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December 2004

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ABSTRACT

The paradigmatic frameworks that give strategic direction to our research and practice in any area of information systems (IS) are often discussed with reference to philosophy. Thinkers working within five major areas in IS - nature of computers, shaping of information technologies, IS development, use of IS for human tasks, technological ecology - appeal to different, incompatible philosophic stances, resulting in incommensurable frameworks. Whilst variety of philosophies can stimulate creative thinking, problems arise when we view IS as a whole story. This paper reviews this variety and suggests we seek a single stream of philosophy to inform every major area of IS in a coherent way. How one philosophy might achieve this is briefly discussed.

Keywords

Frameworks for Understanding, Philosophical Underpinnings, Paradigm Incommensurability, Information Systems Integration, Dooyeweerd.

INTRODUCTION

Thomas Green (1990) once said "HCI is only fortuitously concerned with computers; its real aim ... is to explain the General Theory of the Artifact. Computers happen to be an extremely interesting class of artifacts, that's all." Whereas Green was interested in the local interaction between user and artifact, there are several ways in which humans interact with this extremely interesting class of artifact - as their original conceivers, as shapers of information technology (IT), as developers of information systems (IS), as users, and as those who live in a technologically shaped environment. These give us five main areas of research and practice in IS:

- the nature of computers
- shaping of ITs
- development of IS for human use
- usage of such IS
- our technological ecology.

But what of the whole story that is information systems, a story that embraces all areas? It seems rather fragmented. Information technologies do not fulfil the needs of IS developers, and developed systems that do not fulfil the needs of users. Reasons why this is so might lie not only in our management and failure to communicate but equally in the incommensurability between the meta-theoretical, paradigmatic frameworks assumed by those who research and practice in each area and by which their expectations and values are informed. It is within such a framework that debate takes place within in each area. Lyytinen (2003) calls us "to explore the content of the underlying philosophical argument in these debates and what role they assume to the philosophy as a field of inquiry."

In this paper we respond to Lyytinen's call by surveying the "content of the underlying philosophical argument" in debates in each area. We find not only do thinkers in each area use philosophy in different ways but they tend to appeal to very different philosophical stances - positivism, subjectivism, and others - some of which are antithetic to each other. So the fragmentation is no surprise. We suggest that it might be desirable to seek a single philosophical stance that can inform 'the whole story'. We introduce one that might be suitable, seeking, not a single framework for understanding all areas, but rather coherence among the various area-frameworks.

APPEALS TO PHILOSOPHY

Philosophic stances are often tacit rather than explicit, but they nevertheless influence our classifications, theories and methodologies that guide research and practice. We will briefly survey how thinkers in each major area of IS have cited philosophers. What we are interested in, here, is the broad streams of philosophy to which appeal is made rather than their detailed content.

Nature of Computer Systems

What is a computer? We encounter mouse pointers and mice, screens and computer memory, algorithms and data structures, and want to understand what they are, the relationships between them, and what to expect of them. Various frameworks have been proposed to help us understand computers (such as model-view-controller). Rarely has philosophy been employed to understanding such issues, yet each framework makes philosophic presuppositions whether it acknowledges them or not. For example, the model-view-controller framework presupposes that human perception and action can be conceptually separated.

However, there are three issues related to the nature of computers to which philosophy has been directed: the artificial intelligence (AI) question of whether computers can understand, the nature of information, and systems theory. These issues are inter-related, as in Newell's (1982) notion of the knowledge level and in Colburn's (2000) *Philosophy and Computer Science* and Boden's (1990) collection *The Philosophy of Artificial Intelligence*. Newell founded his proposal philosophically on the positivist, Brentano, and a perusal of the indices and reference lists in Colburn and Boden shows it is mainly philosophers of the rationalist, materialist or positivist traditions that are referred to to address these three issues. A minority opinion is found in Boden's collection: the phenomenological stance of Heidegger, Husserl and Wittgenstein is employed in one paper to argue against strong AI.

This majority philosophic stance (rationalism, materialism, positivism) seems to suit much of the work in this area. Behavioral and cognitive sciences have found positivist techniques useful, and logicians embrace rationalism. But this combined stance means the field has exhibited a tendency towards reductionism.

Shaping Information Technology

IS developers, who develop artifacts and systems to aid human application tasks, employ ready-made information technologies of diverse types (such as programming languages, special-purpose code libraries, data storage systems, specialized editors, application builders) and adhere to protocols and standards like HTTP. These technologies, protocols and standards must be created and 'shaped'.

