Paying back borrowed meanings: The implications of the metaphor-driven history of IS research for its future

Diarmuid J Pigott
School of Engineering and Information Technology
Murdoch University
Murdoch, Western Australia
Email: d.pigott@murdoch.edu.au

Callan F Ledsham
Catholic Theological College
MCD University of Divinity
Melbourne, Victoria

Valerie J Hobbs
School of Engineering and Information Technology
Murdoch University
Murdoch, Western Australia

John G Gammack
College of Technological Innovation
Zayed University
Abu Dhabi, United Arab Emirates

Abstract

The history of a discipline is a history of its dialogue, and its dialogue relies inevitably upon metaphors. However, metaphors can both help and hinder as they pass from fresh insight to normal speech. In this paper we argue that metaphoric analysis can be used to examine how the emergence and evolution of the metaphors employed in a discipline can influence its course. We use metaphoric analysis to survey significant metaphors in the history of the Information Systems discipline, in particular those relating to its central construct, information. We consider the possibility of an account for information that is non-reifying, as well as approaches that eschew metaphors, and the consequences of such formulations for IS.

Keywords

Information Systems discipline, information, metaphor, metaphoric analysis, historical survey.

INTRODUCTION

A discussion as to the nature of discipline per se was missing from the introductions to the recent special issues on the history of Information Systems (IS) in the Journal of Information Technology and Journal of the Association for Information Systems (Bryant, Black, Land, & Porra, 2013; R. Hirschheim, Saunders, & Straub, 2012). A discipline is non-trivial to define and there is no consensus as to its nature. In this paper we use the communitarian and communicative approach to the study of scientific disciplines (following Stichweh, 1992, 2012) to show how the history of a discipline may be examined from the perspective of the dialogue leading to its development. We focus on the metaphors employed in that dialogue, and consider how those metaphors can both help and hinder the development of the discipline. By considering the benefits and drawbacks of outmoded metaphors, and of those currently in use, we can look for potential problems through metaphoric analysis (Andriessen, 2005, 2011). We suggest that metaphoric analysis can usefully be applied to the IS discipline. Following a discussion of metaphoric analysis in discipline research, we use metaphoric analysis to survey significant metaphors in the history of IS, in particular those relating to its central construct, information.

Discipline, Dialogue and Metaphor

According to Stichweh (1992), a discipline is a self-defining community of communicating individuals. Stichweh states that this is a functional differentiation, a claim of autopoiesis (sensu Luhmann, 1986), and stands opposed to definitions based on skill sets, common tasks, professional associations, educational institutions, or even a consideration of the subject matter from the point of view of the practitioners. This is not to say those factors are not hugely significant in the life of a discipline, but rather that they are ultimately non-essential. Examining the

history of scientific disciplines shows that they are not static: the gradual movement of scholarly discourse in both approach and description (Becher, 1989; Becher & Trowler, 2001) is evidenced in (e.g.) functional morphology becoming biomechanics, or philology becoming linguistics (Vasconcelos, 2008).

The history of a discipline can therefore be found in a map of its dialogue (Cahan, 1991): a discipline will progress as the ambit and utility of its dialogue changes, and a changing population of communicants leads to a change in the makeup of the dialogue, as reflected in both learned periodicals and everyday scientific reportage. Active participation in the dialogue involves predecessor selection (Camic, 1992), and leads to the formation of autopoietic communities of practice (Lave & Wenger, 1991) and invisible colleges (Price, 1971) that also shift with the dialogue, in turn potentially becoming sub-disciplines.

Disciplinary change can also occur as the discipline experiences successive popularity of the metaphors in dialogue (Kwa, 2011; Stichweh, 1992; Thagard, 1988). This phenomenon is a natural part of scientific development - as Max Black puts it: "every science must start with metaphor and ends with algebra; and perhaps without the metaphor there would never have been any algebra." (Black, 1960 p.64).

