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On natural science beliefs in IS: Short comments to commentators

Mikko Siponen[1] and Tuula Klaavuniemi[2]

McBride (in this issue) rightfully stresses some differences between IS and natural sciences (NS). For him, for example, the IS phenomenon is more complex than cancer biology. This is questionable.[1] The complexity, however, may be different. Another difference noted by McBride (this issue) is human intentionality, which NS phenomena lack. AI research issues (e.g. ethics of AI), however, may introduce non-human intentionality in IS. We proposed that we can also learn from NS despite the differences (Siponen and Klaavuniemi, this issue):

> "Many differences exist between IS and the natural sciences, and thus IS should not blindly follow the natural sciences. However, there is much that IS research could learn and adopt from natural science research."

Hevner (this issue) clarifies that the goal of scientific research is truth—not absolute truth. This clarification is important. However, it remains to be seen how idealizations common in sciences are compatible with this view. In addition, many candidates for "laws" in IS, including design science, seems more rightly probabilistic statements rather than genuine laws (Siponen and Klaavuniemi, 2020).

According to **Mingers** (this issue), most of Siponen and Klaavuniemi's (this issue) criticism has been covered by critical realism (CR). Although CR advocates in IS often posit CR against, and superior to, positivism and interpretivism, we missed a systematic critique of NS beliefs in IS by CR advocates. Mingers (this issue) criticizes that we did not put forward "an alternative approach," or a model. We in Siponen and Klaavuniemi (this issue) did not introduce a specific model or approach. However, Siponen and Klaavuniemi (this issue) recommended several issues for future consideration. These recommendations were given without restriction to a specific approach, or a philosopher. This is a strength. It allows IS scholars to update their views based on recent developments in the philosophy of science, without imposing any restrictions by a specific philosopher or approach. Mingers (this issue) highlights the promise of mechanism-based explanations (MBEs), as they are often deemed alternative to laws. MBEs are promising, especially given that we hardly have genuine laws or deductive-nomological (D-N) explanations in IS (Siponen and Klaavuniemi, 2020). Mingers (this issue) calls for going beyond the impasse of positivism and interpretivism. Philosophy of science has certainly developed beyond these "-isms." We call for critical understanding of the state-of-art in the philosophy of science, and their prospects for IS, including mechanisms.

Schlagwein (this issue): There is a debate whether IS research should be NS based. Siponen and Klaavuniemi (this issue) aimed at challenging potentially questionable natural science beliefs, not to uncritically copy "correct" NS beliefs to IS. Schlagwein (this issue) correctly notes that we do not clearly differentiate between the actual NS research practice and philosophy of science regarding NS. For Schlagwein (this issue), this matters, first, because philosophy of science focuses on idealized science.[2] In addition, for Schlagwein (this issue), idealized science cannot be misconstrued as actual science. The situation may be even more complex. For example, D-N is reported by Hempel not to present actual scientific explanations, but as a logical reconstruction for philosophical purposes (Hempel in Siponen and Klaavuniemi, 2019). Despite that, some scholars regard IS as following D-N (see Siponen and Klaavuniemi, 2019). In such cases, D-N seems to be misconstrued as actual science in IS and as a philosophical reconstruction.[3]

For **Myers** (this issue), Orlikowski and Baroudi (1991) and Lee (1989) present an idealized view of NS research through positivism. It is questionable that these studies refer to NS as *idealization*, that is, deliberate misrepresentation of NS for a specific strategic purpose. Consider, for example, the natural science model of social science:

Positivism is also known as the "natural-science model of social-science research" because it proceeds to implement, in social science, the image of how research proceeds

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in physics, biology, and other natural sciences (Ngwenyama and Lee, 1997: 149).

