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Jukka Syväterä
Pinni B 3002
33014 University of Tampere
Finland
email: jukka.syvatera@uta.fi

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STS and Enhancement Technologies: A Programme for Future Research

Michael Morrison

The concept of human technological enhancement originated as a tool for the moral classification of technologies, but has since spilled over from ethical debates to become a site for prospective technology development as part of a 'converging technologies' agenda. To date, enhancement and the technologies labelled as 'enhancing' have been underserved by STS research. While case studies do exist, there has been a dearth of co-ordinated investigation. This paper proposes a systemic programme for STS research on enhancement technologies based on five key challenges posed by dominant conceptions of enhancement as a way of understanding technological development. After setting out this agenda, a short history of the enhancement debate is provided to illustrate the changing meanings of 'enhancement' across different contexts. Recognising the limitations of critique alone, particular emphasis is given to the possibilities for productive engagement by STS scholars with the domain of enhancement across its multiple manifestations.

Keywords: bioethics, biotechnology, expectations

Enhance, v. Pronunciation: /ɛn'hɑ:ns/ /-'hæns/

To exalt in dignity, rank, estimation, or wealth.
To elevate spiritually or morally.
To lift up with pride; refl. to exalt oneself, assume superiority.
To praise, extol.

To raise in degree, heighten, intensify (qualities, states, powers, etc.).
To magnify subjectively, make to appear greater; to heighten, exaggerate.

To raise (prices, value); to increase (charges, etc.).

To raise or increase in price, value, importance, attractiveness, etc. (Oxford English Dictionary Online, 2013).

The term *enhancement* is usually used in bioethics to characterise interventions designed to improve human form or functioning beyond what is necessary to sustain or restore good health (Juengst, 1998: 29).

Introduction: What Is Enhancement?

In a broad sense, as reflected in the Oxford English Dictionary definitions listed above, the idea of enhancement can relate to any improvement (or indeed projected

improvement) in the circumstances and quality of human lives individually and collectively. The second quote, from the philosopher and bioethicist Eric T. Juengst (1998: 29), captures a second, narrower and more recent conception of 'human enhancement'. Enhancement in this sense refers specifically to the idea that biomedical technologies can be, and are being, used to advance human performance and boost the physical and mental capacities of individuals in ways that go 'beyond what is 'normal' or necessary for life and well-being' (Hogle, 2005: 695). Emerging in the latter decades of the twentieth century, this concept of human enhancement can be read as a response to concerns about the transformative power of biomedical technologies extending into ever greater areas of human life in ways that trouble commonplace human values and norms. In this, there are at least superficial similarities with the sociological concept of medicalisation (Conrad, 2005). Enhancement, however, has its origins in the discipline of bioethics and was initially developed as a tool for moral evaluations of gene therapy. In the original framing, enhancement uses of technology are understood in direct opposition to therapeutic usage, where 'therapy' is taken to describe the commonplace use of medical technologies to treat and manage disease. In this formulation, therapy is always morally legitimate while enhancement applications of technology, by transgressing the remit of therapy, are *prima facie* ethically suspect (President's Council on Bioethics, 2003). Since that initial formulation, the concept of enhancement has expanded to cover a wider range of technologies and perspectives, becoming a 'standard rhetorical tool' in academic bioethics (Juengst, 1997: 125). The nature of debate has also transformed to include arguments strongly in favour of utilising enhancement technologies for human benefit.

It is likely that most readers will be familiar with at least one, and probably several examples of 'human enhancement technologies', as they are often attract considerable public and media discussion. Some, such as cosmetic surgery (appearance enhancement), have been in existence for many years and have become common, if not entirely uncontested, phenomena. Similarly, pharmaceutical doping in sport, from the use of amphetamines in track and field events during the 1950s to contemporary cyclists taking the anaemia treatment erythropoietin (EPO) to increase their red blood cell count (athletic enhancement), is a recurring issue in professional sports (Wailoo, 2007). More recently, certain blockbuster pharmaceuticals such as *Prozac* and *Viagra*, are said to have stretched the definition of illness to become 'enhancements', where, for example, Prozac is claimed not only to treat clinical depression but also to alleviate unhappiness (mood enhancement), making recipients 'better than well' (Rothman, 1994; Wright, 1994). In addition to these well-known examples, the full range of technological options for enhancement includes human genetic engineering, nanotechnology, cognitive and neurological enhancement, regenerative medicine and human-machine interfaces (Hogle, 2005; Miller & Wilsdon, 2006; Hughes, 2007).

To date the topic of enhancement has been somewhat neglected by scholars in the fields of STS and the sociology of technology. There are of course exceptions (see for example Nordmann, 2004, 2009; Banse et al., 2007; Ferrari, 2008; Morrison, 2008; Roco, 2008; Fuller, 2009, 2011; Coveney, 2010, 2011; Roco & Bainbridge, 2013; see also Hogle, 2005 for an anthropological perspective), but these have largely been isolated contributions and there has been little concerted attempt to systematically address and investigate enhancement as a

topic in its own right. Some attention has been given to enhancement through the lens of medicalisation theory (Conrad & Potter, 2004; Conrad, 2005). While this has yielded some useful insights, it suffers the drawback of ultimately regarding enhancement as yet another avenue for defining social problems in medical terms and proposing medical solutions – in other words the drivers may change but essentially it is regarded as a case of 'medicalisation as usual'. As such, this approach fails to address in depth the dynamics and the substantive content of 'enhancement' as a specific concept and as a means of technological classification. I believe that a comprehensive, integrated programme of research is needed to address the range of different technologies and different contexts of the enhancement debate and that such an approach is capable of generating a deeper and ultimately more productive account of enhancement than one-off studies.

The aim of this paper is twofold: Firstly, I will outline an agenda for a programme of STS research on human enhancement and human enhancement technologies. I use the phrase 'human enhancement and human enhancement technologies' deliberately to indicate the requirement for simultaneous investigation of both technologies labelled as 'enhancements' and the concept of enhancement itself as part of this programme. The context and content, of the term 'human enhancement technology' has changed even over the relatively short course of its history, as has the range of technologies involved. The second contribution of this paper will therefore be to sketch a brief account of the changing dynamics of enhancement from its origins in North-American gene therapy debates to the converging technologies agenda discussed below.

Why Do We Need an STS Approach to Human Enhancement?

In order to answer this question, we first need to consider what an 'STS approach' or an 'STS perspective' entails. Woolgar et al. (2009: 21) advise that 'it is unhelpful to construe STS as a unitary set of approaches, methods and topics'. Despite this, those same authors also recognise the necessity of having a tolerable 'shorthand' answer to this question and propose the following five 'key STS sensibilities':

1) a propensity to cause trouble, provoke, be awkward
2) a tendency to work through difficult conceptual issues in relation to specific empirical cases, deflating grandiose theoretical concepts and claims (and even some ordinary ones)
3) an emphasis on the local, specific and contingent in relation to the genesis and use of science and technology
4) caution about the unreflexive adoption and deployment of standard social science lexicons (e.g. power, culture, meaning, value)
5) reflexive attention to the (frequently unexplicated) notions of our audiences, value and utility (Woolgar et al., 2009: 21–22)

While I am broadly in agreement with this list, it should be remembered that it was developed in the context of presenting or explaining the 'essence' of STS for utilisation in management and business studies. The topic of biomedical enhancement is rather closer to STS' 'home turf' of the study of science and technology. For the purposes of this paper then, a useful 'shorthand' version of an STS perspective reads more like a truncated summary of the foundational themes of STS, than the characteristics and sensibilities of STS listed by Woolgar et al.

(2009). It is a crude summary to be sure and fails to address the heterogeneity of perspectives and concepts within the field, but it should suffice for what is needed here.

Broadly, I construe an STS perspective as encompassing a rejection of technological determinism, an insistence on the local and contingent nature of the production of facts and artefacts, and a constructionist approach that takes materiality seriously. Such an approach means rejecting both technological and social determinism as explanations for the development, acceptance or rejection and modes of use of technologies (Timmermans & Berg, 2003). Material entities – in the case of enhancement the most relevant materialities are those of bodies and technologies – are neither reducible to what is said about them, nor wholly separable from the discourses through which they are mobilised. Rather the 'natural' and 'cultural' are mutually constitutive. To relate this perspective more directly to issues of human biotechnology and biomedicine I will borrow a concept from the anthropology of pharmaceuticals. Nichter & Vuckovitch (1994) proposed that medicines can be regarded as 'vehicles of ideology': that is, they are not just material entities but embody ideas about the kind of bodies that they are interacting with, about the type of individual taking the medicine, about the condition being targeted, about individual and social responsibility and entitlement, and about what is normal and desirable. While not all cases labelled as 'enhancement' involve pharmaceuticals, all cases of enhancement do involve some form of technological manipulation of human bodies, thus giving reasonable grounds to expand this anthropological perspective to cover 'enhancements'. Enhancement technologies, whether 'bio', 'nano', 'neuro' or information/communication technologies, are intended to act on (and in) human bodies and are bound up with ideas such as the nature of those bodies, the end users of the technologies, entitlement, normality and desirability. An STS perspective can serve in the first part to make this entanglement explicit.

In addition, much of the bioethical debate on enhancement to date has been dominated by arguments informed by traditions of (Anglo-American) analytic philosophy such as utilitarian and consequentialist ethics. These approaches to applied ethics tend to incorporate a number of characteristics that are highly problematic from the aforementioned STS perspective. Enhancement readily presents a set of 'grandiose theoretical concepts and claims' (Woolgar et al., 2009: 21–22) that are ripe for critical investigation through case studies of the technologies and practices involved. My first argument in support of an STS engagement with enhancement technologies will therefore highlight in more detail these problematic aspects of the *concept* of enhancement – specifically various forms of determinism and dualism.

As with all areas of contemporary social science, STS scholars are increasingly directed to pay attention to the issues of value, utility and indeed, audience for their work, as raised in the final point in the list produced by Woolgar et al. (2009). With this in mind, my second argument for the value of a programme of STS work on enhancement technologies focuses on the emergence of technological enhancement as a domain for prospective investment of capital and strategic technology development. This domain suggests a particular audience for STS research in the form of science policy makers, futurologists, and technology developers and has the potential utility of informing decisions about investment in human biological enhancement as a domain of strategic techno-science. I will return to this point

in subsequent sections to flesh out the argument that this aspect of enhancement offers a site for constructive work in STS that goes beyond critique and 'causing trouble'.

Problems of Determinism and Dualism

Much of the ethical literature takes the appropriate starting point for (moral) discussion and categorisation of technologies as the moment when a new technology becomes available for application. New technologies though, do not simply arise fully-formed to present ethical dilemmas about their use. Instead, they are shaped by both material factors and the interests and perspectives of social actors involved in the processes of technological creation, regulation and use (Bijker et al., 1987; MacKenzie & Wajcman, 1999). By excluding from consideration the history, context and politics of technology development, many bioethical approaches implicitly effect a kind of technological determinism that produces a limited debate about the 'good' and 'bad' uses of 'neutral' technologies that come into being more or less directly as products of scientific rationality alone. A case in point is the use of human growth hormone (hGH) to increase the height of short children. Bioethical analyses of the appropriateness of using hGH such as Tauer (1995) and Daniels (1992) frame the issue as a dichotomy between using hGH to treat growth hormone deficient children (acceptable therapy) and giving hGH to 'short normal' children as a means of increasing their final adult height (illegitimate enhancement). Alternatively, an STS-influenced historical approach to the case of hGH, (Morrison, 2008) began by enquiring how childhood stature came to be understood as a treatable condition in the first instance. Without starting from the premise that some uses were intrinsically appropriate or inappropriate, it was possible to derive a socio-technical account of how certain applications (diagnostic categories) came to be legitimated (or find a viable technological niche) while others remained contested (failed to attain closure) as a result of shifting social, material, economic and regulatory relations during the course of the drug's career.

Additionally, certain forms of applied ethical argument common in the enhancement debate unproblematically incorporate the strong nature/culture dualism that pervades their analytic heritage (Twine, 2005; Mills 2010; see also Latour, 1993). Dualistic accounts regard material elements, including both technologies and bodies as belonging solely to the 'natural' and being entirely distinct from 'culture'. This dichotomy places knowledge production in the natural sciences as unproblematic, arising positivistically as an unmediated account of physical reality, while the cultural and historical situatedness of meanings and values given to bodies and technologies is occluded or framed as external to technology itself. Such explanations posit enhancement technologies as a problem (or an opportunity) for society but one driven by a medicine and technology that are seen as separate and distinct from the social realm. An extreme example of this can be found in the work of Daniels (2000), which is discussed further in a subsequent section of this paper. For the most part, a dualistic approach is 'neither a conspiracy theory nor simplistically a pernicious or conscious trend' (Twine, 2005: 289). Rather it is more akin to MacKenzie's (1990) concept of the 'uncertainty trough' where the more removed actors are from the site of technology production the more certainty they tend to attribute to the capabilities of new technological products and projects.

Consider the following accounts by Kass (2003) and Sandel (2004). Both argue against the moral permissibility of enhancement

per se and both mobilise a distinction between therapeutic applications of biotechnology and 'non-medical ends'. For Sandel (2004: 6), medical/therapeutic use of technology is such that it 'does not desecrate nature but honours it', while non-therapeutic or enhancing applications are clearly identified as being driven by cultural trends and demands for material and social success. 'Socially motivated' applications of biotechnology are regarded as 'serving ends that range from the frivolous and disquieting to the offensive and pernicious' (Kass, 2003: 9).

In a pro-enhancement account from the same time period, Bostrom (2003: 498) argues that genetic enhancement can deliver socially desirable ends ranging from freedom from genetic disease to faster learning, improved immune capabilities, and '[h]ealthier, wittier, happier people'. Responding to (consequentialist) anti-enhancement arguments, Bostrom (2003) goes on to discuss potential negative outcomes of genetic enhancement, such as the possibility that parents of genetically modified babies would come to regard their offspring more as consumer products and less as individuals valued in their own right, or that availability of enhancements would exacerbate social inequalities. Tellingly, his proposed solutions also involve social (political and economic) interventions such as subsidising enhancements for those with lower socio-economic status or more education to avoid public belief in genetic determinism.

These examples illustrate how, in both pro and anti-enhancement arguments, questions of scientific uncertainty, of how enhancement technologies might be configured in practice, and of the limitations of representing traits like intelligence as biological processes are occluded. Thus content of the technologies is left unexamined, while the potential problems raised by the availability of enhancement technologies and their proposed solutions belong instead to the separate domain of the social.

This widespread unwillingness or inability to recognise the cultural, value-laden aspects of knowledge-production in the natural sciences also means that the promissory, speculative visions of control promulgated by new domains of techno-scientific practice (e.g. neuroscience, nanotechnology) tend to be uncritically received by many bioethicists (Hedgecoe, 2004; Melo-Martin, 2005). This in turn often leads to a tacit acceptance of the reductionism involved when socially meaningful concepts such as personality, intelligence or altruism are reconfigured as mere outputs of variations in the functioning of biological components, as, for example, in discussions of genetic engineering to produce individuals with more desirable personality traits or who are better moral actors (Melo-Martin, 2005; see also Dickenson, 2013 chapter 5 for a review of debates on moral enhancement).

The Converging Technologies Agenda

A second reason why human enhancement technologies warrant greater critical investigation from STS and related fields is that over the past decade the concept of human technological enhancement has spread – spilled over or escaped – from the bounds of academic bioethics to become the subject of social movements such as transhumanism (Agar, 2004; Bostrom, 2003), and future-orientated discourses of innovation policy and speculative investment. The latter aspect is most relevant to my proposed agenda for STS, as it brings enhancement into the realm of national and international regimes of economic operation, strategic management and the generation of technoscientific expectations. The first,

and arguably most significant, articulation of a strategic vision for enhancement technologies was conveyed in the report 'Converging technologies for improving human performance: Nanotechnology, Biotechnology, Information technology and Cognitive science' edited by Roco and Bainbridge (2003) for the US National Science Foundation (NSF) (Fuller, 2009). The report argues for the combination, or convergence, of the four domains of science listed in the report's title in order to yield:

> [T]he potential to enhance both human performance and the nation's productivity. Examples of payoffs will include improving work efficiency and learning, enhancing individual sensory and cognitive capabilities, fundamentally new manufacturing processes and improved products [and], revolutionary changes in healthcare (Roco & Bainbridge, 2003: 1).

In the wake of the NSF report, there have been a number of European responses in the form of reports and assessments from the European Union High Level Expert Group on the New Technology Wave (Nordmann, 2004), the Science and Technology Options Assessment (STOA) group of the European Parliament (STOA, 2006, 2012) and direction to issues of biomedical enhancement in several research projects funded through the European Commission's sixth and seventh Framework Programmes (DEEPEN; ENAHNCE; EPOCH; ETHENTECH and FABRICED among others). The potential of enhancement technologies also continues to elicit national responses, as with the recent joint workshop on 'Human enhancement and the future of work' jointly hosted by the Academy of Medical Sciences, the British Academy, the Royal Academy of Engineering and the Royal Society in the UK (2012).

The relatively high-level policy consideration of enhancement technologies as a strategic domain of technoscientific investment and research has at least the potential to transform enhancement from being the topic of a primarily academic debate into a potential stimulus for economic and practical action. What is said about the future matters because:

> The rhetoric that surrounds [new technologies] produces imagined futures, while concrete technological practices have the power to produce very real futures materially. Moreover, the rhetorical construction of future worlds directly (and indirectly) influences which technologies are brought into existence by, for example, providing justifications for funding, rallying public support, instigating policy directives, etc. (Selin, 2008: 1879)

And yet, as I will attempt to argue in the course of this paper, the concept of human enhancement technology still contains many of the problematic assumptions about technology congruent with its bioethical origins. It is for these reasons of the problematic nature and increased visibility of the concept of human enhancement technologies that I believe greater STS attention is warranted.

What Does an STS Approach to Enhancement Look Like?

Given that human biomedical enhancement is both a (changing) concept and a label applied to certain technologies or uses of technologies, an adequate STS approach must engage with both these aspects of the phenomenon. In part, this can be done by drawing on one of the traditional strengths of the field and carrying out empirical case studies of technologies, or technological

applications, labelled as enhancements. However, before they can be used to critique it, case studies will first need to engage with extant understandings of the concept of enhancement. In doing so, researchers need to avoid the twin perils of uncritically accepting problematic understandings of technology such as nature/culture dualism *and* of unwittingly finding themselves drawn into the increasingly polarised moral arguments for and against permitting human enhancement technologies. An STS approach must adopt a critical distance from the enhancement debate, taking the concept of enhancement as a topic of investigation rather than a given 'fact' about the technologies and accounts being studied.

Researching Enhancement as a Concept

One model that could be usefully copied here is Rappert's (2007) work on the issue of 'dual use' research in the context of biological security. The dual use debate concerns whether, and how, it might be possible to identify scientific research intended for beneficial, often biomedical, applications that might also enable the construction of biological weapons or other undesirable hazards. Although dual use research and enhancement derive from different historical and political contexts, both debates concern attempts to classify bio-scientific outputs as acceptable or unacceptable based on criteria other than the scientific quality of the output itself and both are amenable to similar sorts of critical analysis. Rappert (2007) sets out an investigative agenda for dual use research that does not try to resolve the problem as presented, but begins by addressing the terms on which the debate is being conducted. In this work, Rappert (2007) asks what claims are being made about dual use research and how. How are assessments being made and who makes them (and who is excluded)? What assumptions are built in to starting points of the discussion? What *other* questions can be asked and how should we ask them?

Such an agenda, applied to the study of human enhancement means not taking the category of 'enhancement' (or 'therapy') at face value, but treating it as a claim made by bioethicists and others through the exercise of professional expertise. To inform their case studies, STS scholars must therefore also trace and account for the shifting meanings of enhancement across contexts from bioethics literature to strategic technology evaluations, and unpack the underlying normative commitments in accounts of human technological enhancement. Thus the first component of an STS agenda for studying enhancement technologies should be:

> 1) To map out the changing landscape of the enhancement debate(s) from its bioethical origins to the present converging technologies agenda.

At this juncture, it is helpful to recall some lessons from sociological engagements with bioethics. Certain sociological accounts of bioethics, in tending to portray all bioethical decisions, texts and forms as part of a single, principle-based bioethical orthodoxy have historically caused friction between the two disciplines (De Vries et al., 2006). It is pertinent to recognise that bioethics, as a fundamentally interdisciplinary enterprise – the field was primarily founded by collaboration between philosophers, theologians and concerned physicians – is not a monolithic entity but rather incorporates a plurality of views and approaches as befits the diversity of bioethicists (De Vries et al., 2006; Jonsen, 1998).

The critique I propose in this paper is not a critique of 'bioethics', or indeed of bioethicists, but of certain conceptions and framings of enhancement (especially as part of a dichotomy with therapy) as a way of classifying and understanding technologies. Nonetheless, much in the sociological critique of bioethics was and is warranted, if overly broad and totalising in its application. One of the limits of the argument of De Vries et al. (2006) is that within the multiplicity of bioethical accounts, there remains a detectable 'mainstream' (Kelly, 2006) or dominant mode of bioethics drawing primarily on philosophically-informed applied ethics, while other perspectives more amenable to sociological and STS sensibilities often remain marginalised (Hedgecoe, 2004). When, as with the discussion of the problems of dualism in the previous section, I refer to issues with the 'bioethical origins' or the 'bioethical framing' of enhancement I intend it as a critique of the dominant narratives about enhancement and am not trying to suggest that all bioethical perspectives share this limitation.

Case Studies of Enhancement Technologies

Case studies (rightly) remain a core tool for STS studies. They provide a body of empirical data, something that is often absent from other discussions of enhancement technologies. They also present a means to challenge universalising tendencies (Hedgecoe, 2004) that present all technologies and technological applications labelled as enhancements as merely recurrent examples of the same (moral) problem. A body of STS case studies offers the opportunity to investigate, compare and contrast specific examples of technologies labelled as 'enhancing', drawing out the differences in context, meaning and consequences across cases. Operationalising the critical agenda described above, case studies should also draw out the normative assumptions contained in the claims and assessments made about enhancement, whether by ethicists, transhumanists or technology developers. These goals can be configured as the following components of an STS programme of investigation:

> 2) To study how particular technologies have become labelled or classified as being for 'human enhancement' or having 'enhancement applications'.
>
> 3) To look at the human characteristics that technologies are supposed to enhance and to ask how and why these characteristics are valued. What is the role of wider cultural, economic and political contexts in making some human traits desirable and others undesirable?

For both questions it is also important to remember that 'enhancement' is often a label applied by experts from outside the domain, such as medicine or sport, where a particular technology is actually deployed in practice. One of the purported successes of institutional and professional bioethics has been its 'ability to import into medicine a set of ethical standards that are not native to the occupational and organizational cultures of medicine itself' (Zussman, 2000: 10 cited in Hedgecoe, 2004: 134). However, in the case of enhancement, it is by no means clear whether the classification of technologies as 'enhancing' or 'therapeutic' has exercised any great influence on contemporary medical thought or practice. Case studies should therefore also seek to uncover how technologies and technological practices labelled as enhancing are understood in their domains of application and whether a

label of 'enhancement' has any legitimacy or consequences for everyday practice.

