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Philosophy of Technology as Empirical Philosophy: Comparing Technological Scales in Practice

Casper Bruun Jensen and Christopher Gad

Throughout its history, science and technology studies (STS) have been inspired by continental philosophy in various guises. In this essay we argue that inspiration does not have to be one-way but that philosophy might likewise learn from STS. Engaging philosophy through STS enables us to develop the notion of empirical philosophy proposed by STS scholar Annemarie Mol (2002). Empirical philosophy takes seriously the ways in which actors deal in practice with what are usually considered philosophical concerns: what is good, what is right, what is true, and so on. Thus John Law and Annemarie Mol have argued that:

> Most everyday practices make use of, or try to create, scales to measure or contrast 'goods' and 'bads'. This opens a space for an empirical philosophy. An ethnographic interest in practice can be combined with a philosophical concern with 'the good' to explore which 'good/bad' scale is being enacted, and how this is being done. (Law and Mol, 2002, p. 85)

In this view the many interactions with technologies encountered in empirical studies are taken as more than illustrative input for philosophical deliberation. Instead, such activities are considered central features of situated ontological work and as having philosophically important content as such. In this respect empirical philosophy follows the increasing STS and social anthropological interest in exploring the world as multiple; not in terms of perspectives as in multiculturalism, but in terms of ontological multiplicity as in a *multinaturalism* (Viveiros de Castro, 2004), where technologies are seen as active ingredients in shaping reality itself.

The first part of the chapter sets the stage for this discussion by reviewing the agenda of Don Ihde's philosophy of technology as part of a recent trend towards considering technology in practice. This is also an eminently anthropological concern and we situate the philosophy of technology in

relation to some ideas within contemporary anthropology and to a critical discussion about the increasing emphasis on practice. While there is substantial overlap and resonance between empirically oriented philosophy of technology and the anthropology of material culture (e.g. Appadurai, 1986), we find that more analytical work is required to facilitate understanding of the fluid and variable roles of technology in action. Such attentiveness is not a purely theoretical demand. It is also a methodological requirement, to ensure that analysis of how technologies function in specific circumstances is not overdetermined by a general framework, which views technologies, for example, as autonomously imposing their 'logic' on practice.

Because we expect specific empirical settings to provide philosophically important material, we are required to engage local work with, and conceptualization of, technologies in an open-ended manner, while our own concepts must likewise remain open for change. This follows because we expect specific empirical settings to provide material which is just as important as philosophical arguments for the task of understanding technology. With this symmetrical stance it must be assumed that general analytic rubrics will be imprecise and may be irrelevant when brought to bear on specific technological subject matters. A high degree of analytical openness is required to be able to learn from the discrepancy between the philosophical assumptions one brings along and the situations encountered during empirical investigation.

It is, perhaps, important to emphasize that empirical philosophy does not entail a reversal from (pure) theorizing to (pure) description. Instead, it suggests that the development of philosophical concepts should be practice-driven (and sees philosophy itself as a set of practices). However, since practice is not conceived as pre-theoretical and doing theory is seen as constituted by concrete activities which effect the formation of concepts, we should expect to deal in hybrid forms of thinking and acting. As this is the case, we are not faced with a demand to extrapolate, for example, the theoretical essence of an empirically based argument. But we are also not obliged to purify analysis by removing the 'metaphysical vestiges' so abhorred by positivist-inspired social science and analytical philosophy. Instead, the strengths and weakness of any argument must be found in the specific links and associations they provide between materials, whether these are traditionally conceived as philosophical and conceptual or empirical and practical.

Our view of the practice of philosophy and social science is therefore precisely analogous to our view of technology. Just as we do not start out with a clear-cut notion of what is the relation between theory and practice and how they inform each other in any given instance, so also we do not know a priori what technologies must be like or what they can do. This is made particularly vivid in our first illustration, which follows Annemarie Mol and Marianne de Laet's analysis of the ontological fluidity of the Zimbabwe

bush pump. Our second illustration is from Marilyn Strathern's anthropological work on the cultural implications of new reproductive and genetic technologies. Finally, we are taken onboard a Danish fishery inspection vessel, in a further discussion of both ontological fluidity and technological enablement, with the purpose of understanding the assemblage of new and old technologies that are present on the bridge. This case highlights how specific scales of the old and new, the trustworthy and suspicious, are configured in a pervasive technological setting.

Although our very different cases invite us to take a number of commonsense categories (notably between the high-tech and the low-tech) about technology for granted, we decline to do so. Instead we examine the high- and low-tech as empirically variable *scales*, which are always constructed in relation to specific networks, with the purpose of figuring out how to think about and work with technologies and thus produce new worlds. We analyse and contrast these examples to make the argument that empirical philosophy holds innovative potential for philosophy of technology and opens up avenues for rethinking the relations between theoretical analysis and empirical inquiry.

13.1 Philosophy and anthropology on technology

What are the concerns of philosophy of technology? Obviously multiple answers can be given to the question, but we can start out by referring to three sets of questions, which the prominent phenomenologist Don Ihde has defined as central for the field. The first relates to the question 'How like or unlike is life within our techno system from previous or other forms of life that humans have taken up?' (Ihde, 1990, p. 3). An argument is here often made that the modern world is radically different from the past. An example of this argument can be taken from Albert Borgmann's *Technology and the Character of Contemporary Life* (Borgmann, 1984), referring to the changing circumstances in the work of wheelwrights. Commenting on an account by Sturt, Borgmann (1984, p. 46) notes that it

> is remarkable not only for its portrayal of the strength and character of a pretechnological world of things. It is also painfully aware of the rise of technology and the destruction of the pretechnological setting. This process too becomes visible at the reference points of nature, materials, and social relations. Accelerated by the demands of the First World War, a 'sort of greedy prostitution desecrated the ancient woods [...] I resented it', Sturt says, 'resented seeing the fair timber callously felled at the wrong time of the year, cut too soon, not "seasoned" at all'. The conquest of nature is not confined to the treatment of the forests but moves into the wheelwright's shop too, replacing skill with mechanical power which can 'drive', with relentless unintelligence, through every resistance.

