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Contribution in Information Systems: Insights from the Disciplinary Matrix

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Abstract

The concept of a "contribution" to Information Systems (IS) research is of significant concern for authors, reviewers and editors. We argue that the criteria of novelty and utility are insufficient to evaluate the contribution of a research paper. We expand upon Kuhn's *disciplinary matrix* of shared commitments to symbolic generalization, exemplars and model/theory as the background to which every contribution is oriented. Cogency or persuasiveness of research is the resultof logic, dialectic, rhetoric, and social-institutional argumentation in relation to the disciplinary matrix.We use three examples of published research to illustrate how these elements can be combined to frame research as a contribution relative to the wider IS field. We then discuss the implications for IS when contribution is understood in relation to a disciplinary matrix.

Keywords: contribution, argumentation, disciplinary matrix, novelty, utility

1 Introduction

Evaluating what constitutes a *contribution* in Information Systems (IS) is an issue that continues to vex authors, reviewers and editors. While many submissions identify excellent questions, provide analysis of reasonable data and deliver a literature review which articulates the research background, the Editor-in-Chief of a top journal noted: "the most common comment that one sees on reviews is that the authors need to enhance their 'contribution' "(Straub 2009a p. iii).

In IS and Management Studies the most commonly identified criteria of contribution are *novelty* and *utility* (Corley and Gioia 2011). Novelty and utility are framed as properties of an individual research paper. Specific approaches to achieving novelty are described in terms of clarifying constructs, states, and boundaries (Weber 2012) and as rhetorical practices which construct and problematize contributions (Locke and Golden-Biddle 1997). Utility is framed as improving scientific rigor or as direct application of theory to practice (Corley and Gioia 2011). But neither novelty nor utility is self-evident nor can they be properties of a paper itself. Each can only be evaluated relative to an existing background of accepted knowledge. Scientific contributions, therefore, do not exist as isolated papers but rather are evaluated against a background of accepted knowledge such that research activity increases what is known, what is valued as knowledge, how we come to know, or what researchers aspire to know. In this paper, we argue contribution stems from involvement in the discursive and material activity of a research community.

To this end Thomas Kuhn's concept of the *disciplinary matrix (DM)* (Kuhn 1977) offers possible guidance for understanding *the background in which* researchers become involved and through which contribution can be evaluated. Kuhn conceptualized the DM as the shared but often undeclared commitments of a community of researchers around a specific domain of inquiry. Commitments include shared research orientations and methods, common instrumentation and evaluations, and a shared understanding of relevant problems and exemplary solutions in their domain. Thus, in a broad sense, a DM is the set of commitments shared by a community (Kuhn 1977) which guide how research is performed, critiqued, challenged, or supported. The DM provides a *coherent worldview* within which the questions asked, the methods used, and the research evaluations, fit together and make sense. Research is thus evaluated and adjudicated for contribution through a shared understanding by members of the community. This is central to Kuhn's analysis – that research is performed from beginning to end by involvement within a community sharing a disciplinary matrix. In a more specific sense, Kuhn (1977) identifies specific articulations, concrete examples and analogies that are accepted as unproblematic by the community as the grounds upon which to determine research progress.

Considering contribution as relational casts new light on the concepts of novelty and utility which become secondary features of the relation rather than primary criteria of adjudication. The more important consideration, we suggest, is how authors position their research, through argumentation, in relation to the existing disciplinary matrix. This perspective highlights the range of possible contribution (including but not limited to theory), and focuses evaluation of the argumentation on how the community's progresses from this research. Thus we re-present contribution in IS asresearch resulting in progress in a community's disciplinary matrix. In problematizing contribution itself we ask: *Can the concept of the DM provide guidance to better understand contributions in IS?*

To address our research question we revisit current framing of contribution in the literature. We then explicate the *disciplinary matrix* (DM) as the shared commitments of a community including symbolic generalizations, exemplars, and models. We utilize the concept of the DM as a sensitizing mechanism for an exploratory investigation of select AIS Best Papers recipients considered to offer contribution by the IS Senior Scholars. Our research offers a nuanced approach for understanding how contributions are articulated and evaluated by establishing the authors' participation in the material and discursive background comprising the DM of a community.

