# RE-INTERPRETING THE KUHNIAN PARADIGM IN INFORMATION SYSTEMS

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ABSTRACT

*The goal of this paper is to raise the level of discourse surrounding paradigms by drawing out a number of observations on how paradigms are interpreted in the IS field, and to reclaim the transformative potential of the Kuhnian paradigm concept in encouraging novel, interesting and relevant research and theorizing. After positioning the contribution of the Kuhnian paradigm and its significance in the philosophy of science, we describe the negative impacts of a research community's preoccupation with the epistemological sense of paradigm, which ignited within the organizational sciences decades of unnecessary "paradigm wars" and a misplaced focus on methodology. We show how this epistemological rendering of paradigm, which is adopted by the IS field, differs from the opinions of well-known critics of Kuhn and how this view obscures the Kuhnian paradigm's potential for innovative research. To provide valuable insights into these issues, we introduce Masterman's interpretation of Kuhn's model, which Kuhn himself endorses, and unpack the paradigm concept into its metaphysical, sociological and artefactual components. Using Masterman's interpretation to highlight the primary meaning of Kuhn's paradigm concept as model problem-solution and exemplar, we describe how this multifaceted transformative view of paradigm benefits the IS field.*

**Keywords***: Information Systems (IS) theory, IS philosophy, creativity, IS research methods, Kuhn, paradigm, positivism, interpretivism.*

## Introduction

The goal of this Research Perspective article is to raise the level of discourse surrounding the concept of paradigm in the information systems (IS) field, and reclaim the transformative potential of the Kuhnian paradigm towards engendering more novel, interesting, and relevant research and theorizing. In the organization sciences, Alvesson and Sandberg (2013b) place the blame for the lack of innovative and influential research in the management discipline on the

dominance of “incremental gap-spotting research” (p. 128). Other organization science scholars point to excessive borrowing (Oswick, et al., 2011), and exclusionary polemical tendencies that favor specific types of positivist and functionalist research (Grey, 2010). Similar concerns, voicing the need to develop research that are more forward-looking, influential and socially relevant, have also occupied the attention of IS scholars (Agarwal & Lucas Jr., 2005; Applegate, 1999; Benbasat & Zmud, 1999; Grover, 2013; Grover & Lyytinen, 2015; Grover, et al., 2008; Hirschheim & Klein, 2003; Klein & Hirschheim, 2008). These inter-linked issues are all related to how research is undertaken and, in the most inclusive sense, concerns how certain approaches towards research dominate over others “to the detriment of intellectual innovation” (Grey, 2010, p. 128). In order to overcome these problems in the organization sciences, Alvesson and Sandberg (2014, p. 967-969) propose moving away from “boxed-in” research towards “box-breaking” and “box-transcending” research.

We argue that one of the forces holding back “box-breaking” research in IS can be traced to an over-arching, “boxed-in” view of paradigms in IS as epistemological choices which take both the organizational sciences and IS fields away from the Kuhnian paradigm’s transformative potential. This over-arching epistemological view of the paradigm concept, which tends to be exclusionary, overemphasizes the paradigm’s metaphysical component, primarily its epistemological implications, over the paradigm’s sociological and conceptual components. Based on our analysis of paradigms, we recommend that the IS community abandon this practice of classifying, designing and evaluating research based primarily on its epistemology, and to adopt a more transformative interpretation of the paradigm that incorporates all of its metaphysical, sociological and conceptual components.

The study proceeds in the following manner. First, we position Kuhn’s works and the significance of the paradigm concept within the history of the development of knowledge. We then trace the

development of the paradigm concept and how it was appropriated by the sociological and organizational sciences in a primarily epistemological sense triggering unnecessary paradigm wars and holding back progress. We explain that this epistemological sense of the Kuhnian paradigm is only one part of a larger multifaceted picture of the paradigm. To reinstate the other components of the Kuhnian paradigm, we use Masterman's analysis of Kuhn's use of the term paradigm and subsequently highlight the paradigm's transformative potential. In the second half of the paper, we call for a return to this transformative view of the paradigm and explain the benefits of guiding research using its metaphysical, sociological and conceptual senses rather than on its epistemological rendering. We conclude by arguing that the multifaceted Kuhnian paradigm is more capable of uncovering hidden assumptions, more inclusive of alternative views, and consequently engenders pluralism, innovation and creativity, contrary to the received view of the Kuhnian paradigm in IS. Notwithstanding all of these purported advantages, we emphasize that our Research Perspective is one of many possible directions by which IS research could be viewed and consequently enhanced, and we do not claim that it is either the primary nor the only way forward for the IS field.

## Kuhn's Legacy and *The Structure of Scientific Revolutions*

We begin by emphasizing the critical role of the philosophy of science in enhancing research. The scope of the philosophy of science addresses not only the goals of research but also whether such research qualifies as being scientific, for it deals with what science is, how it works and the justifications through which we build our knowledge. Questions about what phenomena a discipline is actually studying; what theoretical foundations inform the discipline about its object of study; what relations these theoretical principles have with each other and theories in other domains; and what methods and values can be used to guide the research, are all

philosophical questions that often become the object of heated debates amongst the members of any research community.

One of the most influential philosophical treatises that addresses these concerns is Kuhn's *The Structure of Scientific Revolutions* (henceforth called *Structure*). Gutting (1980) wrote that *Structure* has had "a wider academic influence than any other single book of the last twenty years" (p. v). Twenty years later it was still the best-known academic book of the second half of the 20th century, translated into 20 languages and sold over a million copies (Fuller, 2000). On its 50th anniversary edition in 2012, it became one of the most cited books ever with over 80,000 citations and was reported by *Scientific American* as "one of the most influential 20th-century works of philosophy and history of science" (Stix, 2012). The concept of the "paradigm shift" that it popularized is the staple of boardroom discussions among top executives and the source of continuing debates among academics. Why does *Structure* bring about such a significant impact on the minds of scientists and academic discourse, and what implications does it have for the IS field?

In light of the struggle in the IS field to find its identity, legitimacy, and relevance, *Structure* and the paradigm concept have critical roles to play. As the editor to the *Atlantic* once commented (Fallows, 1993, cited in Fuller 2000):

> Its basic point is that people typically go for years and years believing one thing … despite mounting evidence to the contrary. Then all of a sudden, they notice the conflicting evidence, change their minds and wonder why they ever believed otherwise.

Such is the case with the IS field. There may be certain beliefs and practices in the IS field that have become endemic and require major paradigm shifts in the minds and practices of its

research. Such a shift is not likely to happen if the field misunderstands what paradigm shifts entail. If paradigm shifts in research implies shifting from say positivism to some other non-positivist epistemology, then a paradigm shift is accomplished by merely introducing alternative research methods. As this study argues, paradigm shifts that result in extraordinary progress imply much more than epistemological viewpoints. The received view of the paradigm concept in IS needs to be revisited, and the paradigms' other more potent components reintroduced, in order for a transformative understanding to be realized.

At this stage, we should say what Kuhn himself said about the nature of a paradigm, although as we shall see, his view was both multi-faceted and also developmental. For Kuhn, paradigms are strongly related to what he called "normal science" (as opposed to "revolutionary science"). The normal, everyday work of scientists within a particular field goes on within a given and taken-for-granted background of assumptions about the field based on historical practice:

> By choosing ['paradigms'] I mean to suggest that some accepted examples of actual scientific practice – examples which include law, theory, application, and instrumentation together – provide models from which spring particular coherent traditions of scientific research (Kuhn, 1962, p. 10)

This very early (within *Structure*) description of a paradigm is developed in many ways later on – Masterman (1970) found 22 – but Kuhn himself, in the *Postscript* to *Structure,* seven years later, claimed there were two primary ones:

> … in much of the book, the term 'paradigm' is used in two different senses. On the one hand, it stands for the entire constellation of beliefs, values, techniques, and so on shared by the members of a given community. On the other, it denotes one sort of element in that constellation, the concrete puzzle-solutions

> which, employed as models or examples, can replace explicit rules as a basis for the solution of the remaining puzzles of normal science. (Kuhn, 1970b, p. 175)

We can see already that these ideas are much more related to practical examples and practices than to metaphysical questions of epistemology or ontology.

## The Misappropriation of Kuhn's Paradigm

When *Structure* was first published, it caused an uproar within the scientific community, who alleged that his theories tarnished the nobility of the sciences. In response to his critics Kuhn (1970b) added a 1969 postscript to the second edition to stress the primacy of the scientific community and its sociological role in the progress of sciences as well as to elaborate on the notion of the paradigm. Several years before, Kuhn defended *Structure* at a colloquium chaired by Karl Popper along with luminaries such as Stephen Toulmin, Imre Lakatos and Paul Feyerabend (Lakatos & Musgrave., 1970). In that colloquium, Popper (1970) suggested that Kuhn was a relativist, that his ideas dismiss the possibility of objective truth thereby prohibiting any challenges made to his claims. Lakatos (1970) objected to what he considered to be the irrational and dogmatic nature of the paradigm shift (citing the analogy of the shift to a religious conversion) and proposed supporting new theories that produce new facts that demonstrate the research has shown progress. Feyerabend (1970) was concerned about the prescriptive implications of Kuhn's theory including the alleged restrictive nature of the Kuhnian scientific enterprise that limits many theories to one, and to artificially create a normal science that has that single theory as its paradigm. We will show how a simplistic rendition of these sophisticated arguments taking the form of rigid-narrow (Kuhn) versus flexible-diverse (Feyerabend) thinking of research found its way into the organization sciences and the IS field.

A few years after the publications of Kuhn's paradigms, several sociologists began emphasizing the epistemological sense of the paradigm by describing their field as following either positivist or phenomenological paradigms (Walsh, 1972), while others demarcated three paradigms–nomological, interpretive and critical (Sherman, 1974). Despite protests (Eckberg & Hill Jr., 1979) saying that these sociologists misunderstood or perhaps even refused to accept the central meaning of the Kuhnian paradigm, specific research epistemologies were called paradigms as studies on paradigms proliferated the social sciences. It seems that, "if Kuhn has been concerned to delimit the meaning of his key terms, others have been engaged in extending them" (Perry, 1977).

IS researchers will be familiar with the terms used by these sociologists to describe paradigms because they refer to epistemological worldviews that the field had grappled with in its own history (Lee, 1991b; Orlikowski & Baroudi, 1991). As Hirschheim and Klein (1989, p. 1201) note, citing Burrell & Morgan (1979), this meaning of paradigms as "meta-theoretical assumptions about the nature of science and society" is a much broader meaning that Kuhn (1970b, p. vii) intended by "universally recognized scientific achievements that for a time provide model problems and solutions to a community of practitioners." In contrast to this misappropriation of paradigms, studies outside of IS and the organizational science continued to hold views that were faithful to Kuhn's definition. For example, in the philosophy of science, Gutting (1980) describes paradigms as being "universally recognized scientific achievements" while Bloor (1976, p. 57) defines a paradigm as "an exemplary piece of scientific work which creates a research tradition within some specialized area of scientific activity."

