or against, holding narrower views of the IS core. For example, scholars have debated the call for the mandatory prominence of the IT artifact in IS research. Some have argued that focusing on the IT artifact sharpens the research direction and uniqueness of the IS discipline (Benbasat and Zmud 2003). Others have contended that this focus on the IT artifact unnecessarily constricts the IS discipline (Alter 2015; Lee et al. 2015; Lowry et al. 2017). We submit that this debate on the IT artifact as the discipline's core may have been misplaced. Instead, we propose to position the sociotechnical perspective as representative of the IS core, given that it is far more accommodating as compared to the earlier narrow focus on the IT artifact, and thus finds sympathy even with scholars who have argued against the notion of a core of the IS discipline. In fact, some of the strongest critics of the idea that the IS discipline needs a core have themselves undertaken significant work whose roots can be traced to the sociotechnical perspective (e.g., DeSanctis 2003; DeSanctis and Poole 1994; Lyytinen and Newman 2008).

In line with the above discussion, we believe that the sociotechnical perspective has been a valuable axis of cohesion for the IS discipline and, with suitable modifications (as we discuss later in the paper), can continue to be valuable in that role. Of course, scholars may disagree with our position, and we invite them to offer arguments against the need of an axis of cohesion or to suggest alternate axes of cohesion for the IS discipline.

Given the nature of the topic, the general tone of the paper is somewhat critical. It is inspired by the three basic concepts of critical philosophy that stimulate academic progress–insight, critique, and transformation (Myers and Klein 2011). Accordingly, the rest of our paper is structured as follows. First, we undertake an extensive review of literature—papers published in *MIS Quarterly* and *Information Systems Research* from 2000 to 2016—to derive insights on how IS researchers have enacted (or not enacted) the sociotechnical perspective. We then critically analyze the results and offer recommendations regarding how we might modify our current understanding of the sociotechnical perspective so that it continues to offer an integrative and compelling foundation for the IS discipline.

The Sociotechnical Perspective as Enacted in Contemporary IS Studies

To discern how the sociotechnical perspective has been enacted in IS research in recent times, we reviewed and analyzed papers published in the two premier IS journals, *MIS Quarterly* (MISQ) and *Information Systems Research* (ISR), from 2000 to 2016, which amounted to 991 studies (for details and procedures, see Appendix A). Based on Figure 1, our analysis examined two broad aspects: (1) how studies have enacted *the presence of the social and the technical* in conceptualizing IS phenomena *and the relationship between the social and the technical*; and (2) what kind of *outcomes/objectives* the studies have focused on.

The literature review shows that the relationship between the social and the technical has been conceptualized in different ways within the studies reviewed. We categorize these different conceptualizations into six types (I-VI) and discuss them below. With respect to the nature of outcomes, the inves-

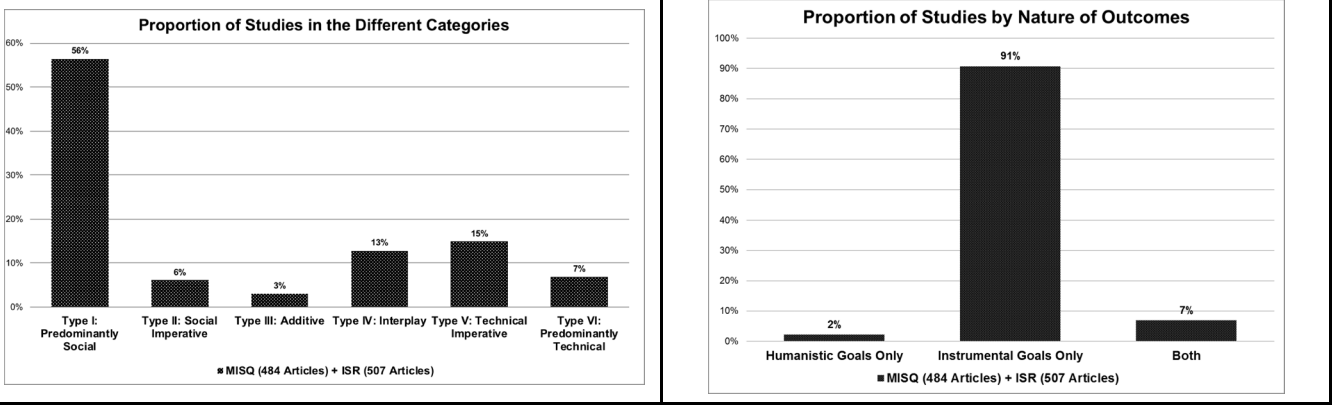

Figure 2. The Sociotechnical Perspective as Enacted in IS Research (2000–2016)

tigation revealed that the majority of the reviewed studies (91%) have focused exclusively on instrumental goals. Only 7% of the studies have considered both humanistic and instrumental goals; the remaining 2% of studies have been concerned with humanistic goals alone (see Figure 2 for an overview).

Type I: The Predominantly Social (In a "Hidden" Technical Context)

The first type of research that we encounter can be characterized as predominantly social, where the investigation focuses almost exclusively on the social (including psychological, sociological, economic, or philosophical) aspects related to the phenomenon of interest, with technological or informational considerations serving as the context. Such research has mostly engaged in the social analysis of technology-related phenomena, such as focusing on social factors (e.g., contract and relationship governance) leading to software vendor profitability (Gopal and Koka 2012), pricing policies of information goods (Chen and Png 2003), or the group features/characteristics and outcomes in technology-mediated teams (Alnuaimi et al. 2010). Much of the IT outsourcing and offshoring literature can also be included in this category, where the phenomenon is described and theorized without considering the role of IT (eg., nature of system, architecture of system, or media for coordination). Due to the "absent presence" of IT (Orlikowski 2010), such research is typically characterized as application/extension/testing of social theories in IT-related or IT-mediated contexts.

Type II: The Social Imperative

The second type of research includes the social shaping of technology and predominantly treats technology as an outcome of social structures or processes. In this perspective, technology is viewed as a product of human choice and action (DeSanctis and Poole 1994). This perspective is closely related to the notion of "organizational imperative" where human actors largely influence technology and its consequences (Markus and Robey 1988).

An example of research in this category is Cooper et al. (2000) who use a case study to illustrate how predominantly organizational characteristics can affect creative IT requirements and logical design. Another example is that of Venkatesh et al. (2011) who investigate how network positions of health care professionals influence electronic healthcare system use.

Type III: The Social and Technical as Additive Antecedents to Outcomes

The third type of research holds that social and technological factors additively explain individual and/or collective outcomes. In this type, both the social component and the technical component are seen as separate antecedents to certain outcomes; however, there is generally no evidence of any interaction between the components themselves in producing these outcomes. As an example of this type, Wixom and Watson (2001) investigate the factors affecting data warehousing success. The major factors deemed relevant are organizational resources, user participation, and the skill of the employees, which influence whether the data warehousing project will be successful (i.e., be on time and budget). Their model also considers two IT-related independent variables, those of unstandardized source systems and poor technology development. Another example is Tanriverdi et al. (2007) who examine how business process modularity and underlying IT infrastructure influence business' choices of sourcing mechanisms.

Type IV. The Social and the Technical as Producing Outcomes Through Their Interplay[2]

The fourth type of research we identified conceptualizes the interplay between the social and the technical to produce outcomes. It is the type most compatible with the social and technical relationship as conceived within the sociotechnical perspective discussed earlier. However, there is much diversity in the way interplay is conceptualized (e.g., reciprocal interactions, entanglement, imbrication, or inscription) to produce outcomes, and we point to selected examples in each subtype.

