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How to Do Things with Knowledge

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In his fascinating article Pablo Schyfter (2020) draws our attention to an often neglected topic in social epistemology and sociology of knowledge: not how knowledge is produced, but how it is *used*. The article mobilizes empirical research on synthetic biology to examine one such case where scientists—synthetic biologists—use knowledge, and how in the case of synthetic biology this is done often with the creation of certain technical functions in mind. Schyfter thus offers an analysis of one of those topics that, once confronted with it, one realizes that one has always been aware of its existence, but never gave it the proper conceptualization that it deserves. This article is an attempt to do so, and provokes a number of interesting questions concerning the function of knowledge in science and society.

Synthetic Biology and Knowledge Use

Schyfter places himself in a tradition of Sociology of Scientific Knowledge (SSK) and Science and Technology Studies (STS). It is from within these traditions that he claims that knowledge use has been neglected in favor of inquiries into knowledge production. There is always an unease accompanying any claim that something simple, yet fundamental has been ignored in the literature. As someone familiar with this tradition, my first response was that this simply must have already been discussed by some scholars, since—once confronted with the topic—it seemed so obvious. It reminded me of Georges Canguilhem's response, when Michel Foucault presented the outlines of his dissertation on the history of madness: "If that were true it would be known." (quoted in Eribon 1991, 102). At least the topic must have been recognized, implicitly, in their works. But in a similar vein, I was reminded of the infamous frustration one can have with modern art, with the common response: I could have done that! To which the artist, just as Schyfter, would reply: Yes, you could, but you didn't.

In fact, there are a number of potential authors to cite who come close to what Schyfter is after here. Hans-Jörg Rheinberger comes to mind, to whom Schyfter refers, and the former's distinction between epistemic things and technical objects. Using case studies from molecular biology, Rheinberger sees epistemic things as the material entities and processes that constitute the later well-defined objects of research, but are initially still opaque and ill-defined. Epistemic things are thus paradoxically "absent in their experimental presence" (Rheinberger 1997, 28). Once understood, however, they turn into technical objects: tools or instruments that can be used to investigate new phenomena.

Think of CRISPR-Cas9: though initially an opaque epistemic thing, itself requiring investigation, it slowly turned into a technical object used to investigate and modify other phenomena and organisms. We thus see a clear recognition here how knowledge is *used* in research. But in the case of Rheinberger, the story seems to be one where epistemic things unintentionally become technical objects. For Schyfter, however, it is rather a question of intention: is it not often the case that scientists produce knowledge with specific goals in mind? It is here, it seems, that the novelty and fecundity of Schyfter's approach resides.

One other way to think about what Schyfter is aiming for, is making an analogy with arguments concerning underdetermination and the use of auxiliary hypotheses (see Zammito 2004). Famously linked to authors such as Pierre Duhem, Imre Lakatos or W.V.O. Quine, it concerns the fact that scientific hypotheses do not exist in a vacuum, but rely on a belt (or web) of auxiliary hypotheses, instruments and assumptions. Falsifying the core hypothesis can then always be rebutted by sacrificing one of those auxiliary elements: 'These results do not disprove my theory, merely that the microscope was badly adjusted'. But whereas these traditional debates focus on the role of these auxiliary elements in the context of justification, Schyfter draws our attention to how they are produced in the first place, often intentionally as auxiliary tools for the central claim they want to defend—or the cells they want to synthesize, in the case of synthetic biologists.

This remark brings us, in fact, to the case study that is central to the paper: synthetic biology. Schyfter aims to explore the functions of knowledge for synthetic biologists, relying on numerous interviews with practitioners from the field. His previous work focused on questions concerning engineering knowledge and functions in the field of synthetic biology (Schyfter 2012; 2013; 2015). It is here, most likely, that the question concerning knowledge use arose. As he also remarks in this paper, to the extent that there is in the literature reflection on knowledge use, it tends to focus on so-called 'applied sciences', such as aviation (Bloor 2011) or engineering (Vincenti 1990). Though he takes these reflections as a starting point, Schyfter's ambition seems to be to expand this functionality talk to other forms of knowledge use, including using knowledge for epistemic reasons.