By holding to an epistemological view of the paradigm, (1) the organizational sciences limit themselves to the few epistemological and methodological approaches underlying research, and (2) choosing an epistemology results in these "paradigms" (which are actually epistemologies)

into becoming incommensurable (Hassard, 1988; Jackson & Carter, 1991;1993; Willmott, 1993). This was very much the case with one of the original works within organizational science that proposed a framework of "paradigms" – Burrell and Morgan's (1979) *Sociological Paradigms and Organisational Analysis.* This book was written at a time when functionalism/positivism in the organizational sciences was dominant and other research philosophies were seen as invalid. Burrell and Morgan wanted to create a legitimate space for alternative philosophies and so argued that these philosophies were distinct paradigms, based on fundamental underlying philosophical assumptions – objectivism/subjectivism and regulation/change. This led to them constructing four "paradigms": (1) functionalist, (2) interpretivist, (3) radical structuralism, and (4) radical humanism, and to argue that they were incommensurable as they were based on contradictory assumptions.

Notwithstanding the admission by Burrell and Morgan (1979, p. 35-36) that they did not use Kuhn's conception of paradigms as the basis of their work (see also Jackson and Carter's (1991) defense of Burrell and Morgan), the implications are the same: the Kuhnian paradigm concept is appropriated in ways resulting in undue preeminence given to epistemology. Incommensurability then becomes absolute because divergent philosophies are by definition, incommensurable. Instead of enriching the possibilities for research with the help of paradigms, research is guided by choosing from a handful of epistemological choices, which in turn spawned the argument for a need for pluralism in research. Banville and Landry (1989), reinforcing Kuhn's critics (Chalmers, 1998; Popper, 1970; Toulmin, 1972; Whitley, 1984), argue that IS researchers should reject the Kuhnian model and abandon the paradigm concept, "as it rests upon assumptions of the Kuhnian model of science which imparts value to knowledge on the basis of the conformity of its methods and results to an explicit standard: physics" (p. 50). Surely, a pluralistic field like MIS is not amenable to such a rigid notion of progress and it would

cause a "break-up of the field into rather hermetic factions and the consequent loss of the creativity generated by exchanges about research topics and research methods" (p. 51)[1]. As a result, the IS field treated the paradigm concept as somewhat like an anathema. In the preface to Ein-Dor and Segev's (1981, p. vii) *A Paradigm for Management Information Systems*, the authors write:

> It is with some trepidation that we adopted the use of the word "paradigm" to describe our work. ... Our trepidations increased when one of our colleagues let it be known that he "wouldn't be caught dead using the word"—a reflection of the recent disrepute into which this word has fallen.

Other studies in IS collectively reinforce similar interpretations that have since become the received view[2]. In contradiction to healthy pluralism, many scholars in IS agree that the "establishment of an MIS paradigm could actually restrict, rather than enhance, the progress of MIS as a scientific discipline" (Cushing, 1990, p. 48). These claims echo Feyerabend's (1970) criticism of Kuhn saying that the Kuhnian model is monistic, a monolithic ideology that "restrict criticism … reduce the number of comprehensive theories to one … [and] has one theory as its paradigm" (p. 198). Consequently, the view that Kuhnian model is too restrictive, and hands over IS to the "rigor" and "objectivity" of a hard science like physics are repeatedly emphasized by many IS authors (Avison, 1997; Hirschheim, et al., 1996; Jones, 1997; Khazanchi & Munkvold, 2000; Klein, et al., 1991; Mingers, 2001).

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[1] This allusion to research methods and epistemology would later develop a life of its own in the form of an overemphasis on methods.

[2] As the following passage argues, this received view may have been inspired by Feyerabend's (1970) criticism of Kuhn.

| Table 1: Use of the paradigm term in IS Research | |
|---|---|
| **Articles** | **IS references to paradigms** |
| Alavi and Carlson (1992) | "the dominant positivist MIS research paradigm" (p. 57) |
| Robey (1996) | "Even the frequently-lamented domination of the positivist paradigm seems to have weakened … [T]hus, in their earlier assessment of articles in mainstream IS journals, Orlikowski and Baroudi (1991) concluded that IS was dominated by positivist research and that interpretive studies and critical theory were underrepresented." (p. 402) |
| Mingers (2001) | "Rather than advocating a single paradigm, be it interpretive or positivist" (p. 240) … "Orlikowski and Baroudi (1991) considered three broad research paradigms—positivist, interpretivist, and critical" … "it is commonly held that research methods are bound to particular paradigms" (p. 243) |
| Mingers (2003) | "Underlying paradigm: in general, research methods develop within a particular paradigm … there has been a tendency to link quantitative methods with a natural science (positivist) approach, and qualitative methods with a social science (interpretive) approach (p. 236) … only 15% of instances used 'nontraditional' methods (p. 248) |
| Chen and Hirschheim (2004) | "In summary, we suggest that the field has been dominated by the positivist paradigm, despite calls to the contrary" (p. 197) |
| Venkatesh et al (2013) | "… there is limited research that has employed methodological pluralism in the IS literature … Mixed methods research has been termed the third methodological movement (paradigm), with quantitative and qualitative methods representing the first and second movements (paradigms)" (p. 22) |

The connection between the claim that the Kuhnian paradigm is restrictive and the need for pluralism is supported by studies lamenting the lack of pluralism in IS research (Chen & Hirschheim, 2004; Mingers, 2001; Mingers, 2003; Nissen, et al., 1991). If a paradigm is the epistemology, then surely selecting a single epistemology entails a lack of pluralism. It is this conflation between the paradigm and epistemology that has caused IS researchers to consider the paradigm concept a threat to pluralism. Empirical evidence that the IS field has given preeminence to the epistemological sense of the paradigm can be seen in the language

discussing paradigms by its senior scholars (**Table 1**). This preeminence of epistemology has led to a number of problems within IS research.

## *Paradigm wars in research*

Incommensurability between "paradigms" becomes absolute because divergent philosophies are by definition, incommensurable. Instead of enriching the possibilities for research with the help of paradigms, research is guided by choosing from a handful of epistemological choices, Even "mixed methods" research is seen as a kind of research approach that "different (existing) paradigms [meaning epistemologies] are routinely combined" (Mingers, 2001, p. 240). As a result, calls for pluralism are usually accompanied by recommendations to apply alternative epistemologies such as interpretive, critical, postmodern or other anti-positivist approaches. This epistemological and methodological tussle assumed "paradigm incommensurability" and its logical conclusion—the "paradigm war" (Mingers, 2004).

Part of the confusion over the distinction between different philosophical research methods stems from the emphasis placed on epistemological choices themselves as a means of classifying, designing, and evaluating research such that the philosophy and the method become surrogates for the content of the research. *Epistemology* is the branch of philosophy concerned with the theory of knowledge and how we acquire knowledge while *ontology*, a branch of metaphysics, concerns the nature of the world around us. "Positivism [is]: an epistemology which posits beliefs (emerging from the search for regularity and causal relationships) and scrutinizes them through empirical testing" (Hirschheim, 1985, p. 14). Certain epistemologies embrace specific ontological positions. Positivism embraces the ontological position of realism (Hirschheim, 1985) and is often associated with certain *research methods*, or procedures "associated with inferential statistics, hypothesis testing, mathematical analysis, and experimental and quasi-experimental design" (Lee, 1991b, p. 342).

As Lee (1991b) notes, positivist and other non-positivist epistemologies are not irreconcilable, in fact, "*describing a paper as positivist tells us nothing about the type of method used (e.g. qualitative methods can be used for positivist research) or the type of explanation provided by the research*" (Hovorka & Lee, 2010, p. 2). In other words, an over-emphasis on the epistemology at least holds back and at worse harms the advance of research. Focusing on whether the research is positivist, interpretivist or whatever else is convenient for methodological purposes, but it comes fraught with problems. Scholars in the management and cross-cultural studies echo similar problems. Eckberg and Hill (1979) argue that the original function of the Kuhnian paradigm is to act as exemplars for scientists to see their way in research on a concrete level, not as abstract representations of beliefs, presuppositions or worldviews. Without a concrete exemplar, puzzle solving becomes problematic, let alone the task of building a revolution in thought and progressing research forward.

## *Squeezing out innovative views*

Peering only through these philosophical lenses prevents researchers from exploring alternative options. Willmott (1993) argues that the philosophical choices, as represented by Burrell and Morgan (1979), constrains the process of theory development because it restricts research within polarized mutually exclusive ways of seeing. They engender within the IS field, rather arbitrarily, that research has to be conducted within discrete "objective" or "subjective," "regulated" or "radical" approaches. Agreeing with Willmott (1993), Deetz (1996) highlights how these limited choices constrain sociological inquiry and demonstrates the limitation in the case of postmodernism, which Burrell and Morgan's (1979) framework ignores—not to mention other forms of inquiry such as feminism, queer studies, post-structuralism, practice theories and many others. Studies in cross-cultural education and management that favors pluralism and paradigm-crossing severely criticize Burrell and Morgan's (1979) epistemological rendering of

paradigms that creates "*a structure of simplistic and ambiguous dimensionality where complex and diverse notions are forced into artificial and ill-fitting unity*" (Greenfield & Ribbins, 1993, p. 178). By launching the paradigm concept "into organization theory in the most *un-Kuhnian* manner … [it contradicts the very] transformational dynamic of paradigms put forward by Kuhn" (Lowe, et al., 2007, p. 238).

An instance of this squeezing out of other epistemological approaches is demonstrated in the IS field with the case of critical research. For many years, the IFIP community promoted the critical IS research agenda (Kaplan, et al., 2004; Lyytinen & Klein, 1985). Nevertheless, critical research is generally ignored (Chen & Hirschheim, 2004), such that there exists "a widespread view that IS researchers face a methodological choice between positivism and interpretivism as the two fundamental ways of researching and understanding the world" (Richardson & Robinson, 2007, p. 252). The problem is, even if critical approaches in research takes over from positivist or interpretive research, it will likely squeeze out those latter approaches too. Research therefore becomes less about the core concern of the study, and more of whether it is say, positivist or interpretive, quantitative or qualitative. Unconsciously, these epistemological considerations trump the goals of the research themselves resulting in a "boxed-in" (Alvesson & Sandberg, 2014) approach to research.

## *Impoverishment from Reductionism*

The scripted manner of choosing the epistemological approach (e.g., positivist or interpretive) risks impoverishing research in IS. The danger comes from lumping together numerous rich and insightful views into a handful of epistemological perspectives. The preoccupation with epistemology leads to a form of reductionism that impoverishes both the paradigm as well as the epistemological or ontological view. For example, the positive philosophy of Comte (1830-42) is very different from functionalism of Durkheim (1951/1897), which is in turn different from

that of Parsons (1949). Although their works are all labeled "positivist," they differ in goals and core concerns, and more importantly, elements of these positivist philosophies can be found in anti-positivist, post-positivist and qualitative approaches.

For instance, concerns for reasonableness and empirical evidence are found in both positivistic thought (Von Mises, 1956) and in interpretivist (Dilthey, 1883/1989) approaches. Malinowski and Radcliffe-Brown are criticized for their functionalism and positivism (Jarvie, 1969; O'Reilly, 2009) even though they are considered founders and scholars of ethnography and cultural anthropology, terms associated with qualitative research and interpretivism. The differences between Radcliffe-Brown's (1940) approach to anthropology and that of Malinowski (1922) are lost when they are lumped together as positivists. The depth of any analysis is lost when all those rich perspectives are lumped into "paradigms" generically called positivism or interpretivism. That is why Hirschheim and Klein (1989) deliberated on this loss in depth of analysis by extending Burrell and Morgan's four paradigms for IS development.