A final issue, as identified above, is the tendency towards reductionism and biological determinism in many accounts of enhancement. This is especially true of pro-enhancement accounts where the full range of human capabilities to be enhanced extends to human traits such as sexual identity, morality and aspects of personality like aggression or shyness. Deterministic accounts propose that behaviours are essentially governed by biological, often genetic, factors, while reductionism holds that *only* these biological factors are worthy of consideration when investigating (human) characteristics. These issues are hardly novel and have already been addressed in relation to claims making in evolutionary psychology (Ehrlich & Feldman, 2003) and behavioural genetics (Rosoff, 2010). The primary limitation of this type of explanation, when applied to complex human behaviours such as altruism or moral judgement is that, as they become understood as quantifiable outputs of biological functioning, such as changing patterns of brain activity or modulations in gene or biomarker expression, complex behaviours become reified as being *only* the expression of those variations. Altruism becomes a particular pattern of brain activity; morality becomes a particular pattern of gene expression as the contaminating 'social' is purified to leave only the 'natural'. As a result, concepts such as altruism or morality become 'flattened', losing any sense of characteristics as internally-experienced episodes of affective reasoning. Accordingly, the fourth component of an STS programme of research on enhancement technologies is:

> 4) To investigate how complex human characteristics and traits are becoming understood as components of a biological system (the human mind/body), which are amenable to intervention and controlled manipulation through technology.

Is Critique Enough?

So far I have presented the case for a programme of STS research on enhancement technologies largely in terms of the problematic nature of the existing enhancement debate and the possibilities for STS research to make these limitations explicit. This is certainly within the 'traditional' remit of STS scholarship. Indeed, it may be too close to existing work within STS. Guggenheim and Nowotny (2003) have argued that the STS critique is in danger of becoming repetitive and thereby redundant. For STS scholars there may always be 'further artefacts to deconstruct, and always a new target group which can be enlightened about the flawed nature of prevailing understandings of science' (Woolgar et al., 2009: 10), but to what useful end? This returns to the question of audience. If STS scholarship is mainly directed at other STS scholars or those in related fields then there is relatively little to be gained by colonising the enhancement technologies debate as a further site for 'more of the same' critique (this may even be a reason why there has been relatively little dedicated STS research on enhancement to date).

I would suggest that the extension of STS perspectives and the 'enlightenment' of new target audiences *is* valuable in itself, but it is potentially limited when presented as critique alone. Critique does not necessarily contain any useful recipe for reforming and constructively improving its targets. We can hardly expect to transform all our audiences into STS scholars and have them abandon all prior convictions. In any case, this would not be especially helpful as it would ignore the limitations of what STS can do

– for example STS scholarship has largely resisted making normative decisions or adopting a particular politics of technology (Keulartz et al., 2004). A further form of STS work is possible through engagement with new audiences in ways that move beyond deconstruction towards 'positive' and constructive engagement (Latour, 2004). Timmermans & Berg (2003) advise social scientists to use their expertise to influence the creation and implementation of medical technologies. Similarly, Harry Collins and colleagues (e.g. Collins & Evans, 2002) have advocated using STS' 'knowledge about knowledge' to advise on the best use of expertise in the public sphere (Woolgar et al., 2009). However, cautionary voices within the field have also warned that a commitment to engagement risks jeopardising STS' cherished potential for (radical) reflexivity.

The case of technological enhancement offers potential avenues and challenges for productive engagement. The aim of this proposed programme of STS research on human enhancement technologies is not in any way a call to try and 'do ethics better than the ethicists'. One productive form of engagement with the bioethics of enhancement might be to use STS case studies of technologies or technological applications labelled as enhancement to contribute to a 'critical bioethics':

> Critical bioethics is rooted in empirical research. [...] This does not mean that philosophers have to become social scientists; simply that if they are interested in the ethics of a particular technology, their first port of call should be the social science literature about that technology, rather than the standard bioethics debates (Hedgecoe, 2004: 135–136).

The viability of this approach depends, of course, on the availability of bioethicists willing to collaborate with social scientists and STS practitioners in an endeavour that requires greater reflexivity about the practice and knowledge claims of both bioethics and the natural sciences than is customary in much 'mainstream' bioethics. However, previous attempts to combine STS with potentially compatible ethical traditions such as pragmatism (Keulartz et al., 2004) and the diversity of bioethicists capable of offering a range of perspectives (De Vries et al., 2006) suggest that there is at least potential for such an exercise.

If, as the title of the chapter by Guggenheim and Nowotny (2003) suggests, 'repetition makes the future disappear', then another option for moving beyond critique is for STS to actively re-engage with and contribute to the future. Much of the pro-enhancement literature and almost all the converging technologies agenda deals in future-orientated claims about the transformative (and economically generative) potential of technology. As such, the claims and the rhetorical framing devices of these works are amenable to critical analysis through the sociology of technological expectations (van Lente, 1993; Brown et al., 2000; Borup et al., 2006). Claims about the future potential of enhancement technologies, as with any other form of technological expectation, are intended to convince and enrol relevant actors such as governments, funders and private capital investors in supporting the work needed to try and realise these imagined futures (Brown & Michael, 2003; Borup et al., 2006). Departing from this approach, a further step for STS scholars would be to engage with Selin's (2008: 1892) ambitious 'sociology of the future'. While the term 'sociology of the future' is not wholly novel, Selin's particular conception describes 'an emerging field of inquiry that works to understand future consciousness drawing from a mix of STS and the practice of foresight' (2008: 1892).

The suggestion is not that we should all become futurologists, but rather that STS scholars 'should tend to the cultural, political, and economic conditions from which future studies arise' (Selin, 2008: 1889). This approach can ask questions about how legitimacy is created or disputed for future-orientated technological claims, whose expertise counts (and whose is excluded) in making these claims and which groups are envisaged as 'winners' or 'losers' in projected futures. Implicit normative commitments and underlying assumptions – such as the pervasive notion of 'technological progress' – can be laid bare and subject to critical investigation. Such an approach is not without consequences; Selin (2008: 1891) warns: '[w]hether as a legitimating or destabilizing discourse, the future is a discourse with effects'. By participating in future-orientated discussions, scholars cannot remain 'neutral' and above the debate, but are inevitably drawn in to the politics of the future as their own studies, assessments and evaluations are sucked back into the 'pool' of available ideas about technological futures. What Selin presents as a warning, however, is positively a prescription for those voices in STS advocating a move beyond 'mere' critique. Effects, of the contributory, constructive variety, are exactly what is wanted.

Of course, there remains the danger of social scientists becoming co-opted as allies of particular visions of the future and the actors whose interests these visions serve. The remedy for this must be for social scientists to be continually, reflexively aware of the nature of their own contributions and to reflect on, and perhaps modulate, their work on an ongoing basis. I prefer to look at this positively: engagement with the rhetorical and material enactment of futures does not mean that reflexivity must be set aside in order to make engagement successful, but rather that adequately reflexive engagement is the only acceptable way to proceed. The fifth and final component of an STS agenda for the study of enhancement and enhancement technologies should therefore be:

> 5) To engage productively, but reflexively, with other disciplines and audiences in reflecting on STS accounts of enhancement and enhancement technologies.

I do not argue that critique is redundant, only that it is not sufficient. It is not an end in itself, but it is a starting point. Critical STS accounts of enhancement and enhancement technologies still need to be carried out to inform our perspectives and generate a body of critical empirical evidence to form a basis for engagement to depart from. The agenda for a critical STS investigation of enhancement and enhancement technologies can be summarised as follows:

> 1) To map out the changing landscape of the enhancement debate(s) from its bioethical origins to the present converging technologies agenda.
> 2) To study how particular technologies have become labelled or classified as being for 'human enhancement' or having 'enhancement applications'.
> 3) To look at the human characteristics that technologies are supposed to enhance and to ask how and why these characteristics are valued. What is the role of wider cultural, economic and political contexts in making some human traits desirable and others undesirable?
> 4) To investigate how complex human characteristics and traits are becoming understood as components of a bio-

logical system (the human mind/body), which are amenable to intervention and controlled manipulation through technology?

5) To engage productively, but reflexively, with other disciplines and audiences in reflecting on STS accounts of enhancement and enhancement technologies.

In keeping with this agenda, the next step for this contribution is to begin to map out the changing landscape of the enhancement debate(s) from its bioethical origins to the present converging technologies agenda. Accordingly, the next section will contain the second major element of this paper: a (brief) review of the nature of the debate on enhancement to date.

A Brief History of Human Enhancement Technologies

What follows is a short history of the bioethical and converging technologies debate on technologies for human enhancement. As Brown & Michael (2003: 5) remind us, both the future and the past are available to us 'only [...] imaginatively through histories and projections'. Histories are one such form of projection: they are accounts of the past, created and structured in the present, in ways that organise and account for past events that accord with contemporary understandings and purposes (Morrison, 2012). The account I present here is inevitably selective and partial. It is intended to draw attention to those aspects of the enhancement debate that I believe are most relevant to the claims I make in this paper and the issues I have identified as most pertinent for a programme of STS research on enhancement and enhancement technologies. This does not, I believe, diminish its value as long as we remain aware of the contingent and constructed nature of our own texts. Furthermore, this brief account can be used as a starting point for further investigation, including investigation of all the rich bioethical discussion excluded or summarised here.

Genetics and the Origins of Enhancement

The bioethical concept of human technological enhancement came to prominence through the debates on genetic engineering and gene therapy during the 1970s and 1980s. Much of the discussion at this time was of North American provenance. As the technology to insert 'foreign' or synthetic genetic material into the cells of a host organism began to look scientifically achievable, the bioethical community became increasingly concerned with the ethical considerations of genetic manipulation being applied to human subjects (Crigger, 1998; Martin, 1999). Two core distinctions were developed within the bioethics literature in order to gain moral purchase on the emerging technology (Martin, 1999; Scully & Rehmann-Sutter, 2001). Firstly, genetic modification at the level of somatic (body) cells was distinguished from alteration of germline (gamete producing) cells on the basis that the former intervention only affects individuals whereas the latter is intended to confer genetic changes that can be passed on to future generations. Secondly, and of greatest import here, the transfer of genes intended to treat existing (genetic) diseases was distinguished as gene *therapy*, from the genetic modification of humans with the intent of boosting human traits above normal levels or adding wholly new capabilities thereby *enhancing* the recipient's abilities (Gardner, 1995; Juengst, 1997). Thus, in its inception, the concept of enhancement was defined as one half of a dichotomy with therapy. Importantly, while enhancement is understood as

distinct from therapy, ultimately it can only be defined by reference to the concept of 'the therapeutic'. As the debate has moved from 'enhancement vs. therapy' to 'anti-enhancement vs. pro-enhancement', the category of therapy tends to fade from view, but, as I intend to demonstrate in subsequent sections, it still has an important role in framing the terms of discussion.

Returning to the genetic modification debate, the resulting moral verdict at the time was that gene therapy affecting regular (somatic) body cells was ethically acceptable but genetic modification to enhance human abilities or pass on traits to subsequent generations was morally prohibited. What can be inferred from the choice of 'enhancement' and 'therapy' as conceptual tools of classification? One, perhaps Whiggish, reading of the decision is that the enhancement/therapy distinction allowed an ethical steering of the nascent technology along a morally acceptable developmental pathway. Alternatively, it could be noted that the choice to valorise therapy and repudiate enhancement is inherently a conservative one, opting to reinforce the value of what is already known and accepted and problematising the unknown and uncertain. Defining 'therapy' as the proper scope of medicine creates a bounded space for medical practice with implicit, if poorly delineated, boundaries, which renders medicine manageable and unthreatening. Beyond the limits of this (safe) domain is the realm of 'enhancement', characterised by potentially unlimited, but uncertain and nebulous possibilities and risks. The casting of enhancement as morally troubling can be seen as an acknowledgement of the need for adequate reflection on the social consequences of the technological choices made by a given society, but also appears to contain an underlying risk averse, even paternalistic element, relying on tradition as a touchstone to protect society from possible harms of the unknown and uncertain. Viewed another way, the creation of categories of therapy and enhancement creates a sphere of 'pure' use of medicine and medical technologies protected from the 'dangerous' and forbidden realm of unbounded application that is enhancement (after Douglas, 1969). In this, the concept of enhancement is rather different from other theories of medical expansion such as medicalisation, which, in its critical formulation, argues that medicine might not always be the best way to address social problems, but does so on a case-by-case basis, not because it posited that there was or should be an *a priori* fixed realm of medicine.

Critical accounts of bioethics such as Evans (2002) and Kelly (2006) have argued that, as bioethics has become increasingly institutionalised as a part of the formal regulation of medicine and biotechnology, it has lost its critical distance from those disciplines it is intended to oversee. Instead, it is argued, bioethical review has come to act as a mechanism for diffusing public anxiety about new technological practices, while ultimately legitimising their deployment, by issuing ethical caveats on (and thereby creating) appropriate ways to use them. In this view the role of ethical rhetorical tools such as the enhancement/therapy dichotomy serve the social function of providing an ethical 'fix' to 'a medical demand to push the limits of medical treatment into new frontiers' (Imber, 2001: 31). Scully & Rehmann-Sutter (2001) make this argument in relation to gene therapy, reporting that when the enhancement/therapy dichotomy was proposed, gene therapy was in its infancy and no capacity for enhancement actually existed. Therefore, identifying enhancement as a morally problematic domain to be prohibited did not actually involve any practical loss of a technological option for

scientists and biotechnology companies, but instead served to initiate the progress of the technology by creating the morally acceptable category of gene therapy, under which the first clinical trials of human gene therapy could be organised.

Enhancement vs. Therapy

While human genetic modification has remained a more or less constant theme in the enhancement literature, during the 1980s the rhetorical tool of the enhancement/therapy dichotomy began to be applied to other areas of bioethical concern. One of these new cases was the use of human growth hormone (hGH) to increase the growth rates and anticipated adult stature of short children. In 1985 a new form of growth hormone was produced through the techniques of recombinant genetic engineering, which promised potentially 'unlimited' supply of the drug. As growth hormone became more available, the numbers of patients receiving hGH for both traditional diagnostic categories and in experimental applications began to increase significantly, raising concerns about the appropriate use of the drug (Neely & Rosenfeld, 1994). For bioethicists such as Daniels (1992) and Tauer (1995) the use of hGH in potentially 'normal' short statured children posed questions about the limits and proper scope of medicine and medical technologies that appeared well suited to moral evaluation in terms of enhancement and therapy.

> [T]he modification of height, which is possible through administration of biochemical GH, raises the same questions about therapeutic versus enhancement uses of genetics (Tauer, 1995: 18).

This question of limits and boundaries to medical practice is central to the enhancement/therapy dichotomy.

Analysis using the categories of enhancement and therapy soon spread to a range of other practices that threatened (or promised) to blur the boundaries between treating disease and biologically or chemically augmenting 'normal' human behaviours. Many of these, such as cosmetic surgery and the use of pharmaceutical agents to improve the performance of military personnel during combat or athletes during sporting events had been practiced long before the enhancement/therapy distinction was devised as a tool of academic bioethics. Others, such as the reported use of Ritalin as a study aid by college students or public speakers taking beta blockers to hide flushing whilst performing appeared to fall even more readily into dual 'medical' and 'social' categories of use. Novel cases also emerged, in the form of blockbuster 'lifestyle' pharmaceuticals such as Viagra and Prozac that claimed, in Peter Kramer's (in)famous phrase, to make people 'better than well' (Rothman, 1994; Wright, 1994).

The exercise of moral evaluation was not merely abstract but was, at this point in the debate, intended to serve practical decision making; for example in deciding which aspects of a new intervention should be covered by health insurance. A bioethical evaluation that could separate technological potential into therapeutic and enhancing forms would support an economic decision to cover those applications considered therapeutic and leave the 'enhancing' options as a matter of individuals' ability to pay. Thus, the spread of the enhancement/therapy dichotomy as an analytic tool can be understood both in terms of its utility to economic and policy imperatives to control healthcare costs and because of its value to professional bioethicists as a specifically *ethical* form of technological assessment that could be used to colonise

past, present and future issues of medicine and technological application.

Taking a less instrumental view of academic bioethics, the enhancement/therapy dichotomy also allows an engagement with traditional philosophical themes of what constitutes a good or worthwhile life. The concerns discussed under the topic of enhancement are multiple, ranging from issues of authenticity and social justice to the question of whether biotechnological interventions have a specific moral character that makes them qualitatively different from 'social' enhancements such as training and education. What is most pertinent to this account, though, is the spread of the label and concept of enhancement to an increasing range of technologies, promoting what might have remained a bioethical modality peculiar to the realm of genetic engineering into a prominent mode of technological classification.

Tools of Classification: From Normal Functioning to 'Beyond Therapy'

In the case of genetic engineering it had been sufficient to prohibit enhancement at the level of intention to intervene in human biology. Once bioethical attention turned to existing practices where technologies were already in use, the work of classifying particular applications as enhancement or therapy meant that enhancement had to move from being an abstract idea of 'not therapy' to a practically achievable categorisation. In order to make the determination of the boundaries of health (and the corresponding limits of medical practice) a more quantifiable, objective procedure, some early formulations of the dichotomy explicitly drew on prior philosophical attempts to define health and disease in biological and statistical terms, as for example in the work of Christopher Boorse (1977: 542):

> [D]iseases are internal states that depress a functional ability below species-typical levels. Health as freedom from disease is then the statistical normality of function, i.e., the ability to perform all typical physiological functions with at least typical efficiency.

This type of thinking, known as the 'normal functioning model', was most prominently championed by ethicist Norman Daniels (1992, 2000; see also Sabin & Daniels, 1995) who argued that the purpose of medicine is to restore, maintain and compensate for losses in equality of opportunity to individuals that result from disability and disease. The normal functioning model provides a way of calculating the appropriate (moral) boundaries of healthcare expenditure where 'proper healthcare services [...] should be aimed at getting people back to "normal", e.g. restoring an individual's functional capability to the species-typical range for their reference class' (Juengst, 1997: 129).

This type of biostatistical approach exemplifies the strong tendency towards nature/culture dualism in certain formulations of the enhancement/therapy dichotomy. Ignoring the historically and socially contingent nature of medical knowledge, it presumes a single apolitical, ahistorical 'species typical' human body produced through 'value free' biomedical techniques as a universal norm. Moreover the use of normal function models conflates the ideas of statistically 'normality' and the 'natural' human state with all the loaded connotations the latter term implies, leading to the moral validation of normalcy and problematisation of the statistically abnormal as socially undesirable. Normal functioning models of healthcare enjoyed a period of popularity and influence in the enhancement debate. However, it should not be imagined that they ever reflected

a dominant bioethical consensus: for example Parens (1998) and Juengst (1998) both review a long list of potential objections and problems with normal functioning models ranging from their potential to make seemingly arbitrary decisions about entitlement to medical resources, through to constructionist accounts of medicine that argue that medicine has no *a priori* boundaries. Even my cursory and selective review of the bioethical origins of enhancement reveals the veracity of Devires et al.'s (2006) claims about the multiplicity of bioethical perspectives.

Recourse to normal functioning approaches has notably declined in recent years. This has largely been due to difficulties in implementation and having to amend the models to ensure that existing, legitimated preventative health measures such as vaccination do not end up being classified as unacceptable 'enhancements', rather than being a result of constructionist or other minority ethical perspectives on 'mainstream' bioethics. It is a measure of the practical complexities of this type of approach that, by 2003 when the U.S. President's Council on Bioethics were ready to launch their major ethical report on enhancement, they opted for the title 'Beyond Therapy?' to reflect the need for debate to go 'not only beyond therapy but also *beyond the distinction between therapy and enhancement*' (President's Council on Bioethics 2003: 13 emphasis added). Indeed, the debate *has* changed in ways that bypass much of the difficulty in marking the exact boundary between normal and abnormal, therapy and enhancement, although probably not in ways that would meet with the approval of the distinctly conservative President's Council of 2003.

Pro-enhancement vs. Anti-enhancement

With the rise of the concept of enhancement, have come pro-enhancement advocates. Some of these are established voices within bioethics such as professors John Harris and Julian Savalescu. Others, often representing the social and intellectual movement known as transhumanism, come from outside the bioethical community to engage with the moral debates on enhancement (Agar, 2004; Bostrom, 2003). For pro-enhancement moral philosophers, futurists and transhumanists the moral polarity of the original therapy/enhancement dichotomy is reversed: The possibilities of using biotechnology to go beyond the current limits of medicine represents not an ethical transgression, but a desirable opportunity to overcome human limitations, while existing therapeutic applications of technology are at best acceptable and at worst inadequate. The range of enhancement technologies under consideration also expanded, covering more recent pharmaceuticals such as Modafinil which 'enhances wakefulness' (Coveney, 2011), technologies at various stages of development including regenerative medicine, bio-prosthetic devices, cognitive enhancement drugs and neuro-technologies (Hogle, 2005; Miller & Wilsdon, 2006; Hughes, 2007), and highly speculative future possibilities such as human-machine interfaces, life extension and personality modification (Kurzweil, 2005; Savulescu, 2007).

As the discussion has shifted to pit pro- and anti-enhancement camps against one another, problematic attempts to devise a quantitative definition of health and illness have been succeeded by a move that places human nature as one of the pivotal concepts at issue between pro- and anti-enhancement advocates. In anti-enhancement arguments, enhancement transforms human nature through biotechnology and therefore violates it, challenging human identity, and unleashing a range of negative social consequences such as consumer markets in enhancement

that will exacerbate inequality, and the instrumentalisation of life as people become valued only for the technological capacities they possess. Even though the term 'therapy' is often absent from these discussions, the ghost of the enhancement/therapy dichotomy can be seen in appeals to human nature. Human nature is, for anti-enhancement arguments as developed by Sandel (2004) or Fukayama (2002), part of the 'natural': a given state of biological human being which must be respected and protected from hubristic notions of mastery and inappropriate cultural desires to improve upon this natural state. Understood like this, the arguments for human nature are not that far away from the valuation of the (statistical) biological norm as natural and the repudiation of enhancement as an inappropriate cultural desire found in Daniels (1992, 2000).

Pro enhancement advocates also engage with concepts of human nature, refuting the claims of their 'bio-conservative' opponents by questioning the idea that there is a single, pervasive understanding of human nature to discuss in the first place, or that human nature is such that intervention represents *a priori* an immoral act (Buchanan, 2009; Kaebnick, 2009). Lewens (2009), at least partially echoing the difficulties of maintaining a clear boundary between therapy and enhancement, argues that many accepted interventions such as dental care or vaccination already enhance human capacities beyond the norm with no socially undesirable affects, rendering the idea of human nature as a moral boundary untenable. In many of these cases therapy/enhancement distinctions become less visible as the technological options they represent become subsumed into a broader set of resources that promote a 'good life' to which individuals and populations are entitled (Savalescu, 2009).

One outcome of the rise of human nature is that the debate appears to become more abstract as it focuses more on the acceptability or repudiation of enhancement *en masse* via theoretical constructs such as human nature and less on engagement with specific technologies. Additionally, as Ferrari (2008: 2) has argued:

> the reduction of the ethical challenges posed by these technologies to the question of human nature has led to a polarization of positions, and has thus generated an impasse from which it is difficult to break free.