There is, however, a pernicious side to this: as the metaphor becomes clichéd, or overstretched, or it invokes too much of the connotative sense of the metaphoric source, then erroneous descriptions or judgements will arise (Ortony, 1975). And since they are expressed as statements of fact, the rhetorical power of metaphoric speech leads to a natural expectation of greater applicability of the metaphor, and consequently what we term "connotative overreach" is very difficult to identify. Indeed, Lakoff and Johnson (1980a) suggest that all metaphoric speech needs to be parsed carefully before being used in decision making.

The IS discipline has progressed in part through the use of successive explorative metaphors for its core construct: information itself (Hanseth, 2004; Lauer, 2001; Madsen, 1989; Morgan, 1980; Walsham, 1991). This transcendence of core metaphors in IS can be seen as a particular instance of Stichweh's generalised trend in the autopoietic process of disciplines, and is to be expected. However, if information is always described using metaphoric speech, then identifying connotative overreach of the metaphors used becomes a core component of the disciplinary narrative.

METAPHORIC ANALYSIS IN DISICIPLINARY RESEARCH

The Role of Metaphor in Discourse

Metaphoric speech is used to conceptualise one mental domain (the *target* domain) in terms of another (the *source* domain), providing a *analogical mapping function* between those two domains (Lakoff & Johnson, 1980b). It is a type of analogical reasoning, specifically an *enthymeme* – a syllogism in which the conclusion and major premise are not explicitly stated, but are part of common understanding (D'Hanis, 2002a; Lyon, 1998).

Enthymemes are frequently used to convey common knowledge or assumptions in argumentation (Brewer, 1996; Walton, 2001; Walton & Macagno, 2006). The reason we accept metaphoric enthymemes in argumentation so readily is that all such assumptions are nearly always unspoken, and therefore are the hardest to confront or contest, let alone refute (Glazier, 2010). However, as analogical mapping functions they do make statements about the real world, and so can be disputed or confuted (Deignan, 2010; Hesse, 1966).

Diaphors: Metaphors as Models

We can distinguish between two metaphoric mapping functions, based on the degree to which the target domain is understood prior to the application of the metaphor. If the target domain is well-known, then the metaphor serves as a kind of florid comparison (formally an *epiphor* per Wheelwright, 1962, after Aristotle, ca 335 BCE). If the target domain not well-known, or a conjectural feature is proposed about an otherwise well-known subject, it serves as a kind of hypothesis (formally a *diaphor*).

Diaphors play a vital role in scientific discourse as a form of model, permitting the creation of operationalized definitions, and inviting experimental confirmation or refutation (D'Hanis, 2002b; Mac Cormac, 1985; Turbayne, 1962). When such models lose their conjectural states, the diaphors become epiphors. Thus the progression from metaphor to algebra described by Black (1960) can be seen as a path beginning at diaphor, moving to epiphor and thence to a nominal expression in normal speech, albeit one with a technical meaning.

Physics abounds with examples of this progress in action: the concepts of "force" (Jammer, 1962) and "mass" (Jammer, 1964), which are crucial to physics, have proceeded through the creation of diaphoric models, while the names for electrical phenomena preserve the aspects of their source diaphors despite having become purely nominal: "current", "capacitance", "flow", "resistance", "attraction", "polarity" and "field" (Gentner & Gentner, 1983). Other epiphors such as the billiard ball model of kinetic behavior of gases do not make the shift to

conventional speech (Bailer-Jones, 1999). Currently the diaphoric conception of tachyons as fundamental particles creating time provides criteria for their observation (MacCormac, 1971).

Diaphoric models can be used to disprove hypotheses as well: the "ether" was operationalized and disproved by the Michelson-Morley experiment (Brillouin, 1962). Additionally a diaphor may not be taken up by the scientific community and so abandoned on the demise of its proponents, such as Tesla's paradigm of dynamic gravity as a rival to Einstein's General Theory of Relativity (O'Neill, 1944). It goes without saying that fantastic and unprovable diaphors, such as Reich's Orgone (Gardner, 1957), or those that are self-contradictory such as Lawson's Lawsonomy (Gardner, 1957), are ignored (Hoffman, 1980). Figure 1 shows these examples placed within the possible paths a diaphor can take within discourse.