## *Obscuring Key Research Concerns*

The conflation of paradigm with epistemology obscures the core concerns of the research. Vaguely defined epistemologies such as posivitism, interpretivism, and critical research do little towards enhancing the core concerns of the research itself. Productive research seldom begins with the epistemological consideration of whether the research should be positivist or interpretivist. *The likes of Emile Durkheim, Max Weber, Karl Marx and Malinowski did not begin their research with these epistemological questions; instead, they worked on explaining the core concerns of their research*: the occurrence of suicide, growth of capitalism, class conflict or universal culture, and as a result, applied a wide variety of theoretical strategies, some of them positivist, many of them interpretivist, and sometimes both at the same time. As Czarniawska (2013) notes, vaguely defined concepts, such as these epistemologies, obscure the empirical

realities that these scholars study rather than illuminate them. In other words, there are no direct relationships between epistemology and research methods. Methods should be chosen not because of the assumed epistemology underlying the research, but because of the fit between the metaphysics of the object of study and methodological requirements.

One example of how research concerns in IS can be obscured is the case of design science research (DSR). Walls et al. (2004, pp. 55-56), in evaluating how design theories are being applied, find that most studies use design theories "as a cloak of theoretical legitimacy" or "as a common language and framework, at a superficial level, rather than in advancing theory," while Gregor and Hevner (2013, p. 338) see researchers experiencing "ongoing confusion and misunderstandings of DSR's central ideas". The reason for the problems design science is facing may be traced to a conflict within its epistemology. The DSR paradigm was constructed based on finding a bridge to the paradigm of the behavioral sciences (Hevner, et al., 2004; March & Smith, 1995; Simon, 1981; Walls, et al., 1992) essentially "by engaging the complementary research cycle between design science and behavioral science" (Hevner, et al., 2004, p. 76-77), whereas the stated goals of DSR is to produce artifacts in the form of constructs, models, methods and instantiations (Hevner, et al., 2004; March & Smith, 1995). We argue, because of this conflict between the epistemology of design science and its goals which are artefactual, the desired progress of DSR is held back. One of Iivari's (2007) theses about the philosophy underlying DSR alludes to this conflict: "Design product and design process knowledge, as prescriptive knowledge, forms a knowledge area of its own and cannot be reduced to the descriptive knowledge of theories and empirical regularities" (p. 55). Instead of attempting to establish tortuous links within metaphysical paradigms, we argue that DSR stands to benefit more from exemplars in design theories (McPhee, 1996) and design-related fields such as architecture (Lee, 1991a;2010).

## *A Misplaced Focus on Methodology*

The reliance on the epistemological sense of the paradigm diverts the attention of the researcher from the "context of discovery" and limits the research to the "context of justification." The appeal of the scripted research model that links epistemology to methods lies in its intuitiveness and simplicity; yet, it masks two faulty assumptions. First, within the context of justification, there is an implicit assumption about a direct relationship between philosophical approaches (e.g. positivism) and methods (e.g. field studies and questionnaires)(Mingers, 2001). This faulty assumption raises questions among researchers concerning methods. For example, why is it that case studies, which have traditionally been a qualitative method can be a positivist method? How can field studies, which are traditionally part of the positivist research methods, be suitable for interpretive studies (Klein & Myers, 1999)? What follows from the ensuing confusion are somewhat less than rigorous results from attempting to be both quantitative and qualitative (Dubé & Paré, 2003; Lee, 1991b). Second, this scripted model does not require extensive study of the nature of object beings researched. Generally, positivist researchers adopt the indicator-latent variable approach and focus on identifying good indicators that feed into measurement and statistical models to derive conclusions (Goertz & Mahoney, 2012). The tendency then is to focus on operationalizing and analyzing datasets rather than on analyzing models, constructs, and concepts. Thus, when a PhD student is faced with a "positivist" study, there is an immediate connection to some specified set of methods that supposedly will reveal the answers to the research questions; or when faced with "qualitative" research, other methods apply. Roszak (1972, p. 202) succinctly describes this over-emphasis on method:

> “The methodologies of a Max Weber or a Freud yield brilliant insights only in the hands of a Weber or a Freud; in the hands of lesser talents, they yield what may be less worth having than the blunders of a great mind. One might almost

> suspect that methodology is the preoccupation of mediocrity, the dullard's great hope of equaling the achievements of the gifted."

Therefore, methodology becomes the façade for legitimacy and the crutch for validity, as if the statistics applied unquestionably made the results valid; or the coding method correctly categorized subjective norms. Ciborra (1998) says it best when contemplating the "crisis" in the IS field: "Hence, *concern with method is probably one of the key features of our discipline, and possibly the true origin of its crisis*" (original emphasis). What is lost in blindly following the epistemologically-guided method is the sense of discovery that can only come from a close examination of the object of study, a detailed inspection of the technology being applied, and the exciting creative thinking from which novel theories are spawned.

## *Struggling with Cumulative Tradition*

The mistaken assumption that epistemologies are paradigms to researchers leaves these researchers in a situation where no paradigms can ever be challenged, since time and resource pressures maintain researchers in their different epistemological camps throughout their research careers. But as Kuhn (1970b) explains, the transition from normal science to extraordinary science takes place when anomalies and achievements in research causes paradigms to be abandoned by the community for other paradigms. Unfortunately, researchers who regularly apply and have invested their careers on, say, positivist approaches, cannot be expected to abandon their positivist methods. The same goes for interpretivist researchers. This creates a situation where novelty and progress in the form of paradigm shifts become unlikely. On the other hand, since paradigms are not merely epistemologies, a positivist or interpretivist researcher can be inspired by any paradigm or work on any novel theory that causes a new paradigm to emerge, without necessarily abandoning their positivist or interpretivist preferences. What leads to novel research is not choosing between philosophical approaches; it

is the subsequent acquisition of new paradigms and subsequent dethronement of less productive ones. Research that allows the epistemological rendering of the paradigm to dominate is unlikely to witness any revolutions in their research, and therefore will see little progress or cumulative tradition.

The transition from normal science to extraordinary science and the accumulation of knowledge often involves challenging the status quo. Merton (1968, p. 30) describes this phenomenon as finding a balance between *erudition,* that is being faithful to the status quo and demonstrating proper scholarly depth, and *originality,* that is, venturing beyond, and even "forgetting" the status quo in order to engender creativity in research. The extent to which IS researchers draw or escape from those same tired approaches determines the contemporaneity and cumulativeness of their research. Fields of studies like IS that have a proportionally larger frontier tend to be inspired by classic studies of reference disciplines more than contemporaneous studies resulting in IS researchers tending not to build upon the works of their colleagues ("eating our own dogfood" (Davenport & Markus, 1999, p. 22)).

Thus, the less IS researchers recycle paradigms from reference disciplines, and the more they build upon the immediate works of their colleagues, the more likely they will build cumulative tradition. It is important to be familiar with the classic paradigms because rereading them enriches the research. But rereading can take the form of excessive borrowing and unhealthy reverence for the original authors and their paradigms. In other words, originality requires a certain level of willingness to question the original thought and even forget previous research. As Whitehead (1917, p. 115) observes: "*A science which hesitates to forget its founders is lost.*"

# Masterman's Interpretation of the Paradigm Concept

These misinterpretations of the Kuhnian paradigm warrant a re-examination of how paradigms are adopted and appropriated in the IS field because they have direct implications on existing and future research directions. As Kuhn had repeatedly emphasized in *Structure* and later writings, the difficulty of pinning down the exact meaning of the paradigm term should not diminish its usefulness as it is applied in different fields. The complex milieu of thinking surrounding the development of and reception to *Structure* was later published in a collection titled *The Essential Tension*, where Kuhn (1977) acknowledged the many interpretations and possible confusion and difficulties his writings might have produced. The received view of the monistic nature of the Kuhnian paradigm in the IS field is inconsistent with other well-known criticisms of Kuhn. Popper (1970), one of Kuhn's most vocal opponents, considers Kuhn a "relativist" (despite Kuhn's protests) for saying that different frameworks and world-views can never be compared unless "we have agreed on fundamentals" (p. 56). This critique developed into the thesis of "incommensurability" (Shapere, 1971, p. 708) which was appropriated in divergent ways by different research communities. Relativism implies that many points of view are equally valid, suggesting that while Kuhn's critics consider his model pluralistic, the received view in IS considers it monistic. The received view in IS also sees the Kuhnian model as physics-inspired, deterministic and epistemologically rational (Banville & Landry, 1989; Whitley, 1984), devoid of sociological perspectives that are so crucial to a correct understanding of the progress of science. While his critics (Keat & Urry, 2010; Urry, 1973) acknowledge Kuhn's sociological contributions and the sociologically irreducible nature of his model, Kuhn's sociological perspective implies that even the most rigorous scientist is merely part of a community that is equally open to ideological strife and controversy. In fact, among the earliest to take advantage of the Kuhnian paradigm were the social sciences, which had struggled for decades under the hegemony of the positivist "hard sciences" (Fuller, 2000).

Ironically, Kuhn himself had anticipated what became the received view of the paradigm in IS. With regard to the allegation that the paradigm concept engenders a monistic unified model, Kuhn (1970b) wrote:

> What has been said so far may have seemed to imply that normal science is a single monolithic and unified enterprise that must stand or fall with any one of its paradigms as well as with all of them together. But science is obviously seldom or never like that (p. 49).

And on the allegation that the Kuhnian paradigm forces the model of physics and the natural sciences on the social sciences, Kuhn (1970b, p. 160) anticipated how this model of progress could be misconstrued to favor certain disciplines like physics:

> Nowhere does this show more clearly than in the recurrent debates about whether one or another of the contemporary social sciences is really a science. … Men argue that psychology, for example, is a science because it possesses such and such characteristics. Others counter that those characteristics are either unnecessary or not sufficient to make a field a science. Often great energy is invested, great passion aroused, and the outsider is at a loss to know why. Can very much depend upon a *definition* of 'science'? Can a definition tell a man whether he is a scientist or not? … Probably questions like the following are really being asked: Why does my field fail to move ahead in the way that, say, physics does? What changes in technique or method or ideology would enable it to do so? These are not, however, questions that could respond to an agreement on definition (Original emphasis).

As this passage explains, it was not Kuhn's intent to impose a physics model on his own model nor will any *definition* of science be able to rescue any field concerned about its disciplinary problems. What does matter is whether or not the field has made progress, regardless of whether it is physics, psychology, the arts or philosophy. In fact, it was the social sciences that took advantage of the Kuhnian paradigm concept by quickly declaring respectability under the protection of their own unique paradigms (Fuller, 2000). As these evidences show, the simplistic received view of rigid-narrow-Kuhnian paradigm versus let-the-many-flowers-bloom dichotomy of IS research is at best mistaken.

Yet another, subtler, view of the paradigm in the IS field is the notion that a paradigm is something that is beyond the reach of any individual or group of researchers, that it is, in some exchanges among IS researchers, "impossible for a researcher to step outside his/her paradigm or invent a new paradigm." Such a view mirrors Popper's (1970) criticism of Kuhn surrounding incommensurability. Kuhn (1970a) acknowledges the "special difficulties about stepping into someone else's framework" (p. 232) but also stresses that "translation" (p. 268) is always possible. Also, Kuhn (1970b) discusses extensively about the invention of theories, and of discoveries and how those inventions were "responsible for such paradigm shifts as the Copernican, Newtonian, chemical, and Einsteinian revolutions" (p. 66).

