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Human in the loop

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Introduction

Klein and Myers' (1999) statement that the natural science model of social science is widely accepted in information systems (IS) epitomises the ongoing debate in IS research about the research foundations and the methods that are applicable in the discipline. This is neither a new problem, nor one isolated to IS. Right from the enlightenment, the abandoning of the theological and the metaphysical led to the reliance on science as the philosophical foundation and direction for enquiry and study. This developing view of what is scientific led to the classification of sciences and an increasing dominance of reductionism as the consensus approach. Comte placed sociology as the pinnacle of science, where all science merges to act on humans. Furthermore, it was Durkheim who sought to place social science on what was perceived as the firmer foundation of natural sciences, viewing the social realm as external to us and hence best addressed by the empirical methods of natural sciences (Prowse, 2005). Human agency was eclipsed and individuals became part of a collective, a deterministic social machine. While Durkheim's influence may have waned, the ideas of what is scientific and its application to our understanding ourselves as social beings have been woven into our culture and way of thinking.

The dominance of logical positivism and empiricism in the 20th century right up to the 1960s suggested that anything not grounded in empirical, repeatable observation should be rejected and was 'unscientific'. The high regard for natural sciences by the logical positivists led to its reification and the view of social sciences as a lower form of academic pursuit. Popper's refining of logical positivism established an ideology that scientific method required theory and that theory must be refutable. Good scientific theory is a prohibition (Ebringer, 2011). Such a philosophy underpins much of IS research in which hypotheses are proposed and then declared true or false as a result of the statistical analysis of surveys. Critical to the logical positivism view of scientific endeavour was a stripping of context and time. Science practice was seen as ahistorical (Okasha, 2002). Positivism sought to strip philosophy itself of reflection and metaphysics and make it more 'scientific'.

However, as logical empiricism disintegrated; it was understood that science is far from a simply neutral and objective process. Rather it is influenced by history, context and is strongly political. Kuhn's (2012) *The Structure of Scientific Revolutions* opened the debate on the nature of science and its practice; something reflected in sociological treatments such as Latour's (1988) *Science in Action.*

The underlying belief or rather worldview which sees science and scientific 'method' as the sole arbiter for thinking and acting has not only persisted but grown in academia. In business schools, a dominant scientific model including abstract financial and economic analysis, statistical multiple regressions, and laboratory psychology (Bennis and O'Toole, 2005) not only excluded exploration of alternatives but rendered research irrelevant to practice and devoid of political and economic context. The questioning of whether IS is a science only reflects debates in business schools or in economics departments where the failure to predict the recent financial crisis despite a plethora of mathematical models raised severe doubts as to the scientific credentials of economics (Wang, 2013).

The afterglow of positivist philosophy permeates popular culture: 'Philosophy is dead . . . scientists have become the bearers of the torch of discovery in our quest for knowledge' according to Hawking and Mlodinow (2010). This dominant paradigm subordinates social sciences as second-class citizens below the natural sciences and creates an ambition to rise to the standards of natural science in our study of IS. And yet as the paradigm of the scientific method frays at the edge as Kuhn predicted, more and more effort is made to ignore problems or explain away the inadequacies of the scientific method in social sciences.

The authors' treatment of natural sciences and questioning what we believe in natural science is one such attempt. If efforts to achieve our ambition to raise social science to the level of respect accorded natural sciences in our society is failing our response will be to reinterpret natural sciences. If we apparently cannot raise our status to that of

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natural sciences, we will seek to topple natural science from its pedestal.

The disintegration of logical positivism, on which IS researchers have relied, must be countered by reinterpreting logical positivism. The Vienna School was diffuse and had many views. Logical positivists did not mean what they said. Case studies were allowed. Logical positivism is not the hard taskmaster we thought it was (Siponen and Tsohou, 2018). Such a liberalisation of logical positivism is preferable to abandoning a worldview and admitting its demise.

Now the authors provide a similar treatment for natural science. Since natural science is the dominant approach to IS, and the dominant paradigm, we cannot question its place in IS so we will reinterpret it and demonstrate that it is our beliefs about natural science which are constraining IS research rather than the paradigm itself.

There are fundamental differences between natural sciences and IS which cannot be papered over by demoting natural sciences. The following sections discuss these differences in terms of what is being studied, by whom and how: the observed, the observer and the observation. The key issue, which is considered in the final section, concerns how we perceive human agency.