Borgmann argues that technologization necessarily leads to deterioration of traditional culture and values. As we shall see below, the view of Ihde, as well as of empirical philosophy, are simultaneously more ambivalent and nuanced.

Ihde's second question 'revolves around whether technologies are neutral' (Ihde, 1990, p. 4). Are they inert objects, for example, or do they affect human perceptions, understandings and ways of acting? To answer this question both Don Ihde and Bruno Latour (1994) have made use of the well-known controversy on whether guns kill people (technical determinism), or people kill people with guns (social determinism and technical instrumentality), which in the American context is related to the contested issue of whether it should be allowed to carry weapons. This controversy is often seen as exemplifying the themes of human or technological autonomy and determinism.

Contrary to what is suggested by Borgmann's analysis of 'mechanical power', driving with 'relentless unintelligence, through every resistance', both Ihde and Latour reach the conclusion that technologies are neither autonomous nor deterministic. Yet, this does not mean that humans are in control of technology. Latour suggests that the associations of technologies and humans form new actors, and this allows for the emergence of new properties, which neither technology nor humans had individually. In a similar vein, Ihde proposes to view technologies as multi-stable (e.g. Ihde, 2002, pp. 106–7). In this view a gun may be turned into a hammer or a decoration on a wall, as well as it may become an instrument for killing people.

Ihde's third guiding question for philosophy of technology is 'What does high technological development portend for our species' future?' (Ihde, 1990, p. 7). Answers to this question can be given utopian as well as dystopian inflections. Both, however, are refused by Ihde and others involved in the 'empirical turn' in the philosophy of technology. Proponents of this turn see such overall characterization as founded on an inadequate idea of technology as an all-encompassing framework or a prime mover. In contrast with both critics of technology such as Borgmann who laments the 'device paradigm' and enthusiasts who celebrate technological progress, these philosophers propose to view technologies (in the plural) as unpredictable and complex (Achterhuis, 1999, pp. 2–8).

Exemplifying this viewpoint Ihde takes a 'navigational perspective'. While navigating, he reminds us, one 'is quite self-consciously aware of being in the midst of what is occurring, but the navigational problem is to locate reference positions through some means of variations' (Ihde, 1990, p. 10). Variation refers here to the analytical strategy of phenomenology, originally outlined by Husserl, according to which the essential structures of a given phenomenon could be captured by analysing a variety of mental or experiential illustrations of the phenomenon, and subsequently reducing

these to their shared features or common core. Consequently, the greater part of his key work *Technology and the Lifeworld* aims to develop a typology of human–technology relations. The general aim of this analysis is to formulate a 'radically demythologized story of the structures and limits of human-technology and of the non-technological possibilities of relation to an environment, or "world"' (Ihde, 1990, p. 17).

13.2 Empirical matters

Ihde's discussions rely on a plethora of examples. Philosophically, this exemplifies the strategy of phenomenological variation. In terms of empirical reference, it means that he often relies on material that social scientists would also claim for themselves. These range from mundane everyday examples from the Western world, to what, from a philosophical point of view, might be seen as rather esoteric illustrations. Precisely such cases, though, would often be the home turf of anthropologists. Indeed, these might agree with several of Ihde's overall conclusions, including the idea that 'cultures embed technologies' (Ihde, 1990, p. 124) and the suggestion that problems of 'technology transfer' are due to the fact that successful 'transfer' requires 'reception of a set of cultural relations' (Ihde, 1990, p. 126), which do not naturally accompany the technology (see also Selinger, 2007).

From an anthropological viewpoint there is thus merit in Ihde's analyses. Nevertheless these analyses are also quite different in both form and content from most ethnographical analyses of material culture. One important difference is in the understanding of what counts as an appropriate level of empirical analysis.

Ihde certainly shows much more interest in empirical matters than some of his ancestors (for instance Martin Heidegger, 1977). Yet his examples are treated precisely as such; that is, with little interest in detailed contextual features, which are often seen as central from an anthropological point of view. From the point of view of the phenomenology of technology there is an excellent reason for the relative scarcity of contextualizing description, since the ambition is not to understand the specific instance, but rather to develop a typology of human–technology relations. In this sense the analysis starts and ends with conceptualization, whereas the empirical becomes an intermediary point of support for the theorizing effort. This, however, is not usually the direction taken by ethnographic studies of material culture, in which theory is often developed with the purpose of understanding specific technological settings.

It is crucial to underline that this does not place the anthropologist in the role of a mere microphone holder, who describes empirical material, for which the philosopher might provide an adequate conceptual grounding. For one thing, ethnographic observation is thoroughly theoretically informed. Thus, while ethnographers certainly report observations, the

purpose of this is still to construct a *different kind of knowledge* about culturally specific ways of handling technology, say, or kinship relations (Hastrup, 2004). The same argument could obviously be made for philosophers, who do not characteristically pick their empirical examples at random, but rather choose them with specific analytical problems in mind. It is thus also important to note that the implication is not that philosophy is superfluous and can be subsumed under empirical disciplines such as anthropology. However, it does imply that philosophically relevant concerns are also dealt with outside of university departments.

This is not a new argument, but rather a way of bringing Michel Foucault's approach to the question of 'representation' to bear on the questions of technology. Foucault denied that the problem of representation should be viewed as specific to the history of ideas, and he proposed to see it instead as a problem which had 'informed a multitude of social domains and practices, ranging from disputes in botany to proposals for prison reform' (Rabinow, 1986, pp. 239–40). In Paul Rabinow's gloss it is therefore not the case that the problem of representation 'happened to pop up in philosophy and dominate thinking there for three hundred years'. Instead, it was 'linked to the wide and disparate, but interrelated, social and political practices that constitute the modern world' (Rabinow, 1986, p. 240). Accordingly, while multiple practices have shared the 'problem of representation' they have defined the contours of that problem differently and, consequently, have also handled such epistemological problems in multiple and often contradictory ways. In Foucault's analysis the question of representation can therefore not be understood as an infra-philosophical concern. Instead it should be seen as related to a set of historical events and social practices.