Why should this apparent semantic stalemate among ethicists concern STS scholars? I suggest a number of reasons. The polarised pro and anti-enhancement framing hides the origins of enhancement as something that took work to distinguish from therapy (however tenuous or problematic that work may have been) and presents enhancement as an unproblematic, established category. The debate comes to position human technological enhancement not only as possible, but as inevitable, where the only thing left to talk about is how to ethically manage the extant or immanent technologies (see for example Baylis & Robert, 2004). This framing also directly informs much of the converging technologies agenda and is therefore relevant to understand when interrogating that phenomenon.

The Converging Technologies Agenda

The concept of technological enhancement has spread to become the focus of innovation policy, primarily through the various iterations of the converging technologies (CT) agenda beginning with Roco and Bainbridge's 2003 report 'Converging Technologies for Improving Human Performance: Nanotechnology,

Biotechnology, Information technology and Cognitive science' and the European response, from the EU High Level Expert Group on the New Technology Wave designated 'Converging Technologies for the European Knowledge Society' (Nordmann, 2004; Ferrari, 2008). Despite a number of differences in content and approach between the US and European articulations of CT (Ferrari, 2008; Fuller, 2009), both retain a core focus on engineering the human – 'enhancing evolution' – to modify individuals and populations to meet the demands of anticipated future social and physical environments.

The concept of convergence invokes currently discrete realms of scientific research and innovation being brought together 'based on the unity of nature' (Roco & Bainbridge, 2003: ix), to permit a comprehensive engineering of humans as biological systems:

> Examples of payoffs will include improving work efficiency and learning, enhancing individual sensory and cognitive capabilities, fundamentally new manufacturing processes and improved products, revolutionary changes in healthcare, improving both individual and group efficiency, highly effective communication techniques including brain-to-brain interaction, perfecting human-machine interfaces including neuromorphic engineering for industrial and personal use, enhancing human capabilities for defense purposes, reaching sustainable development using NBIC tools, and ameliorating the physical and cognitive decline that is common to the aging mind (Roco & Bainbridge, 2003: 1).

The complete inversion of the original enhancement/therapy dichotomy that accompanies 'pro-enhancement' accounts is clearly visible in the concept of technological convergence. At the same time, the domain of 'therapy' and the accompanying themes of boundaries and limits effectively disappear from the debate. They remain only implicitly, as an existing 'limited' state that enhancement improves upon. 'Nature' remains an acultural, scientifically-given domain ('the unity of nature'), but it is no longer valued as a 'pure' domain to be bounded and protected. Instead the malleability of nature is valorised as a potentially 'boundless' source of biological and economic potential. It is no surprise that the possibilities for human enhancement through converging technologies are closely linked to strategic economic planning, speculative investment, and in particular to discourses of neo-liberal capitalism.

While the nature of 'the good life' to be achieved (or lost) through enhancement has been a topic of debate within previous philosophical accounts, the desirability of enhanced traits within the CT agenda is largely calculated from the perspective of securing economic growth and national (or supranational in the case of the EU) competitive advantage in the global marketplace. The enhanced capacities proposed by the CT agenda itself; faster processing of greater volumes of information, working harder, faster or longer, retaining more data (increased memory capacity) etc., are all essentially improvements in worker efficiency and productivity – key attributes of the ideal neo-liberal citizen-consumer. In this, the CT agenda is doubly neo-liberal in that, as well as promoting human characteristics desirable to neo-liberal representations of the world, it does so by fulfilling the core neo-liberal aim of creating new markets for 'high technology' consumer products and new rounds of innovation. The CT approach to enhancement technologies effectively

brings human enhancement in to line as another component in the knowledge-based bio-economy, itself a fundamentally neo-liberal enterprise (Birch, 2006).

There are a number of reasons why this might be considered problematic. As described above, neo-liberal ideology favours a particular model of innovation where the desired outputs are marketable products protected by strong intellectual property rights (Birch, 2006; Lave et al., 2010). Such an approach actively militates against innovations that do not require the transformation of social problems into technical ones, that are non-commercial, public rather than private, or where the role of the state is to provide welfare rather than facilitate the expansion of markets, all of which may arguably be more desirable or more appropriate options in a given situation. Abraham (2010) and Moynihan et al. (2002) have identified potentially socially deleterious effects of market-driven innovation in the pharmaceutical sector, where the creation of new markets sometimes requires the co-promotion of new social problems to which innovative technologies are then presented as the obvious solution.

Birch (2006: 9) also contends that, through the insistence on the inevitably of competition, neoliberalism:

> promotes the collapse of a distinction between market value and ethical value so that commercial value becomes the overriding principle for political economy.

Reminding us, if a reminder were needed, not only that economic, political and technological trajectories are inevitably entangled, but that they are also inseparable from ethical considerations and moral and social consequences.

In setting out this account of the human technological enhancement debate, I have tried to highlight key framings and dynamics in how enhancement has been theorised over the past three decades, with the purpose of supporting future STS studies on this topic. Attention to the changing dynamics of enhancement can help future investigators to locate particular case studies in terms of what framing of enhancement they might expect to be dominant for that particular technology at a given time. For example, a historical study of Ritalin use in the 1990s might expect moral debates of the time to be framed in terms of whether prescription for attention-deficit / hyperactivity disorder (ADHD) is a legitimate therapy or an illicit enhancement, while an investigation of cognitive enhancement drugs currently under development is more likely to encounter ethical discussion of whether modifying cognitive capacity is detrimental or not to human nature. Of course, it is also entirely, and interestingly, possible that studies will find far more nuanced discussions at work, all of which can be usefully fed back to improve and build upon what I have merely sketched out here.

Conclusions

This program for future STS work in the domain of human enhancement technologies offers an opportunity for contributions from a range of existing theories and perspectives from across the heterogeneous domain of practices loosely aggregated under the title of 'STS scholarship'. Some lines of investigation have already been touched on in the course of the paper: case studies of existing, developing and prospective forms of enhancement technologies potentially animated by a variety of concerns from co-production of technology and society

around enhancement, to network analysis, the role of professional boundaries and expertise, technological scripting and user perspectives, technological expectations, markets, and economic representations of the world.

Enhancement is also amenable to investigation in terms of innovation policy, regulation, governance and legal frameworks – for example, how are existing interventions labelled as enhancements regulated in different jurisdictions, what strategies are in place for proposed enhancements to deal with current regulatory and governance frameworks – are they drugs, devices, 'advanced medicinal products' or something else? If enhancements are tested on healthy volunteers in post-phase I clinical trials, what definitions of risk or efficacy might be employed, or will clinical trials even remain the 'gold standard' for assessing enhancement products? What might a future governance landscape look like? Where do enhancement technologies sit in terms of upstream public engagement, or responsible innovation?

Work is also needed on whether technological enhancement is an inherently Western concept or whether it translates across other cultures, and if so how and with what reconfigurations and effects? Anthropological approaches can be especially suited to studying how value schema other than Western bioethics might shape the governance of technologies labelled as enhancements (cf. Sleeboom-Faulkner, 2011 on regenerative medicine in Japan). Ultimately, all of these approaches are intended to contribute to a deeper STS understanding (and theorising) of enhancement technologies as a phenomenon and as a concept. That is not, of course to say that they should come together to form a new 'grand narrative' of enhancement. Rather, findings from a range of STS studies can accumulate to yield iterative and multiple accounts, encompassing the discontinuities and contradictions inherent in the topic as well as the continuities and connections.

The importance of productive future-orientated activities in STS has also been emphasised. There are more possibilities than can be sketched here: One desirable goal would be to produce nuanced discussions of potential technological futures that avoid the utopias and dystopias of certain existing considerations of enhancement. It could be highly productive to develop STS-informed scenario planning or foresight activities around enhancement technologies. Such anticipatory discourses could be used to explore future development of enhancement technologies under different regulatory and economic conditions, for example as public goods rather than marketable products. The point here is not to 'get the future right' or, necessarily, to reduce uncertainty, but to provoke useful discussion and debate.

Finally, a programmatic study of enhancement technologies offers STS scholars the opportunity to explore different articulations of 'progress' encoded in debates around enhancement and ultimately to relate the narrow discussion of contemporary 'biotechnological' enhancement to the older, broader concepts of social enhancement set out at the beginning of this article.

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EU Framework Programme 7 projects:

EPOCH – Ethics in Public Policy making: The Case of Human Enhancement. Project information available at: cordis.europa.eu/projects/rcn/96892_en.html

ETHENTECH – Ethics of Enhancement Technology. Project information available at: cordis.europa.eu/projects/rcn/92742_en.html

FABRICED – French and British Contemporary Ethical Debates on Human Enhancement: Building Dialogue and Shared Vocabulary. Project information available at: cordis.europa.eu/projects/rcn/99853_en.html

Michael Morrison
Centre for Health, Law and Emerging Technologies (HeLEX)
Nuffield Department of Population Health
University of Oxford
Old Road Campus
Headington
Oxford OX3 7LF
UK

Email: michael.morrison@dph.ox.ac.uk

Involving Patients with E-health:
The Dialogic Dynamics of Information Filtration Work

Karen Dam Nielsen

With e-health technologies, patients are invited as co-producers of data and information. The invitation sparks new expectations, yet often results in disappointments. With persistent ambitions to involve patients by means of e-health, it seems crucial to gain a better understanding of the nature, sources and workings of the expectations that come with being invited. I analyse the use of an e-health system for ICD-patients, focusing on how patients sought to serve as information providers. Continuing STS-research on invisible work in technology use, I show how using the system involved complex work of filtering information. I argue that this 'filtration work' was inherently dialogic, that is, characterized by receiver-orientation and the anticipation of response and guided by different communicative projects. For the patients, filtration work thus, first of all, required certain skills and knowledge about the infrastructure of care. Secondly, it entailed the expectation that the system—for better or for worse—would facilitate not just information sharing but open up a dialogue, which glaringly contrasted with the clinicians' expectations of being able to better manage dialogue. I suggest that understanding the dialogic dynamics and 'overflows' of information filtration work can help unpack the challenges of facilitating (patient) participation with e-health and other filtration devices.

Keywords: e-health, patient participation, information filtration work, dialogue

Introduction

The basic storyline of the following anecdote may sound very familiar to readers acquainted with the field of e-health and telemedicine:

A group of researchers and clinicians set out to develop an ICT tool to involve chronic heart patients in their own treatment. Their approach is exploratory and highly user-centred. Through careful tinkering with prototypes in home and clinic, the contours are drawn for a system that will support the work of both patients and clinicians by enabling patients to provide health related information. But already in the pampering environment of pilot implementation, use practices prove difficult to establish and the expectations of users and designers alike seem impossible to fulfil. Clinicians lose interest, patients are disappointed, and in the end everyone involved seemingly agrees

that this may have been a valuable learning experience, but not exactly a technological home-run in the quest for doing chronic care smarter by involving patients. "I'm afraid that this project will end up exactly as all the others. The doctor doesn't bother to read it, hasn't got the time. And then you spend millions on a system which won't work in the long run", as one patient evaluates.

Involving patients by means of *e-health*[1] is a persistent ambition in healthcare (Berg, 2002; Felt et al., 2009; Danholt et al., 2013). Often framed as providing win-win tools, e-health is associated with the hope that involving patients in their own treatment will improve both the quality and efficiency of care (Archer et al., 2011; Wagner et al., 2010). But realizing the ambitions seems difficult. Pilots come and go and efficiency claims remain largely unsubstantiated (e.g. Miller, 2007; Tenforde et al., 2011). The lack of evidence for e-health efficacy may partly be due to the methodological difficulties of evaluating technology outside controllable environments (Pols, 2012). But besides being difficult to measure, the win-win situation may also simply be hard to achieve. As the example of user evaluations above indicate, a central problem is that *people*—patients and clinicians—have to do a lot of work to make the technologies work. STS and CSCW scholars have substantiated this insight repeatedly (Mort et al., 2003; Nicolini, 2006; Oudshoorn, 2008, among others). Moreover, for people to put in the work, it must be worthwhile. So when patients are invited as participants what follows are certain expectations—expectations that are often not met and the invitation results in disappointment.

This article addresses this well-known schism by taking a closer look at the nature and sources of the expectations that follow when patients are invited to provide clinicians with information in new ways. What kind of work does this require? What expectations are entailed? And how come expectations are so often not met despite the careful efforts of designers to create tools capable of aligning different user needs? These questions are explored through the case of an e-health system for ICD-patients and the clinicians involved in their care, 'P-Record'[2], introduced anecdotally above. An ICD is an advanced pacemaker that monitors the heart rhythm and, in case of arrhythmias, treats these by electrical impulses. The care for ICD-patients is divided between 1) a specialized clinic (device clinic) responsible for the ICD-device and remote monitoring and 2) the local hospitals' outpatient clinics (heart clinics) responsible for treating the patients' underlying heart condition. P-Record was designed as an add-on solution to this already technologically dense and distributed care scheme and aimed at improving coordination, communication and patient participation. This overall ambition was translated into a focus on facilitating the flow of appropriate and timely information between home and clinic by enabling patients to provide information. As such, the system shares with many other e-health technologies the basic script of serving as both a standardization and customization device. That is, the system was intended as a sort of *filter* that allows information to travel from home to clinic in a structured manner that fits clinical standards while at the same time opening up for an increased involvement of the individual patient. The tension between standardization and customization has been pointed out as a characteristic of the contemporary evidence-based healthcare paradigm at once patient-centred and rational (May et al., 2006; Storni & Bannon, 2012; Moreira, 2011). E-health technologies may, as illustrated by P-Record, emphasize this tension by inviting patients to a kind

of *filtered participation*. To understand the schism in e-health—the promise and expectations of patient involvement and the recurrent, subsequent disappointments—we might therefore zoom in on what this filtered participation means in practice. How is it performed, who can join, and what does it imply for patients and professionals?

The article focuses on the work that users, and patients in particular, undertook to make P-Record work as a filter. It thereby continues in the line of a classic body of literature that stresses and unpacks the hidden work of technology use (e.g. Suchman, 1995; Star & Strauss, 1999; Heath et al., 2000). However, the article also deploys a more communicatively oriented approach to the patients' *filtration work* by understanding it as a deeply interactional endeavour that involves specific dynamics and expectations[3]. Inspired by dialogism (Bakhtin, 1981; Linell, 2001), the article argues that providing information constitutes an intricate communicative work of assessing relevance and imagining (interactive) outcomes that in turn entails expectations of response. In other words, filtration work is a *dialogically* oriented work that involves the opening of a *conversation* and thus communicative and interpersonal dynamics that counter with and challenge the vision of scripting a structured, standardized information sharing practice, as well as individualizing ideas of e-health as facilitating self-care.

The article is structured as follows. First, I draw up the framework for the analysis by discussing P-Record's script as an information filter and, subsequently, outlining the article's core conceptualization: 'filtration as dialogic work'. After describing the applied methods, I turn to the analysis in which I unfold patients' and professionals' use and valuations of P-Record, showing the dialogic dynamics and derived implications involved in making P-Record work as a filter. In conclusion, I discuss the implications of the findings for e-health as well as the wider utility of the applied concepts.

Filtering Information Between Home and Clinic

While P-Record was designed to support the flow of information both between different clinics and between home and clinic, I focus on the latter script (Akrich, 1992) and the associated practices. I propose to describe this script in terms of an information *filter*; that is, a device that allows certain information to sift through and other information to be left out[4]. In information science, the notion of filtration is central, typically referring to a method for the delivery of relevant information as one strategy among others for dealing with information overload—filtration being the process of "leaving some types of information unprocessed, according to some scheme of priorities" (Savolainen, 2007: 612—paraphrasing Miller, 1962). Depending on the specific approach, filtration is understood as a cognitive and/or social process that can be more or less supported or substituted by technical systems with the aim of "automatically directing the most valuable information to users [...] helping them to use their limited reading time most optimally" (Hanani et al., 2001: 203). Information filtration devices are manifold: spam filters and customized search engines are just some of the more mundane examples. These examples, however, also incarnate features and dynamics that may apply to other domains, as we might understand filters—or sieves—broadly as technologies of 'ontological transformation' (Kockelman, 2013). Indeed, while filters may be understood as "the simplest of interpreting agents", meaning is also "the quintessential form

of sorting" (Kockelman, 2013: 37–39). As anthropological concepts, 'filters' and 'filtration' may thus describe how we order information and produce meaning in general.

The filtration terminology—in its more modest version—is also present in the field of e-health and telemedicine. A predominant narrative here is that filtering information is both *necessitated* and *enabled* by new technologies (Berner & Moss, 2005; Eysenbach, 2008). That is, visions of e-health/telemedicine often involve a dual promise of increasing the production and accessibility of data and solving the subsequent need for filtering the vast amount of data made available in order to "provide meaningful quantities of health information to both patients and physicians" (Warren et al., 1999, my emphasis). Importantly, information filtration is recognized as an already crucial part of medical work where decision-making in a terrain of informational pluralism and uncertainty is a precondition. However, in the light of what has been called a 'patient information explosion' (Berner & Moss, 2005), the call for formal filtration tools intensifies. Yet, the filters that are subsequently put in place with e-health/telemedicine can also be perceived as being too efficient: they may cause vital clinical information to be left out (Lehoux et al., 2002), thus not solving but in some cases rather reinforcing the "struggle between information loss and information gain" (Mort et al., 2003: 292).

P-Record as an Information Filter

Although the term 'filter' is not explicitly used in the design of P-Record, the system materializes the co-creation of the problem and solution of obtaining and restricting information—of what to let in and leave out. First of all, the system was meant to support the automated production and filtration of data involved in remote monitoring. Every third month the data continuously collected by the ICD-device are transmitted through a communicator box in the patients' homes to the device clinic where they are analyzed by specially trained technicians (assisted by cardiologists). Data can also be acutely transmitted if either the patient or the ICD detects a cardiac or device event. Patients still visit the device clinic for semi-annual follow-ups, but before the introduction of remote monitoring, every ICD follow-up required a visit to the clinic. The core idea with P-Record was to provide clinicians with *contextual information* from the patients to be used in the interpretation of remotely transmitted data, that is, the patients' own accounts of general wellbeing, symptoms, and events. With the introduction of remote monitoring, this information—normally articulated during face-to-face encounters—has been 'filtered out'. Furthermore, automated data filters built into the monitoring system filter the raw data that are transmitted to the clinic, highlighting severity and character of recorded events. While this filtration makes the vast amount of data that is transmitted more manageable and potentially reduces the workload (Sinha et al., 2006), it also leaves the technicians with an interpretative uncertainty. In the face-to-face encounters, the technicians match the system's indications with contextual information, often leading the technician to reassess the automated filtration. In the absence of the patient, this reassessment is not possible. P-Record was an attempt to reintroduce the patient as information provider (or "diagnostic agent"), enabling yet again "interlinked processes of interpretation" (Andersen et al., 2011a: 6). Thus, with the aim of providing technicians with the contextual information otherwise 'filtered out' by the telemedical setup, P-Record can be said to be designed as an *adjustment*

of the overall socio-technical information filtration in ICD-treatment.

Secondly, the system was designed to *focus the face-to-face clinical encounters* at both the device clinic and the heart clinic by providing a tool for preparation: the *preparation form* (figure 1). It consisted of four parts: general well-being, status since last consultation, symptoms, and questions for the upcoming encounter. The parts and their order were designed in a way that allowed for free text in the first part, then gradually narrowing down the patients' entries by asking the patients to write key words and arrange them after priority and, subsequently, to indicate symptoms by ticking off boxes linked to prefixed categories. The preparation form would thereby enable the clinicians to gain a quicker overview and focus the conversation with the patient—to "get to the point" (Andersen et al., 2011b)—*and* allow the patients to present their own narratives. This way, P-Record can be understood as in itself designed to both open and narrow the scope of information and to assist both clinicians and patients in their informal filtration of information before and during

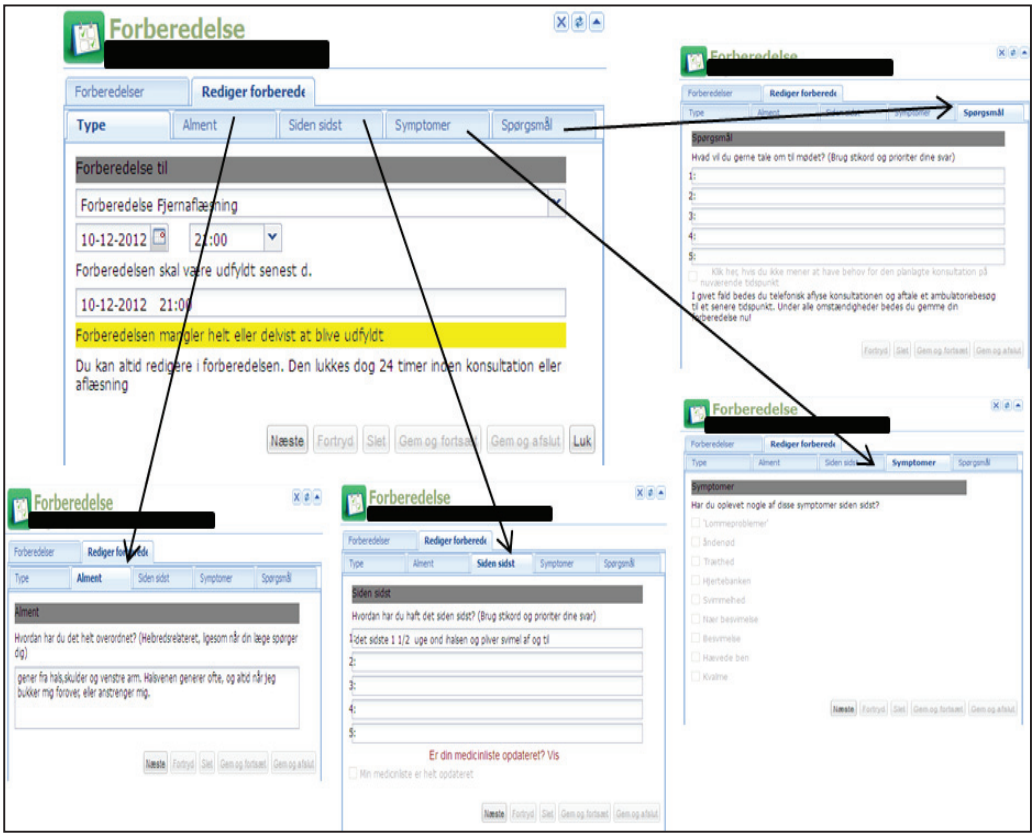

Figure 1. P-Record's preparation form. Consisting of four parts (besides the front page indicating the *type* of appointment): *general well-being* ('alment'), *status* ('siden sidst'), *symptoms* ('symptomer'), and *questions* ('spørgsmål') - in the example, partly filled out by patient-participants in the user-test (personal information concealed).

the clinical encounter—a 'dual filtration script' that P-Record shares with other e-health systems (e.g. Basch et al., 2005).