One subtype highlights the reciprocal interactions between the social and the technical, following the structurational model of technology (Jones and Karsten 2008), where IT and social structures mutually appropriate each other (DeSanctis and Poole 1994; Orlikowski 1992). An example of this broad perspective is Goh et al. (2011) who show how work routines and technology coevolve throughout the implementation process of a healthcare IT system.

Another subtype conceptualizes the relationship between the social and the technical as an interaction or fit. For example, Morris and Venkatesh (2010) investigate the influence of job characteristics such as task identity on job satisfaction (a humanistic outcome), moderated by IT (ERP) implementation. Similarly, Strong and Volkoff (2010) identify different domains of organization–enterprise system misfit, and discuss user problems because of the misfit.

A third, and increasingly prominent, subtype is the sociomaterial perspective. This subtype has strong roots in the sociotechnical tradition (Bjørn-Andersen and Clemmensen 2017; Cecez-Kecmanovic et al. 2014). Two major sociomaterial traditions have emerged, namely those of agential realism (Orlikowski 2007; Orlikowski and Scott 2008) and critical realism (Leonardi 2011, 2012, 2013). These two traditions differ primarily with respect to their position on the ontological separation between the social and the technical (material). In the critical realist tradition, Leonardi (2011) shows how sociomaterial imbrications of human beings and technologies (which are ontologically separate) result in new affordances, constraints, and routines related to organizational action. In contrast, the sociomaterial tradition of agential realism championed by Orlikowski and her colleagues emphasizes that insisting on ontological separation between the social and the technical is futile, as they are always "constitutively entangled" (Orlikowski 2007, p. 1444).

[2]This type demands longer discussion than the other types because it is the most related one to the sociotechnical perspective as espoused earlier. Moreover, there are several variations of this type in the literature.

Yet another subtype sees social considerations as being inscribed within the technological artifact. This type is exemplified by a strand of design science research that draw upon "kernel theories" from natural or social sciences, to derive design goals for the design artifact (Walls et al. 1992). Fundamentally, the theoretical perspectives are embedded within the design artifact (Baskerville et al. 2018). One example of this subtype is value sensitive design, wherein technology design is undertaken by accounting for theoretical conceptions of human values (Dadgar and Joshi 2018; Friedman et al. 2006; Liu et al. 2015). For instance, Chatterjee et al. (2009) propose a design of groupware by incorporating human ethical values highlighted by Kant (1804/1994) and Rawls (1971). Another example is the development of a detection system for fake websites using statistical learning theory (Abbasi et al. 2010).

Type V: The Technical Imperative

The fifth type of research conceptualizes technology as the major antecedent to social outcomes. In this conception, IT is viewed to bring structural, communicative, and decision-making changes in organizations (Pinsonneault and Kraemer 2002). Such influence is often conceived of as a soft form of technological determinism (Robey et al. 2013), which views technologies as influencing and/or constraining changes in the social world (Markus and Robey 1988). This research type includes numerous impact and/or evaluation studies (Robey et al. 2013). An example would be the well-known electronic market hypotheses or EMH (Malone et al. 1987) and the subsequent studies it has inspired. EMH posits that advances in IT will reduce coordination costs, which in turn will influence a move toward a market structure or, alternately, a move away from a hierarchical structure. In addition, IT itself is seen to influence such market mechanisms, and to drive out the intermediary (middleman), leading to shorter value chains (Giaglis et al. 2002). Another example of this type of research is by Deng and Poole (2010), who show how the nature of web interfaces (i.e., order and visual complexity) impacts online behaviors.

Type VI: Predominantly Technical

The final type of research identified has limited and indirect concern for the role of the social. This body of work represents the technical strand of what is referred to as design research in the IS discipline (Hevner et al. 2004). It focuses almost solely on how to develop or improve the technical component. For instance, Arazy and Woo (2007) focus their study on evaluating the usefulness of statistical natural language processing techniques, while Li and Sarkar (2011) develop a data-masking method to protect private information against record linkage disclosure.

Broadly, this type of research aims to advance technology and enhance problem-solving capabilities of technology. Arguably, the publication of the seminal article by Hevner et al. (2004) has opened up opportunities for this type of research in IS. Commentaries and editorials (e.g., Agarwal 2016; Agarwal and Dhar 2014; Gupta 2017) suggest that the increasing importance of big data, data analytics, fintech, AI, and cybersecurity has energized the pursuit of technically dominant IS research (Chen et al. 2012) at a number of leading IS programs (Goes 2014b).

Reflections Based on the Review

In this section, we reflect on the findings of the literature review that followed from RQ1. Specifically, we comment on three issues salient to conceptualizing IS problems or phenomena from the sociotechnical perspective (as per Figure 1): (1) the relative emphasis on the social and the technical in understanding/explaining IS phenomena; (2) the nature of relationships between the social and the technical in producing outcomes; and (3) the nature of outcomes in published studies.

Observation 1: Uneven Emphases on the Social and the Technical

The findings of the literature review (as depicted in Figure 2) indicate that IS studies have rarely handled the social and the technical in an even-handed manner. In fact, a significant proportion (approximately 56%) of reviewed studies may be categorized as Type I, with the research focus predominantly on social considerations, where technology is, by and large, treated as an inert context that has minimal or no bearing on the understanding/explanation of the phenomenon of interest. The predominance of the Type I research suggests that the IS discipline (as reflected in the review) largely enacts the character of a *social* discipline rather than a sociotechnical one.

Interestingly, based on our review, we also identified a small proportion of studies (about 7%, categorized as Type VI) with predominant focus on the technical, where social considerations were, for the most part, missing. Recent editorials and research trends in the discipline suggest, however, that Type VI studies are likely to rise rapidly, and if that were to happen, most of the research would be at the technical and the social boundaries of the discipline. Even without considering the potential expansion of Type VI studies, about 63% (i.e., 56% + 7%) of IS research is already being conducted predominantly on the social or technical ends, leading us to infer that a majority of IS research is not being framed in a way where *both* the social and the technical feature in "a substantive and not incidental role" (Lee 2001, p. iii). We believe that this tendency of IS studies to cluster around mainly social and technical edges on the discipline, neglecting the fertile opportunities in between these two extremes, needs to be reflected upon.

Observation 2: Varying Relationships Between the Social and the Technical

On a related note, our review shows that both the social and the technical considerations have some presence in about 37% of the studies (Type II–Type V). However, only a few of these studies (about 13% from the studies reviewed) are found to be of Type IV, featuring an explicit interplay between the social and the technical, as characterized in the sociotechnical perspective (see Figure 1). Instead, we find that this relationship is often varied, in terms of direction of influence and also in terms of the nature of linkage between the social and the technical. For example, we see unidirectional influence (social→technical or technical→social), reciprocal influence, moderation, inscription of the social in the technical, entanglement, imbrication, and predominant influence (of the social or the technical). It appears to us that relationships espoused in the sociotechnical perspective such as fit, joint optimization, and harmony (as indicated in Figure 1), while interesting, are limiting and fail to do justice to the diverse ways in which the social and the technical come together to produce an outcome of interest.

Observation 3: The Predominant Focus on Instrumental Goals

Another point is that IS research has not maintained a simultaneous focus on instrumental and humanistic goals. In fact, about 87% of the studies reviewed focused solely on instrumental outcomes. This is inconsistent with the sociotechnical perspective that considers humanism as one of its fundamental values, and seeks to ensure attention to *both* instrumental and humanistic goals (Mumford 2000, 2006; Stahl 2007). Indeed, our review epitomizes a substantial problem: that businesses are often increasingly using IT (and associated techniques) without concern about their dehumanizing effects (Moore and Piwek 2017). This view is consistent with the observation that the rapid development of IT, while undoubtedly propelling humankind to new levels of advancement, is also resulting in a society focused on efficiency and control (Orlikowski and Scott 2015). Examples of outcomes emanating from such a position are reflected in phenomena such as those related to the "dark side" of IT, including

technostress (Srivastava et al. 2015), problematic use of social media (Turel and Qahri-Saremi 2016) as in cyberbullying (Lowry et al. 2016), and work–life conflict due to technological intrusion (Sarker et al. 2013). It seems that many IS researchers have forgotten or ignored the premise that technologies need to benefit humankind overall (Majchrzak et al. 2016), not just their economic condition. Such a perspective most likely reflects "a legacy of … discomfort with certain aspects of *humanness*" (Calvo and Peters 2014, p. 3, emphasis added).