Take one of my own cases, namely that of the synthetic biologist J. Craig Venter and his ambition to synthesize a minimal genome: the minimal set of genes required for a cell to survive (see Simons 2020a). Why could we not interpret his experiments with knocking-out genes, aimed to map which genes are 'essential' for survival or not, as functional knowledge? He and other biologists gathered knowledge about which genes are essential not for its own sake, but as a step towards their ultimate scientific goal: a synthetic minimal genome. Similarly to how they develop certain techniques to serve specific goals in future experiments, they produce knowledge with clear uses in mind. Knowledge has functions and is not always merely there for its own sake. The different uses of knowledge warrant the interest of social epistemologists and sociologists of knowledge alike.

This is the spot where Schyfter's paper becomes most ambitious and has the potential of a interesting *Gestalt Shift*: instead of looking at knowledge as always relevant for its own sake, and explaining away knowledge for practical functions as 'applied science', Schyfter invites us to turn this image on its head. All knowledge is functional and knowledge for the sake of knowledge is just one specific type of knowledge use, part of a broader set of functions. Knowledge can be needed to technically create an artifact, to understand why an experiment went wrong, to predict a future trend, to get the necessary data for a grant proposal, or, indeed, for the theoretical aim to understand a certain phenomenon.

Though Schyfter does not go that far, one could even speculate about knowledge uses outside of science. People collect and produce knowledge with all kind of uses in mind: for

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pleasure, to impress friends, to control a population, to find the meaning of life, and so on. These reflections already highlights how a focus on knowledge use can be relevant for a whole number of academic disciplines, but it can be relevant for social epistemology as well: the reasons why humans aim for knowledge potentially has effects on knowledge and knowledge production itself. As Schyfter highlights in his article: "knowledge and its functions are mutually-enabling and mutually-sustaining constructs" (1, 10). How meaningful is it to study knowledge, without keeping in mind which functions it aims to serve?

It is here that the article opens up a number of interesting avenues for future research. Why is this dimension of knowledge use so interesting? What does it teaches us, except that it exists? Why is it a relevant thing to focus on? There are numerous possible answers to this. Either knowledge use characterizes certain disciplines in certain ways. So it offers a new way to differentiate different disciplines (say synthetic biology compared to sociology). Differences in knowledge use, thus, might shed a light on a number of activities, claims, statements, etc. that we would not understand if we would not introduce this epistemic dimension.

A second interesting approach would be to look at historical shifts on the level of knowledge use that might explain certain historical facts. One could, for example, wonder whether the whole knowledge economy debate concerns knowledge use rather than knowledge production. Is Mode-2 knowledge (Gibbons, Limoges and Nowotny 1994) not mainly a question of a shift in what the societal function of knowledge is? Is Jean-François Lyotard's claim (1979) that postmodern science is framed through the lens of performativity not a matter of knowledge use? Again we are confronted here with the idea that much existing literature was already aware of knowledge use, but simply did not articulate it explicitly.

What is the Function of Knowledge?

In general, Schyfter's article provokes us to ask the question of which values, desires, functions are at work behind knowledge: why do we produce knowledge? What do we want from it? It is here, once again, that this paper shows its value, but also risks throwing some critics (and reviewers) of the scent. Schyfter comes close to the old tradition of instrumentalism, conventionalism, positivism and anti-realism, popular at the beginning of the 20th century, but reviled in present mainstream philosophy of science and epistemology (though with exceptions, see van Fraassen 2002). One could think of authors as diverse as John Dewey, Ernst Mach, Henri Bergson or the Vienna Circle. That Schyfter nonetheless falls back on that tradition is not that surprising, since many have noticed strong similarities between the both of them: "Carnap plus Kuhn equals the philosophical agenda of SSK" (Friedman 1998, 251).