2 Contribution in Research

Evaluation of claims to research contribution is of increasing concern as a focus on theory and theory building as the highest form of research effort dominates journals and conferences (Avison and Malaurent 2014; Straub 2009b). A selective review of the management and IS literature indicates that there is agreement that "papers succeed if they offer important [read *useful*] and *original* ideas [read *novel*] (Kilduff 2007 p. 252; original emphasis). As shown in Table 1, the idea that a contribution "rests largely on the ability to provide *original insight* into a phenomenon by advancing knowledge in a way

that is deemed to have *utility* or usefulness for some purpose" (Corley 2011 p. 15) is echoed repeatedly across the literature.

But novelty and usefulness do not speak for themselves and it is incumbent on researchers "to convince their colleagues that their work has value. … [thus] the arguments researchers use to expound their theories' novelty must be crafted carefully; otherwise, their theories' *contribution to knowledge* might be overlooked" (Corley and Gioia 2011 p. 14; emphasis added).

Type of Contribution	Exemplar Statement	References
Novelty	"judgments about a theory's novelty or originality and judgments about its contributions to knowledge [are] closely related"(Weber 2012 p. 14)" contributions "improve our understanding of management and organizations, whether by offering a critical redirection of existing views or by offering an entirely new point of view on phenomena" (Conlon 2002Conlon 2002p. 489)	Colon 2002; Corley and Gioia 2011; Locke and Golden-Biddle 1997; Weber 2012; Gregor 2007; Straub 2009b
Utility	"*practical utility* is seen as arising when theory can be directly applied to the problems practicing managers and other organizational practitioners face" (Corley et al. 2011 p.18) "*scientific utility* is perceived as an advance that improves conceptual rigor or the specificity of an idea and/or enhances its potential to be operationalized and tested" (Corley et al. 2011 p. 17-18)	Corley and Gioia 2011; Smith 1997; Whetten 1990; Van de Ven 1989

Table 1.Characterizations of Contribution.

The broad consensus is that contributions must be in form of theory (Straub, 2009b) a view upon which we now turn a critical eye.

3 Drawing Lessons from the Disciplinary Matrix (DM)

Kuhn (1962) introduced the term *paradigm* to underscore the dependence of scientific research upon concrete examples that "bridge what would otherwise be gaps in the specifications of the content and application of scientific theories" (Kuhn 1965 p. 16). However, his use of the term 'paradigm' has been criticised as ill-defined as the term can be interpreted in an overly-broad manner from a set of distinct positions related to sociology, to metaphysics, and to instruments (Masterman 1970), to a reification of the subject/object dualism (BurrellBurrell and Morgan 1979) that led to confusion regarding alternative positions that continues to this day. Such multiple and conflicting interpretations of the concept of paradigm do not serve well for unpacking the conception of contribution.

Kuhn acknowledged that he "lost control of the word [paradigm]" and began to articulate the *disciplinary matrix* (DM) to describe the commitments of a community which "enabled them to solve puzzles and that accounted for their relative unanimity in problem-choice and in the evaluation of problem-solutions" (1970 p. 271). The intellectual function of these shared commitments is to determine "the patterns of theory, the meaningful questions, the legitimate interpretations, etc. within which theoretical speculation is bounded" (Toulmin 1970 p. 40).

Kuhn suggests:

> "disciplinary matrix: 'disciplinary' because it refers to the common possession of the practitioners of a particular discipline; 'matrix' because it is composed of ordered elements of various sorts, each requiring further specification" (Kuhn 1977 p. 182).