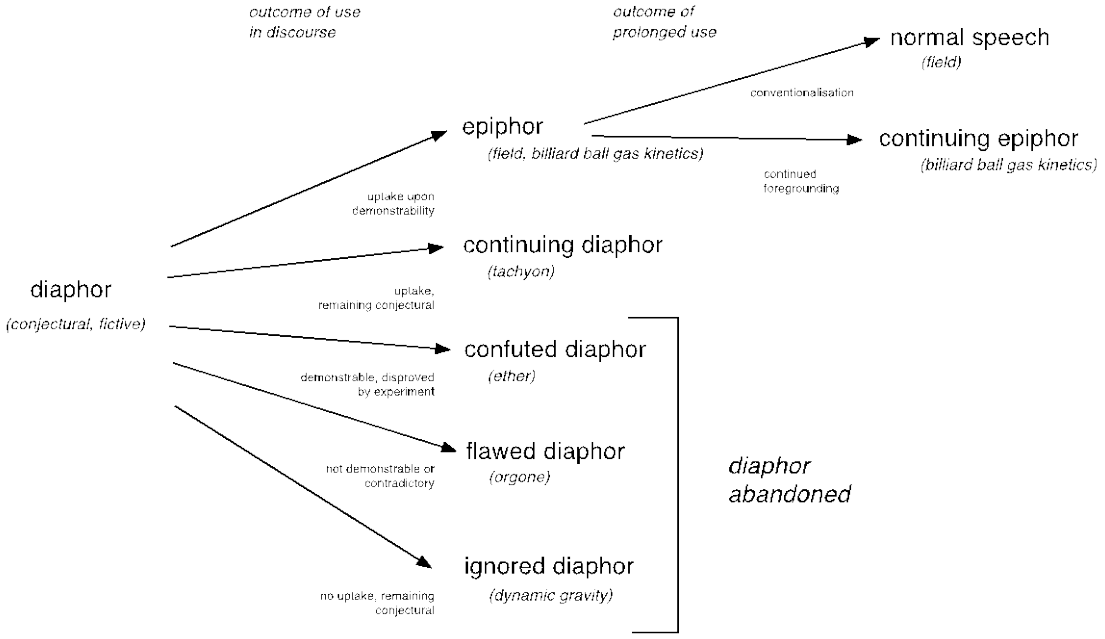

Figure 1: The path of metaphor from diaphor through epiphor to normal speech

Conjectural entities, proposed through use of the diaphoric principle, are termed *fictive* (Goodman, 1978), and are epistemologically contingent. Consequently, while statements can be made predicating features of those entities, and conclusions drawn from those features, absolute existential claims cannot be legitimately made. The worst case scenario involves the fallacy of misplaced concreteness (Whitehead, 1954, p. 52), where an idea or concept is *reified*, that is described as something concrete when only an event or process is occurring. Such reification can be found in nineteenth century physics: by looking for "caloric," "phlogiston," and the "élan vital" instead of the unifying framework of "energy", scientists posited flawed yet widely accepted descriptions of the world in terms of fictive entities (Deacon, 2010). According to Lauer (2001) and Stamper (1985), such erroneously reified diaphors employed in its dialogue may have hindered the development of Information Systems as a discipline.

Metaphoric Analysis

Metaphoric analysis operates by examining the discourse in a given situation to locate explicit or implicit metaphors, and to find unwarranted assumptions in those metaphors' usage. The most recent refinement is that of Andriessen (Andriessen, 2011). However, Andriessen's informal approach to literature surveys and metaphoric elicitation necessitates the use of other tools to formalise the analysis process. The metaphor extraction and unpacking makes use of the enthymemic analysis tools of Walton (2008) and research synthesis techniques (Cooper, 1982; Glass, 1976). The expansion of the metaphorical to literal text follows the example set out by Lauer (2001), but formalises it through the use of the cultural scripts of natural semantics metalanguage (Goddard & Wierzbicka, 2004), and examining the soundness of the expanded metaphor uses the criteria established by Ahrens and Say (2006).