The apathy toward humanistic goals could be attributed to the fact that "many scholars … sympathize with Friedman's … dictum that it is the … responsibility of business to [solely] increase its profits" (Stahl 2012a, p. 649). Importantly, this is not only the bane of IS but also of other disciplines, especially within business schools. Indeed, this solely instrumental position is increasingly being questioned in other business disciplines:

> It is time for management scholars to question if the so-called apocalypse of the efficiency and profitability model of the economy by which future management professionals are socialized, in addition to generating great wealth and technical advances for some, has also threatened well-being at individual, natural system and community levels (Akrivou and Bradbury-Huang 2015, p. 222).

We side with such scholars who have cautioned us not to neglect the humanistic paradigm in our "rush to be scientists" (Zald 1993, p. 514). As IS academics, we need only look to the numerous reports in the press on the alleged callous attitude of companies toward human needs and values with respect to the design and implementation of technologies (Noble 2018) to realize our responsibility.[3] This consideration underlies some of our recommendations later in the paper.

[3]"Silicon Valley Is Not Your Friend," Noam Cohen, *The New York Times*, Sunday Review, October 13, 2017 (https://www.nytimes.com/interactive/2017/10/13/opinion/sunday/Silicon-Valley-Is-Not-Your-Friend.html); "The Ivory Tower Can't Keep Ignoring Tech," Cathy O'Neil, *The New York Times*, Opinion Page, November 14, 2017 (https://www.nytimes.com/2017/11/14/opinion/academia-tech-algorithms.html?action=click&pgtype=Homepage&clickSource=story-heading&module=opinion-c-col-left-region&region=opinion-c-col-left-region&WT.nav=opinion-c-col-left-region&_r=0).

Making Sense of Our Observations: Possible Implications

As noted earlier, the character of the IS discipline is often espoused to be sociotechnical; yet, the review of the literature indicates that research in IS, at least the research appearing in the two leading journals since 2000, has failed to reflect some of the core aspects of the sociotechnical perspective as articulated by leading mainstream IS scholars. We highlight three potentially negative implications of this trend that we had briefly alluded to earlier, derived from Abbott's analysis of disciplines. First, by moving away from the sociotechnical perspective, the IS discipline *risks losing its distinctiveness*, leading to possible uncomfortable questions about its disciplinary legitimacy down the road. Second, the IS discipline *risks becoming increasingly fragmented* as it seeks to expand without a unifying, shared frame in the discipline. And, third, by losing sight of humanistic goals, the IS discipline *risks facilitating the creation of a dehumanized and dystopian society*.

Let us start with the first problem. Moving away from the sociotechnical axis of cohesion signals an erosion of the discipline's distinctiveness, which can undermine its long-term viability. Such dangers are amplified by the fact that most academic fields are increasingly engaging with information technologies to understand/analyze their phenomena. For example, disciplines ranging from health sciences to marketing are placing an increased emphasis on big data and analytics to better understand phenomena-of-interest in the respective disciplines and derive actionable advice for practice. In this context of rapid technological infusion within other disciplines, how does IS maintain its uniqueness*?* What prevents other disciplines from making a claim on the theoretical, methodological, and substantive arenas that have traditionally "belonged" to IS, thus making a case that IS cannot (or need not) be a discipline in its own right, but rather should be subsumed within these other disciplines? Our own experience suggests that this uncomfortable possibility does exist and is being played out at some universities.

The reader may recall that our review of the literature shows that research in the discipline has been increasingly focused on the social end in understanding/explaining IS phenomenon, holding what has been referred to as a "nominal" view of technology (Orlikowski and Iacono 2001). Not engaging deeply with the role of technology in understanding/explaining a phenomenon of interest carries an inherent risk for the discipline. This is because the lack of unique scholarship that can distinguish IS from other "social" disciplines, such as management/organization

studies, marketing (in business schools) and even economics, psychology, political science, human geography, linguistics, and sociology "opens [the] discipline's turf to invasion" (Abbott 2001, p. 146) from these other disciplines, especially those with local power. On the opposite end of the spectrum, a predominance of a stream of research almost exclusively focusing on technology (Type VI) also presents similar possibilities of invasion, but this time from the technically oriented disciplines, such as operations, systems engineering, or computer science. In other words, we need to prioritize the development of new knowledge about relevant phenomena paying attention to the interaction of the social and technical, rather than focus *solely* on knowledge creation at the social or technical edges of the discipline.

The second problem is that by ignoring the sociotechnical perspective (and consequently, ignoring what we see as being the essence of IS), we run the risk of undermining disciplinary unity with respect to creating a common body of knowledge, viewpoints, and assumptions within the field, especially as it expands its existing boundaries. This raises the possibility of fuzzy clustering of the IS discipline and increasing fragmentation (Burgess et al. 2016; Taylor et al. 2010), carrying the risk of having intra-disciplinary silos (Goes 2013), where subcommunities in a discipline are unable to share findings, interests, or vision of (and with) each other, even for topics related to AI and big data (Abbasi et al. 2016). This, for a relatively young discipline such as IS, can lead to too much fluidity where potential problems of cumulative knowledge generation and preservation of a multifaceted IS community and its tradition of scholarship are endangered (Grover et al 2016). As Hirschheim and Klein (2012) assert in their award-winning essay: "The fluid boundary of a field … introduces the possibility of being dispersed into other disciplines … particularly in business schools" (pp. 193-194).

The implications of the first and the second problems—of losing distinctiveness and not having the ability for unified expansion in the absence of an axis of cohesion—are magnified by the prevalent political issues in academic units across universities. The diminishing of the axis of cohesion and clear orientation of IS research, especially in contexts where the IS unit does not hold power and is dominated by another unit, puts IS academics in a vulnerable position (Schwartz 2014). In a fair, nonpolitical environment, there is nothing negative about being a subdiscipline under the different disciplines named above. However, the fear is that IS research contributions may be undermined with respect to incentives and recognition, allocation of resources, and tenure and promotion at business schools or even information/informatics units where IS scholars may be housed. In such situations, IS faculty may face challenges in establishing their scholarship and credentials within their larger academic units.[4] IS researchers would then most likely need to abandon the unique perspective that the IS discipline brings and instead redefine the future content of their research and teaching in line with the vision of other faculty within the larger academic unit. This may result in important areas of the disciplinary content being marginalized and bring to naught years of hard work by the early visionaries and leaders of the discipline.