Since its inception, IS has engaged in debates regarding discipline legitimacy including paradigmatic status (Banville and Landry 1989), agreement on core theories (Larsen et.al 2008; Sidorova et al. 2008), or agreement on the centrality of the IT artefact (King et al. 2006). These debates often assume that modelling one's own research on the philosophy/methodology of other (more successful) sciences is required to become a discipline. Kuhn specifically rejects this interpretation asking if "economists argue less about whether their field is a science… Is that because economists know what science is? Or is it *economics* rather about which they agree?" (Kuhn 1962 p. 160). In Kuhn's view, communities become scientific when they are involved in shared research commitments, not because they adopt or impose a pre-existing "scientific" set of criteria. The community is recognised as the group of researchers sharing a set of commitments, not as a political/institutional discipline established within universities.

While Kuhn's concept of the DM is grounded in the natural sciences, it offers a starting point to investigate the shared commitments of researchers which coordinate and evaluate contributions in the social sciences. In Table 2 we describe and provide illustrations Kuhn's concept of shared commitments include exemplars, symbolic generalizations, and models (Kuhn 1977). We do not advocate that these shared commitments are considered discrete objects by researchers themselves. Rather we use them as analytic categories for unpacking the concept of a DM. These particulars are the foundation for a communities' research activity - they encapsulate the background into which new researchers are enrolled and become the accepted ways to framing problems, the vocabulary used to articulate research and the methods and instruments through which research is performed.

Symbolic Generalizations are the expressions of a community that permit representation of explicit formalizable components of the DM (Kuhn 1977). While some scholars equate symbolic generalizations to theory we narrow the meaning to connote the unquestioned means by which a community represents its own activity. Thus few in physics would disagree that "f=ma" is an acceptable schematic form to represent a generalization which can be logically manipulated and interpreted. While physicists might disagree on the exact law-like relationships for harmonic oscillators or for pendulums, few would disagree with what is an appropriate form of symbolic expression of those phenomenon (Kuhn 1977). In IS, examples would include conceptual frameworks (e.g. a boxes-arrows diagram), regression models, hypothesis, (or propositions) and statistical correlation tables which are widely regarded as accepted means for representing a research problem. Importantly, this does not mean that there will be no disagreement about, for example, a particular conceptual framework, however, in considerable parts of the IS community the use of a conceptual framework as a means to express and conduct research is not questioned.

Exemplars are a key particular in Kuhn's conception of how involvement in indisciplinary practice is learned, maintained and stabilized. A distinction can be made between macro-exemplars and micro-exemplars (Nickles 2012). Macro-exemplars are large theory complexes or the expansive texts such as Newton's *Opticks* and Darwin's *Origin of the Species*. IS examples include Walsham's (1995) Interpretivism in IS and Design Science Research (Hevner et al. 2004) which each contain the key theoretical approaches and techniques and which explicate applications of those approaches in solving important problems. Micro-exemplars are narrower in scope and illustrate a specific problem solution, reveal manifestations of analogies and metaphors, research heuristics, methods of problem solving, or literal illustrations. The most well-known example in IS is the Technology Acceptance Model (Davis 1989) which is frequently used in PhD classes and extended upon in ongoing research.

Symbolic Generalization	"Symbolic generalizations, in particular, are those expressions, deployed without question by the group, … They are the formal, or the readily formalizable, components of the disciplinary matrix. Others are ordinarily expressed in words: "action equals reaction," (Kuhn 1977 p.301) Examples: "all humans who use an information system are members of the class of things called 'information system users'."(Weber 2012 p. 3) Expression of regression in the form: $Y = \beta_o + \beta_{jXi} + \beta_{2X2} + \ldots + \beta_{nXn}$
Exemplar	Exemplars are "concrete problems with their solutions" (p. 303) "Acquiring an arsenal of exemplars … is integral to the process by which a student gains access to the cognitive achievements of his disciplinary group. Without exemplars he would never learn much of what the group knows about such fundamental concepts … the science student, confronted with a problem, seeks to see it as like one or more of the exemplary problems he has encountered before." (Kuhn 1977 p. 303) *Macro exemplars* (theory complexes): Darwin *Origin of the Species* Newton's *Principia* and *Optick*s, Walsham's interpretive research in IS (Walsham 1995) Design Science Research (Hevner et al. 2004) *Micro exemplars* (specific problem solutions): Galileo's pendulum motion "modelled with minimal recourse to symbolic generalizations" Technology Acceptance Model (Davis 1989)