We are not saying that paradigms are routinely shattered or invented by individuals or groups of researchers, nor are we disputing the underlying social processes that need to transpire for a paradigm to be accepted by the community. Cases like those of Copernicus, Newton, Thomas Young, Lavoisier, Einstein (Kuhn, 1970b), Mendel (Brannigan, 1979), Adam Smith, Ricardo, Keynes, Marx (Foucault, 1970) and others demonstrate, that individuals and groups of researchers can directly or indirectly cause the emergence of new paradigms. In the history of science, there is a certain pattern of discovery and of innovation that Kuhn has managed to

distill, and that pattern or paradigm, can indeed be "used" or "applied." For example, several studies describe how the paradigm is *used* as "a puzzle-solving device" (Masterman, 1970, p. 68), how "sociologists and their *use* of the paradigm concept" (Eckberg & Hill Jr., 1979, p. 929 emphasis added) transformed their field, and how the discipline of economics "attempts to apply Kuhn" (Blaug, 1975, p. 408). Closer to the IS field, Bell's (1973) application of normal science in *The Coming of the Post-Industrial Society* (Fuller, 2000)—the classic text that brought ICT and the "information age" to the attention of the public—demonstrates how a new paradigm can be triggered by "an awareness of an anomaly" that challenges widely held assumptions (Slife & Williams, 1995) in technological change. Our point is that new paradigms become possible through many different complex processes, including efforts made by researchers themselves, through the weight of evidence, to convert the whole community to their point of view. This process by which paradigms emerge, which is rarely studied in the IS field, is beyond the scope of this paper.

We are at the point where we can now define the Kuhnian paradigm and introduce one particular interpretation of it that is relevant to the concerns of the IS field. We define the Kuhnian paradigm as **a shared exemplar for scientific practice, which communities of scientists and researchers agree in part or completely, that provide models from which coherent scientific traditions may emerge**. Masterman (1970) was among the earliest to acknowledge the usefulness of this paradigm concept, especially as a guide by which scientists are still able to perform their research in the period in which theories are absent (the pre-paradigm period). During this period, as Kuhn (1970b) describes it, most research communities within that pre-paradigmatic field is "forced to build his field anew from its foundations" (pp. 13-15) giving the examples of the physical optics and the electromagnetism communities, which took a long time to agree on their paradigms. While some fields build their foundations, other pre-paradigmatic

fields, like the IS field, borrow their paradigms from other disciplines and draw their direction of research, with few modifications, from those paradigms.

What transpires during this pre-paradigmatic period, as we can see in the IS field, is a situation where there is wide disagreement on fundamental issues and on the objects of study in the field, or at least in the objects that should be studied (Lee, 1999;2010). The IS community disagrees on which theoretical principles are most relevant (Gray, 2003), and disagrees on whether the field has made any progress (Grover, et al., 2006a; Grover, et al., 2006b; Wade, et al., 2006a;2006b). As many scholars argue (Alvesson & Sandberg, 2013a; Ravitch & Riggan, 2012; Rivard, 2014; Slife & Williams, 1995), progress in any field is made when underlying assumptions are uncovered and challenged, and much of these assumptions take the form of paradigms that have far-reaching consequences. There have been numerous interpretations of the Kuhnian model; however, based on Kuhn's own endorsement, we consider Masterman's interpretation to be most useful for a multidisciplinary field like IS. In an interview, Kuhn fondly recalls the first time he heard of Masterman's interpretation of the paradigm at the International Colloquium in the Philosophy of Science, " … my God, if I had talked for an hour and a half I might have gotten these all in [Masterman's 21 different meanings of paradigms], or I might not have. But she's got it right!" (Baltas, et al., 2000, p. 300). A return to Masterman's interpretation of the Kuhnian paradigm concept offers valuable insights to these questions and issues.

Kuhn's critics, who selectively choose parts of evidence that only support their contention, often omit Masterman's (1970) positive evaluations of the paradigm concept that form the bulk of her commentary on Kuhn's work. Masterman (1970) elaborates favorably on the "originality of Kuhn's sociological notion of a paradigm … paradigms as a puzzle-solving device … paradigm as a way of seeing" (p. 59). As Masterman (1970) puts it, "we are not going to be able to go back to where we were before Kuhn" (p. 87). After listing twenty-one different senses in which the term

paradigm was used by Kuhn, she concludes that they can in fact be grouped into three main categories: (1) metaphysical paradigms or metaparadigms, (2) sociological paradigms, and (3) artefact or conceptual paradigms. These three ways of viewing the paradigm are summarized in Table 2.

| Table 2: Masterman's Categories of Kuhnian Paradigms | | |
|---|---|---|
| Paradigms | Definition | Examples of paradigms in Kuhn's *Structure* |
| Metaphysical Paradigms | Beliefs, myths, speculations, ways of seeing, organizing principles, maps of reality | Aristotelian dynamics, phlogistic chemistry, Descartes extreme scepticism, and the "lightning flash" that "inundates" a previously obscure puzzle |
| Sociological Paradigms | Recognized achievements, political bases, grammatical usage, accepted judicial decision | Benjamin Franklin's "conservation of charges" achievements in corpuscular or wave optics, legal precedence |
| Artefactual or Conceptual Paradigms | Classical textbooks, standard illustrations and analogies, standard procedures, applications and techniques, standard tools | Ptolemy's *Almagest* and Newton's *Opticks*, the standard procedures used prior to the discovery of oxygen, instrumentation and machine-factory tools |

*Compare Kuhn's examples of paradigms with how the IS field applies this term in Table 1, p. 10.

## *Metaphysical Paradigm*

The metaphysical paradigm highlights the philosophical component of the paradigm concept that operates throughout the entire discipline. The metaphysical senses of paradigm include sets of beliefs, myths, speculations, standards, ways of seeing, organizing principles that govern perception, a map or something that determines reality, which was partly described in the title to Structure's 10th chapter as "changes of world view[3]. Masterman interprets Kuhn's (1970b)

[3] Kuhn (1970b) did not use the term metaphysics in the pejorative sense and alluded to it again in his *Postscript* description of the disciplinary matrix: "Consider next a second type of component of the disciplinary matrix … said in my original text under such rubrics as "metaphysical paradigms" or "the metaphysical parts of the paradigms" as "beliefs in particular models" (p. 184).

references to “continual competition between a number of distinct views of nature … incommensurable ways of seeing the world and of practicing science in it” (p. 4) … “body of belief … externally supplied, perhaps by a current metaphysic … [causing] different men confronting the same range of phenomena … [to] interpret them in different ways” (p. 17) … “an essential part of a philosophical paradigm” (p. 121), as this metaphysical paradigm. Specific historical examples of this usage given in *Structure* include: Aristotelian dynamics, *phlogistic* chemistry, beliefs about fundamental entities of the universe, Descartes extreme scepticism, and the “lightning flash” that comes to the scientists allowing them to see what was previously not seeing. Both Aristotelian dynamics and *phlogistic* chemistry assume certain metaphysics (or ontologies) regarding matter. The idea that certain substances are “heavier” than others and the notion of a “natural” downward motion are ontological doctrines presupposed in those paradigms, and these doctrines determine possible ways in which puzzles about nature can be investigated. Descartes’ skepticism is a paradigm that assumes an ontology of knowledge that is certain (*scientia*) or less so (*persuasio*), and an epistemology that certain knowledge can be achieved by removing doubt. Finally, the “lightning flash” that comes to the scientists is analogous to the “gestalt switch,” a different way of seeing that is necessary before a scientist can reorganize the reality of the research anew.

An important distinction needs to be made here between what Kuhn refers to as “ways of seeing the world,” the metaphysics, “and of practicing science in it,” the epistemology. Like in the case of Descartes, a certain metaphysical and ontological view of nature, may lead some to conclude with certain ways of knowing (the removing of doubt or Descartes’ dualism) and epistemologies, but as we argue, the relationship between metaphysics, epistemology and

related research methods in the IS field is not as clear. Metaphysical assumptions do tend to be exclusionary since they usually relate to the discipline as a whole rather than a specific practice or agreement among scientists concerning their research. For example, *phlogistic* chemistry implies a certain metaphysical characteristic of the nature of chemistry as a discipline, preferring specific epistemological views, pushing aside other views that the discipline might adopt.

These examples illustrate a subtle distinction that is missed in IS circles when talking about paradigms. A comparison of how the IS field uses the paradigm concept in Table 1 with the Kuhnian paradigms in Table 2 demonstrates the difference between the paradigm itself and the philosophy underlying the paradigm. For example, Aristotelian dynamics is the paradigm whereas, Aristotelian metaphysics, that is, the "essences of material bodies" (Kuhn, 1970b, p. 104), underlie it. And as we showed earlier, it is the conflation of paradigm with philosophy that became the source of confusion among researchers in IS. In the IS field, the metaphysical paradigms mistakenly take the form of epistemology or the theory of knowledge, as in the case of whether or not an external, independent world exists. Thus, following Chua (1986), Orlikowski and Baroudi (1991) categorize IS research epistemologies into positivist, interpretive or critical paradigms.

## *Sociological Paradigm*

Instead of belief systems that operate throughout the entire discipline, Masterman's sociological senses of the paradigm allude to different multi-faceted sources of influences within the scientific community. Sociological paradigms can take the shape of contrasting forces as different as scientific achievements, sociological bases that hold a political institution together, accepted judicial decisions or grammatical usage. Thus, the examples of sociological paradigms in Kuhn's *Structure* point to the actual practices of the community, intellectually (scientific progress), politically (institutions), legally (judicial decisions) or linguistically (grammatical

usage)(Masterman, 1970). These practices are recognized as the bases for future work. The concept of the sociological paradigm was reemphasized by Kuhn himself in his response to his critics (Postscript – 1969) when he wrote about "the sociological" (p. 175) … "Scientific communities can and should be isolated without prior recourse to paradigms … by scrutinizing the behavior of a given community" (p. 176).

In *Structure*, when a community of researchers rallied around Benjamin Franklin's paradigm of "conservation of charges," they based their research on the assumption that electricity is never created but "collected." This social construction bounded early researchers of electricity into a distinguishable scientific community, ironically called the "electricians" (Kuhn, 1970b). This sociological paradigm is formalized as the Law of Conservation of Charge, the principle behind many inventions and future progress in the study of electricity. Unlike the earlier metaphysical paradigms, the "conservation of charges" paradigm does not lend itself towards characterizing the nature of the whole discipline of physics; instead, it forms the basis for specialization within the discipline for many researchers over a long period of time. The same sense of the paradigm can be seen in the achievements surrounding the different research communities ascribing to the corpuscular theory or wave theory of light in physics. During Newton's time, it was the community that subscribed to the corpuscular paradigm that held sway, even though a smaller community of researchers that held the view of light being a wave phenomenon existed at the same time. Such paradigms are not limited to scientific discoveries. Judicial decisions taking the form of legal precedence in common law sets a standard for future decisions, which is a sociological paradigm that ensures consistent treatment for future legal cases. Research following sociological paradigms are not uncommon in IS; for example, historically, IS research adopted several sociological paradigms from other disciplines in the past including the decision-

making paradigm, information processing paradigm, and the strategic management paradigm, all which dominated research in IS for many years.