'A filter' is a rather material figure, indicating a fixed structure that firmly defines what is let through. As such, a filter can be seen as a mechanical standardization device. In parts of the literature, it seems that e-health technologies are expected to work as filters 'by themselves'—as ensuring, through the materiality of their design, that just the right amount of information is enabled to travel from home to clinic. In the case of P-Record this expectation was also present among clinicians, as will be shown in the analysis. P-Record's script, however, also involves a promise of empowerment and customization by inviting patients to provide their own illness narrative and put individual concerns on the agenda. This invitation brings an ambiguity to the script, which in practice leads to the material filtration script being fundamentally challenged. As a filter, P-Record does *not* work on its own. Users have to act in certain ways to make it work: they have, I propose, to perform filtration work. Although phrased differently, this also resonates with how the designers originally envisioned P-Record as assisting, but not fully determining, "a process of formalization" of patient information (Andersen et al., 2010, adopting the concept from Berg, 1997) requiring that clinicians still perform a *translation* and that patients are *trained* in shaping information.

Filtration as Communicative Work

By directing analytical attention to the filtration *work* involved in the use of P-Record, I place the analysis within a practice-oriented framework. I approach filtration as a socio-technical and transformative *process*: a "subset of information and retrieval practices" (Leaver et al., 2012, my emphasis), which further can be understood as a specific kind of work, namely communicative work. In framing filtration as work, I draw on a valuable strand of STS-inspired research into telemedicine and e-health that has shown how informal or invisible work (Star & Strauss, 1999) is required of both patients and professionals to make use and sense of new technologies (e.g. Mort et al., 2003; Oudshoorn, 2008; Piras & Zanuttoi, 2010; Pols, 2012; Roberts et al., 2012). These studies have also given insights into the (re-)distribution of work that is entailed in using telemedicine (e.g. Oudshoorn, 2011). Work, in this line of studies, is used to describe users' practices of domesticating and tinkering with technologies (Langstrup, 2008; Pols & Willems, 2011), producing knowledge (Mort et al., 2003), building relations and infrastructures (Oudshoorn, 2008), and coordinating and performing care (Langstrup et al., 2013).

I seek to further concretize the notion of work by proposing to look at the use of P-Record as *communicative* filtration work and subsequently unpack the inherently interactional practices involved in using ICT. I do this from a dialogic perspective. A common and basic feature of the multitude of approaches that label themselves 'dialogic' or 'dialogism' (e.g. Bakhtin, 1981, 1986; Linell, 2001; Phillips, 2011) is the onto-epistemological claim that human cognition and interaction are dialogic in nature. For the purpose of the following analysis, I focus on and adopt the most basic analytical figure of dialogism, namely the claim that every utterance is defined by other-orientation or *addressivity* (Bakhtin, 1986: 99), that is, inherently targeted towards a receiver. Producing an utterance thus involves the anticipation of its prospective interpretation and continuation—in short, "what is going to follow" (Linell, 2001: 100). This claim, I propose, resonates with and usefully sheds light on the use practices that went into

making P-Record work as a filtration device. As Maurer (2013: 65) puts it, filtration—or *sieving*—"depends on a set of presumptions, a priori judgements or assessments of probabilities". That is, filtration rests on certain ontological assumptions. These are both transformative and continuously transformed by inference (Kockelman, 2013): we order our worlds based on our assumptions—including assumptions about others' assumptions—but our encounters with the world (and others) provide for recurrent reinterpretations and new assumptions. We adjust ourselves as filters, so to speak. I show how the specific filtration work that the users of P-Record performed was based on *dialogic* assumptions: it consisted of processes of imagining the receiver, the interactional situation, and the response—and shaping ones entries accordingly. Filtration work, I suggest, is thus a dialogic endeavour. And as a dialogic endeavour, filtration work entails certain dynamics and 'side-effects' making the use of P-Record a complex and, in some instances, quite problematic social practice.

The dialogic approach largely resonates with studies in ethnomethodology and, later, in CSCW that unpack the social dynamics of producing and sharing medical information. In his seminal study of practices of keeping medical records, Garfinkel (1967) precisely demonstrates how, in this case, *doctors* shape their entries based on anticipations of the future readers' interpretation and use and, recursively, read entries in recognition of their occasional rather than intrinsic meaning. In CSCW, this insight has been a key to understanding the challenges of digitalizing medical work. As demonstrated by for instance Heath & Luff (1996) and later Berg & Goorman (1999), digitalizing and, thereby, formalizing medical records clashes with the social and contextual nature of medical information. That is, ICT risks impeding rather than supporting the flexible, situational and receiver-oriented record keeping practices, which build on a shared, tacit organizational rationale rather than formal standards. When studying the use of ICTs that also include *patients* as information producers, I propose that a dialogic framework very precisely brings forth the challenges and implications of coordinating information filtration practices in the absence of a shared organizational rationale.

Methods

The article is based on ethnographic research conducted during a 3-month user test of P-Record. The user test involved 6 patients and 6 clinicians at the outpatient heart clinics of two Danish hospitals. During the user test, patients were to prepare for and participate in three kinds of clinical encounters using the IT-system: a remote follow-up of their ICD; an in-clinic ICD follow-up at the device clinic; and a consultation at the local hospital's heart clinic. These activities together constitute the existing distributed care scheme of ICD-patients. However, due to the timeframe of the user test, these activities were rescheduled to take place closer to each other in time than normally. Throughout the user test, I acted as facilitator and instructor. Patients were given instructions in their homes. All parts of the system were demonstrated at the initial visits, although with an emphasis on the more extensive functionalities (the *preparation form* and *medication list*) linking to upcoming appointments in the clinics. The visits also involved interviews with the patients. Likewise, the system was demonstrated to clinicians individually, however, in a briefer manner due to the limited time available in the clinics and the knowledge of the system that they had already gained through their participation in the design process. During

the user test, I accompanied the patients at their visits to the clinics and had telephone and/or email contact with all patients on more occasions. By the end of the user test, all participants were interviewed about their experiences during the test.

By serving as *both facilitator and ethnographer*, I took on a highly interventionist approach. To turn the challenges of this approach into analytical resources, I treat the user test of P-Record as both the object of study and a heuristic device—a transformative *filter*, so to speak—allowing me to gain understanding by disruptively bringing about more nuanced data (Hasu & Miettinen, 2006) and engage with frictions (Zuiderent-Jerak & Jensen, 2007). As part of the following analysis, I thus draw on the insights gained as I became a central knot in the infrastructure and interactions and, thereby, experienced first-hand the dialogic dynamics involved in the use of P-Record.

The analysis is structured as a gradual unfolding of these 'dialogic dynamics' by following the flow of interactions between patients and clinicians as they took place during the user test. In the first section, I show how patients made use and sense of the tool as a way to address clinicians. Then, I show how clinicians perceived and responded to the patients' entries. Finally, I turn to how patients perceived the clinicians' reactions. At the end of each section, I discuss how the (dialogic) use practices can be understood as filtration work.

Writing to Someone

The design of P-Record only vaguely indicated the identity of the receiver of patients' entries. However, a defining feature of how the patients used the system was that they addressed their writings to *someone*: either a specific receiver or a generalized receiver. Proceeding from this observation, I propose that the patients' use of the system was characterized by *addressivity* (Bakthin, 1986; Linell, 2001): their entries were directed towards a receiver with the anticipation of a response and shaped accordingly. That is, in deciding what to write, patients performed a *dialogic* assessment: they based their assessments of relevance on careful considerations about *whom* they were writing to; *what* the receivers might want; and what kind of *responses* to expect. This dialogically oriented process of shaping entries proved a complex interpretative task of de-scripting not only the system but also, and especially, the *context* of use—that is, the overall practices and infrastructures of care that make up the 'real environment' that P-Record only vaguely describes (Akrich, 1992).

Knowing the Receiver

During the user test, patients were to prepare for three different clinical encounters. The preparation form was, however, generic; there was no technical shaping of the patients' entries according to the different kinds of consultations. Instead, the patients took on the work of filtering information for the different consultations by trying to envision who would be at the other end and what information this person would want, also envisioning what actions could be taken. Therefore, the work of filling out the preparation form first of all became dependent on how clear the division of work between different clinics and professionals was to the patients. Some patients were well aware of the infrastructure, as the participant Anne (a health professional herself and long time ICD-patient) who even knew, in details, about the distribution of competencies among named clinicians in the same unit. When filling out the first part ('general well-being') of the preparation

form for remote ICD follow-up, she stated: "is doing fairly well", despite being troubled by various symptoms on a daily basis. When I asked her about her choice of words, she said:

> The problem is that is only our technicians [who read it], right. They can't… it is only about the technical side of the ICD, right. That is why I said to you on the phone: but who sees it? None of the doctors do. They [the technicians] can't go into all that, neither regarding my medicine or symptoms or how I have been feeling. (First interview with Anne)

Later, when preparing for the in-clinic ICD follow-up, she writes that she is experiencing nuisance in her right shoulder and neck caused by the device pressing on a vein. But she is in doubt about the relevance of raising this issue:

> It doesn't help to talk to Mark about it. Then I would have had to get an appointment with… then we should have called in John [cardiologist]. But it wasn't that important, I think. […] If it was a real system that was up and running then we would have to talk about it. But then I would probably have called them […] because usually when you're at the clinic for a reading then it is not supposed to be a conversation with a doctor or a talk at all. (Final interview with Anne)

Anne here assesses the meaningfulness of raising the issue based on well-founded assumptions about the receiver, considering both if the receiver will be able to act on it and if the severity should spark her to try to address another potential receiver by other means. She thus pragmatically draws on her extensive knowledge about the division of work in the clinic. And in the end, her interpretation of the infrastructure of care seems to lead her to make a shift in perception from regarding the clinical encounter as the context of use to seeing the user test as the context or purpose in relation to which she assesses the relevance of her entry. As she explains when asked why she chose to raise the issue about the neck vein after all:

> I think it was just as much because I had to write something [laughs] so that we would have something when we got there [to the first test consultation at the clinic]. (Final interview with Anne)

For other patients, the distributed care scheme and lack of a regular contact person among the clinicians caused greater uncertainty about who to address and, consequently, what would constitute relevant information. This was strikingly evident for the participant, Ben, who to some extent had given up on understanding the infrastructure. Therefore, when filling out the preparation forms for the three different appointments, he did not address a specific receiver but wrote with a collective, cross-institutional, and "typified" (Linell, 2001: 103) receiver in mind—'the doctors'—although he had experienced this collective as highly fragmented:

> Interviewer: And does it mean anything to you who will read it at the other end?
> Ben: I almost don't care when it comes to the doctors. [The local hospital] and [the device clinic] each have their own opinions, that is for sure.
> (Final interview with Ben)

Ben's way of using the system shows, in an intricate way, how the directedness towards a receiver is both inevitable and highly challenging. He may not be addressing a

specific receiver but he nonetheless writes from an experience that it *does* matter which clinicians he is in contact with in terms of which interpretations and decisions will be made, that is, how his utterances will be filtered differently by different receivers. On the one hand, his lack of knowledge about the division of work between the different clinicians meant that relevance became hard to assess and he repeatedly consulted me for advice on what to write. Even at the end of the test period, when filling out the preparation for a visit at the heart clinic, he was still very insecure about what to write, although he could now draw on experiences of what had proved relevant—or irrelevant—to other clinicians at previous encounters:

> Ben: 'How have you been since the last time?' Well, what should I say? What should I write now? [...] I would like to have a day monitor put on, now that I'm working, to see the next 24 hours.
> Interviewer: You could write that as a question, for instance 'Can I have a day blood pressure monitor put on?'
> Ben: Yes, that's what it said here [in the preparation form] the last time I was at [the device clinic], but as she [the doctor] said, it was [the local hospital] who handled that case.
> (Extra visit and instruction with Ben)

Provided with a new means of contact (P-Record), Ben also on his own initiative attempted to bridge what he experienced as a gap in the infrastructure causing him great anxiety. Requesting to have his blood pressure measured over the course of a working day—something he had discussed with his GP—in his preparation forms for his appointments at both the heart clinic and at the device clinic can be seen as a persistent attempt to make the issue a shared responsibility across institutional boundaries. And perhaps more distinctly, he used the system to navigate in the complex infrastructure by directly addressing *me* through the e-mail feature (e.g. with questions regarding appointments outside the context of the project and by forwarding referral letters asking me to help make sense of them), thus making me, at times, the primary and only specific receiver. Ben this way, like Anne, partly shifted his orientation from the clinicians as receivers and the clinical encounters as the context of use to the researcher and the research project—in his case, because the infrastructure remained incomprehensible to him.

Anticipating the Answer

Besides considering who the receivers might be and what they might want, the patients shaped their entries according to reflections on what response they might get and, more subtly, how they would be perceived as senders and how they wished to perceive themselves. For the participant, Carl, these considerations all come together when he is filling out the preparation form for the consultation at the heart clinic and together with me tries to establish what would be relevant to write. Carl takes into consideration the severity of certain health issues and relates it to his knowledge of the division of work between the cardiologist and his GP. He has had a cough recently but does not think that it is severe and is therefore content with already having discussed it with his GP—"it's nothing to start ranking up", he says. His assessment of what is relevant to write is further influenced by his overall experience of illness: how certain symptoms become part of 'the normal' and how he is coping with illness by insisting on a good general well-being:

> Interviewer: If what has characterized the situation the most is that you have felt short of breath, then you could write that.
> Carl: Well, yes, but they know that because it has been like that for many years now. [...]
> Interviewer: And then there is the option to write five things, but you don't have to write five things.
> Carl: No, no, no, because I feel fine. But, well, there is just... when I bike or [walk] up the stairs then I pant a lot, right. That's the only thing. Because otherwise I feel all right. There's nothing the matter with me. (First visit and instruction with Carl)

Later, when filling out the preparation form himself before the consultation at the heart clinic, Carl first states that he "is doing fine" but when asked directly about symptoms, he ticks off almost all boxes: shortness of breath; dizziness; swollen legs; palpitation; and fatigue. On the last page of the online preparation form (questions for the consultation), he repeats "shortness of breath", "dizziness" and "swollen legs". He later explains that he would not normally take these things up as he has just conformed to them as conditions and only thought of them because P-Record provided the keywords. This way he acts according to the script of the system in the sense of being sparked to articulate symptoms that he would normally remain silent about—to adjust his usual filtration by letting *more* through. At the following visit, the cardiologist asks about the symptoms and touches upon lifestyle issues. However, Carl just comments and nods evasively and disinterested and afterwards states that he knows all this, they have talked about it before, but he prefers to continue his lifestyle and just enjoy whatever time he has left. He adds that he would not find the system meaningful outside the realm of a research project; he is happy with the existing care scheme to which he complies. For Carl, the very act of writing about symptoms conflicted with his choice not to focus on illness and, furthermore, sparked the articulation of lifestyle issues at the consultation that he regarded as pointless and merely tiresome to address repeatedly.

Carl's case thus points to a consideration that may be part of patients' filtration of information, namely the wish to minimize the focus on disease. Carl's way of assessing relevant information when shaping his entries mirrors his way of communicating with clinicians in general and can be described as a balancing act between providing the necessary information and keeping symptoms unarticulated—the goal of the balancing act being to cope with illness in a way that minimizes its overall impact in everyday life. He thus filters information with the prospective continuation of the dialogue in mind—imaging not only who the receiver might be and want, but also considering what kind of conversation his entries will lead to and, subsequently, how this will (negatively) affect his overall coping with illness.

For other patients, imagining what their entries would entail played out as attempts to foresee more specifically what kind of answers they might get from the clinicians. Anne, who chose to raise the issue of a nuisance around her neck vein caused by her device, anticipated that she would not get a response since the issue would be outside the scope of the receiving technician's competences. She also expected that there simply would not be time to respond for the receiving clinicians in the device clinic since "they already have plenty of work with all that remote monitoring" and using P-Record would "take a lot more resources". Besides drawing on these assumptions about the conditions of work in the clinic,

she furthermore based her anticipation of response on an assessment of severity; that is, if a certain issue would be considered topical and serious enough by the clinicians to be acted upon. In a circular way, she links her assessment of what the clinicians may regard as serious to the choice of media: using P-record to raise a certain issue may in itself indicate to clinicians that it is not something they need to respond to. As she says:

> If I can be content with sending a message then it's not that serious, you know, then it's not something they have to act on here and now. Because if it was serious then I would get on the phone and call them or I would rush off [by ambulance]. (Final interview with Anne)

Finally, Anne takes into account that the issue may not be 'actionable' (Andersen et al., 2014) at all. That is, the answer she has been given so far is that nothing can be done about it. This adds to her anticipation that raising the issue of her neck vein will not spark an answer in the hoped-for-sense—that is, some kind of clinical action that will solve the problem—and thus not be worth the effort.

Experimenting with Dialogue

In her writings and deliberations, Anne is constantly torn between pragmatic expectations and a wish to experiment as a participant in a user test. Contrary to the script of the system as a means to 'open the scope of information' in relation to remote monitoring especially, Anne chooses to write more extensively to the in-clinic follow-up. Imagining the interactive situation, she concludes that if she is to write something in P-Record it will make more sense for her to provide information when it can actually become the basis of a conversation:

> I can't talk to them in connection with the preparation for [remote device control] so I wrote generally. [...] When I thought about, okay the third of December I am going there [to the clinic], then it was important to include other things, symptoms and so on. (Final interview with Anne)

For her, the potential lies in the hope that providing more information will lead to a richer (face-to-face) conversation. This goes for the patient, Louis, as well. At first glance, he seemed to do 'less' filtration work compared to the other patients who all wrote in a very concise manner. Louis wrote extensively in both the preparation form and in the logbook[5] and, in the eyes of the clinicians, really "opened the floodgates" with entries like this:

> I continue with dizziness and general fatigue, which sometime gets really bad, other days is okay. I have arrhythmias many times a day, especially when I rest. Haven't experienced it while I walk or anything else. The legs are always weak and of course with great difference in temperature. The right leg feels numb sometimes. That may also be due to the lack of vitamin D since I stopped taking them in December. (Louis' logbook, symptom note)

He did, however, still perform a selection of information, only, he regarded the system as a chance to open rather than narrow the scope and provide the information that he was afraid was missed in the existing care scheme. Like for other patients, the distributed and technologically dense character of ICD-care made Louis feel that no one saw the full picture of his condition and treatment and that crucial information was lost. In his case, the infrastructure was complicated by his participation in a clinical

research project where he underwent additional in-clinic device follow-ups as well as various blood tests, measurements, and scans. Although he could be said to be under closer surveillance through the project, all the extra data produced only caused frustration and uncertainty since he experienced that they were neither shared with him nor with the clinicians responsible for his treatment. On this ground, Louis' extensive writings—together with his persistent suggestions to add a file-sharing feature for test results to the system—can be seen as his attempt to mend a severely flawed information infrastructure. Thus, he *does* undertake filtration work by trying to assess the value of the information he gives and, reversely, the risk of leaving out information. He writes from the hope of receiving better answers by providing more information but is at the same time rather pessimistic, worrying that the clinicians will tell him that they "don't want to hear that story anymore".

To Louis, the system provides, if not a promise of resolving his uncertainties, then a *chance* to make the clinicians take on responsibility and sort out his concerns. Like Anne, Louis chose to *experiment,* testing new possible questions and responses in the clinical encounter. They both raised more issues than they actually anticipated a response or re*action* to and thus did not just interpret the context of use in light of existing practices, but also tried to push the receivers towards new practices by addressing them in new ways and with otherwise neglected issues.

Addressivity as Filtration Work

A main intention with P-Record can be described as to 'lure out information' in a strictly focused manner. The work of filtering information was to some extend built into the system with the structure of the preparation form aimed at gradually narrowing down and formalizing patients' narratives. However, most of the patients pre-empted the focusing questions by deeming most of what could be written as irrelevant and writing in a concise and brief style in all parts of the preparation form. Rather than being restricted in their writings by pre-set limitations of the system, they seemed to restrict themselves according to their assumptions about the receiver, interactive situation and possible outcome. The patients' writings (even the more extensive ones) were shaped through communicative work based on an understanding of P-Record as a tool for opening a dialogue rather than 'pure' information sharing. The information they provided was a product of receiver-oriented filtration work, instigated, partly supported, but far from 'automatically' performed, by the device.

Receiving and Responding

So how did the clinicians use and value the information given, and how did they respond? The clinicians' performance as receivers and responders can be understood as an enactment of their descriptions of P-Record as a filtration device, as well as their 'responsive attitudes' (Linell, 2001: 104).

P-record as a Filter (and Receiver) in Itself?

At the local hospital the cardiologists attempted to use the system to focus the face-to-face consultations and thus valuated the patients' entries accordingly. In some cases, they perceived the entries as containing surplus information but were satisfied with the way the system then allowed them to screen this out and *"get to the point"*. In other cases, they perceived the patients' entries as a satisfying way of getting the information that they need but

often have to work hard to obtain from some patients. One of the cardiologists summarized the value of the system as a means to both opening up and narrowing the scope this way:

> You could use it both ways, really. To get the swarm of thoughts that occupies some patients under control, where it just pours out of them. And then with this guy [the patient Carl] it was more the case that if you ask [then he answers] 'it's going well' and [you say] 'okay, then we don't have anything else to talk about'. He would be the kind of guy who then comes home and the wife asks 'why didn't you ask about all these things' or where it pops into his own mind 'oh, maybe I should have asked about something'. (Final interview with Peter, cardiologist)

Two cases lie behind this statement. One of them is Carl, who, provided with keywords in the preparation form, articulated more symptoms than he normally would do at a face-to-face encounter. When evaluating the system later on, the cardiologist highlights Carl's case as an example of the potential value of the system as it allowed him to get information about symptoms that he would normally have a hard time getting Carl to talk about—a 'success' that the cardiologist also tries to share with Carl at the consultation:

> Peter: Do you have anything else on your mind?
> Carl: No, cause I feel fine.
> Peter: Yes, but that's kind of funny because I can see that you write that you are feeling fine but then there was something about being short of breath and there was something about water in your legs.
> Carl: Well, yeah…
> Peter: But it's fine that you are doing well, but still, now we can adjust the details a bit, right.
> Carl: Well, I just thought that I'm so used to being short of breath so you just cope, right.
> (Transcript, Carl's visit to the local hospital)

The other case, initially referred to, is Louis, who wrote extensive entries in an attempt to ensure the articulation of crucial information and to push the clinicians to provide the answers and actions needed to reduce his anxieties. At the consultation, the cardiologist only took up a few of the issues that Louis had raised in the preparation form and later described Louis' entries as "very unstructured with these novel-like or diary-like entries that I can't live up to", also referring to them as "solemn phrases". Despite his critical attitude towards Louis' writing style, or exactly *because* of this, he thought the system proved useful in the situation by allowing him to "control the contact" by quickly screening the information given and avoid its articulation in the brief consultation, thereby perceiving P-Record as facilitating a win-win-situation:

> He had kind of got it out. […] Then it was like he knew that I knew a whole lot, which we then didn't have to sit and start all over on. So this way I actually think that the patient is allowed to get rid of it and I'm allowed to hear it without it taking up too much space. Then they get what they need and I get what I need. I need something more structured and concise. […] If he should sit and present a bigger dramatic contribution in the consultation then it would come between us. (Final interview with Peter, cardiologist)

The cases illustrate how the cardiologists seemed to consider the system, at best, as

a *filter* that allowed them the information they needed to respond to the patients' heart conditions and not their general concerns. They further seemed to perceive the system as an adequate *receiver in itself*: that patients would feel good just getting something off their chest by writing about it and that the clinicians then would not have to spend time on responding to (for them) irrelevant matters. The cardiologists thus regarded P-Record as a filtration device able to remedy existing problematic filtration practices and assist them in their own filtration work. As such, P-Record succeeded in the concrete cases, yet, it did so by also rendering the patients' filtration work 'functionally invisible' (Star & Strauss, 1999) and thereby masking the dialogic imaginations—or expectations—entailed. However, the cardiologists did worry that, at worst, they "would actually be tested in if (they) had read and understood it all" by the patients, whereby the system would fail as a filter.