In a way, one could say that what was at stake for these instrumentalists was the question of the function of knowledge. They denied the monist answer which reduced the aim of knowledge and science to a simple pursuit of truth. Knowledge use, they stated, is plural. Knowledge can and should serve all kinds of purposes. This was often combined with a

social-political agenda, which made them particularly interested in functions of knowledge that served political reform and social emancipation. In that sense, they were skeptical towards any attempt to reduce knowledge use to that of finding out the ultimate metaphysical reality of the world—which they saw not only as unfeasible, but often also as politically dangerous. Such reductions, they argued, tended to be conservative, often sticking to those metaphysical realities that affirmed and naturalized the status quo. This was especially the case for logical positivism, although this political side of their movement disappeared once they migrated to the United States (see Reisch 2005; Dewulf 2021; Dewulf and Simons 2021).

The current philosophical landscape, however, is rather dominated by a variety of realisms, and thus tends to accuse instrumentalism of falling for a kind of reductionism of its own, namely a reduction of truth to practical usefulness in terms of survival or hedonistic pleasure. Take, for example, someone such as Henri Bergson, who saw scientific concepts as abstract fictions, that served life, but should not be confused with reality: "In the end the specificity of intelligence is the faculty of making artificial objects, in particular *tools to make tools*, and to vary this manufacture indefinitely" (Bergson 1907, 138). Despite its unpopularity in philosophy of science, instrumentalism seemed to have lived on in the sociology of science, though often marked by a critical footnote already found in Ludwik Fleck, who argued that conventionalism "pay far too little, if any, attention to the cultural-historical dependence of such an alleged epistemological choice-the alleged convention." (Fleck 1979, 9) In other words: there is a flexibility in the functions of knowledge, but this is not so much a free choice of individuals, but rather a matter of socially embedded choices.

Thus, Schyfter's claims about knowledge in terms of use and functions might evoke a specter of instrumentalism, as if he runs the risk to reduce all knowledge to usefulness in a narrow, practical sense. The decision of the author to capture this dimension of knowledge use in terms of 'utility' and 'function' might play a role here. These terms are hardly innocent and come with a number of instrumentalist connotations. And, under the effect of the vapors of this spirit, the critic will cry out: but what about unpleasant truths? What about truths about useless things, such as stars in galaxies far away without any link to our desires and instruments?

Similarly, the notion of function comes with another historical burden, exemplified by the history of sociology: functionalism. It risks to 'naturalize' certain phenomena, since they are interpreted as the expected response to natural functions that must be fulfilled in any society, otherwise society would fall apart. In the same vein, one could wonder whether for epistemological questions function talk does not provoke a similarly misleading tendency to ignore the contingency of the plural uses of knowledge in scientific practices. Is there a natural, though plural set of knowledge uses? Or is there a history of different knowledge uses, yet to be written? I believe that, in the end, Schyfter does not fall into these traps, as long as he does not lose eye of his plea to acknowledge a plurality of functions of knowledge, of which the pursuit of truth for its own sake is only one kind.

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Nonetheless, with that in mind, the case study of synthetic biology might come back to bite Schyfter. As stated above, it is understandable from a context of discovery, that synthetic biology plays a central role. However, in an unfortunate way it gives the impression that the article affirms this reductionist instrumentalism, since synthetic biology itself is a field linked with the aspiration to just create useful applications, regardless of whether biology 'actually' consists of BioBricks, modules or essential genes (see Simons 2016). But once again, I believe the intention of Schyfter is precisely the opposite.

The impression might arise that synthetic biology is here equated with an application-driven engineering. But Schyfter seems to aim to problematize that picture, either by stressing that engineering itself is more plural in its knowledge uses (Schyfter 2013) or by focusing how in synthetic biology itself has other knowledge uses in mind, even if the ultimate goal of specific projects is a technical artifact. At several places Schyfter also hints at how his framework can be used to study other scientific practices, and is surely not restricted to synthetic biology.

This potential to expand the framework to other sciences once again shows the article's promise, since the current scientific landscape is swamped with new disciplines and projects characterized by this blurring of science and engineering, cognitive and technical goals. Following others, I like to refer to new fields such as synthetic biology, but also nanotechnology, robotics or data science as *technosciences* (Bensaude-Vincent and Loeve 2019; Simons 2020a). What seems particular to these disciplines is that, though they present themselves as science, they often have strong resemblances to engineering fields, including a focus on producing artefacts (synthetic cells, nanomaterials, robots or algorithms). Nevertheless, it would be wrong to conclude that they have abandoned all cognitive goals in favor of practical gadgets.