## *Conceptual and Artefactual Paradigm*

Masterman's third sense of the paradigm term is the conceptual or artefactual paradigm, its most concrete component. It is considered both conceptual and artefactual since in many cases paradigmatic concepts take the form of artifacts in the shape of tools and instruments. Kuhn (1970b) refers often to how paradigms offer "conceptual and instrumental tools" (p. 37) and even describes how certain tools (e.g. weighing tools) insulate or distract scientists from solutions. Examples of conceptual and artefactual paradigms provided in *Structure* include classical works that expound the general body of theory, usually in the form of textbooks of the field (e.g. Ptolemy's *Almagest* and Newton's *Opticks*); the standard procedures used for the discovery of elements; instrumentation and machine-factory tools. In this sense, the paradigm becomes like a tool or apparatus for problem solving. The common threads that bind all of these different artefactual paradigms are their shared nature, the agreement required for their adoption and application, the commitment shown to them by the community, often their obscurity, and their temporality (Masterman, 1970).

It is tempting to view artefactual paradigms as physical objects that are merely applied in research. What makes these concrete objects paradigms has to do with the knowledge embedded in them as a result of years of efforts and discoveries, the metaphysics assumed for the objects they are studying, and subsequent agreement of the community of scientists responsible for those discoveries. An example of a paradigmatic tool is the instrument used for X-ray crystallography, which became the critical tool of discovery of the double helix shape of DNA (Garfield, et al., 1964). Among the most famous example of a technique as an artefactual paradigm is Lowry et al's (1951) technique for determining the quantity of protein in a cell In the

IS field which fetched 300,000 citations. In IS several artefactual paradigms exist, for example, decision support systems that became the basis for much research progress in IS. A more recent example of artefactual paradigms are the Internet search technologies that are made famous by companies such as Yahoo and Google. The early paradigm of searching involved the user finding things on the Internet since no one knew what was out there. Now that we know roughly what's out there, companies like Amazon are applying a different paradigm of searching—a discovery-based search where the things find us—as in Amazon's "people who bought your product also bought …" (Battelle, 2005).

Conceptual paradigms in the form of textbooks are not as common in the IS field. Although the IS field had adopted a classic text in the past (Davis & Olson, 1985), there are no set of classic textbooks on IS that command the same stature as the classics in biology, chemistry, or sociology. Also, there are no standard procedures or techniques that can be considered IS-specific. The quest in defining the "IT artifact" (Orlikowski & Iacono, 2001; Weber, 2003) may be viewed as a search for these kinds of paradigms in IS.

Masterman's (1970) interpretation of the Kuhnian paradigm highlights the common thread between them—the practical more so than the philosophical elements of scientific practice. In fact, Masterman (1970) opined that Kuhn's paradigm is the practical rather than its metaphysical sense ("Philosophically speaking, a paradigm is an artifact which can be used as a puzzle-solving device; not a metaphysical world-view", p. 68), for "*only with an artifact can you solve puzzles*" (p. 70, original emphasis). This more practical view of the Kuhnian paradigm can be clearly seen in Kuhn's elaboration of his conception of the paradigm in the postscript to *Structure* (Kuhn, 1970b) and in a later book – *The Essential Tension* (Kuhn, 1977). He accepted that he had indeed been somewhat profligate in his usage of the term and suggested that there were two primary senses of the term, a general one and a specific one. The general one is "what

the members of a scientific community, and they alone, share. Conversely, it is their possession of a common paradigm that constitutes a scientific community" (p. 294). To avoid confusion, he suggested using a more specific term, the "disciplinary matrix" – disciplinary because it is shared within a discipline, and matrix because it consists of several practical components. The components are:

1. Symbolic generalizations, i.e., formal expressions carrying logical declarations in propositional form that are shared unquestioningly by the community. Kuhn's examples were scientific formulas expressed in symbols (e.g. *f=ma*) or words ("action is equal to reaction"), as he wrote mostly using examples from the natural sciences. The significance of these symbolic generalizations lay in enabling researchers to attach powerful logical and mathematical manipulations in their puzzle-solving efforts, their ability to explain the behavior associated with those symbols as well as simultaneously ascribing community-wide definitions to the symbols. Much of these symbolic generalizations are found in the natural and positive sciences (e.g. Nobel prize winning Black-Scholes option pricing formula). An example that's applied in the IS field is Codd's (1970) database normal forms as the engineering paradigm for databases.

2. Models, i.e., specific analogies or even ontologies that the group shares about its objects of study. For example, in IS, the classic Gorry and Scott Morton's (1971) conception of "structured decisions" vs. "unstructured decisions" and their relationships inspired from Simon's (1960) rational decision making model, was influential within the IS community towards understanding decision making. Kenneth Boulding's (1955) classic hierarchy of information consisting of data, information and knowledge, forms an accepted model and paradigm for understanding information. Keil's (2000; 1999) work on "project escalation" and "runaway systems" uses the ladder metaphor to describe increasing levels of intensity of a problem, and the "runaway train" metaphor to describe systems that are hurtling out of control.

3. Values, the "third sort of element in the disciplinary matrix" (Kuhn, 1970b, p. 184) concerns subjective judgment of the community about their research methods, how theories are evaluated, and the goals of science. These values may be applied in different ways within the community, but they ultimately chart the field's direction. During the early history of IS when influential members of the IS field were inducted from diverse backgrounds, Farhoomand (1987) thought it would take time for the field to arrive at a consensus on its set of values. More recent evidence suggests that the IS field had quickly showed preference for quantitative and statistical-type research for publications as evidence of rigor and predictive accuracy (Becker & Niehaves, 2007; Chen & Hirschheim, 2004; Hirschheim & Klein, 2012).

4. Exemplars. In his Postscript to *Structure*, Kuhn emphasizes that the "fourth sort of element," also the "most novel and least understood aspect of the book" (p. 187) is the paradigm as exemplar. Kuhn (1977) says, it was this sense, in the form of examples of successful practice that a community shared, that inspired his original idea for paradigms (p. 318). As he puts it, "Exemplars, finally, are concrete problem solutions, accepted by the group as, in a quite usual sense, paradigmatic" (p. 298). Unfortunately, he let the term expand to include all the other forms of group commitment. Exemplars as concrete solutions to particular problems (or as Kuhn refer to as "concrete problem solutions") serve as the basis for solving other problems by providing an analogy or metaphor for the puzzle. These concrete problem solutions can come from the community in the form of established paradigms or from creative individuals who undertake research that challenge existing paradigms, or invent theories that contribute to the emergence of a new paradigm for the field. For example, Mendel's (1865) new paradigm for biology came from experiments that he individually performed without any community support. In fact the community of biologists took nearly half of century to accept his new paradigm (Brannigan, 1979).

A classic IS example of an artefactual paradigm is the decision support systems (DSS) (Alter, 1977; Keen, 1987), which for decades provided solutions to decision making problems at different levels and different domains within the organization (Keen, 1981;1987;1991; Keen & Scott Morton, 1978). Despite deriving its inspiration from outside the field (the organizational sciences and their decision-making paradigm), this concrete scientific problem-solution or exemplar became the inspiration for other productive developments within the IS field including the classic research program of group decision support systems (GDSS) (DeSanctis & Gallupe, 1987; Watson, et al., 1988) and the very lucrative executive information systems (EIS) applications (Rockart & DeLong, 1988; Watson, et al., 1991). To highlight the differences between adopting epistemology as paradigms, and examples of sociological and artefactual/conceptual paradigms, we list examples of such paradigms related to IS in Table 3.

Table 3: Examples of paradigms in IS

| Example IS Paradigm | Paradigm Category | Notes and major references |
|---|---|---|
| Decision making (psychology) | Sociological | A psychological paradigm that focus on computers as enabling decision making processes. It is among the earliest paradigms adopted by the IS field (Gorry & Scott Morton, 1971; Mason & Mitroff, 1973) and carried IS research for over three decades (Keen, 1987) and was the basis for the DSS artefactual paradigm. |
| Decision support systems | Artefactual/ Conceptual | Among the earliest applications that were researched. The Minnesota Experiments set the standard for experimental research in the IS field based on an IT artifact (Alter, 1977; DeSanctis & Gallupe, 1987; Keen, 1987; Keen & Scott Morton, 1978) |
| Positivism, interpretivism, critical theory | Metaphysical and epistemological | Drawing from Chua (1986), Orlikowski and Baroudi (1991) adopt these paradigms for IS research and has become the received view of the choices for research paradigms in IS |
| Social-psychology (instance of the behavioral paradigm) | Sociological | Davis' (1989) influential work on technology acceptance model (TAM) applies social-psychology principles for technology adoption |
| Functionalism | Metaphysical and | Hirschheim et al (1995, p. 9) "adopt a paradigmatic assumption analysis following the work of Burrell and Morgan (1979)" for IS |

| | | |
|---|---|---|
| | epistemological | development. Functionalism is considered the most developed of the four Burrell and Morgan's (1979) paradigms within IS. |
| Information processing | Sociological | A cognitive paradigm that is based on human thinking and learning and became the basis for organization design (Galbraith, 1973;1977; Huber & McDaniel, 1986) and other research areas such as media richness and the IS success model. |
| Strategic management | Sociological | Emerged from Porter's strategic management studies and led research on the IS/IT as competitive weapon (Ives & Learmouth, 1984; Parsons, 1983; Porter & Millar, 1985). |
| Boulding's hierarchy of information | Artefactual/ Conceptual | Boulding's (1955) classic hierarchy of information consisting of data, information and knowledge, forms an accepted model and paradigm for understanding information. |
| Keil's project escalation | Artefactual/ Conceptual | Keil's (1995; 1999) work on "project escalation" and "runaway systems" uses the ladder metaphor to describe increasing levels of intensity of a project undergoing crisis |
| Behavioral science | Metaphysical and epistemological | Paradigm that seeks to develop and verify theories that explain or predict human or organizational behavior (Hevner, et al., 2004) |
| Design science | Conflict between metaphysical and artefactual | Paradigm that seeks to extend the boundaries of human and organizational capabilities by creating new and innovative artifacts (Hevner, et al., 2004). |

The organizational sciences went through several paradigm battles as can be seen in Donaldson's (1985) defense of traditional, positivist theories of management: *"Sociological discourse has come often to be preoccupied with the struggle between world-views of structural-functionalism and conflict theory"* (p. x). Sometimes the battles surrounding paradigms can be intense, as what happened between Pfeffer (1993; 1995) and Van Maanen (1995a;1995b) on the need for pluralism in management. No less intense was the battle between the defenders of the incommensurability thesis of paradigms (Jackson & Carter, 1991;1993), and those who find no issue of "paradigm" (meaning epistemological) interplay and integrated theoretical development across different epistemological sense of paradigms (Gioia & Pitre, 1990; Willmott, 1993). Notwithstanding the powerful arguments each side puts forward to support their

respective positions, because both sides share the common epistemological interpretation of the Kuhnian paradigm, their proposals rarely go beyond between choosing or compromising on some kind of worldview and method.

As one of the reference disciplines of IS (Culnan, 1986;1987; Davis & Olson, 1985), the organizational sciences exert a powerful influence on the IS field (Grover, et al., 2006b; Orlikowski & Barley, 2001). Scholars from the IS field regularly publish in major journals in the organizational sciences and attend management conferences. This is not surprising considering the field's origins and the name of the field itself – "*Management* Information Systems." Perhaps because of the diversity of influences within IS, the IS field may have only experienced paradigm skirmishes rather than paradigm wars. Nevertheless, the hegemony of the epistemological sense of the paradigm was felt through the many years the IFIP community struggled to introduce the IS field to alternative epistemological and methodological approaches (Mumford, et al., 1985; Nissen, et al., 1991).