Shifting Responsibility

At the device clinic, the participating technician, Mark, differed from the cardiologists in his responsive attitude, being eager to provide an answer although this was no straightforward task. The system meant that some patients would raise concerns that seemed to exceed the kind of medical analysis and decision-making normally included in his job. This caused insecurity in relation to answering, as in the case of his remote follow-up of Anne where I accompany him:

> Interviewer: What she has written in the preparation (form) – isn't that relevant for you?
> Mark: Well, yes, but she's feeling all right… If she writes 'my legs are swollen' then I have to get a doctor and say 'look here, you have to write to this patient'. Or if the patient writes 'I've had extra heart beats' or something like that, then it can be related to the arrhythmia. So in that sense it does matter to me, right.
> Interviewer: But is it then something you have to act on now when she writes about feeling a pain around her neck vein? [...] Is that something you would normally decide on?
> Mark: No, because she has made a transmission (remote transfer of ICD data). Now, it's just that she writes… Well, I would write a message to her 'if the swelling and pain around the neck vein continues you should contact us'. That's what I would write. [...] Yeah… but… should we write something to her? (Transcript, remote follow-up of Anne's ICD in the device clinic with Mark)

However, by being able to write a message saying "call if the problem continues", Mark was also relieved from responsibility for further reaction, as he could pass this on to the patient. For Mark, passing on the responsibility for reaction became a way to 'filter' the patients' concerns one more time. This filtration both served to help him in his medical decision-making, based on the rationale 'if it is really important they will call' (as illustrated by Anne's case), and to save time:

> Mark: You can communicate quickly [with P-Record]. Right now we have a problem with a patient who does not answer his phone. Then you spend a lot of time calling the patient again and again. If he had this system then we could have said "please just call us", right. [...] So you can say, it's up to the patients [who] also have certain obligations themselves. It's their disease; it's not ours. If they had this [P-Record] and something came up then they would have to go in and tell us if there has

> been anything. [...] But he hasn't contacted us, the guy from yesterday, so he can't be doing that bad.
> (Final interview with Mark)

Filtering to Manage the Dialogue

As a filtration device, P-Record successfully assisted both the cardiologist and the technician in managing responsibility "in a field riddled with uncertainty" (Jerak-Zuiderent, 2012: 738). For the cardiologists, P-Record lived up to their expectations as it supported them in their efforts to respond only to issues within their specialization. The cardiologists seemed to perceive P-Record as a more or less 'automatized' filtration device, not recognising the filtration work done by patients (and its implications) as a crucial part of making the system work (or not). On the contrary, the cardiologists evaluated the system in terms of how well it succeeded in filtering the patients' narratives, thereby supporting them in obtaining just the right amount of information to inform clinical decision-making and "control the interaction". As a filtration device, P-Record also proved a valuable tool in the work of the technician in his 'frontline', experimental attempts to sort urgency from non-urgency and restrict access to specialists—to "act while trying to know" (Jerak-Zuiderent, 2012: 742). In assisting him in filtering information, P-Record also became a means for filtering *access* to the clinic, as he could use the system to push the interactive initiative back to the patients and to another medium: the telephone. This way P-Record became an additional layer in the existing filtration of the contact between home and clinic, and although not an explicit design intention, the system then came to hold another common e-health script as an 'access filter' (e.g. Moreno-Ramirez et al., 2005).

Continuation of the Dialogue

In their evaluations of the clinicians' responses, the patients were torn between pragmatics and disappointment. I suggest that this links back to how their filtration work rested on addressivity and thus entailed drawing on previous experiences of what one can expect (or not) from certain clinicians *and* a basic expectation of response inherent to the opening of a dialogue.

Realism, Hope and Disappointment

Although presented with a system that seemed to promise an improvement of communication both ways, several patients indicated that they, for various reasons, did not really *anticipate* an answer after all, as illustrated earlier and especially clear in the case of Anne. Besides her awareness of the constant lack of time in the clinics and the limitations of the receiver's ability to act, she also recognised the issue of her neck vein as simply unsolvable. This realism led to rather low expectations in the concrete situation and she evaluated the answer she was given accordingly:

> Interviewer: Then Mark wrote to you after the remote reading?
> Anne: Yeah, he sent this [reads out loud from the screen]: 'Your transmission has been read, everything found okay. If swelling and soreness are persistent, please contact us'. But he can't do anything about it.
> Interviewer: No. So what do think of an answer like this?
> Anne: Then I say, well, they know and what are they going to do about it.
> (Final interview with Anne)

Being *realistic*, in the sense of understanding and taking into account pre-existing realities, like the infrastructure,

the qualifications and attitudes of specific clinicians, and medical circumstances, to some extent seemed to minimize disappointment. As I have shown, the patients who took these realities into account seemed better able to address the clinicians in a manner that the clinicians appreciated: they wrote in a concise manner and held what turned out to be a realistic vision of what outcome to expect. In contrast, Louis and Ben, both relatively new ICD-patients with little experience of the 'realities' and an urgent need for contact, wrote extensively and without a specific (named) receiver in mind hoping to spark a reaction from the collective of clinicians or 'push realities', but with little effect.

However, all patients *did* on some level *expect* an answer and expressed being discouraged by the (lack of) response given. As Anne states, despite her pragmatic attitude and awareness of the "realities":

> I would like to use it [P-Record] but then I want some response to what I have written. If I ask some questions or have some problems in relation to my heart condition or my ICD then I want either time in the clinic or a response from them. That requires that the staff will do this seriously. (Final interview with Anne)

For some, the disappointment first of all seemed to be caused by the response not entailing the hoped-for action, as in the case of Ben, who in his preparation for his consultations at both the device clinic and the local hospital had asked for a 24-hour blood pressure monitor and asked for advice regarding an over-the-counter drug. At the device clinic, the technician and accompanying cardiologist did not explicitly take up any of the issues and only gave a brief answer when Ben asked directly, saying that these were matters for the local hospital to handle. At the local hospital, the cardiologist did address Ben's request for a 24-hour blood pressure monitor but simply did not agree with it. He also browsed through Ben's medication list[6], suggesting a few adjustments, but not addressing the issue of the over-the-counter drug that Ben had listed with a question mark. The fact that the action he requested was not taken and the issue of medication not explicitly addressed left Ben with a feeling that his preparations had been useless. For Ben, P-Record did not facilitate a more coherent dialogue across institutional borders, as he had hoped for, and it did not lead to the hoped-for action, thereby in sum not reducing his concern that no one was taking responsibility for his overall situation.

For others, disappointment seemed more about not feeling heard at all. Having written extensively in the preparation for his consultation at the local hospital, Louis was hugely disappointed with the verbal response he got from the cardiologist as expressed in his later imitation of how the cardiologist, only looking at the screen, quickly browsed through and, subsequently, disregarded the issues Louis had raised:

> Maybe it is easier for the doctor himself to have this little system [...] then it is much easier for them to say, 'okay, bla-bla-bla-bla-bla'. [...] I looked forward to this consultation [but] it was more like an IT-consultation, as I call it. [...] I call it an IT-consultation when a doctor doesn't bother to listen and he just sits in front of you and says 'okay, so and so and so'. (Final interview with Louis)

Clearly, Louis did not support the cardiologist's appraisal of P-Record as allowing both patient and clinicians "to get what they want". To Louis, just "getting something off his chest" without subsequent articulation during the consultation was far from satisfying.

Filtering to Open Up (a Better) Dialogue

Louis' and Ben's cases point to a central ambiguity related to the quest for answer entailed by their dialogic filtration work; namely, what actually constitutes an answer? The users' perceptions of this ranged from the idea held by the cardiologists that the shear reading of a patient's entries somehow makes up a response, or at least a satisfactory reception, to the request by some patients that concrete clinical actions should be taken in order for them to feel that their entries had sparked a true reaction. In between these two extremes was a blurred terrain of different kinds of verbal or written answers that seemed to constitute relatively satisfactory answers for patients with low expectations and for others were so insufficient that they felt no response had really been given.

However, across this range of acceptable and unacceptable answers ran a common expectation among the patients, namely that of a particular kind of *responsible* receiver. The patients' primary concern was whether or not there would be one permanent contact person 'at the other end' of P-Record who would take their entire medical situation into consideration and be obliged to follow up and make things happen, which also links to the inherently easier task of addressing a specific or even well-known receiver. As Louis says:

> There has to be more consistency: that the doctor who is to use this system also is the one following you over the course of several years. Because being a heart patient is not like having a disease that stops right now. I won't be cured tomorrow and that part of the heart that doesn't function will never function again. (Final interview with Louis)

In short, without an explicitly responsive and responsible receiver at the other end it would simply not be meaningful to make the extra effort of using P-Record. On this measure, the system failed in most cases. First of all, it only seemed to reproduce the lack of coherency often associated with distributed care as it still left it up to the patients to try to bridge institutional gaps and address the appropriate receiver. And secondly, P-Record delegated greater responsibility to patients for keeping track of their condition and treatment without a clear (interactive) goal. The importance of writing to *someone* and receiving a *response* simply meant that patients did not support the assumption that users would write for their own sake—an assumption expressed by some clinicians and part of the design script, especially the logbook function. Even here, the patients wrote with a receiver in mind and with the expectation that the clinicians would at least attend to the contents. As Ben put it:

> [When writing in the logbook] I had in mind that the hospital would see it, keep an eye on it. Or when I am called in [for consultation], then they would just have a look. Now afterwards I don't know how much they actually looked at it. The doctor I saw he was not interested in anything. So if you were to [implement it] then I would hope that they have a look and read it, just like your medical record. (Final interview with Ben)

By insisting on an interactive use practice, Ben and the other patients can be said to resist central presumptions and ideals in the self-care discourse that guides many e-health designs, including P-Record.

Concluding Discussion

In the analysis, I have showed how patients sought to fulfil their roles as information

providers by conducting dialogic assessments of relevance. They shaped their entries as contributions to a dialogue in the anticipation of response. Although this dialogic filtration work performed by patients, to some extent, made the system work as a filter, it also posed crucial challenges and paradoxically carried the seeds of the system's failure.

First, dialogic filtration work was not an easy task: shaping one's entries required certain skills and knowledge. The patients' entries must themselves be understood as responses—as continuations of a dialogue opened by the system. However, it was unclear who the 'sender' of the system was and thus the interlocutor one was in dialogue with. Patients solely had to draw on their experience with and knowledge about the infrastructure of care. Despite this being an explicit design ambition, the system in itself did not "support patients' invisible work of bridging inter-institutional care" (Andersen et al., 2011b).

Second, undertaking dialogic filtration work entailed expectations of response. However, a vast difference between patients' and clinicians' perceptions of what constituted a satisfactory response became evident. The cardiologists, in particular, acted more as passive receivers than "implied responders"—the role that the patients "casted them in" (Linell, 2001: 104). The patients could, by and large, be said to experience the clinicians' responsive attitudes as either resulting in a discontinuation of the dialogue or, in a single case, leading the dialogue in an unwanted direction. In either case, this ultimately made using the system pointless to the patients.

The differences in expectations and attitudes between patients and clinicians link back to their differing descriptions of P-Record as a filtration device. For clinicians, P-Record showed potential as a tool for *managing* a dialogue, with filtration of information serving this purpose. In contrast, patients seemed to perceive P-Record as *opening* a dialogue—whether this presented as either a hopeful expectation or a negative anticipation. This difference might be conceptualized as an overall difference in *communicative projects* (Linell, 2001: 224) between patients and clinicians—or, in the terminology of Garfinkel (1967: 205), as different "interpretation schemes". Designing and implementing e-health requires careful considerations about which communicative projects a certain system is to support and an awareness of potential conflict between these projects. In the case of P-Record, while the system performed fairly well as a filtration device allowing clinicians to manage the dialogue, for most patients it did *not* perform well as a means to reach a responsive and responsible receiver. From a design-oriented perspective, the case thereby points to a crucial need for unfolding, negotiating and adjusting communicative projects of various users. Importantly, communicative projects are not stabile, but shaped by their mediators (the filtration devices) just as they also shape the use of these. As dynamic socio-technical assemblages, users' experiences, communicative projects, and devices together make up the dynamic filters of e-health—dynamic, since the 'filter' is constantly adjusted "in the repeated iteration between (the filter) and the world, the expectation being revised each time" (Maurer, 2013: 66). When designing filtration devices, a central challenge therefore lies in how to support this continuous adjustment of expectations.

While unfolding, negotiating and adjusting communicative projects of users of e-health is by no means an easy feat, I suggest that a recognition of and engagement with the dialogical properties

of the filtration work involved in the use of e-health is at least a place to start. I propose that an 'analytical filtration device' combining dialogism and studies of invisible work can generate insights into the participatory role as information providers that patients are given with e-health and into the implications it has for both patients and professionals and, ultimately, for the organization of healthcare. Often framed as levellers of participation, e-health technologies—and other participatory devices (Marres, 2012)—both entail and partly conceal substantial work by its users, as has also been pointed out by other studies. I suggest that filtration work is an important, but until now unrecognized, part of this invisible work of patient participation, and that inquiring deeper into what it means to be a participant can be done by unfolding its dialogic workings and implications. While dialogic filtration work is also part of face-to-face clinical encounters, the introduction of e-health seems to have the potential to complicate rather than to support this work, at least from a patient perspective, partly as processes of adjusting the filter—and the dialogue—are inhibited and/or concealed. This stresses the importance of also looking into how filtration work closely relates to the materiality of specific filtration devices—without ever being fully determined by it. In the case of P-Record, a rather ambiguous script meant that especially patients were poorly supported in their filtration work, with Ben as vivid example. Yet, a clearer script might have posed other challenges. Relations and practices of filtration (note the verb form) are the key here: if we think of filtration devices as 'filters in themselves' we overlook or even mask the skills, knowledge, and motivations that go into and result from making them work. Furthermore, looking at *filtration* illuminates how filters (as socio-technical practices) are not just transformative, but also generative: they create overflows, for instance (unmet) expectations. This seems inevitable, and when invoking 'filtration work' as an analytical tool in relation to e-health, it is important to not just treat the differing communicative projects and expectations resulting from and guiding the use of filtration devices as barriers to overcome in and by design. Rather, they point to and should be addressed through broader discussions about how modern healthcare can accommodate (itself to) patient participation, with all the work and overflows it implies. I suggest that STS-scholars may contribute to such discussions by experimenting with and, thereby, learning about what 'good filtration' between patients and clinicians might entail. Moreover, and as a conceptual and methodological addition to CSCW-studies of information work (e.g. Health & Luff, 1996; Berg & Goorman, 1999), 'experimenting with filtration' may also bring forth new insights in other contexts—in healthcare and beyond—where the production and sharing of information undergoes (digital) formalization.

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Notes

1 I use the term e-health to denote various patient-involving information and communication technologies.

2 P-Record was designed through a collaborative research project, CITH – Co-constructing IT and Healtcare (www.cith.dk). The project resulted in a prototype that was then technically implemented by a software company. The name 'P-Record' is constructed for the purpose of this article as a common denominator for the prototypes and the implemented system. Although this conceals important differences between the various iterations, these are not the subject of analysis here and a common denominator is chosen to avoid unnecessary confusion.

3 Contrary to the often noted performative role of expectations in innovation processes (Borup et al., 2006), the case of P-Record is a story of the simultanous fuelling and 'failure of expectations' (Brown & Michael, 2003).

4 The term 'filter' relates closely to such terms as 'sorting', 'sieving', 'retrieving' and 'selecting'. I use the term 'filter' because it is already commonly used in relation to information and communication technology and thus constitutes a 'native' metaphor. I use both the noun and verb form in order to capture the tension between perceived automatized 'filters' and the practices involved in making them function as such.

5 In the *logbook* patients could write free text categorized as either *diary*, *note of symptoms*, or *illness history*. This part of the system was not explicitly associated with upcoming appointments but the entries would, nonetheless, be visible to clinicians.

6 In the *medication list* feature, patients could create an overview of their medication and enter information about doses, side effects, and date of prescription.

Karen Dam Nielsen, PhD, Postdoc
Section for Human-Centred Computing
Department of Computer Science,
University of Copenhagen
Njalsgade 128-132, DK-2300 Copenhagen S,
Denmark
kani@di.ku.dk

Money, Money, Money?
Politico-Moral Discourses of Stem Cell Research in a Grant Allocation Process

Shai Mulinari, Tora Holmberg & Malin Ideland

Concerns have been raised about the marketization of science through the prevailing funding regime. However, the present article will discuss how it comes that the potentially marketable stem cell science is not more commercialized than what is currently the case. We approach this question by analysing discursive pluralism in defining the value of stem cells within a grant allocation process. More specifically, we focus on how the commercial imperative is challenged by other cherished values surrounding stem cell research. The case study used to discuss this is the Swedish Government's funding of stem cell research within so-called strategic research programmes. The analysis focuses on the co-existence of what we refer to as entrepreneurial, translational and basic research *politico-moral discourses*. How the co-existence of politico-moral discourses is possible, despite potential tensions, is investigated by drawing on the theoretical framework of bio-objectification. Specifically, we highlight how the relationship between various bio-identities and values was reorganized along the research grant allocation trajectory. We argue that there are obvious signs of temporally specific discursive shifts away from the commercial imperative in the grant allocation process. This suggests the need to study *located processes*, in order to understand the work of politico-moral discourses in the grant allocation process. This work contributes to an understanding of the uneven and varied impact of neoliberal policies on biomedicine.

Keywords: Stem cell, neo-liberalization of science, politico-moral discourse, bio-object, bio-identity

Introduction: The Non-Commercialization of Stem Cell Research

Stem cells are undifferentiated cells with the potential to develop into more mature cell-types (i.e. differentiation) and the capacity to produce new stem cells (i.e. self-renewal). Stem cells exist both in the embryo and adult organism. A great collective biomedical research effort is underway to elucidate if and how these cells can be mobilized to regenerate damaged tissue, which is a common denominator in a wide array of human diseases. However, looking more broadly in society, stem cells carry various meanings and identities, depending on when and where they figure: as threats

to the dignity of human life; as intriguing objects of science; as promises for new therapies for severely ill patients; and lately, as connected to and drivers of economic growth. While much work on stem cells within the field of Science and Technology Studies (STS) has engaged with moral and religious contestations (Salter & Salter, 2007), circulation and space (Wainwright & Williams, 2008), standardization (Eriksson & Webster, 2008), expectations (Martin et al., 2008), governance (Gottweis et al., 2009), and commercialization (Plagnol et al., 2009; Martin et al., 2006; Webster, 2013), there is a paucity of studies of *national attempts to foster the growth of business through commercialization of academic stem cell research* (however, see Salter & Salter, 2010). Yet policy arguments in support of academic stem cell research often use commercial benefit and job creation as a key justification for permissive policies and increased government funding despite the great uncertainties associated with such projections (Bubela et al., 2010; Caulfield, 2010). Indeed, Gottweis et al. (2009: 23) contend that:

> State interests in stem cell research is [...] economically driven in a broad sense, with population health and benefits and clinical applications assigned a secondary consideration.

They argue that states are not only active in securing funding for stem cell research, but are vigorously promoting its commercialization by orchestrating policies aimed at bringing universities and businesses in closer proximity, including favourable intellectual property (IP) regimes, and by guaranteeing the influx of venture capital into the field. Still, at present, there are very few effective stem-cell-based therapies commercially available (Daley, 2012).

To approach the question of why there are not more successful commercial stem cell-based therapies than is currently the case, the present article analyzes discursive pluralism in defining the value of stem cells – as a broad category that includes human or non-human stem cells in an embryonic or non-embryonic state – within a grant allocation process and discusses its potential effects. More specifically, we focus on how the commercial imperative is challenged by other cherished values surrounding stem cell research and how this can be understood as a process of "bio-objectification" within certain political and moral economies.

To this end, we draw on STS research concerned with the changing relations between universities, the state and industry in general (Gibbons, 1994; Etzkowitz & Leydesdorff, 1997; Slaughter & Rhoades, 2004) and with the commercialization of the life sciences in particular (Sismondo, 2010: 189–195; Rose, 2007). This research has explored how states have developed an assemblage of new techniques of government and governance to foster commercial techno-scientific innovations, including novel funding mechanisms and priorities, increased venture capital influx into high-tech sectors and establishment of technology-transfer offices (TTOs) at universities. In fact, as noted by Cerny (1997: 251) 15 years ago, rather than a predicted decline in state interventions in name of de-regulation, we are facing "the actual expansion of [...] state intervention and regulation in the name of competitiveness and marketization".

For academic researchers working in fields with prospects for innovation, the tendential emergence of a new pattern of state intervention has meant that these researchers have increasingly been cast as "state-subsidized entrepreneurs". Their chief task is to develop commercially

viable products or services that can boost economic growth and employment in the private sector as well as offer solutions to pressing societal problems, including those related to health (Slaughter & Rhoades, 2004).

Lave et al. (2010) frame this changing university-state-industry relation and the commercialization imperative against the background of the broad global movement towards neoliberalism that began in the 1980s. A central tenet in this particular strand of STS work is that the rise of neoliberalism has led to major changes in scientific practice, management and contents, i.e. that "neoliberal political-economic relations beyond academia shape what happens within it" (Lave et al., 2010: 664).

Concerns about the impact of neoliberal policies on science in general and biomedicine in particular have spawned a series of case studies, including work on the commodification of biomedical knowledge (Sunder Rajan, 2006; Rose, 2007) and corporate influence over the generation (Mirowski & Van Horn, 2005), publishing (Sismondo, 2009) and dissemination of biomedical knowledge (Mulinari, 2013).

Notwithstanding the importance of these and other studies highlighting the impact of neoliberal policies on science, it is apparent that the effects of such policies are not uniform but rather uneven, partial and sometimes even contradictory at both the global and local level (Tuunainen & Knuuttila, 2009; Sanders & Miller, 2010; Moore et al., 2011). We therefore need more explorations of how these policies *fail* to align technoscience with the perceived needs of business, including charting the forms of resistance that the commercial imperative encounters. This resonates with Jessop (2002), who urges scholars to be attentive to the increasing dominance of capital in social spheres like science, but also to appreciate that this does not involve a one-sided power relation. Rather, other actors will be varyingly able to limit or resist commercialization and to steer economic activities by imposing their own priorities and modes of calculation.