The problems are not confined to those from external sources. Even from an internal perspective, ignoring the sociotechnical perspective as an axis of cohesion could (and actually does) lead to troubling situations when scholars submit their work to IS journals. From a journal's perspective, it becomes a challenge to determine what constitutes legitimate IS research, and how to differentiate it from, say, computer science, organization studies, marketing, or economics research. For example, consider big data analytics research currently being undertaken by IS scholars, a significant proportion of which does not appear to have an "IS signature" (Abbasi et al. 2016). Evaluating such a piece of work in IS journals could be problematic because the review team may find no IS component in the work; however, the problem is that there is no clear definition on *what constitutes the IS signature*. Notably, in a recent editorial, the current *MIS Quarterly* editor-in-chief has urged IS scholars to address this issue by highlighting (in new submissions) the "primacy of IS in … research," thereby ensuring that "the work is not a mirror image of work in another discipline but rather contributes to the accretion of IS knowledge" (Rai 2017a, p. vii). He advises that authors place "salience on the role of IS in the formulation of the problem and consequently in the contribution" (Rai 2017a, p. vi). Often, determining the "salience" of "the role of IS" becomes a matter of judgment of individual senior editors and/or associate editors, and such judgments tend to be seen as inconsistent (across editors) by authors. Indeed, many of us have experienced the dismay of our manuscripts being returned ("desk-rejected") by IS journals noting that our work is not IS research and that our work belongs in organizational studies, marketing, operations, or computer science. In any case, the predominant clustering of IS research on the boundaries of the discipline—evidenced by the dominance of Type I research revealed through our review, in addition to the projected rise of Type VI research—does raise important questions about the future directions of our research outlets and about formulation of future IS publication policies.

[4]We are actually aware of such situations. Of course, in such cases, a small proportion of scholars might be able to successfully retool and align with the dominant discipline; however, such a transition would not be possible or even desirable for the majority of IS scholars.

Let us now move to the third problem. Not heeding to the core ideas of the sociotechnical perspective has led to increased preoccupation with instrumental goals, virtually ignoring humanistic goals. We worry that a singular pursuit of instrumental goals may ultimately lead to the creation of businesses and societies such as those described in the dystopian masterpieces of the 20th century (Huxley 1932; Orwell 1950). This apprehension may seem extreme, but it is not unfounded. We are not the only scholars concerned that "we currently go about designing [and using] new technologies without any sense of how our … decisions will impact … [human] psychological health and flourishing" (Calvo and Peters 2014, p. 7). Ignoring the humanistic interests compromises our ability to create a better society and leads to embarrassment when answering questions such as

> "How has humanity changed as a result of developments in IS/IT?", particularly with regard to issues of social justice, empowerment, the role of women, various minorities, and the potential for new forms of participation and representation (Bryant et al. 2013, p. 8).

Looking Forward: Re-envisaging and Recommitting to the Sociotechnical Perspective

As technology and its relationship with societies and businesses become ever-more complex and nuanced, our discipline is understandably keen to move forward by engaging with new phenomena and new problems; a potentially effective approach is to propel forward by "reexamining what we have uncovered in the past, rethinking its implications, and leveraging it anew" (Burton-Jones 2014, p. 93). Reacting to recent concerns that the sociotechnical approach is perhaps an anachronism (Forman et al. 2014) and inspired by the work of Winter et al. (2014) who propose a more contemporary version of the sociotechnical theory, we too feel that the sociotechnical perspective, as it applies in framing phenomena-of-interest in our discipline, could benefit from a refresh. Of course, we could choose to look away from the sociotechnical perspective as a framing device-of-mind in the IS discipline (given the fact that recent IS research is found to be inconsistent with it). Alternately, we could advocate that every piece of IS research needs to strictly conform to the sociotechnical perspective as shown in Figure 1. However, we feel that both of these options are rather extreme and hence untenable. A more reasonable middle ground is to return to the sociotechnical perspective, and to explore how the perspective may be reinterpreted while retaining its essence, and harnessed as the discipline's axis of cohesion. On this note, it is useful to remember that the sociotechnical perspective is often seen as being potentially malleable (Kling and Courtright 2003) and configurational (Meyer et al. 1993) in how the social and the techncial are linked, thus allowing researchers to embrace it differently based on their particular phenomenon of investigation. Our recommendations leverage this flexibility implicitly afforded by the sociotechnical perspective.

Earlier in the paper, we acknowledged that we were broadly inspired by the critical perspective to research. This approach includes the steps of insight, critique, and transformation (Myers and Klein 2011). The insight was achieved by conducting the literature review, and the critique followed in terms of the observations and their implications. As the third step, transformation, we now offer three recommendations on how we might reinterpret the sociotechnical perspective so that it can serve as an effective axis of cohesion for IS (see RQ2). These recommendations follow from the three observations made earlier (i.e., the relative emphasis between the social and the technical, the nature of the relationship between the social and the technical, and the outcomes produced by the interaction of the social and the technical).

Recommendation 1: Recognizing IS Problems as Consisting of Social and Technical Aspects along a Continuum

Instead of mandating an equal or comparable emphasis on the social and the technical as a criterion for being considered as legitimate IS work, which may not often be meaningful in a real-world context or consistent with a given author's training or interest, we propose that authors be aware of the position of their work (individual articles, research programs, or entire body of their work) on a *social–technical continuum*, and reposition their work if deemed appropriate. Figure 3 depicts this continuum. On one end of this continuum are the predominantly sociocentric studies such as those with a nominal view of technology where it is no more than the context (Type I); on the other end are the predominantly technocentric studies where the social considerations are relegated to the background (Type VI). Other categories (Types II–V) fall in between, and this is where, we believe, a significant proportion of work in the IS discipline should be undertaken. Nevertheless, each research type/form discussed (Types I–VI) represents malleable "slices of complex sociotechnical fabric" (Williams and Pollock 2012, p. 19) and should be welcome as long as it does not become disproportionately dominant.

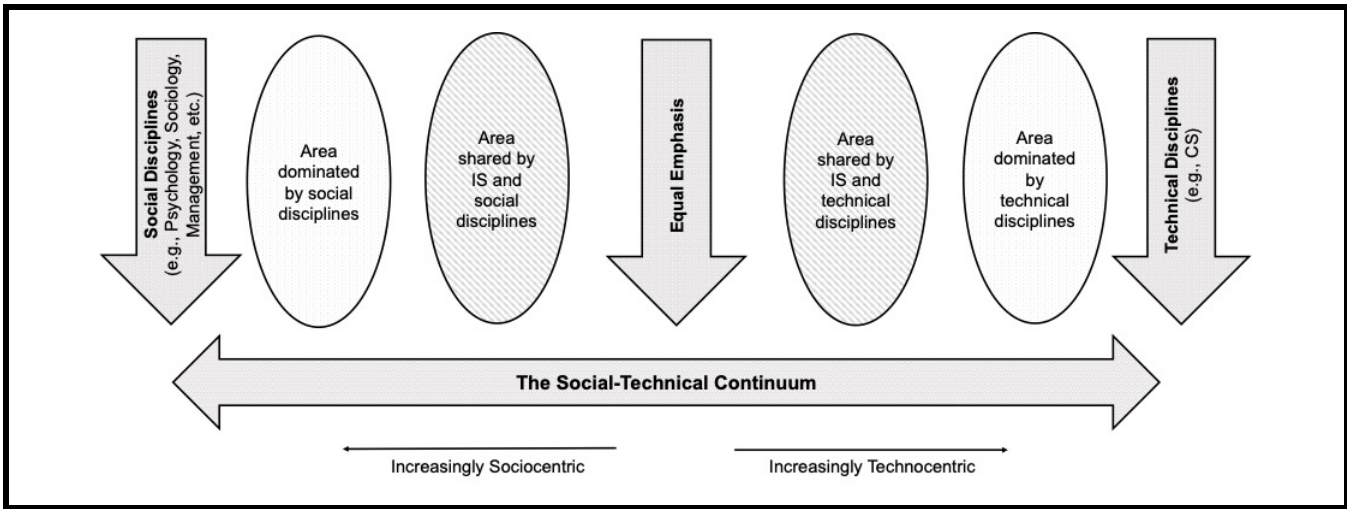

Figure 3. The Social–Technical Continuum

This approach would open up the discipline by legitimizing different areas and types of research (I–VI) in a clearer and more coherent way. Such an approach supports investigating phenomena from multiple theoretical and methodological perspectives, while not discarding considerations related to unity or distinctiveness, given the implicit social–technical framing in the continuum. Locating studies in the predominantly technical type toward the end of the spectrum would allow "scientists and technical specialists, their instruments and methods of investigation, as well as their objects of research" to engage with the discipline while being invited to consider the social dimensions (Ribes and Polk 2014, p. 288), thereby increasing the breadth of stakeholders and thus growth of the discipline. A similar logic would be applicable for predominantly social studies of IT, and this can be a way to allow scholars at the boundaries to see the opportunities of studying the interactions between the social and the technical and appreciate the uniqueness these interactions bring to IS research and practice.