Why say this if the model idealize, namely intentionally misrepresents NS? Moreover, what would be the strategic reason to misrepresent NS? Myers' (in this issue) use of "idealized" seems different from the standard philosophy of science meaning of idealization (Siponen and Klaavuniemi, this issue). Thus, Myers (this issue) and we (Siponen and Klaavuniemi, this issue) may be talking about fundamentally different issues.[4]

With reference to randomized controlled trials (RCTs), Myers (this issue) sees that "quantitative methods are still held up by natural scientists themselves as an idealized model" and as the "gold standard." An RCT is not the gold standard in NS generally. RCTs are commonly advocated in clinical trials in medical research. Siponen and Klaavuniemi (this issue) discusses NS, not medical research, beliefs. In addition, "ideal" should not be conflated with "idealizations" (deliberate misrepresentations). Myers (this issue) claims that numbers are ideal, "as they are in RCTs." But numbers are neither ideal nor idealizations (as used in philosophy of science) in RCTs. One ideal in RCTs is separating causal effects from a mere association. In an RCT, homogeneity of sample and average treatment effect (ATE) are possible candidates for containing idealized assumptions. In contrast to Myers (this issue), numbers are not the gold standard in RCTs, but assumed controllability of causal effects. Finally, RCTs produce ATEs. The application of ATEs to individual cases is not straightforward, and tends to require qualitative, case-by-case application by the physician for each patient as well.[5]

To conclude, NS assumptions have been influential in IS. Some IS scholars report a pressure to meet a model attributed to NS. According to other reports, IS field survival was dependent on drawing on a research model attributed to NS. Others posit their research against NS, or against "positivism" often associated with NS. It should be noted that the influence on NS philosophy in IS is actually much wider than the references to NSs, as suggested in the IS literature. Consider, for example, many well-known concepts, such as nomological, Popper's falsification, D-N, and the hypothetico-deductive (H-D) model. All of these concepts are based on philosophizing in terms of NS. What is perhaps even less known in IS is that all of them (e.g. Popper's falsification, D-N, H-D) also originally assume—and thus are only valid with—a law-based view of science where laws are exceptionless generalizations. Such concepts are questionable, as they can be misleading or require too much due to a lack of true laws or a sparsity of genuinely deductive explanations in both NSs and IS. Notwithstanding, one can easily find these concepts in IS literature. Siponen and Klaavuniemi (this issue) started questioning some of these IS beliefs on NS. Some commentators provide alternative interpretations, some of which might turn out to be more well founded than ours in (Siponen and Klaavuniemi, this issue). Despite that, the existence of many problematic NS assumptions in IS, which asks too much from any science and are misleading, remains a fact. While the task of questioning these beliefs remains incomplete, it should be seen as part of a larger program that critically scrutinizes every scientifically or philosophically important concept in IS. Such a program is actually positive, for example, by debunking misleading or problematic assumptions. For example, realizing that many candidates for "laws" in IS are not actually genuine laws but probabilistic claims would require and open new research avenues to examine the probabilities of such claims in different contexts. Of course, this program in itself must withstand critical scrutiny.

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Notes

1. There are millions of cancer biology studies; the number of different cancer accounts has increased over time to hundreds of different cancer types. As noted in Siponen and Klaavuniemi (this issue), the bad luck theory of cancer formation suggests that we cannot predict at the individual level who will get cancer.
2. Although logical empiricists put a premium on logical reconstruction of NS for philosophical purposes (Siponen and Klaavuniemi, 2019), it remains debatable to what extent modern philosophy of science reconstructs the "ideal type" of science.
3. The suitability of anything from the deductive-nomological (D-N) model of explanations is questionable in IS (see Siponen and Klaavuniemi, 2020).
4. "A point that the authors fail to note, however, is that these idealized models are usually taught to students as the truth" (Myers, (this issue)). But idealizations in the philosophy of science are deliberate misrepresentations. It is not a deliberate misrepresentation if "models are taught to students as the truth."
5. Diffuse large B-cell lymphoma (DLBCL) is one type of

cancer. One treatment is chemotherapy. For DLBCL, at the 2-year follow-up point, 57% of patients treated with this treatment is alive; 57 is the ATE. This means that the effect of chemotherapy treatments varies from patient to patient. One patient might die before the 2-year follow-up, a second patient might be alive up to that point or even longer, and a third patient might experience lethal side effects of the chemotherapy.

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