In the following, we study the uneven and varied impact of neoliberal policies on biomedicine. In order to do this, we depart from a case study: the Swedish Government's funding of stem cell research within so-called *strategic research* programmes. The national context is thus unmistakably Swedish. However, although the regulatory heritage of national institutions and policies is important to acknowledge, the overall political and scientific context is shared with a number of European countries (Gottweis et al., 2009), and likely with countries outside Europe as well (Salter, 2008). In sum, by investigating discourses of stem cell research in a grant allocation process, we aim to contribute to the burgeoning STS literature on neoliberal governance of science.

The article begins by outlining the theoretical frame, in which the concepts of *politico-moral discourses* and *bio-objectification* are delineated. The subsequent section describes the empirical material and the method used. Looking through the lenses of politico-moral discourses and bio-objectification, we then define the predominant discourses that are competing for defining the value of stem cell research, before analysing how these discourses operated during the allocation of public grants to Swedish stem cell research. Finally, consequences for evolving understandings of the uneven and varied impact of neoliberal policies on stem cell research are discussed.

Theoretical Frame: Politico-Moral Discourses and Bio-Objectification

Our conceptual frame for approaching neoliberal science policies in regard to stem cell research consists of the twin concepts of political and moral economies of science, on the one hand, and bio-objects and bio-identity, on the other.

We frame the neoliberal governance of science, as discussed above, in terms of political economy. This concept denotes how states organize the production, distribution and consumption of wealth (Jessop, 2002). Following from this definition, the "political economy of science" has been used to designate the production, distribution and consumption of scientific knowledge and artefacts, as well as the policies developed to orchestrate this production, distribution and consumption (Sismondo, 2010). As a corollary to this usage, the political economy of stem cell research can be construed as the production, distribution and consumption of stem cell research, including the role that stem-cell-based products or services play, or are considered to play, in national economies and the related policies and agendas. Closely tied to the term political economy of science is the concept of moral economy of science. In the literature, at least two definitions of moral economy of science are found. One focuses on moral rules (e.g., Kohler, 1994), the other on epistemic values (e.g., Daston, 1995). The latter usage was pioneered by historian Lorrain Daston to address the question of why and how scientists choose to work on certain problems using certain materials, tools and concepts. Specifically, her focus is on historicizing a web of "affect-saturated" epistemic values, such as objectivity, testability, precision, reproducibility, accuracy, explanatory power and simplicity. Moral economies are, according to Daston, upheld by moral or thought collectives and are "integral to science: to its source of inspiration, its choice of subject matters and procedures, its shifting evidence, and its standards of explanation" (Daston, 1995: 6).

Such moral economies are highly resilient to pressure from the surrounding societal milieu, but they can evolve over time. In our understanding, however, the political and moral economies of science cannot be separated other than analytically. Thus the distribution of funding, construction of policies, and the values of scientific knowledge production are intimately connected, as has been pointed out in numerous studies (see for example: Braun, 1998; Mirowski & Sent, 2002).

In an attempt to synthesize the concepts of political and moral economies, Pestre (2005) introduces the concept of "cités de justices" – or common worlds of moral and political economies – and categorizes a number of such common worlds that work side by side in contemporary life science. As Pestre, we are concerned with how the plurality of political and moral economies is upheld in research – in our case, stem cell research – despite the growing emphasis on the commercialization of knowledge. We do this by looking through the lens of "bio-objectification" (Vermeulen et al., 2012). The term "bio-object" refers to new contested forms of life – for example, transgenic animals, genetically tested foetuses, synthetic biological material, or as in our case, stem cells and stem-cell-derived products and services – that are produced by contemporary bio-medicine. A common characteristic of these bio-objects is that they may challenge prevailing boundaries – for example, between humans and animals (such as the xenograft), person and non-person (experimental human embryos), life and matter (synthetic biology), commodity and non-commodity (patentable/non-patentable stem cell lines), and thus

produce governance challenges (Brown, 2009; Hansen & Metzler, 2012). Given that stem cells can be considered "material-semiotic figurations" (Haraway, 1997), their materiality as well as the discourses in which they are articulated, must be considered. As bio-objects, stem cells have both internal and social orders and orderings, but they are contingent and shifting (Tamminen & Vermeulen, 2012). Thus, as stated in the introduction, stem cells come with various applications, negative as well as positive values and possible futures, and as other bio-objects, they are ascribed meaning and value through processes of bio-objectification (Vermeulen et al., 2012). The bio-objectification process involves institutional and discursive work in order to stabilize the, sometimes contrasting, meanings or "bio-identities" ascribed to the bio-object (Holmberg et al., 2011). As a corollary to this, our research task is to track how the multiple and sometimes contrasting bio-identities become established, typically through cycles of negotiations and re-negotiations within and between arenas and through discourses. In sum, the struggle over how to name, frame and govern bio-objects can be called *bio-objectification*, while the outcome of this process is referred to as *bio-identification*.

For analytical purposes, we assume that the bio-objectification of stem cells within and between political and moral economies are reflected and reinforced by the "politico-moral discourses" surrounding them. These discourses can thus be viewed as an operationalization of the theoretical frame (see below). Similar to e.g. Hall (1996), who describes how discourses produce sets of available and unavailable subject positions for human actors, we argue that politico-moral discourses on stem cells contribute to constructing their bio-identities: the discourses may limit and enable what characteristics and values are connected to the bio-object. Conversely, we argue that the politico-moral discourses contribute to producing certain positions for the human and organisational actors involved in stem cell research, as well as help articulate the proper and legitimate driving forces in this research. In order to scrutinize the plurality of political and moral economies – reflected and reinforced by politico-moral discourses – we chart the specific values (e.g., epistemic, therapeutic and commercial) ascribed to stem cells throughout a research grant allocation process and describe how the commercial imperative was challenged by other cherished values surrounding stem cell research.

The Case: Strategic Research Funding of Stem Cell Research in Sweden

The present case study concerns the allocation of funds to stem cell research within so-called strategic research programmes. This research policy reform was part of the Swedish centre-right Government's "Research and Innovation Bill 2009–2012" (Swedish Government, 2008). Essentially, the Swedish Government identified 24 areas, mainly in science and technology, acknowledged as being strategically relevant to society and business. For these areas, approximately 140€ million in funding was earmarked for three years. Stem Cell and Regenerative Medicine (SCRM) was one of the strategic areas where vital industries were believed to benefit from public research, and the Bill proposed an addition of 7€ million, corresponding to five per cent of the total budget for strategic research, to be distributed by the Swedish Research Council between at least two SCRM projects.

Using the 2008 Bill, the Call for applications for SCRM projects, four ensuing applications (for simplicity these are referred to as Application I-IV in the

text), and written assessments of these applications by a panel of reviewers, we followed the process of research grant allocation. This set of data is rather unique; thanks to the relatively transparent nature of the Swedish Research Council we were able to scrutinize the full body of data – including research applications and assessments. To complement and contextualize this document analysis, we analysed relevant texts from Swedish authorities regarding the commercialization of SCRM as well as a 2011 public evaluation of the strategic research reform performed by Sweden's Innovation Agency, VINNOVA, in total close to 1000 pages of text.

These texts are empirically and analytically interesting since the "grant-genre" (including call, applications, reviews and evaluations) is supposed to exclude contradictions, leaving the messages clear and coherent. Therefore, the discursive conflicts — when they appear — remain implicit. Such conflicts may be a reflection of different sub-genres within this "grant genre". Thus different sub-genres invite different discourses to "play" (Fairclough, 1995); for example, the Call is clearly attuned to a more explicitly political sub-genre while the applications are more scientific. Still, we find it important to analyse how one outcome of such discursive conflicts is that the commercial imperative is challenged by other cherished values surrounding stem cell research.

Moreover, to investigate challenges associated with stem cell research and commercialization, and to clarify and supplement documentary findings, we included semi-structured interviews with three stem cell scientists associated with the projects that received strategic funds, two supervisors of life science commercialization at the respective university's TTOs, and a former CEO of a major Swedish stem cell corporation, thus a total of six interviews. The interviews were performed in Swedish during 2012 by two of the authors, and quotes when appearing in the article have been translated and anonymized. By combining these document and interview sources, we intend to shed light on the politico-moral discourses presently employed to make sense of stem cell research. In turn, as proposed above, this may provide a window into how the values of stem cell research and of the cells themselves are negotiated between different political and moral economies. Moreover, by investigating politico-moral discourses, we aim to shed light on the process of bio-objectification insofar as stem cells are attributed specific bio-identities in various discourses. In other words, through the discursive struggle of bio-identification, various identities get stuck to the stem cell bio-object.

In a first step of the discourse analysis, we identified three competing discourses on the value of stem cell research and stem cells as objects: 1) The entrepreneurial discourse; 2) The translational research discourse and; 3) The basic research discourse. These three discourses are unlikely to be the only ones operating in the grant allocation process, but they emerge as dominating in the data as a whole. The next section describes how the discourses were defined and analysed. In a second analytical step, we considered which bio-identities were made available, attached and valued with respect to stem cells in these discourses. In a third and final step, we investigated how the relationship between various bio-identities and values was reorganized along the research grant allocation process, i.e. how temporality imposed on the bio-objectification trajectory.

Three Politico-Moral Discourses

In this section we present three politico-moral discourses that emerged as dominating in the grant allocation

process: the entrepreneurial discourse, the translational research discourse, and the basic research discourse. The aim is to exemplify how these discourses are naming and framing the stem cells towards certain bio-identities.

In the entrepreneurial discourse, stem cells emerge mainly as putative commodities. While the entrepreneurial discourse is strongest in the Research and Innovation Bill, it was propagated well beyond this political document. Consider the following excerpt from the reviewers' assessment of SCRM Application III, that revolved around activation of endogenous stem cells to regenerate damaged tissue and nerves *in vivo,* and culturing and differentiation of stem cells into transplantable complex tissues *in vitro*.

> The creation of improved therapies will likely be accompanied by intellectual property that may be of commercial value. This may translate to the generation of start-up companies that will increase the international impact of Swedish Regenerative Medicine industry. [...] Therefore these research projects can be viewed as the pipeline, providing new technologies that will benefit patients and provide opportunities for the development of start-up companies or industrial collaborations. (Swedish Research Council, 2009b: 208)

Here, stem cells' *commercial* values are essential to their bio-identity: Stem cells are appreciated insofar as they can be traded on a market for profits, job opportunities, or national competitiveness. This commercial value is at the same time positioned in relation to the future benefit for patients, the lead motif of the next dominant discourse.

The second politico-moral discourse revolves around how strategic research will bring about therapeutic advances within the (public) health care system. Here, stem cells' *clinical* values and therapeutic bio-identities are foregrounded: The cells are attributed value insofar as they can be employed in the clinic, for example as stated in the following assessment of SCRM Application III:

> The CREATOR program is a rich basic-translational environment with scientists who are primarily interested in the "bench to bedside: bedside to bench" paradigm that is very effective in accelerating research in clinical applications. [...] The investigators have targeted clinical applications where there is clear unmet needs. For instance, the prevention of infection in corneal grafting or the improvement of fracture repair or wound healing will be quite important. (Swedish Research Council, 2009b: 208)

This translational research discourse mirrors in many respects the entrepreneurial discourse, but with another arguably more altruistic goal in sight: improving patients' health. As such, this goal relies on successful and thus highly cherished translational research.

If stem cells were something that could be tamed and packaged into a commodity by entrepreneurial research, and turned into a therapeutic breakthrough by translational medicine, the stem cells in the basic research discourse take the shape of something that is yet to be perfectly understood – something that must be further explored and explained. Consider the excerpt below from the assessment of SCRM Application I. Here, the emphasis is on stem cells' *epistemic* bio-identities, i.e. the cells have intrinsic value as objects of knowledge – which should be discovered, investigated, followed and understood.

> Decoding cell lineage at the organism level. This is certainly the most original component part of the proposal and from the fundamental point of view the most interesting [...] A group of PIs at the Institute proposes to follow the lineage relationship in intact organisms by following the evolution of polyguanine repeats. This procedure can be done at the single cell level and will be useful not only in tracing the progeny of cell, deducing tissue regeneration, and tracing progenitor cell compartments, but also in anticipating tumour relapse. (Swedish Research Council, 2009b: 209)

Arguably, this discourse could be characterized as more traditionally academic: Scientific progress derives from curiosity, the search for mechanistic explanation, and a will to know the world through experimentation, rather than striving primarily towards commercial or clinical ends – although commercial and clinical output may often be seen as welcomed by-product of science (Styhre & Sundgren, 2011).

Discursive Shifts in the Grant Allocation Process

While these discourses are made explicit throughout the grant allocation process, they operate, as we show below, with different emphasis along the trajectory, i.e., in the (1) 2008 Research and Innovation Bill, (2) Call for applications, (3) SCRM project applications, (4) Panel assessments, and (5) 2011 Follow-up evaluation of the strategic research reform. In the section below, we analyse the interplay between the three politico-moral discourses and demonstrate a shift from a strong focus on commercialization towards therapeutic and epistemic concerns and values in the grant allocation process – an orientation later challenged in the 2011 follow-up evaluation and the subsequent 2012 Research and Innovation Bill from the centre-right Government.

Research and Innovation Bill: Ushering Commercialization

In 2008, the Swedish centre-right Government presented its *Research and Innovation Bill for 2009–2013* (Swedish Government, 2008). The subtitle – *A boost to research and innovation* – indicated a main concern with converting state investments in public research into commercially viable innovations for industry. As such, the Bill should be viewed against the background of the current political consensus on state policies aimed at boosting national industrial competitiveness in high-tech sectors. Accordingly, the Government opened the Bill by emphasizing that,

> In today's era of globalization, Swedish competitiveness must be largely based on our exports having a high level of knowledge content, which is why research, development and innovation are central components of our growth policies (Swedish Government, 2008: 14).

The Bill also expressed concerns about an alleged history of repeated failures in commercializing academic research. To amend this, several reforms were suggested. On a general level, the Government proposed increased research funding, especially for research with commercial prospects. In parallel, faculty should be legally required to report any commercializable results to their home universities. Moreover, entrepreneurial activities should be fostered "through increased access to public risk capital" (Swedish Government, 2008: 126) and through financial support for TTOs.

However, the primary research policy innovation was the earmarking of money for so-called strategic research – a political programme for orienting academic research towards commercial outcomes[1]. In light of recent debates on the shift in national research policies from basic research to research aimed at increasing industrial competitiveness, and on the potential conflict between epistemic and commercial values or priorities in public research, it is interesting note how this tension was treated in the Bill.

> It is of vital importance that those seats of learning granted funds for a strategic venture give scope to free, curiosity-driven research within the framework of the strategic area. It is also important that representatives of society and industry in the relevant areas be allowed to participate in formulating research questions and that companies be made part of the project and participate in carrying it out. This will result both in solid research results and in the application of proficiencies. (Swedish Government, 2008: 68)

Thus, according to the Swedish Government, there was no immediate conflict between cherishing curiosity-driven research and simultaneously stating that other stakeholders, particularly industry, should be involved in formulating research directions. Rather, basic research was seen as a prerequisite for commercial application. However, while the value of "curiosity-driven research" was defended in the Bill, the projects' commercial aspects should still to be considered decisive when allocating strategic funds. Indeed, all applications for strategic funds were to contain specific sections detailing the project's relevance and connection to Swedish business, including strategies and plans to commercialize research, and existing supportive entrepreneurial capacities. Moreover, while the Bill repeatedly stressed the importance of the selected strategic areas to business *and* society, as regards to policy initiatives these were basically all aimed at facilitating the flow of ideas and products from academia to business (e.g. faculty should be legally required to report any commercializable results to their home universities; increased access to public risk capital and support to TTOs). There were no complementary policies proposed for facilitating the flow of non-commercializable ideas and products from, for example, biomedical research to clinical settings.

Arguably, therefore, the Government effectively touted entrepreneurial research as an obligatory passage point between basic science and patients/consumers. This is consistent with the contention that state policies have moved "from an ideology that defined the public interest as best served by shielding public entities from involvement in the market, to one that saw the public interest as best served by public organizations' involvement in commercial activities" (Slaughter & Rhoades, 1993: 287). Within this neoliberal ideology, strongly associated with the entrepreneurial discourse, stem cells, as other bio-objects, gain legitimacy insofar as they can be transformed into commercial objects, with health benefits being cast as a result of effective marketization. To illustrate this, Figure 1 schematically outlines the policy pattern that permeates the Bill. This pattern is expressed, first, through the idea of sequential translations from epistemic values to commercial and then to clinical values and, second, by the primacy of the commercial bio-identity.

In the next two sub-sections, we explore how these associations between epistemic, commercial and therapeutic values were

Figure 1. Representation of view expressed in the Swedish Government's 2008 Research and Innovation Bill. Values and translations between values are indicated.

reorganized along the SCRM research grant allocation process.

Call for Proposals: Making Room for the Therapeutic Bio-Identity

In addition to the more general political programme revolving around entrepreneurship, commercial innovation and economic growth, the Bill contained specific sections on each of the 24 strategic research areas detailing the reasons for the Government's decision to allocate funds[2]. These texts formed the basis for the Call for grant Applications. The Call clarified that all submitted project applications were to be judged based on two categories of criteria:

> 1) that the research should achieve the highest quality in an international comparison, and 2) concurrently it should be of strategic importance for society and the business sector. The fundamental criterion, however, is scientific excellence (existing capacity or the potential to achieve scientific excellence in international comparison). (Swedish Research Council, 2009a: 3)

It is at this junction that we discern the first sign of a downplaying of the primacy of commercialization, which we propose is associated with increased articulation of the translational and basic research politico-moral discourses. Thus, in the Call for SCRM projects – in which Regenerative Medicine was cast as "an area of application" for stem cells (Swedish Research Council, 2009a: 21) – epistemic, clinical and commercial ends were given at least equal prominence. This was stated in the SCRM Call as follows:

> It is essential to prioritize and support research, based on new knowledge, concerning whether stem cells can prevent, ameliorate, and possibly cure serious, widespread diseases. This also applies to producing specific cells to counteract deficiencies in organs for transplantation as well as for other applications in health care. Mapping of the different stages, from stem cells to different precursors of specialized cells, opens new opportunities to develop drugs that can regulate the formation of specific cells. (Swedish Research Council, 2009a: 21)

We also suggest that this shift from predominantly commercial considerations is associated with the forging of a different set of associations between epistemic, commercial and therapeutic values. Instead of the idea of *sequential* translations present in the Bill, we discern a conceptualization of scientific progression characterized by *parallel* translations from epistemic to commercial and therapeutic values, respectively (Fig. 2). In other words, stem cells can be translated either into a commodity or therapeutics, or both. Importantly, in this pattern, entrepreneurial research and commercial values are *possible* but not obligatory passage points between basic science and patients/consumers.

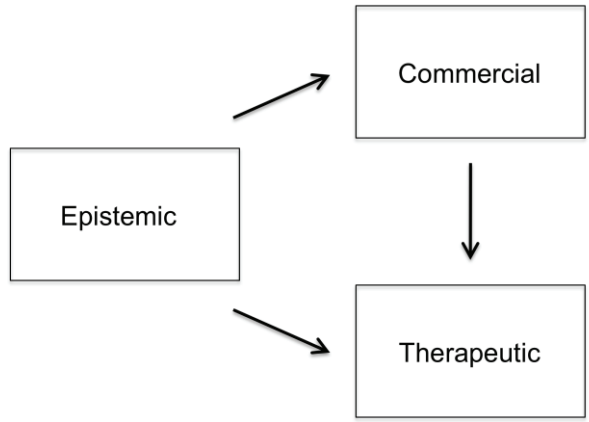

Figure 2. Representation of view expressed in Call for SCRM project proposals. Values and translations between values are indicated.

Proposals and Assessments: Upgrading the Epistemic Bio-identity

Unsurprisingly, given the difficulties associated with commercialization and therapeutic innovation, the SCRM applications centred on basic research efforts to improve knowledge in stem cell and developmental biology, i.e. there was a strong articulation of the basic research politico-moral discourse and the epistemic bio-identity. What was perhaps more surprising then, in light of the political pressure to commercialize, was that the applications stressed clinical possibilities and challenges more forcefully than commercial ones. We illustrate this by focusing on the two applications that received the highest ranking by the panel of reviewers and that hence received funding (referred to as Application I and II).

Application I suggested the establishment of a Centre for Regenerative Medicine,

> with the vision of conducting research leading to development of new concepts in stem cell biology and new therapies in several disease areas.

As explained in the application abstract, it centred on five programme areas which integrate basic and clinical science:

> 1) Molecular basis of cellular differentiation.
> 2) Steering stem cell differentiation.
> 3) Transplantation biology.
> 4) Development of novel technology to trace cell lineage at an unprecedented, organism-wide level.
> 5) Integration of biomaterials and nano-biology with stem cell research.

In sum, the application focused on basic research in stem cell and developmental biology (points 1, 2, 4), improving current methods and protocols for stem cell differentiation, culturing and expansion (2, 5) and advancing transplantation biology in clinical settings (3). Commercial considerations and prospects were not explicitly mentioned in the abstract. Nor was commercialization explicitly mentioned in the reviewers' summary assessment, which instead centred on epistemic and therapeutic prospects within a bench-to-bedside, bedside-to-bench paradigm aimed at integrating basic research and clinical work:

> There are few institutions with such a combination of experts in regenerative research that combine a very strong basic research interest with an immediate application to the patient. A very strong aspect of the proposal is the lineage tracing programs which are innovative and will be extremely useful to understand the physiological role of different cell types in tissue repair and also in the follow up of tumours. (Swedish Research Council, 2009b: 210)

Here, excellence in the investigators' track record was valued, along with epistemic and therapeutic values combined with an innovative methodology. One of the central figures in this research milieu confirms these priorities in an interview, stating that:

> This is basic research in well, we don't make any patient, we don't test new drugs on patients or anything like that. Instead we try to understand how things work. Even though we're very interested in contributing to some kind of therapeutic development as well [...] Well, I think that... a combination of basic understanding of how the body normally functions and how to modulate it in order to develop regenerative therapies, is what is fun, or, well, the possibility to perhaps contribute to the development of regenerative treatments. (Stem Cell Scientist 1)

What becomes positively valued ("what is fun") is to understand normal and abnormal physiology ("how things work"), with the prospect of helping patients ("the development of regenerative treatments"). In the interview, the pros and cons of entrepreneurship were also discussed. The scientist was very positive about the possibilities of commercialization, but mainly as means to secure additional funding for basic and clinical research.

Turning to Application II, the constellation of researchers summarized their intentions as follows:

> The overall objectives within the next 10 years are to demonstrate at least in one disease, i.e. diabetes, that stem cell-based cell replacement therapy is effective and safe, to provide therapeutic candidates for stroke and haematological diseases, and to build a strong base of knowledge about stem cells and disease mechanisms to pave the way for future efforts to devise new clinically effective treatments.

Thus, compared with Application I, therapeutic values were stressed more than epistemic ones (the "strong knowledge base" aiming at paving the way for "new clinically effective treatments"). Moreover, unlike Application I, commercialization was mentioned in the abstract alongside clinical translation:

> The objectives will be of strategic importance for both the Swedish society and industry. Swedish scientists will take a leading role in the development of novel stem cell-based therapies for serious diseases, and, hence, provide solutions to important health problems in society. Generated new knowledge will be translated into commercial products.