The shaping of IT has been guided by meta-theoretical frameworks like the Turing machine and procedural, functional, logic or object-oriented models of programming. But these cannot account for the diversity of technologies - statistics, geographic information systems (GIS), animators, Internet, computer games, text-handling, databases, etc. - nor usefully guide researchers or developers who shape them. For example, why is it that text technologies offer spelling checkers, but neither GIS nor games need them.

There have been few attempts to account for such things philosophically, with the possible exception that Gibson's (1977) notion of affordance has been adapted for data visualization, and Basden (1993) proposed a similar notion of appropriateness for knowledge representation. Both presuppose diverse ontology that transcends humanity. Each IT implies a different concept of information, means of expression, style of user interface and other facilities.

Direct reference to mainstream philosophers has been sparse, but it does occur. Brachman and Levesque (1985) cite Leibniz as 'the father of AI'. Winograd and Flores (1986) discuss what makes computers difficult or easy to use on the basis of whether they are shaped according to Descartes' or Heidegger's thought, while Basden and Hibberd (1996) use Polanyi's thought to the same end. Still however, these give little help in accounting for the diversity of types of IT. More substantial use of philosophy, and more able to account for diversity, has been made by Poli (2002). With a background in philosophy himself, he makes careful use of several philosophical ideas, especially Hartmann's notion of ontic strata,.

Information Systems Development

Information systems development (ISD) consists of moulding extant information technologies into IT artifacts and systems for human use, and also forming human structures around them. The main issue debated is methodology, for analysing situations and requirements, developing IS therefrom, and managing such development.

Early ISD grew out of the first two areas as the application of computers, and a generally functionalist or positivist stance was adopted. The stance was assumed, rather than argued for, and philosophical reflection about it was rare. But as the importance of human 'appreciation' (Vickers, 1983) was discovered, new approaches were sought. They had to be justified, so philosophical reflection ensued and has now become quite common.

Perhaps most renowned of these approaches is soft systems methodology (SSM) (Checkland, 1981). Of central importance to SSM are the lifeworld and, in stark contrast to positivism, *Weltanscauungen* ('Ws' - perspectives and values), so philosophical justification for these was sought in a generally subjectivist phenomenology. Checkland himself is a prolific

thinker and one can find reference to nearly 40 philosophers in the index of his classic work (1981). But, Probert (1997) points out, many of these are inconsistent with subjectivism: does this cast doubt on the validity of Checkland's use of philosophy?

SSM has also been criticised for being "more suitable for preserving the status quo than going beyond it" and "incapable of understanding the social structures that condition these Ws" (Jackson, 1991:174-5). As a result, a second new approach developed, critical systems thinking (CST), based especially on Habermas' critical theory and perhaps more philosophically coherent. In contrast to subjectivism, this embraces a transcendent normativity, especially in its notion of emancipation. A third new approach is emerging - 'multi-modal' (de Raadt, 1997) or 'disclosive' (Strijbos, 2000) systems thinking - that likewise embraces a transcendental normativity but is geared to diversity and based on the thinking of Dooyeweerd.

The use of philosophy in this area contrasts in two ways with that in the previous areas. First, the philosophies appealed to are not the positivist or ontological ones found useful in the previous areas, but are ones that acknowledge interpretation and/or normativity. Second, while the nature of computers is itself a largely philosophical issue and can take philosophical arguments ready-made, and technology shaping takes from philosophy ready-made ontologies, in this area philosophy is used to critique old approaches and justify new ones (as above), to enlighten our understanding of issues and to develop methodological guidance. For instance, Checkland (1981) uses Dilthey to explain *Weltanschauung*. More substantially, Winfield (2000) uses Dooyeweerd's (1955) notion of modal aspects to construct a Multi-Aspectual Knowledge Elicitation method, and Bergvall-Kåreborn (2001) uses the same philosopher to help IS developers identify what is important in a system.

Usage

Usage involves both usability and usefulness. Work on usability, focusing mainly on design of user interface and interactions, can be seen as technology shaping, and has traditionally been grounded in psychology and linguistics rather than philosophy.

Usefulness, a more recent concern, is concerned with the benefit or detriment of employing IT in human application tasks, with success and failure. Especially challenging are issues of diverse, indirect, unexpected, long-term impacts, and conflict. Philosophy has been more important here, employed approximately as in ISD.