Ahrens presents three criteria for soundness of a metaphor: *metaphoric validity* (whether it unpacks to have three statements with common terms), *salience* (whether it is applicable to the source domain, and reveals something useful about it) and *mapping constraint* (whether the metaphor is uniquely and unambiguously applicable to the subject in the target domain).

Ahren's mapping constraint – the observable link between the source and target domains of the metaphor – cannot be verified in the case of diaphoric metaphors. When metaphors that are diaphoric are only evaluated in terms of their own predication they remain diaphors, and the entities that they identify cannot be assumed to exist outside the shared discourse (Kovecses, 2010). In examining metaphors that have been employed in IS throughout its history, what must be determined is whether or not those metaphors were diaphoric, and if so whether they remain fictive, and therefore conjectural and open to question. Ignoring this conjectural nature is committing a *reifying* error.

In addition, there is a standard checklist drawn from the literature by Døving (1994) of four common errors arising from the injudicious use of metaphors: *commission* (forcing irrelevant information on the target domain by insisting on features of the source domain), *omission* (missing significant features of the target domain by adhering to the features of the source domain), *inappropriateness* (forcing a metaphor where the mapping function is trivial) and *redundancy* (where nothing is added to the understanding of the target domain by the use of the metaphor).

These errors are concerned with single instances of metaphors. However, a common use of diaphor in the literature is to provide a point of differentiation between rival IS schools (Walsham, 1993b). Accordingly we can identify two further errors. Drawing on Leibniz (1990), we know to look out for the errors of *separating indiscernibles* (differentiating features where there is no discernible difference) and of *equating discernibles* (making a diaphoric superset to group different features as one).

Lack of agreement as to the nature of the fundamental construct in IS has bedevilled the discipline. We suggest that metaphoric analysis, by analysing the literature of a discipline for metaphors, checking them for Ahrens' criteria compliance, and checking for the seven errors described (reifying, commission, omission, inappropriateness, redundancy, separating discernible and equating indiscernibles), can provide an audit for the IS discipline in terms of its unresolved conjectural bases.

However, metaphoric analysis also has a positive aspect: following the path of Schön (1979), Morgan (1980) and Walsham (1991), Andriessen proposes a systematic examination of potential alternative source domains in the construction of diaphors. By subjecting the new diaphors to the same evaluative framework, new avenues of IS research may be made possible.

Consequently, we may usefully distinguish *critical* metaphoric analysis (comprising a systematic and methodologically justified review of the literature) from *explorative* metaphoric analysis (where a diaphor is proposed as a research direction). Of course, the two approaches are not mutually exclusive, and indeed in practice many metaphoric analyses combine the two. In the next section we show how we can apply such analyses to the IS discipline.

APPLYING METAPHORIC ANALYSIS TO THE IS DISCIPLINE DIALOGUE

Existing Metaphoric Analyses of the IS Discipline

In this section we review both explorative and critical metaphoric analysis in the IS literature. Space does not permit an exhaustive review; rather we identify significant occurrences of these practices in the literature.

Explorative metaphoric analysis is as old as the IS discipline itself: Shannon and Weaver (1948) conceived of information as a message that was sent, while Mackay (1950) considered it the answer to a posed question. Fairthorne (1967, 1968) used fluid to highlight the continuous and dynamic aspects of information in streams or stored in bottles (Fairthorne, 1975). Mooers (1957), in constructing the term "information retrieval", used the diaphor of a bird-dog, retrieving the answer from the stored information.

More generally, Berkeley (1949), von Foerster (1967) and Arbib (1972) presented computers as brains containing minds that thought, while Gabor (1954), MacKay (1969), Pask (1971) and Simon (1978) modelled them as brains that observed. The process was reversed as well - Sloman (1978) and Newell (1980) discuss computers as models for the thinking mind.

We have discussed elsewhere (Pigott & Hobbs, 2011; Pigott, Hobbs, & Gammack, 2005) how the triple construct of data-information-knowledge has been conducted chiefly in terms of fictive entities: information (data and knowledge) is the object of discovering, hunting, capturing, harvesting, mining, extraction, cleaning, processing, hardening and distilling using sieves and filters in refineries and factories, and storing the outcomes of these processes in stores, silos and warehouses. We have shown how many of these diaphors are fictive and indiscernible.