Models	Models "… provide the group with preferred analogies or, when deeply held, with an ontology. At one extreme they are heuristic: … a gas behaves like a collection of microscopic billiard balls in random motion. At the other, they are the objects of metaphysical commitment: the heat of a body is the kinetic energy of its constituent particles," (Kuhn 1977 p.301). For some IS researchers a model is "abstracted, simplified, concise *representation* of something else (phenomena) in the world. Models help us to comprehend the world by representing only those major features of the world that are important for our purposes." (Weber 2012 p. 5). From this perspective, people are a class of things with specific attributes (e.g. perceived Ease of Use; Computer efficacy) that can be measured with psychometric instruments. *Examples:* Rogers diffusion of innovations; Task technology fit; Gartner's Hype Cycle

Table 2. Particulars of Disciplinary Matrix.

Models are generalized beliefs or patterns (e.g. the analogy that electricity can be viewed as a "fluid" flowing through conductors.) Models become the foundation for future problem solving by analogy (*this* phenomenon is like *that* problem solution) and when deeply held, may become ontologies for the community. An example of a deeply help model in IS is presented by Weber (2012) as "All concrete things in the world possess properties … a human (a concrete thing) may possess a property that he uses an information system, … we perceive a property … [as] an attribute … a particular user of an information system has two attributes that relate to the information system: "perceived ease of use" and "perceived usefulness")". This model represents relationships between humans and information systems and also specifies the ontological commitments of a community of researchers. Theories are then more specific and precise attachments of symbolic generalizations to specific phenomenon of the world. Kuhn does not specify what a *theory is* but it is clear that development of theory is not the preeminent goal of the community but rather a foundation upon which problems are solved -- "scientists must premise current theory as the rules of the game. His objective is to solve a puzzle … at which others have failed and *current theory* is required to define the puzzle …" (Kuhn 1970). When a DM is strongly held in a problem solving community, theory development is often incremental and surprisingly is not intended to produce major conceptual or phenomenal novelties in part because all but the fine detail detail of the result in known in advance (Nickles 2012). Theory is a critical part of the enterprise but continuous creation of new theory is neither necessary nor valuable.

4 Argumentation for Contribution

Kuhn's disciplinary matrix indicates that argumentation for contribution cannot be understood at the level of an individual paper. A paper in isolation cannot make a contribution, as a contribution requires involvementin an existing research discourse. "*Involvement in*" requires relating a paper 'outwards' to the DM in which the research is located. This view of contribution requires attention to the arguments researchers advance to establish a relation between their work and what is known (Hovorka and Boell 2015). The plausibility and persuasiveness of claims rely on the force of argumentation establishing a relation within the disciplinary matrix. For example, Davis (1971) asserts that "all interesting theories constitute *an attack* on the taken-for-granted world or the audience" (p. 311 – emphasis added). But the relation of *challenge* is only one form of argumentation. Other relations arguments may advance include *extension* (of existing theoretical models), *contrast* (with existing metaphysics or research perspectives), *measurement* (with new techniques or instruments), *reproduction* (as a replication of prior studies) and, in extreme cases, seeking to *refute* aspects of a DM.

Argumentation is necessary to convince editors, reviewers and colleagues that of a paper's involvement in the DM discourse and is thereby contributing. To this end, Locke and Golden-Biddle (1997) identify two rhetorical strategies that legitimize research through constructing inter-textual coherence (disagreement, cumulative progress, latent consensus) and problematizing the existing literature (identify gaps, oversights, or alternative accounts) to expose opportunities for contribution to knowledge. In identifying that *rhetoric* is important in constructing a perception of novelty, Locke and Golden-Biddle (1997) explicate one element of argumentation. However, argumentation also involves logical, dialectic, and socio-institutional dimensions (Rehg 2009; Toulmin 1958). The insight that argumentation is essential to involvement with a research discourse requires us to engage more thoroughly with argumentation theory (Rehg 2009; Toulmin 1958).