What follows from this realization, argues Rabinow, should not be the construction of new epistemologies (one for each 'domain' of practice). The important point is rather that Foucault's analysis allows us to recognize 'our historical practice of projecting our cultural practices onto the other' (Rabinow, 1986, p. 241). This viewpoint is both anthropologically pertinent and philosophically relevant since it indicates how concepts produced at a specific time and place easily turn into unquestioned assumptions on which other inquiries are based. For example, Edward Said (1978) argued that almost all literature on 'the Orient' says more about the Orientalism of the anthropologist than about life and practice in the places designated by the term. A similar argument can be made about ways of conceptualizing technology. Thus, Marilyn Strathern has argued that Western assumptions about 'enablement' deeply infuse everyday as well as theoretical understandings of technological capacity (Strathern, 1996). We will return to her argument in our second example.

Transported into the realm of technology, what follows from this relativization of the problem of technology, is not a requirement to develop *regional* theories of technology use based on geography or developmental *stages* or

cultural habits. Rather, it requires the philosopher to become attentive to the ways in which specific Western conceptualizations of technology inform philosophical analysis. Analogous to the reflexivity which follows the disclosure of Orientalism in anthropology, it becomes important to consider how concepts of technology that are produced in philosophical settings are subsequently put to use elsewhere. While scholars such as Evan Selinger (2007) have argued for the centrality of the problem of 'technology transfer' for the philosophy of technology, we argue therefore that it is of equal importance to bring into view problems attending 'technological concept transfer'.

In spite of the differences, phenomenology of technology and the anthropology of material culture share some broad concerns. For one thing, much of anthropology and philosophy are based on an interest in what could be called 'the human condition'; for instance, Ihde is concerned with why and how human beings are able to co-inhabit lifeworlds with multi-stable technologies. Although anthropologists may be less enthusiastic about conceptualizing 'humanity' in general terms, a focus on the variety of human life forms is also at the heart of its knowledge production.

Even more importantly, newer approaches in both anthropology and philosophy accept that technologies are neither autonomous nor fully determined by their users. The technological essence evaporates, and in its stead the analyst encounters culturally embedded technologies. For this reason empirical philosophy aims to simultaneously retain a strong 'praxiographical' emphasis and a commitment to philosophical elucidation. Following the Foucauldian analysis, empirical philosophy can obviously not aim to define any general technological structure. However, it might well concern itself with inventorying some of the many ways in which issues relating to technologies are handled in different settings, with the purpose of getting a better analytical or, indeed, philosophical grasp of the multiple overlaps and disjunctions, resonances and connections between technologies in action.

From the point of view of STS and empirical philosophy, this means that they cannot be analysed out of context. Instead technologies as well as concepts of technology must be analysed as part of practice.

13.3 Practice, epistemology and technology

Indeed, in recent years both philosophy and STS have seen an increasing interest in technology in 'practice' (e.g. Pickering, 1992; Schatzki et al., 2001). The turn to practice has been seen precisely as a solution to the problem of how to avoid overly abstract and generalized characterization. Nevertheless practice analysis, in itself, does not solve this issue. Indeed, it may instead simply displace the analytical problem. This is the argument of Stephen Turner's *The Social Theory of Practices* (Turner, 1994), which criticizes

a whole series of practice-oriented concepts, many of which have their roots in phenomenological thinking. In Turner's view 'tacit knowledge', 'taken for granted knowledge', 'communities of practice', 'epistemic practices', 'local knowledge', 'forms of life' and so on all exhibit similar analytical problems. The problem identified by Turner is that although these terms promise to take the analyst closer to the real world of practice, they are often simply 'plugged into the explanatory place previously occupied by the now-discredited teleological agencies of Reason, Nature, Moral Sense and Will' (Lynch, 1997, p. 338). In his review of Turner, sociologist of science Michael Lynch draws the lesson that 'it is easy to overthrow "traditional" metaphysics by replacing one prime mover with another, but it is not so easy to set aside what Wittgenstein called the "craving for generality" which tempts philosophers (and also social theorists) to turn vernacular concepts into transcendental agents' (Wittgenstein, 1958, p. 18). When Lynch refers to a 'temptation to turn vernacular concepts into transcendental agents' he is criticizing the same 'craving' for generalization that the new philosophers of technology also problematize in the case of their determinist ancestors. Yet, Turner and Lynch also argue that the urge to abstract is not necessarily diminished by relying on a vocabulary of practice.

This problem echoes the peculiar tension between a philosophy-driven analysis using preconceived concepts to explain what is going on in practice and a bottom-up approach aiming to derive its specific concepts from empirical material as proposed by the ethnomethodological programme defined by Harold Garfinkel (1967) or by grounded theory (Glaser and Strauss, 1967).[1] At the same time Lynch's own prioritization of the production of *local* order has its limitations in turn. For one thing, such a focus prevents the researcher from analysing how local orders are interlinked. This is an especially crucial consideration with respect to the study of technologies, which often form the concrete links between otherwise dispersed practices; for example in the cases of 'technology transfer' referred to by Don Ihde and Evan Selinger, or in cases where technologies function as 'boundary objects' (Star and Griesemer, 1989). Additionally, it also fails to consider that local actors, if prompted, will often make use of non-local modes of accounting for their technological urges, goals and ambitions, for example by relating their own agendas to globally circulating narratives (Tsing, 2005) or by referring to general aesthetic, ethical, economical, scientific or technological values and criteria (see Boltanski and Thevenot, 2006). Such cross-local linkage and local modes of accounting in terms of the global suggest that simply studying action is not satisfying, since the 'whole situation' is never revealed by analysing the behaviour of any particular set of actors (Clarke, 2005). In turn, this suggests that so-called bottom-up approaches need to be rethought in a way that enables them to analyse links and connections distributed between practices. But this has to be done without

reinstating 'social structures' or explanatory devices as 'transcendental agents' (see also Jensen, 2007).