When we consider critical metaphoric analysis, we can see that as a disciplinary critique it is also quite mature, and though it is usually accompanied by a call for reform of some sort, it is not always calling for use of an innovative diaphor. Stamper wrote several scathing reviews of reifying diaphors (1971, 1973, 1985), concluding

with a call for their replacement by a non-metaphorical approach based on semiotics. Beynon-Davies repeated this review more recently, with a similar outcome (Beynon-Davies, 1992, 2009, 2011). Deacon's review (2010) also ends up suggesting a focus on semiotics.

Walsham's analysis (1993a, 1993b) focussed on organisational aspects of IS, calling for use of structuration with its emphasis on power and control to be used in systems design, while Gazendam's analyses (1993, 1999) drew on Walsham's approach, and called for a focus on the language of communication, with an emphasis on Speech Acts theory, specifically the Language/Action Paradigm. Linger and Burstein's (1998) review of organisational memory examined metaphors in use to call for a focus on the work and tasks involved. Similarly Hirschheim and Newman (1991) call for a work practices-oriented focus after their review.

The literature also contains many instances of critical and explorative metaphorical analyses in combination. Lauer (2001) explicitly calls for an innovative metaphor on the conclusion of his review, replacing the resource metaphor with a question-answering metaphor. Our review (Pigott, 2013; Pigott & Hobbs, 2011) also takes this pattern. Ciborra and Hanseth (1998) call for the use of Actor Network theory, which can be viewed as a diaphor, as does Cordella (2010).

Summing up, a common theme of all of these reviews is that there are fundamental problems with the persistent use of reifying metaphors that have remained conjectural rather than having a justifiable transition to epiphoric or nominal status. In their reviews the authors find all of the seven errors we have enumerated in the previous section, and bemoan the waste of fiscal and human resources in pursuing what are ultimately chimerical.

We now survey some current diaphors in the active dialogue of IS, to see if there is a departure from a dominance on the reifying.

Metaphors in Current Use in the IS Dialogue

A systematic review of the IS dialogue finds that the innovative diaphors are still reifying. This section presents some illustrative examples that are indicative of the continued practice.

It is too early to tell if successive instrumenting will reveal whether the phenomena highlighted by the innovative diaphors are to be found in the world, and to make the transfer to nominalism via epiphoric usage. That said, we can see that the use of diaphors using terms like cloud (Chellappa, 1997), swarm (Evans, 2000), or cascade (Bikhchandani, Hirshleifer, & Welch, 1992) has again led to connotative overreach through reifying.

Cloud computing as a diaphor, while reifying, points to a distributed always-on mechanism of storage, and terms like "data cloud" or "information cloud", might be said to have made the progression to epiphors because the reference is to a storage mechanism. We do, however, see extension of the metaphor to include ideas of "diffuseness" or "nebularity" (Fuchs, 2008) or of "obscuration of light" (Katz & Gandel, 2008) being superimposed upon the object of consideration. Unless it can be shown that this omnipresence leads necessarily to diffuseness or obscuration, this is an unwarranted connotative overreach. Moreover, expectations of cloud computing are similarly effected in the business community, with it being seen variously as located in the sky, being short-lived, or even as being part of the weather system, or at least being affected by storms (Wakefield Research, 2012).

Swarm computing as a term likewise has its origins in a mechanism for control. It posits massive concurrent action in swarm-like behaviour, and once again might be said to be progressing towards nominalisation. An "information swarm", like an "information cloud", can be seen as a legitimate extension of the term to cover the information that is residing in a swarm, such as BitTorrent activity (e.g. MacDougall, 2009). But once again, the key point of swarming theory is immediate responsive behaviour. And extension of the metaphor to cover "paralysis of information swarms by groupthink" (Nordmann, 2012) might be committing the error of omission, and possibly inappropriateness.