However, this approach of placing work anywhere on the social–technical continuum has important caveats. First, the social–technical continuum would quite appropriately exclude studies that focus solely on the social or solely on the technical. Second, loosening the original sociotechnical constraints of "comparable/even-handed emphasis," the social–technical continuum offers freedom to scholars to pursue diverse problems/perspectives/ methodologies, and to embrace a broader intellectual and stakeholder base. However, stakeholders, particularly journal editors, department heads, opinion leaders of the IS community, and individual researchers, all have a role to play in ensuring that we avoid focusing exclusively on the types of IS research at the two extremes of the continuum. After all, if most papers in IS journals were to fall around the extreme ends of the continuum (Types I and VI), then we may as well be producing research in those neighboring disciplines and being their members rather than pursuing the distinctive knowledge that an IS perspective can offer. This a position that we need to avoid (Rai 2017a).

We recommend that the IS community strive to ensure a *healthy distribution* of papers of Types I through VI in the leading IS journals. To make the distribution more transparent, researchers engaging in literature reviews could help in identifying gaps with respect to types (Type I through Type VI) and in problematizing research for a given topic using these categories. This could serve as a feedback loop to correct growing imbalances with respect to certain types of research on a topic. Similarly, editors can signal the journal's openness to a range of positions on the social–technical continuum, rather than continue to publish the same "type" of work. This could be done in many ways. One way could be to commission certain special issues focusing on questions, theories, and methodologies pertaining to specific types of IS research to maintain a reasonable variety of studies on a given topic or across all topics. Further, mainstream disciplinary journals (e.g., AIS Basket of Eight) could include editorials to make disciplinary scholars aware of the different contributions to knowledge resulting from the various types (Types I–VI), and signal to authors that the different types are valued and welcome. For this purpose, a diverse set of scholars would need to be on the editorial boards. This is because the different types of research (I–VI) will require very different

yardsticks and scholarly priorities for evaluation. For example, Type I research would be evaluated on the development/application of compelling psychosocial or economic theories or approaches, Type IV would be evaluated on the nuanced insights arising from an understanding of *interplay* between the social and the technical that have been surfaced, and Type VI research could be evaluated on how sophisticated and useful the technical artifact (that has been designed/ proposed) is. Type I and Type VI assessments would largely be guided by standards of the relevant social or technical reference disciplines respectively, while Type IV research would be assessed not so much on the fidelity/ sophistication of the social or the technical components individually, but on the unique insights that arise from examining the interactions. A mismatch of editorial and reviewer expectations with the type of research often leads to unfair criticisms and rejection, and this must be avoided. For example, when a Type IV study is evaluated by a Type I and a Type VI specialist, it is altogether conceivable that the two evaluators may focus on and critique less important aspects of the study and fail to see the real contribution the Type IV manuscript seeks to offer.

Recommendation 2: Accepting Variations of Social–Technical Relationships

This recommendation follows from the previous one. The nature of the relationship between the social and technical was originally described as fit, harmony, or joint optimization. As our review reveals, such relationships are not the only form of possible relationships between the social and the technical. There are other kinds of relationships between the social and the technical, such as contextual relationships (e.g., Type I), inscribed relationships, or imbricated relationships (Type IV), to name a few.

Consider, for example, the notion of ubiquitous systems where the technology often recedes to the background (Yoo 2010) or the emerging idea of evolvable systems where technology is embedded and is continuously structured/ restructured (Agarwal and Tiwana 2015). In both of these examples, conceiving of an explicit relationship of mutual influence between the social and the technical can be quite challenging, and potentially unrealistic. Therefore, our recommendation is to look anew into the requirement for social and technical interactions such that we open up multiple possibilities of engaging the social with the technical. This would include, but not be limited to, the various types of relationships our review revealed, so as to accommodate diverse ways to think about and examine phenomena of interest. As an example of a type of relationship not revealed through the review, one could investigate disharmonious/discordant relationships between the social and the technical, suggested by the complex adaptive systems (CAS) perspective (McKelvey et al. 2015; Nan and Lu 2014). According to CAS, creative tension/disharmony between the social and the technical can lead to favorable outcomes in certain contexts (Chae 2014; Colbert 2004), and there is no reason to exclude this possibility. Also, pervasive technology could bring the possibility of role-reversal of humans and IT artifacts (Demetis and Lee 2018) and the wide-spread reliance on technology could bring "techno prosthetics"[5] to the forefront of research. The value of accepting variations in the social–technical relationships is manifold. Indeed, different kinds of relationships may effectively capture the relevant dynamics between the social and the technical, depending on the unit of analysis, the time horizon of the analysis, and the level of maturity and pervasiveness of the technology.

By flexibly linking the social and the technical as recommended here, we may also be able to meaningfully import problems from the reference disciplines and to frame them as IS questions. This effort holds particular relevance for both junior and senior IS scholars (including Ph.D. students), who can creatively engage with interesting combinations to study different facets of a given phenomenon and to frame it uniquely for the IS community. This will lead to linkages with different reference disciplines and consequently help expand the stakeholder base of the IS discipline, but IS scholars would have something distinct to say about the phenomenon in many cases. For example, studying and preventing epidemics falls within the scope of health sciences, but we can convert it to an IS problem, and thereafter to IS research projects that might lead to different knowledge creation (and outcomes) based on the position on the social–technical continuum and the type of relationship conceptualized.

Two further implications arise from accepting variations of social–technical relationships. One, accepting variations in social–technical relationships may force us to contemplate what methodological approach can be appropriate for a particular kind of social–technical relationship. For example, studying unidirectional causality (social→technical or technical→social) could be accomplished using an experimental approach. However, the same experimental approach may not be appropriate for studying mutual causality between the social and the technical, and alternate methodological approaches particularly suited to study mutual causality are needed.

[5]This idea is inspired by the work of Kosslyn (2011) who has argued that people are becoming more and more "plug compatible" with other human and ICT devices to extend themselves.

Second, flexibly linking the social and the technical can stimulate us to deeper engage with a particularly important construct of our discipline: information (Petter et al. 2018), a central, yet often forgotten artifact of our community (Galliers 2003; Lee et al. 2015). Information, at least from an IS perspective, always arises at the confluence of the social and the technical (Ess 2009) and imparts dialog, meaning, and utility to sociotechnical interactions (Seddon and Srinivasan 2014). As a flexible concept, information has been understood in many different ways (Boell 2017). For instance, information can be conceptualized as a medium through which the social and the technical interact, as the outcome of the interaction that leads to instrumental and/or humanistic outcomes, as the mediator between the social and technical components, and the outcome, or sometimes even as the agent shaping the social and the technical (Henfridsson and Bygstad 2013). Therefore, viewing the social and the technical as related in flexible arrangements allows us to develop varying conceptions of information—a worthwhile future endeavor, given the value of information to the current IS research and practice, especially in this age of big data and analytics (Agarwal and Dhar 2014; Chen et al. 2012; the 2016 special issue in *MIS Quarterly*; Nunamaker et al. 2015). For example, building upon arguments in physics, one could characterize information as the level of negative entropy (negentropy) (Brillouin 1951, 1953; Holt 2012) generated by different kinds of social–technical interactions. Such conceptual engagement with information will also help align IS scholars in business and information schools, thus building a more unified and robust IS community.