The strength and appeal of these disciplines is precisely that they, in tandem with their practical goals, also raise fundamental cognitive questions, concerning the origins and nature of life (see Simons forthcoming), materiality, behavior and intelligence. But it is conceptually challenging to grasp this Janus face of technoscience. Schyfter's proposal of knowledge use might offer a way out: technoscience could be interpreted not so much as the abandonment of knowledge production for the productions of technical gadgets, but of a gradual shift in the function landscape of knowledge.

A Question of Reflexivity

This brings me to a final reflection, linked to the question of reflexivity. Sociologists of science are known for reflexively applying their insights to their own production of sociological knowledge. Indeed, reflexivity was one of the pillars of David Bloor's original four-point Strong Programme: "It would be reflexive. In principle its patterns of explanation would have to be applicable to sociology itself" (Bloor 1976, 7). One can find a similar tenet in Schyfter's text, for example when he acknowledges the situatedness not only of knowledge functions, but also of the analyst's role in giving meaning to these functions (4). But, what is perhaps still missing, is a confrontation between reflexivity and this new notion

of knowledge use: what is the function of the sociological knowledge produced in this paper?

A partial answer to that question is shattered throughout the text. For instance, it is clear that Schyfter is in a way infiltrating into foreign—perhaps even enemy—territory: we are faced with a sociologist publishing in a journal often read and reviewed by more analytically minded philosophers of science. In that sense, part of the function of the knowledge produced here is not just knowledge for its own sake, but also that of starting a dialogue between different traditions. In a way, what is at stake is the question whether SSK has something meaningfully to offer, or even to teach, to mainstream Anglo-American epistemology. I believe it does, though I fear that a more hardcore social epistemologist would exclude knowledge use as irrelevant to the core business of epistemology—thereby, ironically, affirming that the function of knowledge in social epistemology is about more than truth alone (but perhaps also about identity building).

Nevertheless, this is still a meagre answer to the function of this sociological knowledge. In fact, it seems to be the case that there is a certain naiveté at work, where the goal of the paper resides in a simple plea for pluralism. The epistemic function seems to be: we should all realize that there multiple functions of knowledge exist, irreducible to one central category. I am the first to recognize that such a plea for the recognition of pluralities is a noble undertaking, since I have attempted something similar regarding the diversity of engineering conceptions in synthetic biology (Simons 2020b). But, I recall the response of Dominic Berry to my attempt: synthetic biologists know that already! Who are you trying to convert? Why should they know? What should they do with this? Or, as we know can say with Schyfter: what is the function of this knowledge?

It is known that STS has a hard time dealing with developing a critical and normative stance (e.g. Fuller, 2000). It is often a matter of description, not evaluation. But Schyfter's paper forces us to face that question once again, especially since we are not here just among sociologists and STS scholars. In many sociologist papers, the implicit assumption often seems to boil down to 'the more the merrier', a simple celebration of plurality. There is indeed a plurality of knowledge uses, but what should we, as social epistemologists, do with this fact? Is this plurality something that should be praised, cultivated, protected? Is it under thread? Should we plea in favor of some functions and against others? Should we install a hierarchy? Exclude some forms of knowledge uses?

In this context we are faced, once again, with the case of synthetic biology. This new technoscience presents us with a particular set of knowledge functions that it prefers, stresses, cultivates. But is this the science that we want? In synthetic biology the embodiment of the kind of knowledge use we stand for? In that sense, echoing what I said before, the issue is not just a matter of the commodification of science and knowledge (see Radder 2019), but also, and perhaps first of all, a redistribution of knowledge uses. How should social epistemologists relate to these shifts? What should be the function of our knowledge in the light of them? That seems to be the ultimate relevance of the question of knowledge use: what to do with knowledge?

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