Actor-Network Theory is increasingly popular as a framework to understand usage that enables us to address indirect impacts. In developing it, Latour (1987) makes much more reference to science and the activity of scientists than to philosophy, but he does argue philosophically, and he makes philosophical presuppositions about the equivalence of human and non-human actants and that the usage situation can be modelled as a network.

Kamm (1997) employs Parsons' ideas of functional subsystems to address issues of conflict and consensus. Romm (1997) and many others use Foucault's notions of power. Lyytinen and Klein (1985) employ Habermas' notion of knowledge constitutive interests and typology of action types, as does Ngwenyama (1991).

But few of these seem able to differentiate between benefit and detriment, success and failure, except in the simplest of ways, and yet to do so would seem fundamental to this area. Basden (2001) tries to address this by a different approach based on Dooyeweerd.

Technological Ecology

The final area studies how information technology itself becomes our ecology, an environment in which we live and work. Thinkers in this area tend to focus on two main issues: how IT affects society and the way we live, and how our world views 'inscribe' technology. Our environment both shapes us and is shaped by us.

Philosophical thinkers like Heidegger and Ellul have addressed the first issue in terms of technology as a whole, rather than information technology specifically, and tend to fall into two camps, optimistic or technology-rejecting. More recent debate about how IT as such (especially the Internet) affects life and society often circles around issues like globalisation, privacy, international law, democracy, freedom and ethics, but with little reference to philosophy. Korten (2001) makes only two references to philosophers while Langform (2000) makes none.

More reference to philosophy is made regarding how society's world views are 'inscribed' in technology. Winograd and Flores (1986) argue that a Cartesian view results in diminished usability and that Heideggerian technology, easier to use, could have significant social consequences. But Spaul (1997) argues that the Heideggerian approach would affect social structures very little, and recommends the social theories of Weber and Habermas.

A major stance that informs debate in this area is feminist thought. Adam (1998), for example, argues that gender is inscribed in IT, making it less suitable for use by women. Though she makes reference to a dozen 'standard' (masculine) philosophers, her framework for thinking is more substantially based on a feminist thinkers such as Haraway and Suchman. In like manner, Pacey (1993) argues that Western values are inscribed into IT, and thus current IT is not appropriate for the non-Western world; but he does not make much explicit reference to philosophy.

Schuurman (1980) addresses both issues. After criticising the ideas of various thinkers (Heidegger, Ellul, Wiener, Habermas and others) he develops a 'liberating perspective for technological development' that is both critical and affirming of technology but needs development.

DIVERSITY OF PHILOSOPHIC FRAMEWORKS

From the necessarily brief overview above, we can see that widely divergent philosophic stances are appealed to in the five areas:

> 1. nature of computers: positivist, rationalist, materialist
> 2. shaping of IT: ontological
> 3. ISD: phenomenological, subjectivist, critical
> 4. usage: critical, multi-aspectual
> 5. technological ecology: feminist, various.

Variety can be beneficial. One philosophy might fill gaps left by another, and variety can stimulate thought, debate and research. But it can also bring problems because each philosophical stance defines an 'horizon' within which certain things are meaningful and other things are not. As a result, "two scientific schools ... will inevitably talk through each other" (Kuhn, 1996:109) because what one values is deemed irrelevant, superficial or even "radically misconceived" (Spaul, 1997:40) by the other. Interdisciplinary working is hindered because those working in different areas cannot fully understand what is important for each other. Then, because different things are valued, often tacitly, conflicts can ensue. And when philosophically based conflict does occur, neither philosophy can help resolve it because each stance is held as a dogma that excludes the other, often unwittingly so.

It is not surprising, therefore, to find that technologies developed under frameworks informed by positivist, rationalist and materialist philosophies often prove inappropriate for IS developers who must contend with differing human values. Consequently, developers are forced to employ complex algorithms to get round the limitations in the technology, which extends project development times and can be a source of errors.

In theoretical discourse, the main dichotomy at present is between areas 1, 2 ('technological') and areas 3, 4, 5 (human, social). But we can also see tensions between the latter areas . Discourse in ISD tends to give more attention to perspectives of those involved than to the more difficult usage issues. Discourse about usage is content to focus on benefits to users and overlooks societal impacts. Discourse in area 5 seldom considers the more practical issues. The problem lies not in what is said but in what is left out. Each area has its own horizon within which only certain things are meaningful. Other things, being largely beyond the horizon, are thus unable even to be 'seen'.