Goles and Hirschheim (2000) suggest that the war may be over, and the field needs to be more pragmatic in order to reclaim the field's practical relevance with practitioners. Mingers (2004) describes this experience as a 20-year battle between the imperialists, isolationists, and pluralists that is experiencing a ceasefire. Even though segments of the IS community embrace these alternative approaches, little change is seen in the majority of research undertaken in IS (Chen & Hirschheim, 2004). This purported lack of change may be symptomatic of not only a continued presence of the hegemony of positivism as the epistemological approach of choice, but also the inability of the field to escape the incommensurability gridlock produced by the conflation of paradigms with epistemology. A notable exception of the paradigm view is Dando et al's (1981) penetrative analysis of the crises that overtook the operational research (OR) field and how they prognosticated the closing down of OR departments in schools of business across

America. As Dando et al's analysis shows, a field that is faced with an either-or choice between a few discrete epistemological approaches is unlikely to invent novel and creative insights concerning its diverse phenomena of interest.

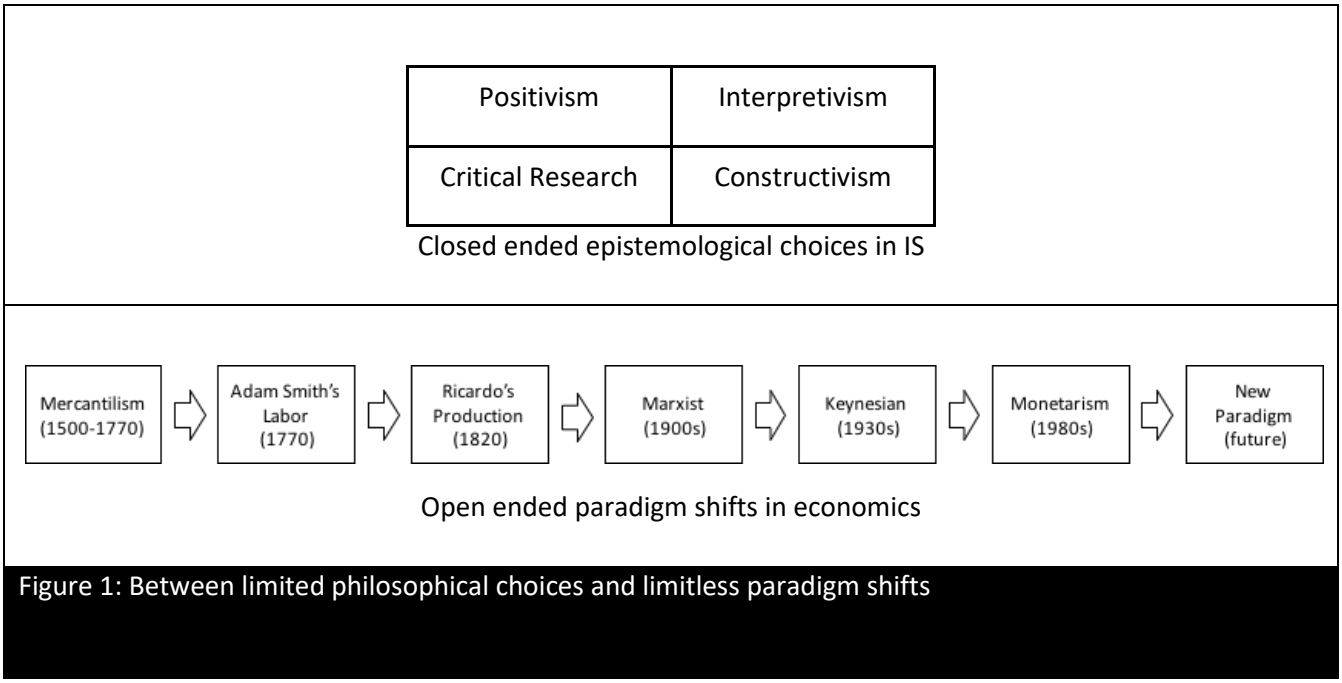


Figure 1: Between limited philosophical choices and limitless paradigm shifts

In response to allegations that the Kuhnian paradigm applies only to the natural sciences, we offer Foucault's (1970) paradigmatic analysis of the discipline of economics, a social science. A comparison of the development of the discipline of economics with the IS field highlights the difference between limited epistemologies in IS with a discipline that is inspired by continuing series of paradigm *shifts* taking place about every 20-30 years (Figure 1).

Foucault (1970)[4] describes how different communities in economics each adopts different paradigms in their effort to theorize on economic value and prices, beginning with coinage, moving on to mercantilism and labor to the more sophisticated factors of production,

[4] The depiction extends Foucault's description by including Keynesian economics and monetarism as a continuation of economic theory

macroeconomics, and later monetarism. This depiction of the progress in economics shows how scholars of economics invent and construct different explanations and theories for economic phenomenon, each enacting a different paradigm. This progress can be contrasted with research that is limited to epistemological categories. The categorization of IS research into a handful of methodological systems has become so deeply embedded in the discourse on IS research that they have become ideal types for research and are the subject of numerous articles and special issues of IS journals (Hovorka & Lee, 2010). It is important to note that we do not claim that the adoption of the epistemological sense of the paradigm is the sole cause that is holding back IS research. As mentioned earlier, research is a highly complex endeavor and many causal factors can simultaneously impact IS research. The epistemological sense of the paradigm encourages exclusionary polemical tendencies alongside other negative practices such as excessive borrowing, incremental gap-spotting research, and scripted approaches that engender "boxed-in" research (Alvesson & Sandberg, 2014).

Why then do researchers in the sociological and educational sciences, and our own IS field, tend to gravitate towards the epistemological sense of the paradigm to seek research ideas? Masterman (1970) says it is because these researchers do not take Kuhn's account of normal science seriously. What she means by this is the tendency to depend on the epistemological so much that they have forgotten to allow for the material and practical, which is a large part of normal science, to guide the research. The nature of the scientific system as "a marriage between metaphysics and technology" (p. 71) has somewhat being passed over by a focus on the metaphysics alone, exemplified by a dependence on blind methods. Based on the necessity of the practical in inspiring new thinking in science, Masterman (1970) contends that it is in fact the conceptual and artifact sense that Kuhn meant in his paradigm concept.

# Benefits of the Transformative Paradigm

The Kuhnian paradigm, when adopted in its transformative form, establishes the correct balance of metaphysical, sociological and artefactual components, encourages inclusion rather than exclusion, and engenders innovative research. The Kuhnian paradigm has already benefitted numerous disciplines, from some of which, ironically, the IS field itself derive inspiration. We've already noted earlier how Kuhn's ideas inspired studies surrounding the information revolution. Berger and Luckmann (1966) credits Kuhn for inspiring their understanding of the social construction of reality. In sociology, Ritzer (1980) is indebted to Kuhn for his multi-paradigm perspective of that field. In the cognitive sciences, De Mey (1982) titles his work *The Cognitive Paradigm* and elaborates on how paradigm detection studies "greatly contributes to our understanding of the social side of the paradigm concept" (p. 105). Kuhn's *Structure* inspired top universities around the world including the University of California Berkeley and Cornell University to found policy-oriented programs that brought multiple perspectives from historians of science and philosophers to join their new Science and Technology Studies programs (Sismondo, 2003).

Bloor (1997), in defending Kuhn against charges of relativism and pure idealism, states, "Perhaps the most shameful of all misunderstandings was the idea that, for Kuhn, science has no significant contact within independent reality" (p. 124). Political scientists, religious scholars and artists have all benefited from the Kuhnian model (Perry, 1977). Cognitive historian Edwin Boring (1964) analogizes Kuhn's paradigm and incommensurability thesis to the notion of "cognitive dissonance" in cognitive psychology. Marvin Minsky (1975), among the pioneers of artificial intelligence, admits his debt to Kuhn for his frame theory and writes, "The basic frame idea itself is not particularly original–it is in the tradition of the 'schema' of Bartlett and the 'paradigms' of Kuhn" (p. 113).

As a result of their preoccupation with epistemology, the organizational sciences fields have already suffered through unnecessary paradigm wars. The IS field has also undergone its own version of battles and arguably, certain communities of IS researchers that favor specific philosophical approaches may still be at odds with other communities that favor different approaches. These "skirmishes" between opposing philosophies continue albeit in a language that does not directly mention paradigms or epistemologies (Mutch, 2013; Scott & Orlikowski, 2013), but are nevertheless philosophical in nature. To prevent future gridlock, we recommend that the IS community abandon this practice of classifying, designing and evaluating research based on epistemology, and adopt a more transformative interpretation of the paradigm that incorporates the metaphysical, sociological and conceptual components. In addition to other examples earlier of how paradigm shifts have benefitted the IS field, we follow the development of social construction of technology (SCOT) studies, a source of inspiration for several IS studies (Davidson, 2002; Doherty, et al., 2006; Orlikowski, 1992;2000; Walsham, 1997) to illustrate the potential the Kuhnian paradigm for IS research. At the same time, we will refer to the development of several paradigm within the IS field itself. Although SCOT itself is not yet a paradigm within the IS field, it has triggered a paradigm shift within the field of science and technology studies. As Bijker (1995) explains the basis of his concept of the "technological frame," he notes: "The analogy with Kuhn's 'paradigm,' among other concepts, is obvious" (p. 123) … "Technological frame is evidently one of the many children of Kuhn's (1970) disciplinary matrix" (p. 126) much like Collins and Pinch's (1982) "frame of meaning," Constant's (1980) "technological tradition," Rosenberg's (1976) "focusing devices," Gutting's (1980) "technological paradigm," and Jenkins' (1975) "technological mind-set." In the following subsections, we describe the benefits of marshalling all the components of the Kuhnian paradigm, its metaphysical, sociological and conceptual/artefactual components.

### *Benefit#1: Engender Cumulative Tradition*

The Kuhnian paradigm contains in-built mechanisms that encourage cumulativeness. As Kuhn (1970b) states (p. 23):

> A paradigm is rarely an object for replication. Instead, like an accepted judicial decision in the common law, it is an object for further articulation and specification under new or more stringent conditions.

Instead of replicating paradigms from reference disciplines, as can be seen in most research in IS (Grover & Lyytinen, 2015), a realization or discovery of alternative paradigms opens doors for IS researchers to build cumulative tradition and transition into extraordinary science. The first step in this direction starts with a recognition of the existing paradigms operating within the field. Opportunities for adding knowledge in the field can only be seen when the members of the field are cognizant of the underlying paradigms (Slife & Williams, 1995). Once the underlying paradigms are clear to researchers, work on alternative paradigms will not merely replicate the status quo; instead it will articulate and specify new approaches that build cumulative tradition.

Bijker's (1995) work in developing the SCOT approach demonstrated the process of developing alternative paradigms to an existing mainstream paradigm within science and technology studies (STS). Up to the 1970s and 1980s, STS were concerned with the social impact of science and technology on society, a form of technological determinism (Bijker, 1995) that focused on their negative implications (e.g. nuclear arms proliferation, environmental degradation). In the mid-1980s, studies began suggesting a paradigm shift in the opposite direction towards the impact of society on technology—a technological paradigm. The existing paradigm of STS was considered inadequate in explaining the inherently social nature of technology (MacKenzie & Wajcman, 1985; Winner, 1980). To explain this different paradigm in thinking about

sociotechnical change, Bijker and colleagues (Bijker, et al., 1987; Pinch & Bijker, 1984) developed a new way of unpacking technology "to understand the relations between technology and society and to act on issues of sociotechnical change" (Bijker, 1995, p. 6). This approach involves focusing on the concrete problem-solution, uncovering the strategies taken by relevant social groups to resolve those problems, and the artifacts that emerge as a result of the inter- and intra-group relations.