Lynch also notes that 'ethnographers (not unlike investigative journalists and spies) can make a living out of the fact that by trafficking across barriers between "insiders" and "outsiders" they are likely to find newsworthy items to convey to relevant audiences' (Lynch, 1997, p. 341). Indeed, one merit of empirical philosophy would be its capacity to move between different places and in that process simultaneously 'learn technology' from actors there and 'teach technology' to others in turn. The point in empirical philosophy is therefore neither to produce general analytical concepts nor to glorify the local. It is rather to develop a vocabulary in which analytic scales such as the local vs the global or the high-tech vs the low-tech do not pre-empt the analytical work of understanding technologically mediated situations.

We suggest such a project might allow the philosopher of technology to obtain a different kind of philosophically interesting knowledge about technology. This would require taking an interest not only in the ontological fluidity of technology but also in the scales that are being enacted in relation to technologies. These considerations take us into the territory of empirical philosophy.

13.4 Empirical philosophy

As noted, the radically de-essentializing approach to the question of what technology is and does, means that no specific site can function as a privileged or generic exemplar. Rather, several illustrations allow us to identify some important themes which run across these cases but are expressed differently in each. Although our examples are empirically diverse, then, we do not analyse these differences as due to an underlying structure, which would explain them (e.g. that they are high-tech versus low-tech or that the cases are from industrialized versus developing countries). Nor are we interested in developing a typology of human–technology relations. Instead our main concern is to elucidate aspects of the particular networks of which these technologies are part.

Our first example is taken from Marianne de Laet and Annemarie Mol's analysis of the Zimbabwe bush pump. The case exemplifies the analytic mode of empirical philosophy and specifically directs our attention to the ontological fluidity of the technology under consideration.

The second example is taken from social anthropologist Marilyn Strathern's analysis of the cultural consequences of new genetic and reproductive technologies. This example supports the notion of fluid technologies, but it also highlights a Western understanding of technology as *enabling*. Strathern suggests that technologies have rather more ambiguous effects than often assumed. They cannot simply be understood in terms of their modernizing

potential, but rather as devices which create simultaneously more *and* less of *both* modernity and tradition.

In the third example, we move to a quite different setting, as we explore the configurations of technologies on a Danish fishery inspection vessel. The ship is viewed as a technological conglomerate which is regularly tinkered with by adding new technologies. In this case the fluidity of technology is made visible through the observation that the capacities of any technology are only understandable in relation to the entire configuration of technologies. We also show that determining how, why and when different technologies can be trusted to represent reality is an ongoing (philosophical) concern onboard.

We use the similarities and contrasts between these three illustrations to highlight some distinct analytical foci of empirical philosophy: the ontological fluidity of technology; the theme of technological enablement; and use of local scales in determining the specific characteristics of their technologies.

The Zimbabwe bush pump and the fluidity of technology

Mol and de Laet's analysis of the Zimbabwe bush pump is an attempt to develop a certain kind of philosophical engagement with the analysis of technology. The authors are especially interested in the theme of 'technology transfer', which, they note, 'goes to the question of the "nature" of technology' (Mol and de Laet, 2000, p. 256 n. 4). The term 'technology transfer' suggests a stable and fixed technical object, which can be moved in geographical space and used in new settings without transformation. Given this basic understanding, technology transfer has traditionally been of little interest in the philosophy of technology, except to the extent that it could be subsumed under more general questions such as 'the impact of technology on society and the ethical questions surrounding such impact' (Mol and de Laet, 2000, p. 256 n. 4). What happens if one instead studies technology transfer as an empirical issue of importance for the philosophy of technology?

Mol and de Laet do not study the impact of technology on society but neither do they approach technology transfer as a general analytic rubric. Much more specifically, they explain that their 'paper is about water pumps. Even more precisely, it is about a *particular* hand water pump: the Zimbabwe Bush Pump 'B' Type' (2000, p. 225). Precisely this exceeding specificity with respect to the technical object enables the authors to make an analytical argument about the fluidity of the technology. As we shall see, the fluidity of the bush pump is not an epistemological fluidity relating to the many perspectives one might adopt in viewing it. It is rather an embedded, ontological fluidity, which 'is built into the technology itself' (Mol and de Laet, 2000, p. 225). If this argument can be made, they suggest, then it might be of use in other settings, where 'artefacts and procedures are being developed for

intractable settings which urgently need working tools' (Mol and de Laet, 2000, p. 226). The reason is that when travelling to such out-of-the-way settings, 'an object that isn't too rigorously bounded, that doesn't impose itself but tries to serve, that is adaptable, flexible and responsive [...] may well prove stronger than one which is firm' (Mol and de Laet, 2000, p. 226). The argument therefore goes on to show that the bush pump is in a deep sense a variable object and that its ontological variation depends on the specific ways in which it becomes entangled with other objects, subjects, practices and agendas in the process of what is quite unadequately referred to as 'technology transfer'.

In attempting to understand the scope of the bush pump, Mol and de Laet make use of both a temporal and a spatial argument. The pump is variable in time, because it has existed for over half a century, yet has been under constant revision: 'the current model results from restyling and improving an older manually-operated water pump that was first designed in 1933' (2000, p. 228).

But the fluidity of the bush pump has not to do simply with its transformation in time. Crucially, it also relates to the multiple operating principles guiding any one pump. Operation refers here not only to its hydraulic or mechanical principles. Instead operation must be taken as a rather broad term, which allow Mol and de Laet to show that the pump must do much more than simply pump to work well in its intended setting. For one thing, the pump is meant to 'convey messages', which influence its chances of being adopted by users.

Thus, it is cobalt coloured because this signals the clear and pure water, which it is meant to help procure. Experience has taught the producer that the pumps 'work better that way'. In action, it appears, colours are not insignificant 'secondary qualities', which have no bearing on understanding the technological itself. Instead, they might be quite crucial constituents in making technology work. But of course they do not work alone. An obvious aspect of the bush pump has to do with what would usually be seen as its technical parts. Thus, it consists of a 'pump head or water discharge unit, a base or pump stand, and a lever' (Mol and de Laet, 2000, p. 228), which along with numerous other components gather the forces that allow it to pump water out of the ground. Hydraulic principles, however, do not specify what makes the pump special in comparison with numerous other kinds of pump. Among pumps it belongs to a family with 'lever activated lift pump mechanisms' (Mol and de Laet, 2000, p. 231) and within this group it is recognized by having more powerful and efficient strokes than most others, enabling it to lift water up from wells up to 100 m deep. Here, the relevant quality is its lifting capacity.