Of course, in everyday life and work, integration of concerns from different areas can and does occur, with people working in one area seeing things from other areas as meaningful, even if their professed philosophic stances might not underpin such meaning. So can we not find a philosophical stance whose horizon is broad enough to allow what is important in all areas to be visible?

Philosophical Requirements of Each Area

First, let us review what each area might require to be visible within the horizon of any candidate philosophy. Our discussion above suggests a number of things required of philosophy to help us form frameworks for understanding each area.

- The nature of computers requires a philosophy that takes ontology seriously. It is difficult to see how a purely nominalist philosophy can help us discuss the nature of computers, as opposed to help us discuss our beliefs about the nature of computers. Moreover, it is not helpful when a philosophy presupposes either that computers and humans are basically the same or that they are so radically different that there can be no comparison between them. It is difficult to see how either rationalist or romanticist philosophies can, ultimately, do more than fall back on dogma when confronted with these issues. We need a philosophy that enables us to discuss the ontic status of both humans and computers, and of the relationship between them.

- The shaping of technology requires not only ontology, but an ontology of diversity. Otherwise, ultimately, we have no basis for discussing the variety we encounter when we take a pre-theoretical attitude to information technology, and are driven back to reductionism. But the ontology we need must also be able to speak of the coherence we experience within this diversity. That suggests we need a pluralistic ontology in which the ontic categories are irreducible to each other and yet there are ontic relationships between them. Reviewing the history of philosophy, we can generally observe that when ontology has been informed by Aristotle's substance-concept, we have usually tended towards reductionism, either of a monist or dualist type. Plato's Ideas concept gives ontic diversity but finds it difficult to account for coherence. Historicism and subjectivism likewise allow for diversity but it is difficult to avoid fragmentation.

- ISD requires a philosophy that can give a genuine account of human freedom, interpretation and perspectives (the insight from SSM) and at the same time possesses a transcendent normativity (the insight from CST). It is difficult to see how a cognitivist stance, or one based on language games, can be sufficient here, even though they might be able to provide a theoretical account of such things in their own terms. Moreover, philosophy should be able to speak to the management aspects of ISD, and not just relegate them to the realm of practice.

- Usage of IS involves humans and IT, and so requires philosophy that acknowledges the possibility of a genuine point of contact between technology and human beings. Being mostly of the lifeworld, with the human being in a social context, usage requires a philosophy that affords dignity to everyday life and to what it means to be fully and socially human. So materialist and rationalist philosophies are unlikely to be helpful. To deal with impact of usage, especially unexpected impact, including on non-human stakeholders like animals or the environment, requires a philosophy that can transcend and yet acknowledge the perspectives of human stakeholders. To differentiate benefit from detriment, especially when both occur, demands an intrinsic normativity within the philosophy, and, again, one that transcends, rather than being derived from, the value systems of those involved in usage. Therefore subjectivist philosophies are unlikely to be sufficient.

- To understand technology as (part of) our ecology requires a philosophy that enables us to analyse the circular dependency between environment and technology. It must see both inscription and societal structures as meaningful and mutually irreducible. Philosophy that presupposes environment (including society) can be reduced to interactions between individuals is unlikely to be useful.

TOWARDS A COHERENT PHILOSOPHY

It is clear that positivist, materialist and rationalist philosophies are of little use in areas 3-5. Can we extend philosophies found useful in those areas back into areas 1, 2? Since subjectivist and some phenomenological stances downplay ontology, often assuming it arises from epistemology, it is unlikely that these will be of much value in areas 1, 2.

It may be that Habermas' thought could speak into all areas. His notion of emancipation speaks into the area of technological ecology, his theory of communicative action could inform our understanding of usage, the action types delineated therein could inform the shaping of communications technology, and his notion of interests could inform ISD. He has a strong theory of the lifeworld. He has discussed technology as such, and of course his notion of ideal dialogue might be usable to distinguish IT from other technologies. But that he talked about the 'demise of ontology' and said (1986:82) "I would like to replace the ontological concept of 'world' with one derived from the phenomenological tradition" may give cause for concern. It seems even Habermas finds it difficult to keep ontology, epistemology and normativity in one picture.

This author is exploring the potential of Dooyeweerd (1955) to provide a coherent philosophy in which neither ontology, epistemology nor normativity are reduced to each other. All derive, Dooyeweerd suggested, from Meaning (by which he meant 'referring beyond to the other', and ultimately to the Divine Other). Initial investigations suggest that his thought can underpin the five areas. The following condensed account will be expanded in Basden (forthcoming).