In the IS field, Doherty et al. (2006) demonstrate an example of this new approach, extending Orlikowski's (1992) study of the role of interpretive flexibility, one of SCOT's paradigmatic concepts. Doherty et al's (2006) case study focused on the problem of a nationwide implementation of a healthcare management system and how stakeholders interpreted that implementation in different ways (i.e., empowering versus controlling) causing various organizational conflicts. The results of the study showed how modifications are introduced and meanings get embedded into the design of the artefact as a result of the different interpretations in what Bijker (1995, p. 84) calls "closure" and "stabilization" of the technological artifact. This study demonstrates how uncovering the sociological and conceptual paradigms deliver new insights into the limits and opportunities of human choice and systems design.

### *Benefit#2: Opening Space for Alternative Views*

Instead of the few mutually exclusive philosophical approaches that squeeze out innovative views, the more concrete version of the paradigm frees the IS field from the time-consuming and debilitating debates on whether the study is correctly monist or pluralist, positivist or interpretivist, idealist or critical realist, all of which tend to exclude opposing approaches and inflame unnecessary and unproductive intra-community quarrels. With no epistemological doctrine to defend, the focus of the research returns to its core, channeling efforts towards

progressing their research. As Maxwell (2013, p. 39) describes this work of theorizing, the research framework and the resulting paradigm, is like a "coat closet" allowing the researcher to hang different, seemingly unconnected ideas and concepts of a paradigm in a neatly organized and coherent fashion. Because a research community can rally around a paradigm that can be as simple as an instrument, space is opened up for a more elegant and parsimonious model instead of complex, unwieldy box-arrow diagrams. The presence of a paradigm does not mean that the research is entirely determined by any specific set of rules necessarily. The error in stating that paradigms rigidly determine a specific direction (Banville & Landry, 1989) assumes that researchers are somehow tied to certain rules. Kuhn (1970b) rejects this view by emphasizing shared paradigms, not shared rules, as a source of coherence for normal research. This “strong network of commitments—conceptual, theoretical, instrumental, and methodological” define the shared paradigm that generates the rules, since "*[R]ules, I suggest, derive from paradigms, but paradigms can guide research even in the absence of rules*" (p. 42, added emphasis). Since philosophical approaches take a back seat to paradigms, the paradigm becomes capable of achieving a balance between the unified and the diverse, the monist and the pluralist, the critical realist and the idealist.

As Smith (2006) notes, it is the “limited philosophical choices researchers have drawn from to represent causality that” sustains the unproductive debate about whether the social or technical is the cause. Opening up the issues of causality between technology and society to alternative views, both Bijker (1995, pp. 14-15) and, Markus and Robey (1988) agree that the causal structure between technology and people is emergent, and to that Bijker (1995, pp. 14-15) adds; technology works not just because of any intrinsic property of the technology (i.e., the characteristics of the IT artifact become the *explanans*), rather why it works in a social setting requires explanation (i.e., the characteristics of the IT artifact become the *explanandum*). Thus,

the success or failure of the IS are to be explained symmetrically using the same balanced framework, not tied to any metaphysical positivist or interpretive "paradigm" that views technological change as based on either determinism or volunteerism (Leonardi & Barley, 2010). The old paradigm might attribute success primarily to the quality of the system (Delone & McLean, 1992), or attribute failure primarily from not paying attention to social and behavioral issues (Lucas, 1975). The new paradigm which includes sociological and artefactual concerns allows the researcher to provide a more symmetrical explanation that focuses on the success of the technology as an achievement contingent on numerous different material, social, and political factors, all of which emergently explain both success or failure.

### *Benefit#3: Enrich Theorizing Efforts*

Researching without clearly understanding the hidden assumptions and paradigms subjects the field to the dictates of specific reference disciplines. A field that depends blindly on the paradigms of its reference disciplines can never be expected to go beyond the limits and blinders imposed by those paradigms. Within the organizational sciences, Burns and Stalker's (1961) integration of the organismic paradigm from biology into management to invent the concept of the organic versus mechanistic organizational structures is an example of an innovative use of paradigms. In this instance, the notion of organism in biology takes on a whole new paradigm that allowed the authors to theorize about the sources of innovation—a concept that is not strictly biological. Their adaptation was not guided by epistemological considerations. There was nothing positivist or interpretive in how they applied biological metaphors. In other words, the authors did not merely borrow from biology, they allowed the paradigms in biology to enrich their theorizing efforts.

Unlike Burns and Stalker's (1961) adaptation of biological paradigms, IS adopts its paradigms from the organizational sciences in a more wholesale fashion. This wholesale adoption can be seen in the history of the IS field beginning with the decision making paradigm of the early 1970s (Keen, 1987) to the strategic management (or competitive advantage) paradigm of the 1980s (Porter & Millar, 1985) and the business process (Davenport & Short, 1990) as well as the social-psychology paradigm (Davis, 1989) of the 1990s. They were useful, allowed IS to leverage off studies from its reference disciplines, but essentially tie the IS field's theorizing to those disciplines. Even if new concepts were invented in the process, those concepts are unlikely to go beyond the bounds of the organizational sciences. Instead of borrowing wholesale, a creative adaptation of those existing paradigms might allow IS researchers to found concepts, models and theories that are not as bounded to their reference disciplines. For instance, instead of adopting parts of the paradigm from social psychology (Davis, 1989), an IS researcher interested in adoption or acceptance of technology can benefit from an adaptation of both social psychology and communications of innovation (Rogers, 1983), the latter of which is a communications theory for the diffusion of technology. By uncovering the metaphysical, sociological and artefactual components of these two paradigms, IS researchers can enrich their theorizing process for the acceptance of technology.

The technological frame concept introduced by Bijker et al. (1995; 1987) for analyzing technological change is an example of teasing out the metaphysical, sociological and artefactual paradigms in order to enable productive adaptation. Bijker (1995) uncovers the underlying paradigm of technological phenomena by breaking them down into their components consisting of goals, key problems, problem-solving strategies, current theories, tacit knowledge, users' practices, exemplary artifacts and other artefactual models and analogies. Early applications of the frame concept in IS were limited to its more socio-cognitive dimensions that focus on

"differences in expectations, assumptions, or knowledge about some key aspects of the technology" (Orlikowski & Gash, 1994, p. 180), whereas Bijker's (1995) technological frame includes all elements that influences interactions within relevant social groups and are "not governed by cognitive and social factors alone" (p. 124). By being open to a wider set of metaphysical, sociological and artefactual assumptions, IS researchers can enrich their theorizing efforts by adapting or inventing concepts that work for the IS context.

### *Benefit#4 Focus on Core Concerns*

The Kuhnian paradigm positions the focus of the researcher on the concepts and core concerns, not on the epistemological or methodological concerns. A large part of the seeing the IS field's own paradigms emerge lies in asking the right questions and returning to the context of discovery rather than testing foreign theories in the context of justification. The reason why new interdisciplinary fields like Women's Studies are established was not because there were no concepts or theories about women. They were certainly addressed in other fields such as politics, psychology and sociology and even biology. The reason why it was established, about the same time the IS field was established as a doctoral program, was because the right questions about women concerning gender issues, race, class and sexuality in the multicultural context were not being asked by these other fields (Tobias, 1978). The focus shifts from methodological concerns to topical concerns, from justification to discovery.

In the case of the IS field, there is much to be gained by going back to its roots, interrogating even the elements that seem trivial (Lee, 2010; McKinney & Yoos, 2010). Especially in an inter-disciplinary field like IS that accepts input from numerous avenues, it is very likely that terminology from another discipline may be incorrectly used or at least limited by the confines of its originating discipline. Bijker's SCOT approach offers novel ways of reexamining what the IT artifact could mean to the IS field, especially IT's emergent nature. The SCOT approach places

the focus of the study on the technology itself—the IT artifact—which has so far eluded IS researchers (Akhlaghpour, et al., 2013; Orlikowski & Iacono, 2001; Weber, 2003). The SCOT approach offers a way of unpacking both the social as well as the technical nature of technology. Recent efforts in IS suggest the plausibility of this novel approach. Using a similar approach, Iivari (2003) unpacks and positions IS as a category of the IT artifact. Riemer and Johnston (2014) applies practice theory and social construction to explore a non-dualist view of IT as equipment. Answers to these questions that interrogate the roots of the IS field go a long way in ascertaining whether or not their application in the IS context is appropriate.

### *Benefit#5: A Judicious Application of Methodology*

The intent of this essay is not to disparage research methodologies, or their underlying philosophies. The caveat placed on methodology is the preeminence given to it over the core concerns of the research resulting in research that appears “valid” or “rigorous” but always leaving readers with the uneasy feeling that the research is not getting to the heart of the matter (Grover & Lyytinen, 2015; Lee, et al., 2014). By focusing less on its methods and more on the study’s core concerns, the researcher is more likely to get to the heart of the matter. Instead of depending on epistemology to provide the creative thinking in science, all three components, metaphysical, sociological and conceptual together uncover a novel "way of seeing" (Masterman, 1970, p. 73) and those considerations in turn shape which methods work best.

The question of finding a judicious application of methodology has concerned IS scholars as well as organization science scholars for some time. As the organizational sciences realize that their paradigm wars and restrictive paradigmatic views of research were detrimental to theory building (Gioia & Pitre, 1990), several multi-paradigm approaches were proposed to address the gridlock (Willmott, 1993). Metatriangulation (Lewis & Grimes, 1999) uses paradigms as

heuristics to help researchers explore theoretical complexity in the hopes of extending the scope, relevance, and creativity of organization theory. Multimethodology interventions in systems practices, especially if inspired from different paradigms (Mingers & Brocklesby, 1997), are claimed to better address the richness of the real world.

Unfortunately, all these approaches stop short of addressing the preeminence given to epistemology. Following the organizational sciences, most of the discussions in the IS field revolve around finding a mix of the epistemology-method combinations that could "bypass" the incommensurability issue (Becker & Niehaves, 2007; Chen & Hirschheim, 2004; Mingers, 2001; Venkatesh, et al., 2013). These proposed solutions preserve the problems discussed earlier concerning epistemology and overstate its importance. Although there is a close relationship between metaphysics of the object of study and the epistemology for researching it, there is no direct one-to-one relationship between metaphysical paradigms and research methods.

In investigating the social construction of plastics, Bijker (1995) applied what might be called positivistic methods of analyzing the physical characteristics of various early versions of plastic, documenting the temperatures and chemical makeup of alternatives, but at the same time applied concepts of interpretive flexibility and technological frames to arrive at conclusions as to which chemical and heat-treatment combinations produced the dominant plastic form we use today. Hypothetically, the technological frame could be applied in analyzing the perennial problems besetting IS development, where a large proportion of IS development projects continue to encounter some form of failure (Nelson, 2007). Analyzing all three paradigmatic components will provide researchers with "multiple perspectives, to move beyond narrow considerations" (Dwivedi, et al., 2015, p. 143). Bijker's (1995) technological frame concepts offers an alternative conceptual paradigm for studying IS failures by structuring the interactions among the actors of each relevant social group (often called stakeholders in IS development

studies). This new paradigm avoids both technological imperative view of failure as well as the other extreme, organizational imperative view (Leonardi & Barley, 2008; Markus & Robey, 1988) As far as we know, such a rich perspective of IS development has not been taken up by IS researchers.