Each of these features is a necessary but not a sufficient requirement to understand the multiplicity of the Zimbabwe bush pump. They are insufficient because the technology can only be understood in relation to other

actors in the network in which it operates. A key actor here is *E. coli*. Thus, a prominent reason why the pump is such an important actor in Zimbabwean villages is because it ideally ensures a flow of water uncontaminated (or less contaminated) by *E. coli* bacteria than would otherwise be available. In short, then, the pump is not only a water- but also a health-providing technology. Yet again the capacity of the pump to produce health is thoroughly integrated with the implementation of the pump in specific villages. To function as a health-creating actor it is crucial that the headworks of the pump are installed properly, since 'poorly made concrete headworks can crack, and will allow leakage of waste water from the surface back into the well or the borehole' (Morgan, quoted in Mol and de Laet, 2000, p. 233). And proper installation of the headworks requires cooperation between the pump and many more technical and non-technical actors. Crucial among these is the tubewell drilling device, among which the Zimbabwean-manufactured Vonder rig is an increasingly popular choice in African countries. The reason for its popularity, again, is in its specifics: it is 'hand-driven, durable and bright yellow. It is designed so that the boring of the water hole [...] can be almost entirely "community-based" ' (Mol and de Laet, 2000, p. 233).

In turn, community-based well-drilling is an activity which integrates more than narrowly technical features of the rig and the pump. Thus the instruction manual states explicitly not only how to operate the equipment, but also that local diviners, *nganga,* must be consulted to decide where drilling should take place. Their advice is followed even when it goes against the understanding of Western engineers, because this is a precondition for village adaptation of the pump. This integration of engineering and divinatory, technical, aesthetic and hygienic concerns into the technology itself facilitates the emergence of a situation in which villagers can and will take on joint ownership and collective responsibility for the pump. For Mol and de Laet this suggests 'yet another way of describing and setting boundaries around our object. In critical ways, the Zimbabwe bush pump includes the villagers that put it together [...] Thus the boundaries around a community pump may be widely drawn. Indeed, they embrace the community' (2000, pp. 234–5).

We are now in a position to say something about the fluidity of this particular technology, for as the authors state: 'it is not clear where this pump ends'. It is not clear what it is:

> a water-producing device, defined by the mechanics that make it work as a pump? Or a type of hydraulics that produces water in specific quantities and from particular sources? But then again, maybe it is a sanitation device – in which case the concrete slab, mould, casing and gravel are also essential parts. And while it *may* provide water and health, the Pump can only do so with the Vonder rig – or some other boring device – and accompanied by manuals, measurements and tests [...] And what about the

> village community? Is it to be included in the Pump – because a pump has to be set up by a community and cannot be maintained without one?

It might even be that the boundaries 'coincide with those of the Zimbabwean nation', since 'in its modest way this national Bush Pump helps to make Zimbabwe as much as Zimbabwe makes it' (Mol and de Laet, 2000, p. 237).

In Mol and de Laet's argument the main component in the successful adaptation of the Zimbabwe bush pump is that its ontological fluidity allows it to be connected to widely varying settings in rural Zimbabwe. The pump, in short, can contain multiplicity without being compromised by it. So should our analysis of it.

Enabling technologies

While the specific argument about the fluidity of the bush pump may appear surprising, it should come as no surprise that one might do anthropology in Zimbabwe. It may, however, appear more counter-intuitive to follow Paul Rabinow's recommendation that we must also 'anthropologize the west'. Nevertheless this is an important theme in the work on technologies done by social anthropologist Marilyn Strathern.

Strathern argues that technology in Euro-American culture is seen as 'enabling' in the sense that Euro-Americans primarily perceive technology as a facilitator of action, or:

> quite simply, that *given the technology* they can do anything. If technology is society made durable, it is at the same time ability made effective. The enabling effect of 'technology' is a guarantee of that. Choice comes afterwards. Sever ourselves from our disabilities, and then we shall see how we want to live, and how we want to create the certain identity we feel, like children severing themselves from unsatisfactory parents. (Strathern, 1996, p. 49)

The concept of enablement offers a contrast to a utopian vision, which views technology in terms of human empowerment as well as of the reverse notion that technology is a dehumanizing force. Rather than evaluating technological effects on this one-dimensional scale, Strathern aims to display how Europeans attach value to their technologies and how pervasive is the value of enablement itself.

Strathern's mention of 'unsatisfactory parents' refers to a 1992 case in which a boy and a girl were reported to have 'divorced their parents'. This and other controversial cases connected to surrogacy all indicate that the question of what is entailed by family relations has been opened up in new ways due to reproductive and genetic technologies. These technologies have definitely offered 'a cultural enablement of a kind' (Strathern, 1996, p. 47)

as it has become increasingly possible to view one's family as a matter of 'choice' rather than 'blood'. However, biology has not become any less important for envisioning kinship.

As specific technologies become part of a culture we may begin to think differently about the possibilities and limits, certainties and uncertainties relating to kinship. For example, doctors can now help their patients by genetic testing but this may require them to also collect genetic samples. Through this process, however, the doctor might obtain knowledge that a presumed father is not the genetic parent of the patient-child. Genetic testing can (re)confirm an existing kinship tie as biological, but it can also disconfirm it. For instance, it can also be used to argue against *Pater est, quem nuptiae demonstrant,*[2] which has been a core rule in family law in many Western countries. Genetic testing therefore simultaneously produces more and less certainty about kinship ties. The same is the case with reproductive technologies which both render kinship ties more certain (cryo babies can be more certain who their biological parents are, and that they are really wanted) but at the same time more uncertainty is produced (eggs, sperm or embryos could always have been (mistakenly) swapped at the clinic; and cases of surrogacy dispute what constitutes motherhood).