In the Call, as noted above, the commercial output – or "bio-value" (Waldby, 2002) – of the epistemic labour was stressed. However, as one of the scientists in the milieu told us, commercialization was not uncontroversial; it was increasingly demanded from "above" and involved certain risks:

> Now they require commercialization and patenting if you want to have a... get grant money or a position or whatever. And everybody needs funding and positions to do their research. And so you have to do it. To get the right qualifications. And so maybe you focus on something you can patent rather than on something that will generate the real and important discoveries. (Stem Cell Scientist 2)

The problem of orienting research towards commercial outcomes and valuing a less legitimate object – the commodity – was stressed ("focus on something you can patent"). Later in the interview, the scientist added that this did not imply that their research results should remain only within the remit of the university, but that like all research it should serve society at large. However, to achieve that goal, the research cluster had chosen to focus more on the translational dimensions of their research than on commercialization, which was also confirmed by Stem Cell Scientist 3, working in the same research cluster.

This contention, that the applications stressed epistemic and clinical possibilities and challenges more forcefully than commercial ones, is further supported by the assessment made by the panel of reviewers. While enthralled by the epistemic prospects of the two applications and by the possibilities for clinical translations, they were less impressed by the entrepreneurial strategies and existing structures to support commercial exploitation. For example, Application I was criticized for having

> limited relationships with biotechnology and Big Pharma companies at the present time (Swedish Research Council, 2009b, p. 210)

and Application II was chided for having too little venture and business capital influx. The latter project was described as possible to commercialize, but with a hint that it would become expensive and that more capital was needed (Swedish Research Council, 2009b).

Taken together, our analysis supports the idea that a certain shift from the commercial imperative took place through the grant allocation process. This orientation, we propose, is associated with an insistence by researchers and reviewers on the epistemic and therapeutic value of stem cell and developmental biology research and an emphasis on therapeutic and epistemic outcomes over and above commercial ones, i.e. with a downplaying of the entrepreneurial politico-moral

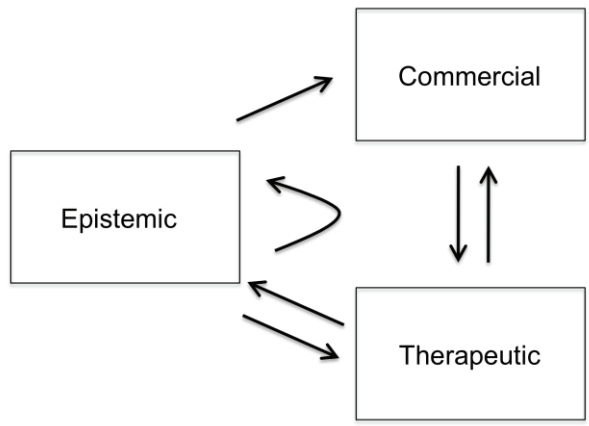

Figure 3. Representation of view expressed in SCRM project proposals and assessments. Values and translations between values are indicated.

discourse. Schematically, as delineated in Figure 3, we suggest that (1) in addition to the idea of *parallel* translations from epistemic to commercial and therapeutic values, respectively, already present in the Call, the applications and assessments are characterized by the idea of an *epistemic loop,* i.e., more knowledge about stem cells is needed to boost basic research; (2) there are translations in the texts not only going from epistemic to therapeutic values, but also in reverse from therapeutic to epistemic values (i.e. the bench-to-bedside, bedside-to-bench paradigm); and (3) commercialization is at times framed as a by-product of clinical application rather than the other way around, as was the case in the Bill.

Follow-up Evaluation and the New Bill: Coming Full Circle

Thus far, our analysis has shown how the entrepreneurial discourse was challenged by translational and basic research discourses through the grant allocation process. These discursive shifts also made room for other bio-identities and different values of the stem cells. According to our informants at TTOs preoccupied with the commercialization of biomedical research, there was a lack of commercial commitment among certain researchers. This was, in their view, due partly to genuine disinterest – a lack of the "entrepreneurial spirit" as a TTO manager put it – and partly to specific difficulties associated with stem cell commercialization. In brief, stem cell research is difficult to commercialize because it does not fit easily into current business models in the life sciences that revolves around chemically synthesised drugs. Moreover, the stem cell patent landscape is tricky terrain. This latter point was explained to us as following:

> I'm not so up on stem cells really, but the little I know is that there are many steps that have to work. And say he [talking about a stem cell scientist] solved one part, then he's still dependent on a whole lot of other patents earlier in embryonic development, differentiation. So it's pretty hard to navigate all that, as I see it, to find the freedom to operate and who else is interested and such things. (TTO manager 1)

Getting a stem cell patent is, in the TTO manager's view, contingent on many steps. In particular, the challenge is not only to isolate a sufficiently novel aspect of the stem cell bio-object that can be patented without infringing on existing patents, but also to find a commercial application that is not curtailed by existing patents on prior or subsequent steps in a cell differentiation trajectory, for example from embryonic stem cell to insulin producing pancreatic beta cell. It should be noted, however, that SCRM is not unique in having commercialization difficulties – at least if we are to believe a 2011 follow-up evaluation of the conditions for innovation in the areas of strategic research, performed by Sweden's Innovation Agency, VINNOVA (2011). According to them, industry and other organizations had, overall, "been involved to a limited degree or not at all in a dialogue about research priorities" in assessed research projects and that "there was no direct incentive and follow-up criteria for this and, moreover, the venture has not generated new, expanded or deepened collaboration" (VINNOVA, 2011: 3). VINNOVA concluded their evaluation by saying that one should

> not expect the strategic research venture to contribute to any great extent to the generation of innovations in the participating organizations, because

> direct collaborative relationships are a necessary prerequisite for an effective exchange of knowledge (VINNOVA, 2011: 3).

The evaluation is pertinent to the present argument not only because it supports our contention of shifts in the grant allocation, but also because it outlines a possible neoliberal policy response to this. Thus, to amend this alleged commercialization failure, VINNOVA recommended that the Government establish a ”strategic innovation programme” in which

> [a]ctors from industry and society should play important roles in making research priorities in the same was as university researchers play important roles in establishing strategic research priorities (VINNOVA, 2011: 4).

And, indeed, in the *Research and Innovation Bill* from 2012 this was exactly what was proposed: A new research policy instrument denoted “strategic innovation areas” in which increased intermingling between the academy, business and the state would be fostered through co-funding mechanisms (Swedish Government, 2012). For Government, co-funding was seen as a way to prioritize research already selected by businesses (or other financially strong actors) as evidenced by their financial commitment to the project. If effective, this neoliberal research policy instrument will put a premium on academic research aligned with the expressed needs of big business and, arguably, possibly further curtail opportunities for epistemic and therapeutic values to take a centre stage through the basic and translational politico-moral discourses as addressed in this paper.

Conclusion

We began this article by noting that one of our main concerns is with how neoliberal policies impact on the topography of stem cell research. As we have shown here, the science political commercialization imperative, strongly associated with the entrepreneurial discourse, may be challenged by translational and basic research discourses within a grant allocation process. Notably, these politico-moral discourses are highly unlikely to be unique to stem cell research, or even to biomedical research, but probably exist throughout a wide range of fields of research (cf. Pestre, 2005).

At this juncture it is important to again point out that while the entrepreneurial discourse is not the only one present it the Bill, it still constitutes the primary discourse insofar as other discourses (translational, basic research) gain legitimacy directly or indirectly in relation to it. This is seen for example in the legitimization of non-commercial science by claiming that it indirectly contributes to the overall competitiveness of the life science sector or of a region. A similar argument is put forth by the Innovation Agency VINNOVA that perceived basic stem cell science to be of such importance for business development that basic research in the field should be subsidized by the state rather than left to the vagaries of the market (Rickne & Sandström, 2009) (see note 2). This resonates with Jessop’s contention that the increased importance of structural competitiveness and/or systemic competitiveness leads to a fundamental redefinition of the “economic sphere” because many phenomena previously regarded as “extra-economic” are now seen as directly economic and/or economically relevant (Jessop, 2002: 135).

Through the discourse analysis performed, we showed how the

entrepreneurial, translational and basic research discourses co-exist and mingle even though the different values they promote occasionally come into conflict. Here, we suggest that the intermingling of discourses results in negotiations over the values of stem cell research and stem cells. This contention is supported by the way the various values ascribed to stem cells became reorganized along the research grant allocation process, as schematically outlined in Figures 1–3. Thus, rather than loudly opposing the commercial imperative, we have argued that stem cell researchers displaced it by emphasising: the need for more knowledge about stem cells to boost basic research, the bench-to-bedside, bedside-to-bench paradigm, and by framing commercialization at times as a by-product of clinical application rather than the other way around.

This analysis is consistent with the idea of temporally specific epistemic and clinical shifts in the grant allocation process. Thus, commercial imperatives are strong in the Bill, but shrink throughout the grant allocation process while epistemic and therapeutic identities and values are foregrounded. This could be interpreted as suggesting the need to look at both time and place, that is, to study *located processes*, in order to understand the work of discourses in science policies. Crucially, this is what the framework of bio-objectification aims at, since a focus on conflict – however implicit it may be – challenges the common idea of implementation of policies as top-down:

> However, debates and controversies on these innovative entities, as well as on the technologies and practices that help to make and to sustain them, suggest that the process of bio-objectification should not be understood as a one-way street. Such debates include, on one hand, controversies on who or what is amenable to be "objectified" – and how, but also less vociferous debates in which scientists, policy-makers, and other groups of actors discuss how to order these entities, who to entrust with their oversight, and in light of what sort of principles. (Hansen & Metzler, 2012: 80)

We have also pointed out how the stem cell bio-object may eschew commodification, despite a seemingly hegemonic entrepreneurial discourse in science policy and a strong political will. Thus our informants repeatedly underscored some specific difficulties, including difficulties related to the intricacies of stem cell biology and mismatches between proposed models for stem cell therapeutics and the current commercial models of Big Pharma that revolves around chemically synthesised drugs. Moreover, as the Reviewers of the SCRM proposals noted, commodification of academic stem cell research is likely to require increased private sector investments and support. As a result of such difficulties, apart from hematopoietic stem cell transplantation, essentially all other stem cell treatments remain experimental or are practiced in the absence of standard clinical evidence of benefits and safety (Lau et al., 2008). Ostensibly, the issue at stake here is whether the stem cells can be made to fit, or if the commercial models themselves will change.

Finally, we would like to reconnect this concluding discussion to our initial outline of the sets of values that prevail in the different political and moral economies of science – or "cités de justices" (Pestre, 2005). One advantage of analytically connecting political and moral economies to the concept of bio-objectification is that this approach allows us to grasp how the commercialization imperative is, if not resisted, at least offset by the tenacious

political and moral economies of science (Daston, 1995). Thus, by adding the concept of "politico-moral discourses" to the framework of bio-objectification, we were able to point out how the relationship between various bio-identities and values were reorganized along the research grant allocation process. In this way, our work may contribute to the understanding of the varied and uneven impact of neoliberalism on science: the total marketization of academic research might not be possible, partly because, as argued here, there are diverse political and moral economies of science at work, conflicting discourses in operation and bio-objects that, at least thus far, eschew commoditization. Clearly, more knowledge is needed regarding how the various political and moral economies of science interact, and if and how political and moral economies are changing due to the pressure to commercialize scientific results. Conversely, more knowledge is needed regarding if and how the various barriers – scientific, economic, social, and legal – facing stem cell research commercialization are strengthening a political and moral economy that cherishes epistemic and therapeutic values over and above commercial ones.

Notes

1 This earmarking of money to strategic research represents an extension of the research policy reforms initiated by the previous centre-right Government in 1994 with the establishment of a set of new foundations, using money from the so-called wage-earner funds, to foster new alliances between academia and industry (Benner & Sörlin, 2007). Thus, these foundations – like the strategic research – would "create new environments that would be conductive to both basic science and economic growth" (Benner & Sörlin, 2007: 35). For example, one of these foundations, the SSF, funded a set of large "centres of excellence", the objective of which was to foster "strategic relevance for the present and future industry" and "an integration of basic and applied research" (cited in Benner & Sörlin, 2007: 40).

2 The Government's selection of SCRM as a strategic area was preceded by commissioned analyses of business opportunities in the area. Thus the text "Swedish possibilities within tissue engineering and regenerative medicine" produced for the Swedish Innovation Agency VINNOA argued that, for Sweden to excel in the area, a coordinated and strategic effort from the state was needed "to complement the present funding of projects, centres and cluster development the field is receiving through the Swedish R&D funding system and lead to a more pronounced effect on research and innovation in this field" (Rickne & Sandström, 2009: 16).

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Shai Mulinari
shai.mulinari@soc.lu.se
Lund University

Shai Mulinari carried out this work as part of a PostDoc at the Department of Science, Environment and Society, Malmö University, Sweden. Currently Mulinari is Researcher at the Department of Sociology, and Unit of Social Epidemiology, at Lund University, Sweden. Mulinari holds a PhD in Developmental Biology from Lund University. His more recent research focuses on the history of psychiatric research, regulation of the pharmaceutical industry, stem cell science policy, and public health.

Tora Holmberg
tora.holmberg@ibf.uu.se
Uppsala University

Tora Holmberg is a Senior Lecturer and Associate Professor at the Department of Sociology, and the Institute for Housing and Urban Research, Uppsala University, Sweden. Her research interests include human/animal relations in various contexts, and her cultural sociology approach combines STS, urban sociology, animal studies and feminist theory.

Malin Ideland
malin.ideland@mah.se
Malmö University

Malin Ideland is Professor in Educational sciences with specialty in Ethnology at Malmö University. Her research interests concern a) cultural perspectives on modern biotechnologies, e.g. transgenic animals and stem cell research; b) critical studies on science and sustainability education.

Civilizing Drones: Military Discourses Going Civil?

Sven Braun, Michael Friedewald and Govert Valkenburg

This article presents an account of how a technology being transferred from one area of deployment to another entails that specific discourses travel along. In particular, we show that the development of Unmanned Aircraft Systems (UAS, often referred to as drones) is importantly determined by its military progeny, as the civilian context inherits specific discourses from the military context. Contemporary ideas of privacy and security in drone use can be largely traced back to this original context. We show that concepts and their relative importance primarily depend on the discourses that travel together with the technologies on which the concepts aim to act. There is no technological reason for privacy and security to be implemented the way they are, nor can their implementation be explained merely from socio-political or moral discourses. Instead, material and discursive mechanisms successfully enact and reproduce the dominant military viewpoint.

Keywords: drones, privacy, security

Introduction

Whenever technologies migrate from one context to another, concepts by which people understand and harness those technologies travel with them. While unmanned aircraft systems (UAS) or 'drones' are no longer merely military devices – but now also commercial and even leisure devices – some remnants of their military genesis can be discerned in the discourses that surround them. Looking at a particular class of UAS, we trace back how incumbent conceptions of security, and adjacent notions of safety and privacy, inherit from this military history a tendency to 'externalize' human values from the design of UAS.

Under the umbrella term of UAS, a wide range of airborne devices is captured which, in one way or another, fly without a human pilot on board. Well known are the military devices used by, amongst others, the United States to assassinate alleged terrorists in areas outside its sphere of military control (Syed, 2013). Less prominent is the use of similar devices for mere reconnaissance and espionage purposes. At the same time, unmanned aircraft carrying a payload are increasingly used for civilian purposes such as infrastructure monitoring (Woody, 2014) and crowd control (Heise, 2013) and even for leisure by private persons – for example to take photos and footage of themselves from above. Compared to the much longer history of military uses, leisure and civilian

purposes that do not focus on the aspect of flying have only appeared fairly recently.

The proliferation of UAS applications naturally raises issues of privacy: aerial observation becomes less costly and less risky, and thereby more affordable. We show that privacy is not some abstract value that is either respected or violated by a technology such as UAS. Instead, we consider it as multiple, situated and contingent (Gutwirth, 2002; Finn et al., 2013). What privacy consists of in this particular case is itself defined in the process of developing an operational UAS. In this development, or so we will argue, military narratives have seemed to be able to persist, even though the practice has moved beyond the military context.

We aim to shed new light on the tensions around privacy when pursuing regulation of UAS by looking particularly at the concept of security. Much like privacy, the concept of security in the drone context lacks an *ex ante* definition – for example, as to what is to be secured, and how. Rather, such notions emerge in the many negotiations – which include social, economic, political, technical and cultural aspects – that take place in the process of development. Since UAS have a substantial history of applications in (national) security, particular notions of security and particular configurations of UAS are fundamentally co-produced.

At the same time, transferring UAS – or elements thereof – from military to civilian contexts, will generally modify or *translate* both the technological design and the specific notions of security. Thus, we find ourselves confronted with a double set of questions. On the one hand, it merits further scrutiny whether, and how, narratives with a military origin persist into practices of non-military UAS application – in other words, which 'hinterlands' (Law, 2009) they carry with them. On the other hand, we should investigate how these narratives are modified and translated in their new habitus, and how they lead to particular 'enactments' of the concepts of privacy and security (Law, 2004).

The Case: Unmanned Aircraft Systems (UAS)

The empirical base of our argument is a case study on Unmanned Aircraft Systems used for surveillance purposes. UAS are also referred to as Unmanned Aerial Vehicles (UAVs), Remotely Piloted Aircraft Systems (RPAS) or simply as drones. UAS have been defined more systematically as 'powered, aerial vehicles that do not carry a human operator' and that 'can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or non lethal payload' (Bone & Bolkcom, 2003: 1). Systems typically comprise a ground station and a data communication link (see figure 1). Depending on the payload, UAS can be deployed in various military and civilian scenarios. In this case study, military scenarios will be acknowledged, but the focus will be on non-military governmental and commercial applications. We intend to explain how the meanings of privacy and security emerge in this context, as opposed to considering how UAS are, or are not, ethically problematic.[1]

In this paper, we will engage with one particular class of UAS, namely the fixed-wing type suitable for both civilian and military purposes. Historically, most military UAS have been of the fixed-wing or 'aeroplane-like' type, quite different from the multi-rotor type that flies much more like a helicopter. The history of the latter is much more tied to civilian applications. Hence, if there is one site to spot military discourses riding piggyback on technology transfer, it should be with the fixed-wing type.

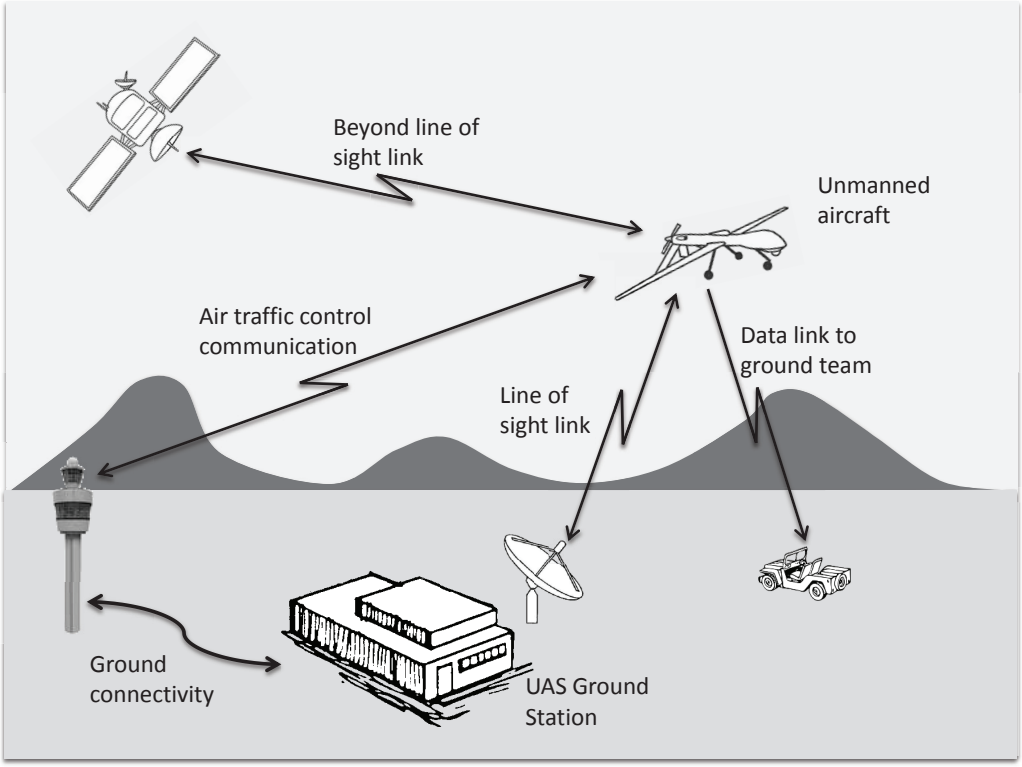

Figure 1. Communication links between ground station, airport, satellite and unmanned aerial vehicle

History

UAS have been around since the First World War. As soon as the technology emerged, it was immediately adopted by the military. While initially used for training anti-aircraft crews, transport of weaponry and for remotely launching bombs, their usage as reconnaissance aircraft began with the Vietnam War (Fahlstrom & Gleason, 2012). Throughout history, UAS have been most commonly associated with the military, only to appear in civilian applications more recently. They have been extensively used in armed conflicts for intelligence gathering and so-called targeted killing missions, e.g. in Kosovo (1999), Iraq (2003), Afghanistan and Pakistan (since 2001) to name a few recent examples (McBride, 2009; Gregory, 2011). Except for small scale UAS, unmanned aircraft are currently only allowed to fly in dedicated zones. A worldwide legislative process aimed at the integration of UAS into the civil airspace is currently underway, which would ultimately enable manned and unmanned aircraft to share the same airspace. In the European Union, this integration depends on initiatives at both member state level and at Union level. In the United States, the aim is to achieve full integration by 2015 – although this is considered very ambitious (Kornmeier, 2012: 8). Pilot applications for UAS may be possible by 2015, but

not general integration. Furthermore, a global coordination of national airspace regulation by the International Civil Aviation Organisation (ICAO) is planned to be complete by 2025. Only after this coordination will integration be complete (according to developer D3 involved in the regulation process; interviewee codes are explained below). This process depends not only on legal issues, but also on technological developments, e.g. on the improvement of sensor and collision avoidance systems and other as yet underdeveloped mechanisms to guarantee sufficient operational dependability and safety. Small-scale UAS can already be operated without major restrictions, whereas large UAS have a lengthy application process in most countries (European RPAS Steering Group, 2013).[2]

Despite the regulatory barriers, the number of users of unmanned aircraft has been growing slowly but steadily (Kornmeier, 2012: 8). It is expected that once the integration of UAS into civil airspace is complete, it will open the market for unmanned aviation.

Current Technology

In the last few years, UAS have received considerable media coverage in relation to targeted killing at war – not least the 'war on terror'.[3] Requirements for UAS to successfully execute combat, surveillance and reconnaissance missions are: the ability to fly at high altitude, long flight endurance time, long range and sometimes also undetectability. In addition to the flight requirements, the payload is expected to deliver high quality sensor data. In the ground station, the data must then efficiently be interpreted automatically or manually. According to multiple interviewees (D3–D5; interviewee codes will be explained below) who are working on large-scale military products, all these technical requirements are reflected in the technical design and thus in the resulting systems themselves.