Rehg's (2009) concept of cogency views research as a social process. Accordingly, the logic of argumentation alone is not the source of cogency as persuasion requires reference to existing understanding that provide a valid ground for argumentation to a particular audience. Building on Toulmin (1958), Habermas (1973), and Kuhn (1962), Rehg (2009) suggests that four dimensions of cogent arguments can be distinguished in scientific discourse: logic, dialectic, rhetoric, and social-institutional. *Logic* is concerned with how arguments as products are built. The *dialectic* dimension involves inter-subjective accepted agreements on how arguments can be assessed and made. *Rhetoric* is concerned with the effective presentation of arguments in a social-psychological sense. The *social-institutional* dimension is related to social and institutional procedures and rules acting as presuppositions for academic argumentation.

Individual papers seek to contribute to aspects of the DM of the community into which the authors place the paper. A paper may contribute towards a DM in different ways, such as by providing an exemplar, a model, new observations or even instruments. Importantly, contribution does not involve adding new elements to a DM but contributions can be made by challenging existing elements of a DM. A paper may thus question the way in which a relationship was previously understood and thus strengthen the DM by postulating a better model for describing a phenomenon of interest. Thus, a contribution emerges when a paper successfully presents a logic, dialectic, rhetoric, or socio-institutional argument toward an element of the DM.

5 Challenging the Disciplinary Matrix

In the following section, we examine a selection of papers to investigate whether the disciplinary matrix exposes the author'(s) involvement with the DM in a way that alters a community's worldview. Some of the empirical material is from the set of AIS Best Papers (2015) selected by the senior scholars in recognition of "the breadth of high quality work that is being published in the Information Systems discipline". In each case "The award will reflect the paper's contribution to theory in the IS field, its contribution to practice in the IS field, the uniqueness/originality of its ideas, and the quality of its arguments." We note that this may prioritize theory as the primary yardstick for assessing contribution. Subsequently one additional paperwidely recognized as contributing to IS was selected to illustrate an atheoretical contribution. We extract vignettes from select research papers for comparison and analysis.

Vignette 1 – Beyond the organizational 'container': Conceptualizing 21st century sociotechnical work (Winter et al. 2014)

"Information systems (IS) research typically focuses on the application of computers in organizational contexts. This organization-centric view can be traced back to the field's birth, and in many ways, marks its unique identity. [...] A fundamental tenet of STS [sociotechnical systems] is that technologies themselves are not deterministic, but rather their impacts arise from complex interactions. [...] Many studies of IS build on this approach, either implicitly or explicitly, assuming that organizations act as "containers", encapsulating both the work that is done and the infrastructure used to do it rather than explicitly considering where and how information and work system boundaries could or should be drawn. [...] There is an increasing awareness that many important work practices, routines, and digital artifacts occur outside of organizational containers; increasingly work is not cleanly encapsulated within a single organization's boundaries. For example: [cross organization platforms, Free and Open Source Software, infrastructure and standards] [...] The technology reaches beyond traditional local sociotechnical ensembles, across large numbers of organizations, and shapes industries, institutions, and society. [...] IS scholarship that is rooted in the STS tradition will be limited in its ability to address the organization of work outside of traditional organizational containers. [... we] extend the STS approach to account for cross-organizational infrastructures and extra-organizational work arrangements. In doing this we update an important conceptual foundation for the IS field, providing a basis for studying and organizing work and information technologies outside of organizational boundaries. [...] [We] show how the proposed Neo-STS approach provides a conceptual basis for IS scholars to engage and address emerging work trends and interesting technology enabled phenomena and issues." (p. 251-252).