Indeed, it is one of Strathern's general arguments that whereas technologies do not create a negative or positive cultural condition as such, they do help to shape a cultural situation in which there is *more of everything* (Strathern, 1996, p. 39). Contrary to the common argument that tradition is rapidly replaced by modernity, then, Strathern argues that in the case of genetic and reproductive technologies the present state of affairs is far more ambivalent, because it simultaneously produces tradition and modernity.

The concept 'modern' is commonly used by Westerners to designate what they at any given moment consider to be new in their world, while 'tradition' is used to designate what people take for granted. However, if the new technologies infuse kinship ties with both less and more certainty, the relationship between tradition and modernity cannot be understood in terms of linear progress or deterioration. Technologies may be considered modern in the sense that they are 'new', but the promise of innovation they summon is ancient and can, indeed, be viewed as very traditional. Likewise, technologies can be seen to bring along more tradition since people take more things about kinship for granted (as indicated by the pleonasm 'biological kinship ties') and more modernity, since people recognize that many specific things about kinship are new, contested or changeable.

Strathern notes that the observation that there is 'more of everything' could also be understood in terms of a notion of 'cultural exaggeration'. She does not suggest that technology is the sole cause of this cultural predicament. However, she does argue that the situation is facilitated by the prominent value attached to the idea of technological capacity: 'Euro-Americans

imagine that they can do "more" things than they once did, crystallized in the hypostatization of technology as "enabling"' (Strathern, 1996, p. 46).

The analysis suggests that reproductive and genetic technologies involve important cultural displacements. But do they have any import for philosophy as such? An example shows how directly entwined philosophical conceptualization may be with its cultural environment.

In 1982, the Danish philosopher Jan Riss Flor exemplified 'analytic concepts' (that are undisputably true due to their self-evidence) in the following manner: 'a rectangle is a square and I am the child of my mother and father' (Flor, 1982). However, only 25 years later this self-evidence can no longer be taken for granted, since it is now technically possible to dispute parenthood, as controversies around genetic testing and surrogate parenting demonstrate. It appears that indisputability is not given in an unalterable order of things, but is rather shaped by cultural assumptions and technical possibility. Indeed, the idea that something is philosophically 'indisputable' appears directly linked to the fact that we always do take certain things (in this case precisely about kinship ties and technologies) for granted.

Strathern does not conclude that the proliferation of technologies has led to a situation of constantly increasing uncertainty. Instead she suggests that we inhabit a world of simultaneously more and less certainty. Since the scales of risk and certainty are not mutually exclusive, this poses the challenge of how to describe and theorize how technologies are everywhere infused with variable scales of valuation. This is highlighted in our final example.

13.5 Fishery inspection and technological scales

Following Strathern's argument we can imagine that new technologies do not simply produce more or less certainty. In the case of the final example, from an ethnography of fishery inspection on the vessel *Vestkysten* (*West Coast*), we also find that there is 'more of everything'. The fluidity of technology noted by Mol and de Laet and the value of enablement attached to technology is also visible here but in a particular guise that has to do with the conglomerate nature of the vessel.

West Coast was built in 1987, to be put to use as a fishery inspection ship, a rescue vessel and as an assisting unit for fishing vessels. A few years ago the rescuing and assistance were the predominant tasks of the ship but today almost all work has to do with inspection.

A first impression upon entering the ship's bridge is that it is a technologized environment.[3] There are five panels for manoeuvring the ship, each of which has three different levels of automation; there are GPSs, radar, gyro, Global Maritime Distress Safety System, an electronic sea chart, paper charts, signal flags, echo sounder, magnetic compass, phones of various sorts (satellite, radio, internal) and also large panels for controlling the

lights, anchor and so on. Several PCs are also present on the bridge, including a server, one used for the electronic sea chart, and one which displays the present whereabouts of fishing vessels in a surveillance application called V-track. Another PC is used for multiple purposes including administration. In this setting it would be possible to follow Mol and de Laet and explore a single technology in detail in order to demonstrate its fluidity. For instance, GPS positioning is connected to a network of satellites, the electronic sea chart and to a range of culturally important issues (see Parks, 2005) such as surveillance. Thus GPS, like the bush pump, does not seem to end at any specific place. But the fluidity of technology is also seen in the conglomerate nature of the entire situation. Thus we aim to show how the fluidity of technology is manifested relationally, both with reference to work practice and other present technologies, previous and present.

Functionally many of the technologies overlap. Positioning, for instance, can be done in many ways. It is possible to take bearings using radar, compass or even landmarks and paper maps (Hutchins, 1995). However, positioning is very rarely done this way any more. Rather the position is displayed and updated automatically by GPS on the electronic sea chart. The electronic sea chart is thus an important technology for positioning. Yet, it is striking that none of the older technologies have been discarded as the electronic sea chart was introduced a few years ago. Indeed, it appears that the new does not simply replace the old onboard. This was expressed when the captain picked up a telephone handle connected to a now obsolete communication system and called out: 'hello is anybody there?' In this case the technology was dysfunctional but the interface remained. Similarly, a positioning system based on receiving FM waves from towers on land, fills out an entire panel on the bridge although it is never used. And the ship still carries a sextant and a magnetic compass, as, indeed, it is obligated to by law. However absurd these technologies may seem in the light of the 'much smarter' electronic sea map, they also indicate how technologies do not in any simple sense replace each other. Instead they are added to the existing network of technologies and tasks onboard.

One obvious reason for such technical redundancy is the cost of replacement, another is security. Old, trustworthy technologies are available as a back-up in case other technologies fail. However, the relationship between old and new technologies cannot simply be stated in terms of more or less security. The new electronic sea chart, for example, is not always considered as 'trustworthy' as the older radar. When queried about the difference between the two (since both display the position of the ship relative to land and other vessels) the crew refers to the radar as displaying how reality 'really' is. First, they emphasize that the electronic sea chart contains more invisible layers of data interpretation than the radar and these many mediations remove the representation from reality. Second, they point out that the sea chart is presented through a software application running on a PC,

which means that it is vulnerable to the errors and breakdowns that are common with computers. The radar, on the other hand, has proven through the years that it reliably displays reality 'out there'.