Recommendation 3: Connecting Humanistic and Instrumental Outcomes in a Synergistic Manner

Our third recommendation is to link humanistic and instrumental outcomes in a synergistic manner. There are many examples that showcase the predominance of the instrumental goals in research, primarily due to the tangible appeal and defensibility of instrumental outcomes.

Given that much of IS research occurs in business schools, where instrumental outcomes are understandably valued, scholars are often led to believe that creating instrumental knowledge and knowledge for legitimizing managerial action (Astley and Zammuto 1992), and uncritically supporting what profit-maximizing firms seek to achieve with IS, is their primary responsibility. Humanistic concerns arising from the curtailing of human freedom and development, and from racism, sexism, and commodification of the human body are overlooked for the apparent benefits that systems, including widely used search engines and medical databases, promise to deliver (Noble 2018; Wachter-Boettcher 2017). Indeed, there is a rising need for a thorough ethical interrogation of algorithms (O'Neil 2016) that underlie systems mediating many critical human activities, so as not to marginalize certain stakeholders, especially those "who are already in the margin" (Noble 2018, p. 171).

We feel that a key reason for the exclusion of humanistic considerations, in addition to the profit-seeking orientation of businesses understandably embraced in business school research, is the existing *disconnect* between humanistic and instrumental outcomes in the literature. Scholars and practitioners often tend to think of the two as mutually exclusive, or even at odds with each other (Chatterjee and Sarker 2013), and thereby focus on the instrumental due to its immediate and tangible appeal to powerful stakeholders. Even within the sociotechnical perspective, where both outcomes are valued, the relationship between instrumental and humanistic outcomes has often remained unspecified (e.g., Stahl 2007). For example, the sociotechnical perspective does not inform us as to whether we should consider humanistic outcomes as primary facilitators of instrumental success or embed them as a secondary goal that guides IS-related endeavors (Stahl 2007).

In light of this existing ambiguity in the relationship between instrumental and humanistic outcomes—leading ultimately to the relegation of humanistic outcomes to a secondary consideration—we urge researchers to imagine a *recursive linkage* between instrumental and humanistic outcomes, thus placing the two outcomes on a comparable footing. In fact, we suggest that researchers go further than the original sociotechnical recommendation by IS scholars of considering both instrumental and humanistic outcomes, and instead recognize that these outcomes can form a virtuous cycle wherein both are synergistically connected. Pursuing humanistic outcomes breeds positive actions, which, in turn, can lead to feedback to create even more positive instrumental outcomes, thereby amplifying the positive synergy in the organization or collective (Grover et al. 2009). Our assertion has parallels with the ideas of scholars who emphasize that "ethics [i.e., an explicit acknowledgment of humanistic values/ideals] is good business …. [and] business activities, like other human activities, cannot exist unless people follow a minimum moral principle" (Culnan and Williams 2009, p. 682). In other words, there is a need to connect humanistic and instrumental outcomes, so that we look for and enable positive synergy that emerges out of this connection.

This positive synergy between instrumental and humanistic outcomes could be harnessed by following the work of

scholars such as the Nobel Laureate Amartya Sen, who developed the "capabilities" approach where a collective promotes individual human capabilities, which, when synergistically managed, enhance the capabilities and opportunities available to the overall collective (Sen 1999). Arguably, this leads to social welfare and a promotion of humanistic outcomes, while also energizing instrumental progress, since capabilities lead to material benefits over time.

In short, we envision a mutually recursive and virtuous relationship between instrumental and humanistic outcomes, wherein each moment of this recursive process may be temporally separated but both benefits can be expected over time. In this way, humanism and instrumentalism work hand-in-hand to elevate both types of outcomes, rather than being (considered) unrelated or in opposition. We are encouraged to note some positive signs that humanistic considerations are increasingly being embraced by the IS discipline. This is evidenced in the recent calls/publications and special issues related to information and communication technologies (ICTs) overcoming societal challenges (Majchrzak et al. 2016), enabling ICTs for development (Sahay et al. 2017), building "bright" societies with ICTs (Lee 2016; Oh et al. 2018), and responsible research and innovation (Stahl 2012b; Stahl et al. 2014). Clearly, however, much work remains to be done and we hope that some of the ideas in our discussion can help IS scholars as they pursue these directions.

There are obvious implications, as well as disciplinary benefits, to pursuing this recommendation of connecting humanistic and instrumental outcomes synergistically. For example, such a pursuit could facilitate the expansion of IS into other disciplines where either instrumental or humanistic outcomes have been traditionally overlooked. Further, this dual focus on humanistic and instrumental goals is likely to lead to distinctiveness of IS with respect to other related disciplines and strengthen a shared purpose within the discipline. A key area of future research that emerges is the need to develop *mechanisms* to magnify such mutually reinforcing effects in this synergistic cycle or investigate situations when such effects are attenuated. This could be especially important in understanding and harnessing emerging, and potentially disruptive, technologies in various contexts. Considering recommendation 2 in light of recommendation 3, one can also ask what kinds of relationships between the social and the technical might lead to greater synergy between humanistic and instrumental outcomes. Are there considerations that we can draw upon to better align these two outcomes?

We summarize our three recommendations and their implications for both IS scholars and IS departments/journals in Table 1.

Concluding Thoughts

Reflecting on the IS discipline, we find two competing narratives: one optimistic and the other pessimistic (Davis et al. 2005; George 2017). The optimistic narrative portrays the IS discipline as being a central player within the interdisciplinary arena of business research and practice, due to the ubiquity of IT and its relevance to virtually every facet of business and society. Indeed, due to emerging areas such as digital innovation, analytics, big data, and artificial intelligence, some prominent IS scholars have proclaimed the arrival of a "golden age for IS research" (Agarwal and Dhar 2014, p. 444). Further, the optimistic narrative emphasizes an interdisciplinary, applied mode of research that is directed toward pushing the disciplinary boundaries outward, exhorting the IS community to "embrace the challenges and claim our territory" (Goes 2014a, p. viii). The pessimistic narrative, on the other hand, expresses concern about the discipline having too much overlap with other disciplines, insufficient intellectual cohesion (Burgess et al. 2016), reference discipline envy and opposition (e.g., Schwartz 2014), and fears of being subsumed in, or becoming subservient to, more powerful disciplines (Hirschheim and Klein 2012).

Our position is that there is some truth to both narratives, and our paper seeks to strike a balance between the two, such that we do not lose sight of one while being engrossed in the other. As we rightly celebrate the current success, vitality, and increasing influence of the IS discipline in practice and in reference disciplines, and offer paths for disciplinary expansion, we caution colleagues against becoming complacent and ignoring concerns about disciplinary erosion, invasion, and fragmentation, perhaps by dismissing such discussions as part of an "anxiety discourse" (Lyytinen and King 2004).