In this paper Winter et al (2014) participate in the discourse of organizational phenomena of IS by raising two challenges to the community. First, by extending influence of technology beyond "traditional local sociotechnical ensembles" to include a wider domain of organization, institutions and society the research exposes a broader reach for technological interactions. Second the researcher challenges the taken-for-granted concept of work itself to include activities which occur outside the

organizational container. This second challenge provides a new conceptual model for what constitutes work itself. The authors further engage with an outward discourse with the broader IS field as the paper argues for IS extending reach of technology interaction into infrastructures and extra-organizational work.

Vignette 2 – How posture-profile misalignment in IT innovation diminishes returns: Conceptual development and empirical demonstration (Fichmann and Melville 2014)

"We provide new evidence for a contingent link between IT and performance, in which the returns to IT innovation depend on the degree to which a firm has aligned the aggressiveness of its innovation posture with the level of its innovation resources. Our results have implications for future work on innovation complements, which are presumed to magnify returns regardless of whether a firm has matched its level of innovation to the level of complements. Our results suggest a more complex formulation whereby those complements that are part of the innovation resource profile may be less influential in misaligned firms. For managers, our results suggest a substantial performance penalty for jumping on an innovation bandwagon for reasons divorced from the innovation resources of the firm. Rather, managers should engage in a process of mindfully aligning the firm's innovation posture and innovation resource profile." (p. 234)

Fichmann and Melville (2014) argue that IT is linked to organizational performance. They argue that to date the relationship between IT innovation and performance outcome is not sufficiently understood. Through their study the authors show that investment in IT innovation and the organizations posture of being an innovator need to match in order to have a positive organizational outcome. Hence what matters is not investment into IT as such but an alignment between the allocation of resources and the organizations innovation posture.

Vignette 3– Design Science in Information Systems Research (Hevner et al. 2004)

"Our objective is to describe the performance of design-science research in Information Systems via a concise conceptual framework and clear guidelines for understanding, executing, and evaluating the research. [...] [the paper provides] knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artifact." (p. 75) [...] "Technology and behavior are [...] inseparable in IS research. Philosophically these arguments draw from the pragmatists [...] who argue that truth (justified theory) and utility (artifacts that are effective) are two sides of the same coin and that scientific research should be evaluated in light of its practical implications" (p. 77). [...] "The effective presentation of design science research in major IS journals, such as MIS Quarterly, will be an important step toward integrating the design-science and behavioural science communities in IS." (p. 100)

The publication of Hevner, March, Park and Ram (2004) legitimized design activities by providing a set of guidelines upon which community members could agree regarding types of problems, methods, values and evaluative criteria. The epistemic approach was grounded in a pragmatic worldview (model) in which truth is inseparable from utility. Participation and thus contribution were specifically oriented toward building artefacts as the means of creating knowledge and providing exemplars. Thus, creating artefacts is both the instrument of research and the contribution of research. In addition, the authors challenge a long-standing separation in academic IS and claim to integrate the two contrasting 'paradigms' in IS. The expanding discourse, DSR special issues, and conferences, workshops, and tracks dedicated to DSR suggest that a DSR community with its own unique DM has been established.

6 Discussion

This selective analysis presented reveals how the disciplinary matrix can be a useful guide in determining contribution. Employing Kuhn's conception of different elements of a DM reveals how, and to what, different papers contribute (Table 3). We observe that there is agreement on symbolic generalization in so far as every paper relies on some form of symbolic generalization to articulate its contribution. However, within our set of examples there is no one form agreed upon within the "IS community" that is "readily employed" by everybody. Instead we observe a range of symbolic expressions through the research problems is articulated. Expressions of research problems in IS includes mathematical forms such as linear regression, logical forms such as hypothesis formulation, but also ordinary language expressions in the form of premises or the formulation of principles. This indicates that Kuhn's concept of symbolic generalizations as "those expressions, deployed without question by the group" (Kuhn 1977, p. 301) does not hold up as a general means for identifying single DM within a unified IS field. Instead, the evidence of multiple accepted forms of symbolic

generalization indicate the presence of distinct and coherent communities in which IS scholars participate and contribute.