- Nature of computers. "Meaning is the Being of all that has been Created" (Dooyeweerd, 1955, I:4) - including computers, mice, algorithms, and even human beings. Distinct spheres of Meaning ('aspects') account for different ways of Being of the computer, and hence these beings. We find a link can be forged between the opposing camps of AI.

- Shaping of IT. Each broad type of IT corresponds to a different aspect. Aspects define different basic types of objects, properties, functionings, affordances and meaningful facilities. For example spell checkers are meaningful in the lingual aspect, but not in the spatial nor aesthetic - which answers the question posed earlier. See Strijbos and Basden (forthcoming).

- ISD. The diversity of spheres of Meaning (aspects) provides a framework for analysing ill-structured situations - such as Winfield's (2000) Multi-Aspectual Knowledge Elicitation. The later aspects are normative, enabling free human interpretation and action. The pistic aspect is concerned with *Weltanscauungen*. The aspects may be used to guide ISD process: for example, the economic aspect provides norms of frugality and management, the juridical aspect, of giving each stakeholder their due.

- Usage. Dooyeweerd's crucial insight was that aspects are also law-spheres, enabling (rather than constraining) meaningful human functioning of diverse kinds. Together, aspects form a transcending law-framework that enables all we meaningfully do and are (cf. Heidegger's Dasein). In the normative aspects (analytic, formative, lingual, social, economic, aesthetic, juridical, ethical and pistic) we have freedom, but with repercussions. Diversity of aspectual types of repercussion explains diverse, indirect impacts. Differentiation of beneficial from detrimental usage and impact arises from the normative nature of aspectual law, and this transcends humanity. Everyday life (lifeworld) involves functioning in all aspects more or less tacitly - usage of IT is seen as such - which accounts for unexpected impacts. See Strijbos and Basden (forthcoming).

- Technological Ecology. Dooyeweerd's theory of entities, enkaptic relationships and *Umwelt* can throw light on the circular relationship in which IT both shapes us and is shaped by us. His theory of ground motives as "spiritual driving force that acts as the absolutely central mainspring of human society" (Dooyeweerd, 1975:9) may be used to understand inscription of technology by our world views. Schuurman's (1980) 'liberating vision of technology' is based on Dooyeweerd.

From these indications, it seems that Dooyeweerdian philosophy has an horizon wide enough to include what is important in each area. But its proposal of an ontology and normativity that transcend human interpretation and yet do not deny the latter might seem impossible to some readers. Arguments for its feasibility and validity are lengthy (Dooyeweerd, 1955), but we draw attention to the following. Dooyeweerd started with different presuppositions than those underlying Western thinking for 2,500 years. He redefined subject and object in a non-Cartesian way that does not presuppose a thinking ego. He made theoretical thought itself a critical problem for philosophy, going deeper than even Kant did in his 'critical' approach, and healing the breaches made by Kant between Thought and Thing, between Is and Ought. Dooyeweerdian philosophy is increasingly finding application in fields as diverse as management (de Raadt, 1997), environmental sustainability (Lombardi, 2001) and understanding Korean culture (Choi, 2000) in addition to information systems.

CONCLUSION

Philosophy has been used in the various areas of IS in several ways, and the types of philosophy appealed to are diverse and frequently incommensurable. We have argued that a single philosophic underpinning for frameworks for understanding the areas of IS might be desirable, and feasible if based on Dooyeweerd's (1955) thought. It does not give us a single framework by which to understand all areas, but rather provides a philosophical stance whose horizon is wide enough to embrace all that seems important in all areas, and thus enables us to construct and critique frameworks for understanding each area that stand some chance of cohering with those in other areas. Frameworks for the five areas mentioned are being worked out and will be reported shortly (Basden, forthcoming).

Lyytinen (2003) believes that a search for 'ultimate foundations' is 'hopeless'. But that should not deter us because what we seek is not an 'ultimate foundation' but rather a philosophic stance that enables us to develop frameworks for understanding each area of IS that will cohere by their inner tendency rather than being forced together. This is not the positivist search for an "ultimate language and logic for the justification of IS knowledge" that Lyytinen (2003) criticises, because, as Dooyeweerd (1955) argued, adoption of any philosophic perspective including his own rests on presuppositions that are extra-theoretical in nature, and so no philosophic perspective can be ultimate. What it does is enable us to bring together things that have little meaning in terms of each other in the hope that 'the whole story that is IS' will become coherent.

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