The observed

The complexity of any natural science system is immense, and our attempts to explore such systems through the scientific method only expose greater levels of complexity. Simple genetics experiments led eventually to the sequencing of the human genome. This led to the unexpected revealing of an extensive library of short sequences hidden in apparently repeated sequences of 'junk DNA' which turn out to be complex programmed switches.

The subject matter of natural sciences, stars to cells, atoms to volcanoes, is different to the subject matter of IS which concerns the interactions between humans in organisations and communities and the effect of the technological mediation of those interactions.

The observed in IS, in contrast to cancer biology, is more complex; cause and effect are layered, interactions are multiple, intervention is complex and the effects hard to predict. But it is not just a case of a different level of complexity; it is also the nature of a human system under study compared with a cancer system. Humans have agency. They can change their environment based on rational decisions and intentionality. They do not just react to the environment: 'Ice-creams don't choose to melt, but we choose to buy one'. We act with intent. We have free will to fulfil desires or deny them. Furthermore, we are self-aware and conscious. Humans can make attempts to predict the future and change behaviour accordingly. Such decision-making capability is aided by the IS, pattern identifying machine intelligence systems and big data systems, for example, which are the subject of our academic scrutiny.

Individual human agency and intention is then melded into institutional and organisational shared intention. Individual commitments may be subsumed in joint commitments (Tollefsen, 2014). Individual and organisational decisions are further influenced by context and history. No two organisations are the same, nor are two individual humans because everyone has a unique history, a specific narrative through time which influences intentions, agency and action. As such this is conceptually different from a polymerase chain reaction (PCR). As long as we follow the instructions on the kit, PCR will work the same today as yesterday.

Most importantly the human has moral agency. Whether concerning individuals or organisations, the IS phenomenon is value-laden. The progression of an organisation and its use of information are underpinned by moral frameworks and assumptions. Ethical beliefs are held and power wielded in the exercise of agency and control. There is a moral responsibility which is absent in the cancer cell.

The observer

The appeal of IS researchers to natural science involves a false sense of distancing. Microscopes and telescope emphasise the separation between the observer and the observed. The observed is outside the system under study. And being outside the system, we can bring the system under study into the laboratory, bounding it and simplifying it to study one isolated aspect. But as Siponen and Klaavuniemi rightly note, intervention is a common strategy in natural sciences.

Furthermore, in natural sciences the observer may not be objective. Natural science is itself value-laden. Value-based decisions are made on what to research, how to research and what the data mean. Natural scientists bring their own motivations, ambitions and world-views to their work. This can lead to intentional and unintentional bias in investigation and results, and even falsifying of results as illustrated in the recent retraction of papers on spider behaviour (Viglione, 2020).

While the phenomena in natural sciences may be ahistorical, the human observer lives in a historical, social and political context which will influence understanding and interpretation. And of course these interpretations change with time. The observer is of the same stuff as the observed.

The structure the observer perceives in the world around her will to some extent be a result of projecting her concepts onto the world (Webb, 2020). While this may be of little concern in studying Cambrian rock structures and cellular transport mechanisms, it is more critical in management science. In studying IS, we are studying a projection of the mind, a distilled representation which filters out perceived irrelevancies, and which seeks to control through simplification and standardisation.

The observation

Faced with such complexity, the natural scientist has to construct and isolate the system in some way. Sea urchin development, for example (Martik et al., 2016), involves a complex network of more than 40 genes which are switched on and off as development proceeds. Scientists study sea urchin embryo development by mutating individual genes with chemicals and observing the effect. The output is not an abstract theory but a developmental map of the genetic and biochemical changes which occur in the development of the first 50 cells. As with pharmaceutical research, there is no delusion that what we see in the laboratory is directly transferable to the world. If laboratory results were transferrable, then massive investment in clinical trials would not be required.

The methods natural scientists use are both qualitative and quantitative. They involve experimentation and observation, laboratory work and field work, microscopes and telescopes. They also require interpretation within the social community. As Siponen and Klaavuniemi suggest, even the most explicit data such as slices through biopsies are subject to interpretation and even disagreement among experts. The whole process of scientific investigation is one of negotiation and debate to come to agreed conclusions within communities of practice, as Latour (1988) and others have illustrated.

Natural science employs a wide range of research methods which include statistical techniques and mathematical modelling. There is not a case for differentiating between natural science methods and statistical and mathematical methods. The latter are natural science methods.