	Symbolic Generalizations	**Exemplar**	**Model**
Fichmann and Melville, 2014	Hypothesis formulation Regression model	Identification of misalignment as related to value	Causal mechanisms (of misalignment)
Winter et al, 2014	Formulation of Premises	Future of work	Socio-technical systems
Hevner et al. 2004	Set of guiding principles	Knowledge via: Relevance-Build-Evaluate cycle	Pragmatism

Table 3.Characterizations of Contribution.

Models are also prevalent in contributing papers, hence supporting Kuhn' claim that models form an integrative part of a disciplinary matrix. But the variety and type of models which are accepted as contributory suggests a lack of consensus across the larger IS field. Although this is a small sample, it supports prior studies which criticise IS as a field for not converging on one or a few central models to agree on an intellectual core around which IS research efforts gather Banville and Landrey 1989; Lytinen and King 2004). Instead the proliferation of models, epistemological and ontological commitments and theories places the concept of the DM in new light. In addition, the disparity of focus when looking through Kuhn's concept of exemplars is particularly striking in IS. Each of the papers makes a claim for contributing to a particular research phenomenon in the IS literature. While we have illustrated in Table 2 that exemplars play an important role for understanding the concept of DM in IS, it seems the concept of exemplar plays a different role in evaluating contribution in different communities.

These few examplessuggest that different communities in IS are involved to a greater or lesser extent with discourse outside the institutional boundary of "native IS". Our analysis of different aspects of a DM suggests an understanding of the IS field as composed of multiple, distinct, but overlapping communities. Kuhn describes the DM as the shared commitments *of a community* and weargue that contribution can only be understood in relation to a specific DM. This important observation challenges the taken for granted narrative that there can/should be a monolithic "information systems discipline" if only we could agree on our paradigm.

There is increasing acknowledgement across the IS literature that it is possible and valuable to have different approaches to research into phenomena which implicate information systems, people and organizations. The idea that multiple communities exist within IS is further substantiated, firstly, by the existence of multiple intellectual communities within the umbrella term "IS" (Larsen et al. 2008) and secondly by the range of special issues, specialty conferences and special interest groups (SIGs) which exist. The use of the DM concept reveals the burden of contribution as discursive and material arguments which directly influence the DM of a particular community. Authors will benefit by clearly articulating the argument advanced in relation to the specific community from which fundamental commitment arise. Only then can authors argue for impact on the wider IS community who may not share the same symbolic expressions, exemplars, or models. This understanding of contribution revealsfour important insights for the social sciences such as IS.

First, our perspective invites a re-examination of social sciences as scientific practices. To paraphrase Read et al. (2012): to think adequately about *social science*, it helps very much to think adequately about *natural science*– and vice versa. Kuhn's (1962) historical analysis of natural sciences has been broadly interpreted as suggesting two modes in science which lead to progress: (a) normal science as "the generally cumulative process by which the [DM] of a scientific community is fleshed out, articulated and extended (*ibid* p. 250) and (b) "changes in which the conceptual commitments fundamental to the practice of science [...] must be jettisoned and replaced" (*ibid* p. 250). In contrast, for IS and the social sciences generally, contributions do not result in the latter type of "conceptual change which [...] is fundamental to its [science] advance" (Kuhn 1970 p.250). IS as a scientific practice is not subject to the refutation and overthrow of extant theories approaches which characterise Kuhn's account of revolutions in the natural sciences. Unlike the *correspondence* (to nature) approach of the natural sciences, IS largely pursues a *coherence* approach which enables sub-disciplines to flourish, collide and create constant tensions. This lack of revolutions and the inability to

find a unified paradigm for all of IS has been used to argue that IS is not a discipline or a science (c.f.King et al. 2006). As IS research does not progress through scientific crises and revolution in the face of the accumulation of anomalies, how then does it progress?