# Discussion: Disagreement on Paradigms within the IS field

The discussion on paradigms has been contentious and as a result the IS community holds differing conflicting views about paradigms. Some of Kuhn's critics consider his views dogmatic and relativistic while others consider his model restrictive and monistic.

Table 4: Different Views of the Kuhnian Paradigm

| Theme | Against Paradigms | For Paradigms |
|---|---|---|
| The importance and significance of the paradigm concept | Whether or not the Kuhnian paradigm concept is correctly adopted is inconsequential to IS research. A study of the history or philosophy of science have little to do with how the field conducts its research. | The philosophy of science addresses not only the goals of research but also what science is, how it works, how to conduct their research and the justifications through which we build our knowledge. The understanding of paradigms make up a major part of the philosophy of science and will have lasting implications on the progress of the IS field. |
| Nature of the paradigm | The Kuhnian paradigm is monistic, rigid and deterministic (Banville & Landry, 1989; Whitley, 1984). It hands over IS to the "rigor" and "objectivity" of a hard science like physics which is not suited for a pluralistic field like IS | The Kuhnian paradigm concept freed the social sciences from the hegemony of the natural sciences (Fuller, 2000). His own critics consider him a relativist, not a monist (Popper, 1970; Shapere, 1971). The paradigm concept is a pluralist concept because Kuhn (1970b) states that "science is obviously seldom or never like … a single monolithic and unified enterprise" (p. 49). |
| Relationship between theories, models and the paradigm | Is a theory or a model a paradigm? If so, why are not all theories and models (e.g. TAM, UTAUT, Media Synchronicity Theory) paradigms? | The theory or model plays a more specific role than a paradigm and can be a component of a paradigm. Thus, TAM and UTAUT is derived from the social-psychology paradigm that describes theories of attitude. Media synchronicity and the theory it sought to replace, media richness, are derived by combining a communications paradigm with the information processing paradigm. |
| The metaphysical paradigm | Positivism, interpretivism, postmodernism are paradigms. The Burrell and Morgan (1979) model of research describes the sociological paradigms of management. | These philosophical approaches and worldviews of science are metaphysical aspects of the paradigm. They ignore the concrete problem-solutions that paradigms offer, limit the choices of paradigms (Deetz, 1996; Willmott, 1993) and misrepresent the Kuhnian paradigm concept (Lowe, et al., 2007) |
| The sociological | The Kuhnian paradigm is rationalistic and | Kuhn was among the first to acknowledge the sociological dimensions |

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| dimension of the paradigm | ignores the sociological dimension of science and its nature as a social construction (Banville & Landry, 1989; Whitley, 1984) | of science (Keat & Urry, 2010; Urry, 1973). The Kuhnian paradigm is the basis of Merton's sociological analysis of disciplines (Merton, 1973) |
| Value of the paradigm | The term "paradigm" has been abused and misused, and has fallen into disrepute so much so that it no longer holds any value (Banville & Landry, 1989; Ein-Dor & Segev, 1981) | The paradigm term remains valuable. Numerous disciplines, especially the social sciences, have taken advantage the paradigm concept (e.g., Merton, Bloor, Berger and Luckmann, Ritzer, Bijker, De Mey, Boring and Minsky to name a few) |
| Vague meaning of the paradigm term | Masterman (1970) finds 21 meanings of the paradigm term and criticizes Kuhn (Banville & Landry, 1989; Whitley, 1984). Kuhn disagrees with Masterman's assessment of the paradigm. | Masterman agrees with and supports Kuhn. Masterman (1970) elaborates favorably on the originality of Kuhn's paradigms. Kuhn acknowledges Masterman's depiction of the paradigm: "she's got it right!" (Baltas, et al., 2000, p. 300) |
| Many different versions (earlier and later) of the paradigm | Kuhn contradicted his own early conceptualization of the paradigm. In effect, he made a U-turn. His notion of the disciplinary matrix is a different concept from the paradigm. | Kuhn refined his definition of the paradigm in response to criticism. The original sense of the paradigm did not change. For clarification, the disciplinary matrix breaks down the original concept into several perspectives which together still emphasize the primary meaning of the paradigm as exemplar |
| The paradigm's inextricable connection to the community | The locus of the paradigm is the community. There cannot be a paradigm without a community's unanimous assent. No one has control of these macro-social processes and therefore cannot individually or in a group establish a paradigm. | There are many examples of paradigms in the sense of exemplars that existed before the community assented, e.g. Copernicus's and Mendel's paradigms to name a few and in the case when a paradigm is borrowed from other disciplines. Individual members or groups in a research community can play a major role in dethroning existing paradigms or establish a new paradigm by using the weight of evidence. |
| Nature of the paradigm as | A researcher cannot step out of his/her paradigm since a researcher's paradigm is the | Stepping out of an existing paradigm is what Kuhn to as a "paradigm shift." Once identified, paradigms can be used and applied. Kuhn |

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|---|---|---|
| unconscious practice, background and worldview | implicit background of practice or of a worldview that the researcher is socialized into. A paradigm cannot be "used," "applied" or "extracted" either as a tool or a technique. | (1970b) specifically mentions and implies the "use" and application of paradigms<br><br>Symbolic expression -- "In grammar, for example, 'amo, amas, amat' is a paradigm because it displays the pattern to be used in conjugating a large number of other Latin verbs." (p. 23).<br><br>Legal precedence – ""[a paradigm is] like an accepted judicial decision in the common law, it is an object for further articulation and specification under new or more stringent conditions." (p. 23)<br><br>"…was required in order to provide the special data that the concrete applications of Newton's paradigm demanded." (p. 31).<br><br>See next row on "the tools a paradigm supplies." |
| Creation and invention of a paradigm | Paradigms are not created or invented. It cannot be prescribed or dictated. The paradigm is a post-hoc analysis of scientific practice that can only be identified in hindsight. It is not something that is likely to bring any change in scientific practices or conditions shaping those practices | Scientists may not consciously set out to invent paradigms. Kuhn (1970b, p. 169) explains the paradigm as having "concrete problem solving ability" which can of course be invented. Some paradigms are identified in hindsight, but since paradigms are essentially social constructions, they can also be proactively worked on. We often come across the expression "need for a paradigm shift," which represents a proactive effort to change the existing paradigm. In the words of Kuhn, encouraging the invention of new paradigms was among the goals of writing *Structure*: "invention of alternates [paradigms] is just what scientists seldom undertake … So long as the tools a paradigm supplies continue to prove capable of solving the problems it defines, science moves fastest" (p. 76). (See also Kuhn's title to "Chapter IX: … Necessity of Scientific Revolutions"). As Richard Mason et al (1997) cite of Francis Bacon notes: Histories make men wise; poets, witty; the mathematics, subtle; natural philosophy, deep; moral, grave; logic and rhetoric, able |

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|---|---|---|
| | | to contend. |
| Goal of the Structure of Scientific Revolution | Kuhn set out to write a commentary (he was an historian of science) of the progress of science, not to dictate or propose his own model for other scientists | As a historian of science, by definition what Kuhn (1970b) did was post-hoc. And his analysis, judged by the reaction it received, had and continues to impact future research. As the aphorism goes "whoever does not learn from history is doomed to repeat it." So, as both historian and philosopher of science, Kuhn's writings and especially *Structure* are both commentaries and analyses of previous patterns of scientific progress as well as a proposal for future researchers. He begins his introduction to *Structure* by stating the need to move away from the linear incremental image of science towards his revolutionary view of science that will have "profound implications about its nature and development" (p. 1) and considered how such an historical study "can possibly effect the sort of conceptual transformation aimed at here" (p. 8). |

The received view within the IS community views the paradigm concept as an anathema, and considers the Kuhnian paradigm unsuited for the pluralistic IS field. Some even see little relevance of paradigms for the IS field. In Table 4 , we compare and contrast many of these conflicting assumptions that researchers may find discussed within IS circles. These assumptions or opinions may or may not be published and may be entirely anecdotal, but they represent the wide-ranging and conflicting views that beset the understanding of what paradigms mean to IS researchers. We therefore return to the goals of this paper mentioned in the introduction – to raise the level of discourse surrounding paradigms in the field towards engendering more novel, interesting and relevant research and theorizing. We believe that by clarifying many sides of the debate surrounding the Kuhnian paradigm concept, the IS community will be better informed, be more able to uncover the hidden assumptions underlying their research, and be able to consider alternatives outside of their comfort zones.

As Kuhn notes in *Structure*, paradigms can take the form of patterns, analogies and metaphors applied by the researcher to see the "resemblance, grasp[ed] the analogy between two or more distinct problems" (p. 189). They can also take the form of more concrete exemplars such as scientific achievements that have captured the imagination of the research community, best practices of either academic or professional experts, classic textbooks or research studies that continue to inspire, and even IT artifacts or instruments that are adopted by specific communities. Thus, we argue for abandoning the practice of classifying, designing and evaluating research based on limited philosophical choices, specifically those modeled on the epistemological sense of the paradigm, and for the IS community to adopt a more transformative interpretation of the Kuhnian paradigm that incorporates all three metaphysical, sociological and conceptual paradigms.

# Conclusion

This paper seeks to illuminate an aspect of IS research that has become the received view within IS circles for many decades since it was first introduced in the late 1980s—a distorted view of the paradigm that follows a monistic, rigid, restrictive one-dominant model of the natural sciences, unsuited for a pluralistic field like IS, and incapable of engendering disciplinary progress. This thinking, which found its way via the organizational sciences into the IS field, takes the shape of paradigms as epistemological and methodological worldviews, instead of shared exemplars of scientific achievements by the research community. The call for pluralism, which was offered as a solution to the alleged rigidity, involves applying alternative research methodologies or mixed methods. In the meantime, the transformative power of the paradigm concept with its exemplars, models, tools and techniques that place focus on the core concerns of the research and help researchers solve problems and hasten progress, is left largely unexploited by IS researchers.

To unearth these potential heuristic elements of the paradigm concept, we reintroduce Masterman's interpretation of the paradigm as consisting of metaphysical, sociological and artefactual/conceptual components. The metaphysical paradigm differs from the epistemology that IS researchers replace it with, and offers researchers numerous possible ontological views into the workings and mechanisms of their phenomenon of interest beyond just positivism, interpretivism or critical research. The sociological paradigm abstracts the multi-faceted sources of influences within the scientific community and inspires the future researcher from past scientific achievements, political attainments, legal precedence or linguistic nomenclature. The conceptual and artefactual paradigm offers paradigmatic applications, instruments and tools for problem solving, embedded knowledge from their practice, and examples of their accomplishments.

These aspects of the Kuhnian paradigm highlight the more practical and heuristic nature of scientific practice and demands from the researcher, not a passive sterile compliance with research methodologies, but an active engagement into theorizing and solving problems with the help of paradigms as exemplars. These concrete exemplars embed decades of knowledge and effort on the part of their prognosticators, and become by their nature, paradigmatic. This transformative view of the Kuhnian paradigm is far removed from the receive view of paradigm in the IS field; it admits diversity in views, focuses on the core concerns of the research and the achievements of its scholars and encourages creative, multi-faceted research. This re-interpretation of the Kuhnian paradigm carries potential for a field with multiple specialty areas such as IS, each supported by its own history of research. Uncovering the hidden assumptions and Kuhnian paradigms behind the research allows the IS researcher to find alternatives to begin a new chapter that truly subscribes to the aphorism famously said by Newton "If I have seen farther, it is by standing on the shoulders of giants."

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