Paper charts are still present on the bridge and play an important role in case of power cuts, juridically in case of accidents, and when entering a harbour, where maps of good detail are required. But their representational merits seem altered with the introduction of the electronic sea chart. New technologies do not simply replace but they do affect displacements throughout the network.

Furthermore, old technologies are also not automatically perceived as more trustworthy. For one thing, one may easily forget how to use them when new technologies are introduced. Thus, crew members do not consider themselves equally equipped to use every kind of available technology. For example, not everyone can use a sextant today or do positioning by use of paper charts.

Furthermore, the specific configuration of trustworthiness, which might be referred to as the perception of technological enablement onboard, also changes according to the unstable sea environment. Thus, when the weather is good, looking out of the window using binoculars is considered to bring one closest to reality. In this situation binoculars are considered an enhancement of human perception, much as in Ihde's analysis. The point might seem mundane; however, binoculars are not always considered in this way. In bad weather, where one can hardly see anything, the radar picture is considered a far better representation of reality; among other reasons because it can be set up to more or less ignore deflections due to weather conditions.

A different and more complicated example refers to the common task of fishery inspection. During inspection and registration of fishing vessels, observations are double-checked both with the fishery surveillance system V-track and by at least one other crew member. Here perception with binoculars is considered error-prone, because it can be very hard to distinguish registration numbers on distant fishing vessels and it is crucial not to make a wrong registration. Successful perception is here enacted as a distributed and collective achievement among binoculars, humans and the V-track-system. Relating this discussion to the question of what counts as high-tech and low-tech, it is also worth noticing that when monitoring the movement of fishing vessels, confirmed visual contact rather than systemic representations establishes the certainty of representation. In these cases, again, binoculars are more central actors than the satellite-based surveillance system.

The technologies onboard *West Coast* are thus fluid both in relation to particular circumstances, such as weather, and also historically, as technologies are slowly added to an existing technical configuration. We think this situation also accounts for sailors' philosophically inflected discussions about how different technologies relate to the environment. Since sailors

put their trust and sometimes their lives into the hands of technologies it is no surprise that they show a serious and ongoing concern with their environment of representational technologies. Concern and even care for these technologies is a central dimension of their working attitude.

Further, the ship is presently a part of many other negotiable networks involved in fishery inspection. The surveillance system V-track has profoundly changed the planning and organization of everyday life on board. Earlier, the role of the inspection vessel was mostly preventive and it sailed wherever it was thought fishing boats might be. Since paper files were almost impossible to keep up to date, the crew could not really check anything at the time of boarding a ship. Today, however, permits and catch records can be checked via the Internet even before boarding. Inspection vessels have thus been provided with a concrete way of measuring deviations from fishing quotas, although it is still difficult to determine illegality. Furthermore, the V-track system updates a display of the whereabouts of fishing vessels, making easier the decision of where to sail. This means, though, that the everyday inspection work is now entirely dependent on satellite connection.

Similarly, making new administrative IT systems accessible on board, has allowed the ministry to move the planning of fishery inspection to a land-based 'risk assessment' unit. So here the enabling value of the V-track system also makes it possible for other actors to interfere in the everyday planning of work onboard. We are considering, then, a technological setting which simultaneously enables and disables numerous actors and activities.

When asked to assess the introduction of a future IT system, the electronic catch record, one captain said that this 'technology will be good if it works' (see also Lützhöft, 2004). Clearly the value of enablement itself is not at stake in this pronouncement. However, another captain held the opposite view. As he saw it, the fact that tasks can now be planned from land also affords politicians with an argument for cutting down sailing time and crew in the name of efficiency. Thus, V-track is not under local control but links *West Coast* to other parts of the network of fishery inspection in such a way that distant actors can control its activities more easily. According to several crew members, this situation puts at risk the traditionally valued independent and ad hoc planned practice of fishery inspection. If new technologies enable gains in efficiency this may make them disabling in terms of job autonomy and security.

Hence in contrast to the captain who picked up the old phone and laughed about it, another captain is less amused since he is aware that 'the good old days' will never return. Yet, even he views the future as bringing interesting challenges and notes that sailing has also become much safer than it used to be. Apparently the continual addition of technologies on *West Coast* has not led to a situation of more *or* less certainty. Instead it seems there is more and less certainty with respect to work tasks, job security and many other issues. This confusing situation accounts for the proliferation of comparative scales

put to use by sailors. And it indicates why an important task for empirical philosophy is to make sense of such scales.

13.6 Ontological fluidity, scales and enablement

Technological fluidity has been a prominent theme in each of our cases. This was most obvious the case of the Zimbabwe bush pump, which, indeed, defined this idea for us. In that case, the central question was where to locate the fluidity of technology. A main conclusion was that fluidity was a feature of the bush pump and its relations to other human and non-human actors, not of human perceptions of the pump. People certainly did have different perspectives on the pump, but the technology itself also shrank and expanded, stabilized or destabilized through the links that were forged with a heterogeneous set of actors, including headworks, tube-drilling devices, *ngangas*, paint and *E. coli*.

Through processes of temporal as well as spatial transformation the pump, in its own way, contributed to the production of health no less than the construction of community, and perhaps even nation-building in Zimbabwe. It is because technologies can have such far-reaching and unforeseeable effects in the shaping of nature no less than society that we find Viveiros de Castro's notion of multinaturalism far more enticing than the multicultural idea of different appropriations of technology. This notion takes us directly onto ontological territory by emphasizing that technologies, people and 'natural' objects become tied together in assemblages, which produce different versions of communities, water accessibility, rural health or African nations: multiple natures which do not always fit as neatly as seems to be the case of the Zimbabwe bush pump.

In the case of the inspection vessel such fluidity was also manifest, not least in the way in which the addition of new IT and other advanced technologies changed both local work practice onboard the ship and the relation of the ship to administrative practices on land. The case offered an illustration of how new technologies, rather than simply replacing older ones, are implemented in and transform existing networks of technologies and humans. In such situations technologies can only with difficulty be understood as free-standing devices. Instead it encourages us to consider technical landscapes, where older and newer technologies coexist with older and newer working tasks.