The conception of the sociotechnical perspective offered in this paper, consisting of three simple ideas of the social–technical continuum, the diverse nature of relationships between the social and the technical, and the intertwining of the instrumental and humanistic outcomes, along with observations regarding the progress of disciplines by Abbott, provides avenues to balance the tensions between the competing narratives above. The sociotechnical perspective as an axis of cohesion allows the IS discipline to engage with other disciplines across boundaries, yet maintain a distinctive and cohesive character, thereby strengthening the discipline for the future. An added advantage of the axis of cohesion is that it allows IS researchers from any tradition to map their work on the framework and identify areas their research can expand into in the future, by varying the position on the continuum, the nature of the relationship, or the way outcomes are conceptualized. Also, an aggregate view of such a map can help

Table 1. Recommendations and Implications

Recommendations	Value/Implications for IS scholars	Implications for Journals/Departments
Framing IS problems as consisting of both social and technical aspects and locating them on a social-technical continuum	• Highlight the inclusive nature of the discipline, by legitimizing a wide range of research as being IS research • Look for the existence of the social or technical dimension in each phenomenon, even if those dimensions are not readily apparent • Pursue research and knowledge contributions not only at the social or technical boundaries of the IS discipline but also on other types along the social–technical continuum • Engage in literature reviews to help identify gaps with respect to "types" and problematize research for a given topic using these "types"	• Journals now have a more inclusive and well-defined yardstick to determine what is or is not IS research • Journals should commission special issues to promote rarer "types" of research and interrelationships between the social and the technical • Journals should appoint diverse editorial board members with expertise and belief in the different "types" of research • Journals should formulate and use different evaluation criteria for different "types" of research • Journal editorials should promote inclusivity and cross-fertilization of different research "types" • Departments need to be aware of the variety of scholarship possible within the sociotechnical perspective and staff departments accordingly; some departments may choose to specialize on selected types, but we urge departments to consider building a well-rounded faculty representing the different variations • Departments should adjust their IS programs and curriculum to acknowledge the existence of the various IS research "types" and the knowledge created from them
Accepting Variations of Social–Technical Relationships	• Attend to unique ways of connecting the social and the technical • Focus on the nature and role of information • Import novel problems from reference disciplines (e.g. economics, sociology, and CS) and frame them in a uniquely IS way • Consider and develop different methodological approaches, each uniquely applicable to a specific kind of social–technical relationship • Develop alternate conceptions of information, appropriate to each type of social–technical interaction.	
Connecting Humanistic and Instrumental Outcomes in a Synergistic Manner	• Raise awareness of the importance of humanistic outcomes • Engage in research on promoting humanistic *and* instrumental outcomes, and in identifying conditions when synergy between the two can be achieved	• Departments should consider prioritizing research programs that are concerned with humanistic as well as instrumental goals • Journals should commission special issues with an explicit agenda of the linking of humanistic and instrumental goals/outcomes

Note: "Types" in the table refer to those discussed referred to earlier in the paper.

reveal if certain types of research are dominating the field's view of a given phenomenon, and this can trigger the adjustment of research production and editorial priorities.

We must emphasize that while we would like members of the IS community to be aware of the sociotechnical nature of the discipline, our work is meant to serve as a rudder and not as a barrier or constraint to researchers' freedom in formulating work in the discipline. For example, we do not expect each and every study in our journals to consider both instrumental and humanistic outcomes. Indeed, the renewed sociotechnical characteristics (or ideals) discussed in this paper may be pursued at a manuscript level or at a program level by researchers, and/or at a department level by department heads, and, perhaps most importantly, at a disciplinary level by journal editors, based on an aggregate of all papers published in a given period (say, in a year). The awareness will prompt self-correction if certain key sociotechnical elements are overemphasized or marginalized.

Apart from clarifying the kinds of research our discipline might undertake, our goal was also to prompt reflection in the community on what it means to be an IS scholar. We do not believe that it is an exaggeration to claim that many young scholars in the discipline are confused about the nature of IS and tend to anchor their identity on a set of journals in which they publish, the departments in which they are homed, and their association with certain skills, diverse phenomena they study, and so on. Many indicate predominant allegiance to reference disciplines rather than to IS. Such confusion cannot

be good for the discipline in the long-run, and we hope our paper provides some impetus to addressing this problem.

Finally, while we hope our IS colleagues will find value in this work, we also invite those who disagree with our views to challenge the arguments and their implications, and to suggest improvements as applicable. Furthermore, they could propose alternate axes of cohesion, based on perspectives such as infological systems (Langefors 1980), inquiring systems (Churchman 1971), or even general systems theory (Demetis and Lee 2016; Matook and Brown 2017), which seems to be gaining traction, and offer them to the community for similar assessment and critique. In the end, we all stand to gain by adopting a cohesive disciplinary foundation that allows us the freedom to pursue scholarship on meaningful problems within and beyond the traditional disciplinary boundaries while ensuring that we remain intellectually tight-knit members of an enduring discipline that offers unique knowledge.

Acknowledgments

The authors are grateful to the anonymous reviewers, the associate editor, and especially the senior editor for believing in our work and for the constructive comments throughout the review process. The authors also acknowledge the thoughtful inputs, inspiration, and, in some cases, much needed encouragement, of scholars including Ritu Agarwal, Cynthia Beath, Roger Chiang, Walter Fernandez, Dirk Hovorka, James Howison, Steven Johnson, Karlheinz Kautz, T. P. Liang, Allen Lee, Sandeep Purao, H. R. Rao, Matti Rossi, Saonee Sarker, Daniel Schlagwein, Jason Thatcher, Daniel Veit, Ron Weber, and Leon Zhao. However, the authors alone are responsible for the opinions expressed or for errors, if any.

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About the Authors

Suprateek Sarker is Rolls-Royce Commonwealth Commerce Professor at the McIntire School of Commerce, University of Virginia. His research, which is largely qualitative in nature, has been published in many leading journals. He serves or has served on a number of editorial boards, including *Information Systems Research* (senior editor), *MIS Quarterly* (former senior editor), *Journal of MIS* (on the board of editors), *Decision Sciences Journal* (former senior editor), and the *Journal of the AIS* (the outgoing Editor-in-Chief). In 2016, he was awarded an honorary doctorate by the University of Jyväskylä (Finland), and in 2017, he was named a Fellow of the Association for Information Systems.

Sutirtha ("Suti") Chatterjee is an associate professor at the University of Nevada, Las Vegas. Suti's broad research interests are ethical issues in IS, IT-enabled innovation, mobile work, and e-commerce. His research has been published in prestigious journals such as *Journal of MIS, Journal of the AIS, Decision Sciences Journal, European Journal of Information Systems,* and *Decision Support Systems*. Suti has received multiple awards/honors during his career, the most recent being the *JAIS* Best Reviewer Award (2018). He was also ranked amongst the top 100 IS researchers (2013–2015), based on publications in the AIS basket of top six journals. Suti is currently an associate editor for *Information Systems Journal* and a senior editor for *Journal of the AIS*. He is also currently serving as an associate editor the special issue on gamification for the *European Journal of Information Systems*.

Xiao Xiao is an associate professor at Copenhagen Business School, Department of Digitalization. She received her Ph.D. in information systems from Washington State University. Her main research areas include IT servitization (with the specific instance of cloud computing), ICT in emerging economies with a specific focus on digital commerce in China, qualitative research methodologies, and sports digitalization. Her research has appeared in premier IS journals such as *MIS Quarterly, Journal of the AIS, Journal of Information Technology, Information and Management*, and *MIS Quarterly Executive*, as well as in conference proceedings such as the International Conference on Information Systems.

Amany Elbanna is a reader (associate professor) at Royal Holloway University of London. Her research applies social science theories and approaches. Her current research examines digital platforms and crowdsourcing in addition to technology adoption and project management. Her research has been published in journals including *European Journal of Information Systems*, *Journal of Information Technology, Journal of Strategic Information Systems, IEEE Software, Information systems Frontier,* and *Data Base,* among others. Amany earned her Ph.D. in Information Systems from The London School of Economics and Political Science.