Information cascades occur when there is a surge in crowd behaviour – when many observers mimic the behaviour of others reflexively as an adaptive strategy. As a model for a curve shape in statistical analysis of crowd behaviour it is legitimate. So swarm adaptivity to an information cascade (Wang, Miller, Lizier, Prokopenko, & Rossi, 2012) can be seen as an equally legitimate. However, we again see connotative overreach when someone suggests that individuals are "damming up an information cascade that was threatening to drown the financial system" (Fitzgerald, 2008) or have individual behaviour "drowned out by observation" (Klemens, 2013).

Alternative Strategies: Circumspection, Non-Reifying Metaphors and Paradigm-Adherence

The abundance of reifying strategies both in current and past use suggests a natural predisposition to forming them that is unlikely to go away soon: this is reflected in the literature on metaphor (Lakoff & Johnson, 1980a; Ortony, 1975; Steen, Dorst, Herrmann, Kaal, & Krennmayr, 2010). The most straightforward solution to avoiding the error of connotative overreach would therefore be exercising caution in using both diaphors (while conjectural) and epiphors (when corroborated). While this works as a tactical response to the problem, it requires monitoring of every derived usage to avoid the solecisms. None of the proponents of the three diaphors described in the previous section would have underwritten the solecistic usage. It may be impossible to ever plan for avoiding potential errors, since logically such errors would already be avoided.

A different strategy, one that we adopt, is to aim for non-reifying metaphors. This avoids the problems inherent in reifying metaphors by ensuring that the end result of the metaphor is not a thing in the world. The knowledge representation language, FERL (Pigott, 2013) created a complete system for representation as questions and answers. But, again, there may still be a danger of connotative overreach here: if there are questions and answers (which are legitimate erotetic logical constructs, per Rescher, 1982, 2000) there is a temptation to look for a personified, if not reified, entity within the system: a ghost in the machine. Moreover, the question-and answer metaphor for information was first presented by Mackay (1951) at the Macey Conferences at the same time as the classic theories of Shannon (1948), but have always been in the shadow of the reifying approaches to information. This may reflect the predisposition to reifying metaphors mentioned in the previous paragraph.

A third strategy is to attempt to avoid metaphoric speech altogether. This is ultimately not possible (Lakoff & Johnson, 1980a; Ortony, 1975), but it is possible to avoid making the metaphoric construct the aim of the research. For instance, the FRISCO school (Falkenberg et al., 1998), by considering information to be a sign, set up a framework for analysis that enabled discussion of information in terms of a reference discipline (semiotics), to some considerable success. Likewise, the L/AP school (Ågerfalk, 2004) used linguistic philosophy as a reference discipline to avoid looking for concrete structures in the world. However what is lost is the possibility for diaphoric exploration, which as we have seen, is at the heart of all science.

CONCLUSION

We have seen that a discipline is autopoietic: it is formed by the dialogue amongst its practitioners, which leads to a gradual change in the nature of that discipline over time. Mapping this dialogue maps the history of the discipline, and mapping the dialogue in turn requires an analysis of the metaphors that have been used to frame the dialogue. By using the established tools of metaphoric analysis, this paper set out to examine the dialogue, and consequently the discipline, of IS, in this light.

Surveys of metaphor utilisation in IS throughout the history of the discipline have revealed a propensity to error-prone reifying diaphors. Moreover, a survey of three popular diaphors in current use shows that while they have led to useful discoveries, they too have led to over-reach and the commission of metaphoric error. On the other hand, diaphoric conjecture is foundational to disciplinary advancement in the sciences (and a fortiori in information science) so is too valuable a tool not to use in formulating research questions.

The survey of metaphors in the IS dialogue has led to the conclusion that metaphors are unavoidable in conjectural descriptions. While the continued usage of metaphors in the discourse of IS is likely inevitable, three alternative strategies – adopting greater care with reifying metaphors, using metaphors that cannot be construed as entities, and eschewing metaphoric core constructs through use of non-reifying reference disciplines – were examined and all shown to be potentially beneficial, though requiring vigilance in use.

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