In turn, it is because of such (everyday) complexities that crew members were involved in an ongoing work to develop evaluative scales. How do technologies compare under different conditions? Which are better for which kinds of tasks, given different kinds of constraints? This non-abstract yet conceptual endeavour to measure and contrast 'goods' and 'bads' is brought into focus by empirical philosophy. We might be interested not only in defining our own scales (and aim for them to be the 'correct' ones)

but in understanding the locally produced scales which actors bring to bear on their situations when dealing in technical environments.

Several things follow from such a focus. While the scales of 'good' and 'bad' technological representations could likely be problematized from any given philosophical position, they are nevertheless workable in native settings. For this reason it is not the ambition of empirical philosophy to evaluate the adequacy of those scales by means of an externally produced philosophical criterion. Rather, it is to try to understand what such scales might teach philosophy. However, as noted earlier, this cannot entail a simple reversal from a focus on philosophical conceptualization to ethnographic description of local practice. For one thing a number of analytical distinctions, which have their origins elsewhere, are also regularly set in play onboard *West Coast*. For example, although the common-sense scale of the high-tech and the low-tech is not simply accepted on the ship, it is still operative in many ways, as when the vessel is compared to others. The notion of high-tech is brought into play in a way reminiscent of how Strathern describes usage of the term 'modern'. High-tech like 'modern' is used on the ship to designate brand new things at home, but mostly it refers to new things that are taking place *elsewhere*, such as some recently built fully automated and reportedly captain-free Japanese vessel. Nevertheless the crew does not simply consider their technologies (old or new) 'low-tech'. Instead, the 'low-tech' is used to describe practices that are not seen as purely technological, such as positioning, which uses paper maps. The scale from high- to low-tech is invoked comparatively in local statements, and not as a designator of any definite technical feature.

For this reason we have argued that, just as the activities on the ship are technologically linked to multiple other settings, which it is our job to investigate, so they are conceptually linked to many other locations and practices, which take part in shaping assumptions guiding technology use onboard. Further, we have suggested that this concept transfer calls for analytical attention. This is why we called for studies of 'technological concept transfer' to complement analyses of technology transfer. Another implication follows, which allows us to generalize the problematic of scaling encountered onboard the inspection vessel. Even in this delimited situation the new and the old, the low-tech and the advanced appear difficult to delineate and certainly to evaluate. Mol and de Laet recognize that different scales help to construct technological potential and danger, and to make technologies work differently in practice. This is why they praise the designers of the bush pump for not taking for granted the superiority of accepted scales of development, which prioritize the supposedly high-tech, modern and standardized at the cost of the low-tech, backward and uncontrollable technology uses in developing countries.

In Mol and de Laet's view it is precisely because of the adoption of alternative scales of technical worth among the developers of the bush pump, that

this technology has become capable of effectively participating in the work of multinaturalism. Hence follows the conclusion that although the pump is a relatively low-tech and simple device when analysed in terms of its technical principles, this may be precisely what facilitates its ontological fluidity. This situation is the more striking when juxtaposed to many advanced and putatively fluid technologies, notably information technologies, which are popularized precisely due to their flexibility, but nevertheless, in practice, are implemented with a rigid and rule-bound ambition. The built-in 'fluid mechanics' of the bush pump may thus exemplify a better development practice than many modernizing projects aiming to develop Third World countries. Yet we should obviously not expect to be able to make this into a general model for technical development, which can be easily transferred to other practices.

In the case of seafaring, for example, advanced and flexible technologies may exhibit their main strengths in the way they ensure that security measures are rigidly adhered to. Yet, this situation, in which the simple is flexible and the advanced rigid, itself suggests how empirical philosophy may unsettle our notions of the high-tech and low-tech. And although no transfer can be guaranteed, it also leaves room for the possibility that ontological fluidity may be worth striving for in some Western settings.

Finally, in terms of the relationships between new reproductive technologies described by Strathern, it is clear that these are also fluid. Strathern further shows how they are tied to a specific cultural conception of technology as enabling. This argument both extends and strengthens the idea that studies of technology might focus simultaneously on the hybrid assemblages created through the implementation of new technologies and on the assumptions concerning technological capacity guiding attempts to build new technologies. Strathern analyses technological development not in terms of prominent scales, which indicate that they give rise to 'more or less' risk or uncertainty (Beck, 1992) or 'more or less' tradition (Albert Borgmann). Instead she argues that the specific relational features of the use of technology, for example in relation to understandings of kinship or disease, give rise to simultaneously more and less certainty. In this process, she sees potential for a dramatic change in our capacity to make decisions about what it is 'rational' or 'good' to do. A certain kind of relativity emerges in this analysis but it does not have its basis in an epistemological or moral pluralism. Rather, a Western belief in technological enablement combined with the ontological fluidity of technologies creates situations in which unequivocal determinations of fact and value are increasingly undermined. We provided one small illustration of this situation by bringing Strathern's argument to bear on the philosophical definition of analytical statements provided by Flor. The example suggested that even basic building blocks of philosophical conceptualization may be up for grabs due to continuing technological change. Thus technological ambiguity poses as an important analytic concern.

This concern is not related to celebrations or lamentations over the fact that we live in technological societies. Empirical philosophy suggests a different kind of intellectual engagement, which does not presume its own scales, concepts and assumptions to be working everywhere. It does not try to provide explanations of structures or mechanisms ineluctably guiding technical development. Empirical philosophy instead aims to add to reality its articulation of the ways in which technologies function and are worked with in different settings.

Empirical philosophy assumes that we are often faced with technological situations of ambivalence, danger and possibility, in which indigenous and academic forms of action, value and conceptualization are associated and often at stake. In such cases we believe that this analytical mode offers a viable and interesting point of entry for a nuanced engagement with pressing technological matters of concern.

Notes

1. Grounded theory and ethnomethodology are major methodological positions in STS.
2. Literally: the father is whom the marriage shows.
3. Gad conducted fieldwork onboard the ship in the winter of 2006 and the spring of 2007, focusing especially on technologies and work practices on the bridge.

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