MIS Quarterly

RESEARCH COMMENTARY

THE SOCIOTECHNICAL AXIS OF COHESION FOR THE IS DISCIPLINE: ITS HISTORICAL LEGACY AND ITS CONTINUED RELEVANCE

Suprateek Sarker
McIntire School of Commerce, University of Virginia,
Charlottesville, VA 22903 U.S.A. {sarkers@virginia.edu}

Sutirtha Chatterjee
Lee School of Business, University of Nevada, Las Vegas,
Las Vegas, NV 89154 U.S.A. {Sutirtha.Chatterjee@unlv.edu}

Xiao Xiao
Department of Digitalization, Copenhagen Business School,
Copenhagen DENMARK {xx.digi@cbs.dk}

Amany Elbanna
Royal Holloway University of London,
Egham, Surrey TW20 0EX UNITED KINGDOM {Amany.Elbanna@rhul.ac.uk}

Appendix A

Literature Review

We conduct a systematic review and coding of all the empirical research published in the two premier journals of our discipline, namely *MIS Quarterly* (MISQ) and *Information Systems Research* (ISR), from 2000 to 2016. We follow a comparable coding procedure to the ones employed by similar published studies (e.g., Grover and Lyytinen 2015), which consists of journal selection, sampling of articles, development of coding schemes, coding, and validation.

Journal Selection

The two journals sampled are MISQ and ISR. Both are consistently the top tier journals in the IS field over the years and are representative of the status of the IS field. Based on expert rankings and bibliometric measures including impact factor, h-index, and social network metrics, Lowry et al. (2013) confirmed that MISQ and ISR continue to occupy the position of the two highest ranked journals in the IS discipline.

Sampling of Articles

Articles published between January 2000 and December 2016 from these two journals are selected and coded. The qualifying criteria for the articles to be included in the sample were that the article (1) employs an empirical component and (2) that the empirical component is examining an IS-related phenomenon.

This excludes empirical papers that examine IS scholars' views on promotion, journal quality, etc. Also, theoretical articles including statistical measuring debates, methodological views, editorials, and literature reviews were omitted from the sample. Further, two more articles were dismissed during the coding process due to their unique nature (see the more detailed explanation below). Therefore, in total, 228 articles are excluded from our review. This left us with 991 articles that were included in the analysis. These consist of 484 articles published in MISQ and 507 articles published in ISR.

Coding Scheme

All articles were coded based on the four attributes regarding (1) the nature of the social component, (2) the nature of the technical component, (3) the nature of the outcome that the social and/or technical components were directed toward, and (4) the relationship between the social and the technical components or components (see Table A1). As shown in Table A1, we predefined the values that could be assigned to three out of the four attributes (1, 2, and 3), and performed the coding deductively for these three aspects (Bandara et al. 2015). As for the attribute regarding the relationship between the social and the technical components, we performed inductive coding (Bandara et al. 2015). In other words, no predefined categories were used in the coding process, but, rather, we developed the categories based on the emergent patterns discerned in the articles based on an initial sample of 50 papers and refined through another sample of 100 papers. As explained in the following section, our efforts eventually led to the development of six categories characterizing how the relationships between the social and the technical components tend to be represented in our discipline.

Coding Procedure and Validity

To verify the reliability of the code, *qualitative inter-rater assessment* was conducted during all the coding stages. The coding and verification was conducted in the following four stages.

In *the first stage*, two of the authors conducted coding of a random sample of 50 articles (25 articles published in each journal). Then, the two authors met to discuss the issues and problems encountered during the initial coding process, which resulted in the refinement of certain aspects of the coding scheme (mostly related to the predefined values). The authors also reflected on the emerged patterns regarding the relationship (between the social and the technical) aspect, and agreed upon precise phrases that they would pay attention to when coding this attribute, such as the direction of the relationship and the nature of the relationship (one-directional, bi-directional, etc.).

In *the second stage,* two of the authors coded an additional 50 papers from each journal and compared notes for the emerging categories, especially regarding the attributes of the relationship between the social and the technical components of the focal study. This coding resulted in eight categories for one author, and six categories for the other author, with a total of nine distinct categories. Discussion between the two authors based on the papers reviewed led to the amalgamation of three of these nine categories, since these three categories represented variations/subtypes of other categories rather than separate categories. At this stage, a six-category coding scheme for relationship between the social and the technical components was agreed upon.

In *the third stage*, all articles were coded. No additional categories for the relationship attribute were discovered. Both coders randomly selected a sample of 50 articles from the other coder's work to check attributes and codes assigned. No new codes emerged at this stage.

In *the fourth stage*, the entire team checked the coding based on a sample of articles. Also two papers of a relatively unique nature were discussed. These papers were coded by the first two coders as non-IS papers and the team was consulted regarding these particular papers. The team decided that these two articles were not addressing, directly or indirectly, any technical component (one article focusing on movie broadcast and piracy, while the other focusing on general decision making of agents), and hence dismissed these two articles from the final analysis. In the end, the team agreed on the six categories that represent the distinct patterns of existing IS literature in terms of how published articles enacted the relationship between the social and the technical components. See Table A2 for a description for each of the six categories.

Table A1. Coding Scheme

Attributes	Explanation	Possible Values
Social component	The nature of the social component, if any, being investigated in the study	Nation/Society, Industry, Network, Government, Organization/Company, Community, Project Group/Team, Individual, Process, Multiple
Technical component	The nature of the technical component, if any, being investigated in the study	Web/Internet, Infrastructure, System, Platform, Hardware, Software, Data Sources, Multiple
Objectives	The nature of the outcome of the study	Instrumental, Humanistic, Both
Relationship	How the relationship between the social component and the technical component was captured in the study	No predefined values

Table A2. Summary of the Six Categories with Examples

Type	Name/Label	Description	Examples
I	Predominantly Social	Either the investigation only focuses on the social component, and does not directly address technical component OR the investigation mostly focuses on the social component, and the technical component is addressed in an indirect or contextual way	**Banker et al. (2011), MISQ**: Exploration of how firms' strategic positioning influences their CIO reporting structure, and how alignment of strategic positioning with reporting structure leads to improved firm performance **Gopal and Koka (2012), MISQ**: Investigation of the effects of formal contracts and relational governance on vendor profitability and quality in the CONTEXT of software outsourcing industry
II	Social Imperative on the Technical	Technology as a predominant outcome of social structures or processes	**Beaudry and Pinsonneault (2010), MISQ**: Exploration how human emotions influence the use of IT **Venkatesh et al. (2011), ISR**: Investigation of how network positions of health care professionals influence electronic healthcare system use and hence quality of care and patient satisfaction
III	Social and technical as additive antecedents to outcomes	Both social component and technical component are antecedents to certain outcomes; however there is generally no evidence of any interaction between the components themselves while producing these outcomes.	**Tanriverdi et al. (2007), ISR**: Investigation of how business process modularity and underlying IT infrastructure together influence the choice of sourcing mechanism **Wixom and Watson (2001), MISQ**: Examination of how a range of social factors (e.g., management support, resources, user participation) and technological factors (e.g., development technology and team skills) influence implementation success of data warehousing and hence system success.
IV	Social and technical as interactive to produce outcomes	Social and technical are both considered as critical to produce outcomes, but the focus is on the interplay between the two components (such as fit/alignment, reciprocal interactions, or entanglement/imbrication) that produce those outcomes	**Goh et al. (2011), ISR**: Investigation of how work routines and HIT (Healthcare IT) co-evolve and interact with each other in a HIT implementation **Strong and Volkoff (2010), MISQ:** Identification of different domains of organization-enterprise system misfit, and discussion of the problems experienced by users because of the misfit
V	Technical imperative on the social	Technology as the major antecedent to social outcomes, such as those in impact or evaluation studies	**Aron et al. (2011), ISR**: Investigation of how automation of core error prevention functions in hospitals influences medical error rates **Deng and Poole (2010), MISQ**: Exploration of how web interfaces (order and visual complexity) impact online behavior (approach tendency towards the website)
VI	Predominantly Technical	Focusing solely on how to develop or improve the technical (e.g., database algorithm) and very limited and direct concern about the role of the social.	**Arazy and Woo (2007), MISQ**: Study of the usefulness of statistical natural language processing techniques, and specifically of collocation indexing **Li and Sarkar (2011), ISR**: Development of a data-masking method for protecting private information against record linkage disclosure

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