Second, acknowledging the foundational importance of the DM as the basis for conceptual changes in research highlights opportunities for other types of contributions that refine and increase the cogency of a community's discourse. If IS is considered a single community, the shared commitments of the larger IS community may counter and constrain contribution in sub-communities. For example the epitome of contribution across IS is claimed to be theory development and testing. The phrase "theory is King" (Straub 2009b) has been reinforced by claims that development of new theories is critical to the future of the field. But as argued by Avison and Malaurent (2014) and Hambrick (2007), business disciplines, including IS, risk fetishizing theory at the expense of contributions which progress a specific communities DM. Here the taken-for-granted role performed by reviewers, editors and journals can be seen as enacting *magisterial authority* (Toulmin 1970), a socio-institutional argumentation that constrains change. Thus integrating new symbolic generalizations, exemplars, or models into specific communities is a slow process of attrition as reviewers reject valuable papers that do not fit their DM conceptions of "scientific research". A study of the social and political aspects of reviewing practices would reveal opportunities for opening up publication outlets to other forms of contribution. In addition, we see the opportunity to challenge the format of conferences and publications in IS. For example, the argumentation element of dialectic invokes the claim that cogent arguments should stand up in open debate. Yet as a discipline, few contributions are debated or the focus of a discussant. Rather they are commented upon and shaped by editors and reviewers in a process that is invisible and inaccessible to the wider IS community.

Third, argumentation and philosophical inquiry play a crucial role as communities borrow from or infiltrate other communities of scientific practices both within the IS field and from other disciplines. When symbolic generalization, exemplars or models from one DM are imported into another DM *compounding* must occur. This is not simply aggregation or translation from one DM to another, but indicates fundamental changes and the emergence of altered models, generalizations, values or problem domains. Ontological and epistemological assumptions must be questioned, evaluative criteria critiqued and the particulars of the phenomenon itself brought under scrutiny. This suggests that IS may progress not via refutation of theory but rather by translating an existing model into another metaphysics or model.

Lastly, new communities may coalesce as epistemology, models, and exemplars are compounded and institutionally legitimized. An example of a nascent DM is the Design Science Research community (Vignette 3). Design activities, design outcomes/products, and design models have long existed in IS in various guises, were widely dispersed across communities (Kuechler et al. 2008) and were difficult to publish. A paper (Hevner et al. 2004) commissioned by a top journal consolidated prior knowledge into what has become a seminal exemplar around which specific symbolic generalizations, exemplars, academic practice, and the institutional force of journal special issues, conferences and expertise has evolved. Notably DSR has not overthrown or subsumed other communities nor does it represent a revolution in research thought. Rather it coexists with other communities and is becoming a legitimate approach to creating knowledge within the broader domain of socio-technical research.

7 Conclusions

Framing contributions in terms of novelty or utility is insufficient without acknowledging *to what* the paper contributes andprovide limited guidance to researchers in formulating argumentation of contribution to editors and reviewers. Viewing contribution as *involvement in* an ongoing discourse will enable authors to articulate their argument more clearly and will provide guidance to reviewers and editors to assess contribution. For a paper to be assessed as a contribution, the reader (reviewer, editor) must be persuaded that the paper improves the research discourse of the community. Thus, specific attention to the relation between elements of argumentation in a paper and the community disciplinary matrix can focus and strengthen IS research practice and presentation. We highlight that contributions can only be made *in relation to* the commitments held by specific communities. We put forward Kuhn's more developed concept of a DM to avoid the ambiguity and misappropriation of the word paradigm. DMs are the "prerequisite of research, their grip on the mind is not merely 'Pickwickian' nor can it be right to say 'if we try, we can break out of our [disciplinary matrix] at any time'" (Kuhn 1970 p. 242). The DM is thus not a set of tools researchers use but rather the background understanding of a practice in which the researcher enrols and is *involved in* through writing a dissertation, reviewing research by others, writing and referencing, and attending conferences. Thus, the DM forms the research worldview through which the world is disclosed and investigated; it makes

apparent the kinds of problems that are relevant and valued, and it highlights applicable references, appropriate methods and instruments of observation and measurement. The focus on argumentation and on the DM shifts our understanding of "a contribution" to the researcher's involvement in challenging, extending, contrasting, measuring, reproducing or refuting shared commitments of the community.

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