But it is not the method which is key but the measurable. What is being measured and what assumptions are being made about the relation between the measureable and the observed phenomenon? The selection of a measure is not value-free, neither is the resulting dataset which may have bias, for example. However, there is a world of difference between the selection of carbon dioxide concentration as a measure of plant respiration and the selection of perceived ease-of-use as a measure of usability. Carbon dioxide measures are reproducible physical measures. Perceived ease of use is subjective. My opinion, recorded on a Likert-type scale, may vary according to how tired I am, what others opinions are, my experience of using a particular application or even my perception of, or attitude to the company whose software is being evaluated. Proxy measures in IS may be so far removed from the phenomena as to be meaningless. IS studies tend to select proxy measures whose relationship with the actual phenomena is questionable at the least.

In addition, reproducibility is a problem across natural sciences. Failure to demonstrate reasonable levels of reproducibility in psychology (Owens, 2018) and issues concerning low statistical power are present in the natural sciences (Neuroscience News, 2019). If replication is a problem in natural sciences, it is likely to be a greater problem in social sciences because of the complexities of involving conscious agents who exercise free will. The IS replication manifesto not only looks to physical sciences as its model, but suggests that failures to replicate in social sciences are down to inadequacies in statistical technique (Dennis and Valacich, 2014).

Similarly, laws which might be deduced from observation are generalisations, as Siponen and Klaavuniemi suggest, whose function is to enable us to make sense of the world. They are law tools for enabling management of the world we are in. The law itself does not exist out there. Contrary to Hawking, a law has never made anything happen or brought anything into existence. Gravity is not created by the law of gravity. Rather, the law of gravity is a concept which enables us to make sense of the world around us.

The problem in observation lies more in our fetish for numbers than our perception of natural science. This trust in numbers is deeply cultural. There is safety in numbers; they are perceived as being objective (Montuschi, 2014). This deeply embedded belief permeates not only the research but the practice. The more numbers we have in big data systems, processed by AI applications, subjected to data analytics, the more definitive answers we have. We pursue a numerical single source of truth to provide an external justification for decisions which negates human responsibility. The truth is in the statistics, and the conclusions out there, objective, unquestionable.

Human in the loop

The authors' appeal to the range of methods in natural science, to the flawed objectivity and value-laden nature of natural science research and to the uncertainty and non-deterministic nature of many phenomena studied, from weather to quantum tunnelling in the brain, does not excuse the obsessive concentration of IS research on method and the scientific justification of method. Declaring natural sciences to be as open to qualitative methods only serves to deflect attention from the attempts to marry IS to physical sciences, stem cell research, or the mathematical modelling of populations. The fundamental issue does not concern what method we apply, but what the phenomenon is we are studying and how we relate to it.

In an attempt to categorise IS research as scientific, as yielding to the robust methods of science and engineering, Siponen and Klaavuniemi seek to reinterpret natural science to make it more palatable to the wishes of IS researchers. But it is a category error to suggest that the study of non-conscious natural systems is on a par with the study of human agents. A kettle boiling provides one focus on facts: its electronic mechanisms, the heating, the movement of atoms. The kettle has no agency. It did not decide to turn on. Nor will it decide to turn off. That is determined by the physical properties of the thermostat or the programming. Agency resides in the human and the learned and practised social norms and rituals of human community.

The elephant in the room concerns not our characterisation of methods, but our characterisation of the human. The study of IS is the study of the human. The organisations in which the IS resides are complex interactions of agents pursuing both aligned and conflicting purposes and desires. The IS is located in a sea of moral responsibility. IS mediates power relationships; they express contracts between humans; they crystallise shared meaning and ambition; they mediate conflicts; they reflect historical and social contexts; they give expression to the ebb and flow of power between organisation and organisation and organisation and individual. IS are an expression of humanness. Of more relevance, perhaps, is the Nietzschean thesis of the will to power, since IS encode relationships between humans, mediated through transactions and contracts. They act as distributors of power. They reflect what we think we are and how we relate to each other.

The IS research mindset which embodies the range of beliefs concerning natural sciences maintains that all reality can be explained by natural sciences. It is this epistemic scientism that permeates IS research. But it is human beings who do the academic research: human beings enquiring of human beings. And human beings are centres of subjective experience, steeped in values and culture, imposing interpretations on the world.

At its heart Siponen and Klaavuniemi's thesis concerning IS researchers' beliefs about natural sciences is a red herring. The study of IS is the study of humans as distinctive manipulators of information. Our effort in addressing the philosophy of IS should be directed not to the justification of the application of natural science methodologies, but rather to the understanding of the ethics of IS as instruments of power and the expression of human existence.

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