UAS are systems consisting of a flying unit, usually equipped with some kind of payload. Those units require a ground station and a communication and data link (see figure 1). They can be as small as an insect or as large as an airliner (Eick, 2009). Often UAS are classified by weight (from less than 100 grams to 5 tons), range (from 1 to over 2000 kilometres), altitude (from less than 250 metres to 20 kilometres and above) and endurance (from less than 20 minutes to 48 hours of permanent flight). Shapes also vary considerably: airplane-like fixed wing designs and multi-rotor systems that can vertically take off and land are currently prevalent, UAS with other aerodynamic shapes are in development (Kornmeier, 2012: 13).

Usually systems are remotely operated and monitored by human flight operators (pilots) and additional evaluator(s) for interpreting payload data – all normally located at the ground station. The number of operators depends on the size of the system. Only one person is needed to operate very small UAS, while huge fixed-wing models, such as the MQ-9 Reaper by Northrup Grumman, requires more than 180 people (The Economist, 2011). However, not all systems require human operators in real time. There are aircraft that can fly (semi-) autonomously, e.g. on the basis of GPS and other sensor data, and, for example, supported by a collision avoidance system. Coordinates and/or routes are calculated on the basis of data obtained through sensors in real time during flight (Hing & Oh, 2009: 6). Additionally, some UAS also have the capability to operate in 'swarms', where units communicate with each other and are able to perform complex tasks together.

In most civilian applications, payload will typically consist of an attached video, infrared or thermal camera to get a bird's eye view. Surveillance missions often require additional signal intelligence hardware. Armed UAS for law-enforcement purposes are envisioned (Homeland Security News Wire, 2011; Brumfield, 2014), but to the best of our knowledge not in use yet. Sometimes the data captured by the payload is processed on-board, e.g. to calculate the flight path. However, it is more common for the payload to transfer data to the ground station. There, it can be processed directly – for example, using pattern-recognition algorithms, or by human operators – or it can be stored for future analysis.

In terms of operational advantages, unmanned aircraft are ideal for use due to the possibility of deploying small-scale systems on demand and due to the high range and altitude capabilities and, most important, the endurance of larger systems. In addition, UAS are argued to be more economically efficient than manned aircraft. However, this applies mainly to small-scale systems (Kornmeier, 2012: 8).[4] These characteristics can be taken advantage of in different mission scenarios, including border protection, law enforcement and surveillance, airborne sea patrol, search and rescue operations or scientific data collection (e.g. in hurricanes or forest fires). In general – at least in comparison to manned aircraft – UAS are typically deployed in dull, dirty or dangerous missions.[5]

Civilian Technologies, Military Narratives

Within *science and technology* studies, it is commonly understood that concepts by which people understand and take control of their life worlds cannot be separated from the technologies through which they shape that life world. This implies that translating a technology from one practice to another may offer particular concepts and the discourses organized around them the opportunity to ride piggyback on the technology. While the intrinsic political qualities attributed to technologies – as in Winner's famous discussion of the allegedly racist bridges on Long Island (Winner, 1988) – have long been questioned, postulating a connection between discourses and artifacts does allow us to see how incumbent discourses come to appear as poorly applicable to the practice they relate to.

While there are no such things as, *the* military realm and *the* civilian realm, we do observe certain elements in debates concerning the civilian use of drones that are surprising in light of existing moral and political discourses. These would, at the same time, be less surprising in a military context. Notably the low relative importance attributed to privacy by particular players in the development of drones, to be discussed shortly, seems unacceptable once programmes such as *Privacy by Design* (Cavoukian, 2009) have seen the light of day. Additionally, the fact that privacy has become a leading principle in the development of other surveillance technologies such as *automated license plate recognition* and the *body scanners* (van Lieshout et al., 2015) that are nowadays omnipresent at international airports, clearly dismisses as overly simplistic the explanation that technologists in general would be unreceptive to moral arguments. Also, it is highly unlikely that there is something exceptional to UAS in some technological sense that hampers privacy-friendly implementations. That would be a rather substantive, even deterministic, understanding of technology (cf. Feenberg, 1995) and the argument would be particularly unconvincing in regards of the other aforementioned privacy-

sensitive technologies. In fact, a rejection of such determinism provides an important ontological foundation for a doctrine such as *Privacy by Design* to be deemed feasible in the first place.

Rather, if politics are understood as a struggle for discursive hegemony (Hajer, 2005), then this is one way artifacts have politics. As will be articulated, the conceptual frameworks that travel with UAS technology are successfully displacing the aforementioned privacy-sensitive frameworks. That they are indeed discourses travelling with the technology (Harris, 2010), and not some category of essential properties belonging to the technology itself, is revealed when researchers and developers are invited to reflect on the possibilities of implementing privacy-friendly features on UASs. A considerable number of times they argue that such things would be possible, yet not the primary concern of UAS developers. Interviewee D1 (interviewee codes will be explained below) stated clearly what the primary concern is: '*In our development process, privacy plays no role in the first instance. Because when you develop technology, you try to solve a technical problem.*'

In the following empirical sections, we will present examples of such discourses, and explicate the clashes between those discourses that come with the technologies and those discourses that come from the purportedly 'more civilian' spheres of society.

When looking systematically at reasons for privacy not to be considered a technical problem, strong parallels appear with six rhetoric patterns articulated by Langheinrich (2003) in discourses concerning the potential privacy implications of ubiquitous computing:[6]

- Langheinrich's first pattern is that researchers do not feel morally responsible for privacy, either because privacy problems would not be applicable to their field of expertise, or because other social processes were felt to be more adequate to regulate such issues.
- The second rhetoric pattern is that privacy does not need to be paid any heed, since existing security mechanisms sufficiently safeguard it.
- Third, privacy as such appears as a premature issue or even a non-issue in many cases, since researchers thought that privacy could only be properly addressed after initial prototypes had been built.
- The fourth pattern is based on the third, namely that privacy would be no problem for prototypes, since privacy is not part of the context in which the early development takes place.
- Fifth, some researchers thought of privacy as too abstract of a problem to offer any sensible input to a technical design process.
- Finally, privacy is often not part of specifications and requirements, which entails that it is also not included in deliverables.

Variants of these patterns or story lines can be recognized clearly in the interviews that we conducted with UAS developers (D1–D5) and one researcher (R1). We understand these patterns as particular ways of 'externalizing' privacy concerns from the technology development discourse. This is an important constitutive element of the relevant discourse coalition, i.e. the group of actors across practices that share this discourse and its meaning (Hajer, 2005): by tapping into this repertoire of story lines, the actors *enact* drones as something

fundamentally distinct from discussing privacy. They thus reproduce and sustain a practice of UAS development that is devoid of privacy concerns, and uphold their legitimacy to do so.

Empirical Base

This case study is based on an analysis of relevant literature and ten qualitative interviews with UAS operators, developers, manufacturers and researchers in German-speaking countries, conducted in August/September 2013. Two users and two potential users of UAS were interviewed, five industrial developers and/or manufacturers, and one academic researcher in the field of unmanned aerial systems (see table 2).

In addition, *freedom of information* requests regarding privacy impact assessments related to UAS were sent to police forces in Essex, Merseyside, Staffordshire and Derbyshire in the United Kingdom and to the police in the German state of North Rhine-Westphalia as well as the German Federal Police. The aim was to understand which UAS privacy impacts police forces had identified and how they had dealt with them.

Civilizing Drones

Moving UAS from military uses into civilian uses, their 'civilising' if you like, involves their *translation* (Latour, 1987): not only are they to be moved physically to different spaces and sociotechnical practices, they also have to undergo qualitative changes in order to be fit to, and function in their new context. Likewise, the discourses that we presume travel with them, will undergo translation. Like any translation, this is a negotiation in which various discourse coalitions strive for hegemony. Translation of both the technology and the accompanying discourses requires work, as with new contexts come new demands.

If translation is the case, it is not self-evident for any element of either technology or discourse to survive or to decease: it requires explanation why some elements change while others don't.

We focus on a particular element of the military discourse that seems to survive this translation: a low priority assigned to concerns of privacy. Even though our analysis does not warrant an explanation of the low priority of privacy concerns merely in terms of the military origin of fixed-wing drones, it is worth pointing out that this prioritization appears both in the military

Table 1. Overview of interviewees

Identifier	Role	Description
R1	Researcher	In public research and technology organization
D1	Developer	In medium-sized aerospace company
D2	Developer	In small company specialized in mini UAS
D3	Developer	In big aerospace and defence company
D4	Developer	In medium-sized company specialized in UAS
D5	Developer	In big aerospace and defence company
U1	Potential user	Use in commercial environment
U2	User	Use for law-enforcement, part of the management
U3	Potential user	Use for law-enforcement, part of the management
U4	User	Use in commercial environment, sometimes in cooperation with law-enforcement

context and in the civilian contexts of UAV deployment. This is especially noteworthy, as privacy is among the primary concerns when technologies with a potential information impact are considered for application in non-military contexts. The discourses enacting this prioritization resemble the story lines identified in an abstract sense above by means of Langheinrich's (2003) conceptual inventory. Also, we see that it is not only a discourse with low priority for privacy, but also a further enactment and institutionalization of the externalization of privacy issues: those are literally delegated to sites outside the design practice.

In the first place, many of the narratives held up by people involved in drones reproduce an externalization of considerations of privacy. Those considerations are not reckoned part of the design space in which drone development takes place. This is atypical, as privacy considerations are amongst the primary hurdles that may be expected to appear if a technology is to be deployed with potential public impact. Notably, within the same population of experts, awareness is reflected of the existence of approaches such as *Privacy By Design* (Cavoukian, 2009), which explicitly pursue the implementation of privacy through (amongst other means) technological design. Also, in the light of their own expertise and position, interviewees recognize that much more is technically possible to implement privacy than is currently done in the development of civil-purpose UAS. It is in the ambiguity of whether or not privacy is external to technology design that, at least apparently, military styles of inference seem to retain dominance.

In addition, the externalisation of privacy issues appears clearly as an institutional distribution of responsibilities. Both users and engineers see the issue primarily as the duty of the competent supervisory authority: they must supervise the privacy compliant application of UAS. The interviewees mentioned the aeronautical authorities and the authorities that grant flight clearances as a potential source of compliance monitoring. A certain displacement is visible: if the problem of privacy is predominantly enacted as external to design practice, it is indeed likely to re-emerge somewhere else.

Interestingly, interviewees did not mention data protection authorities in this regard, which is again an interesting parallel with military practices, as data-protection authorities concern situations of peace rather than war.

Interviewed user U2 assumed that if there were any privacy impacts in the technology, they would have been addressed in the procurement procedure. The *freedom of information* requests we sent to police forces asking for privacy impact assessments made in the context of UAS procurements, showed that no such impact assessments had been made prior to any procurement. Therefore we assume that privacy considerations were not part of procurement procedures. All explanations provided boiled down to the idea that 'there is no legal requirement for us to do so.'[7] Alternatively, user U3 lists a number of privacy measures such as non-retention policies and compliance with data processing laws as protection mechanisms, which relate to operation rather than design – technical measures and early-phase design adaptations being notably absent.

Reasons for privacy not to be part of the design problem also exist in the form of perceived attributions of moral responsibility. Five out of six interviewed developers and the researcher (D1–D5, R1) did not feel morally responsible for protecting privacy. If at all, privacy would become important in later development processes such as system integration and

deployment. It is reflected in the majority of interviews that *'each system operator is responsible for a lawful operation'* (D2), including privacy laws, as the exact privacy relevance of the technology hinges upon its particular application.

All interviewed developers and the researcher (D1–D5, R1) stated that privacy is too abstract of a problem to solve technically. D2 even stated '*that [it] is not possible*' to solve technically. They argued that during the development process, it is not foreseeable how privacy will be situated in the contexts in which the system is to be used. One interviewee stated that privacy is not a problem for prototypes, since these preliminary models will never be used outside the development context. Thus, from their point of view, there is no need to protect privacy in a technical way, as it is not part of the UAS's problem and design description. Five out of six literally confirm that privacy is not part of their deliverables, since customers do not ask explicitly for such features. Also, as manufacturers, they are not obliged to implement privacy protecting features. While we would not go as far as claiming that the developers maintain a purely instrumental view of technology, it is clear that they do maintain a view of technology that attributes much of the meaning of the technology to the context of operation.

In addition, there is yet another institutional arrangement that helps see privacy as not being a design problem. The market for fixed-wing UAS is dominated by manufacturers who supply to both military and non-military customers. Interviewees D2 and D4 stated that they sell their systems only to users who are certified to comply with laws and do not abuse the technology. One interviewee from this group (D4) stated that his company sells exactly the same fixed-wing systems to the military and law enforcement agencies, be it with differently configured payloads. This means that non-military governmental customers in some respects have similar technical possibilities as do military customers. As the market supply of civilian fixed-wing UAS is not very high compared to the military market, purchase options outside military-oriented suppliers are limited. This means that for potential civilian users, a tendency exists towards the purchasing of technologies that have been developed in a context in which privacy was not a primary consideration. Also, D4 argues that military parties are hegemonic in the development of drones. As a consequence, privacy is not likely to be a feature in the 'drone catalogue'. Even if non-military governmental customers have other requirements, it is difficult for them to find alternatives (Rodrigues, 2015).

These institutional and discursive forms of externalization consistently render privacy a retro-fitting problem, to be resolved once the functional design of the UAS is more or less completed. This is where the paradox, that possibilities for implementing privacy in a technological way are both confirmed and denied, becomes even more pressing. Indeed, with *Privacy by Design* in mind, it should be expected that such retrofitting will at best deliver sub-optimal solutions (Cavoukian, 2009).

Remarkably, the interviews do not provide any evidence that the persons involved in the development of UAS think of security as a value that is to be implemented in merely technological terms. Much like the general trend in the story lines mobilized when discussing privacy, security is also not seen as something particularly linked to technology, but rather as something that is the result of a practice in which some technologies happen to be deployed. Both the engineers and the users interviewed agreed that security is something that emerges as a result of how technologies are

used, not as an unmediated consequence of those technologies. Developer D2, for example, mentions that UAS technology *'alone cannot contribute to public security'* but rather adds to an already existing set of tools of governmental users. This view is consistent with the other engineering interviewees who claimed that they provide a tool that is then deployed by someone else. This view was epitomized in one interview, when developer D4, who is only supplying to governmental customers, explicitly rejected the view of UAS as being a security technology. Rather, he described it as platform systems: *'It depends on what you do with this platform, how you equip this platform, which payload will be mounted, and above all, how the [information generated by the] payload will be used in the ground station'* with security being only one of many use cases.

This is again the intricate balance between technological instrumentalism and radical social constructivism: neither technologies nor socio-cultural arrangements determine what privacy and security are, but rather how the technology operates in its proper context. It is vital to recognize here that this shape of the discourse silences contestation of hegemonic perspectives. In particular, it silences privacy issues, and it leaves perspectives on security uncontested. In this very particular arrangement, a strong parallel is reflected with the military deployment of drones, and their appearance as security devices. While the latter may not be the cause of the former, it is worth pointing out that the *de facto* structure of the discourse on civilian UAS is favourable towards patterns already existing around military UAS.

Thus far, we have mainly considered how privacy is thought to be something existing outside the technological design space. Another question is whether or not privacy and security can be realized at the same time. The literature has widely disproved the idea that privacy and security must be mutually exclusive values (Solove, 2008, 2011; van Lieshout et al., 2013; Valkenburg, 2015). Yet, in the discourse coalition of UAS producers and users it seems as if these values cannot be served at the same time: it takes the function of security as the main driver for the development of drones, while putting privacy 'on hold' for a later phase of development.

The idea that privacy is not a moral obligation for designers and producers to implement into their UASs, is of course closely related to what they think privacy is. All five engineers (D1–D5) and the researcher (R1) interviewed reproduce a legalistic understanding of privacy in the context of UAS development, namely that *'what is meant here by privacy is enshrined in law'* (D3). It became clear that this view hinges heavily on the principle of informational self-determination and on existing data protection laws. When talking about privacy, most interviewees did not distinguish between the protection of personal data and the protection of privacy and the private sphere in a wider sense. Thus, the ontology predominantly maintained in practice constitutes a relatively narrow definition of privacy. This results in a low likelihood for privacy to become an integral part of the design process.

This is again a salient similarity between the military discourse and the *de facto* discourse on civilian UAS. In war and combat situations, military operations are a matter of life and death. The life of a soldier is valued highly, even when national security is at stake. This means that even if national security ultimately outweighs the soldier's security, the two are at least commensurate in the sense that it is considered that both should be considered and weighed against each other. To deliver these two forms of

security, the highest possible quality of data is needed, without any limitations, or so it is argued in the military discourses that we observed in multiple interviews. In such situations, privacy is not much of a concern, and certainly ranks below national security and soldier life. Thus, if indeed a military perspective is assumed, it is at least understandable that privacy becomes excluded from the discourse, and by consequence fails to become part of technical requirements for military UAS.

Interviewee D5, who is working for the governmental as well as for the commercial market, reported that his company's business model is not just to sell UAS, but also to offer services based on unmanned aviation, e.g. monitoring of critical infrastructure such as gas pipelines. In this case an interesting situation emerges: the manufacturer is also the user who has to comply with all regulations. Consequently, this interviewee has a general interest in technological designs that implement and guarantee privacy and, at the same time, fulfil the desired mission. These thoughts confirm that privacy could indeed become part of the technical problem description through the shifting and merging roles of manufacturers and users. Hitherto, though, while this opens the door for *Privacy by Design* and similar approaches, the emphasis is yet on operational and post-design solutions, not on the implementation of privacy in the technological design at an early phase.

The interviewed users' and potential users' understanding of privacy concurs with the engineers' understanding of privacy as a post-design issue. An important difference was, though, that the users additionally reflected on the socio-political consequences of UAS deployment and even had personal concerns and fears regarding privacy. This aspect did not come up in interviews with engineers. Oddly enough, only interviewee U1 gave a thought to technical mechanisms to ensure compliance with legal requirements regarding data protection and privacy.

Conclusion

It followed from the interviews that the problem of privacy was largely assigned to users, not to designers. However, as existing discourses show, quite some potential exists for privacy to be pursued in the (arguably technical) design phase, rather than *post-hoc* in the form of regulation. There is no natural or self-evident reason why this potential could not be realized, and in fact interviewees often acknowledged this potential as realistic. We have tried to explain the 'unrealisation' of this potential by reference to the capability of military discourses to travel with the very technologies in question.

Part of the answer, as we argued above, might be in the military history that preceded the current state of affairs in unmanned flying. Privacy simply is not an important concern in military operations. Also, since, even today, the military is still an important client of UAS vendors, it is to some degree understandable that incentives are missing to pay more attention to privacy in the development of UAS. However, this explanation is far from complete: as unmanned flying is currently developing rapidly, especially in the civilian sector, it could be equally self-evident that there is economic potential in creating marketable products that offer innovative solutions to privacy concerns.

It is for this reason that additional research might reveal further reasons why this seemingly military discourse is so attractive outside the military sphere. While it long has been suggested that it is not naturally given for technological design practices to realise other values than

efficiency (Feenberg, 2002), it is also fair to say that considerable attention has been paid to examples of technologies where other human values are yet inscribed, not least the *Privacy By Design* framework mentioned earlier (Cavoukian, 2009). More detailed study of the histories and contexts of involved people might reveal why privacy has yet not become part of their practice. It might have been missing in their education, it might be that tacit parts of the corporate structures they work in are particularly geared against such considerations, it might be that spheres in which procurement takes place are unfavourable to such offers, or other.

Yet, despite the fact that we at least have to be open to such alternative explanations that are neither confirmed nor disproved by our empirical analysis, we can conclude first, that a particular distribution of responsibility is apparently *reproduced* in the practices of UAS development. This reproduction takes both material and discursive shapes. The discursive part has been explained above: as is clearly witnessed in the interviews, people keep *talking* about UAS in the particular frame that renders privacy a non-issue – or at least as a non-issue for technical design. The material part is the fact that change is always costly in the short term: it is not surprising that the cheapest option is simply to recycle military designs (the so called 'lock-in effect'). It is also in the fact that once these UAS are there, they pre-structure how people tend to talk and think about them. Some options are more within reach than others, simply because a particular material configuration already exists.

Second, part of the answer to the question of why respect for privacy is not an internal part of the design process may lie in the fact that 'implementing privacy' is never just that. It also involves redesigning notions of safety and security, it involves redesigning how costs and benefits are defined and how they are distributed, and it involves redefining the notion of privacy itself so as to make it apt for informing technological design *in this particular practice*. That is to say: the problem of privacy will have to be *translated* such that it fits the development process of UAS. In this respect, it is important to realize that the technical potential to develop privacy-friendly solutions is not something that sits on a shelf to be picked up, but requires further adjustment and fine-tuning towards the very design of UAS. In consequence, making privacy respecting UAS takes more than simply discussing what privacy could be in this particular context. It also requires discussing how the development process of UAS must itself be revised, and how discourses and institutional structures must be devised that resemble less the military context and discourses that externalize the issue of privacy.

If the argument of this paper cuts ice, any normative program pursuing a more privacy-friendly design for UAS should start not at the level of normative ideas, but at the meta-level of how discourses are arranged. This should include an idea of how this meta-level depends itself on the technologies it discusses and of how technologies and discourses are closely knit together. Only then can the more conceptual avenue, of discussing how privacy can be internalized such that it becomes commercially interesting, be explored and hence made part of the (technical) design specifications. This would include an exploration of ways the design of UAS can be better politicized, rather than defining privacy outside the scope of design requirements, thus emptying the design practice of one particularly controversial issue. Bringing it in will likely generate the friction that is needed to come to creative solutions and connect the radically different

discursive universes of the military and the civilian realms (cf. Tsing, 2005).

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Notes

1 For a recent analysis of the privacy and ethical aspects of UAS surveillance see (Finn & Wright, 2012).

2 In Europe discussions are going on whether small scale UAS should be brought under the umbrella of European Civilian Aircraft Authorities as well; this also deals with the private use of UAS for sport and leisure.

3 Even though it is questionable whether the war on terror is formally a war, we believe this distinction is not relevant to the current argument.

4 Accordingly, small-scale systems mostly have low range, altitude and endurance. Large and mostly fixed-wing UAS having a high range, altitude and endurance are mostly very expensive. For example, the Global Hawk by Northrop Grumman, which is not yet in use for civil applications, costs about $ 222 million without maintenance costs. In addition, interviewee R1 stated that due to personnel and infrastructure costs an unmanned flight is generally more expensive than manned flights, except for systems that can be operated by few persons. See (U.S. Government Accountability Office, 2013: 113)

5 In the context of UAS `dull' means long-endurance missions requiring very long flight times. `Dirty' means missions with a risk of human exposure to nuclear, biological and chemical agent concentrations. `Dangerous' missions are those with a risk of human exposure to air defence and counter-air defences.

6 Ubiquitous computing is the concept to invisibly embed computing and communication hardware in all kinds of object and in the environment with the goal to make computing capabilities available everywhere and anywhere.

7 In Europe, privacy impact assessments are a relatively new instrument and not required by law. As 'data protection impact assessment' a variant is proposed in Art. 33 of the draft General Data Protection Regulation. See (European Commission, 2012)

Sven Braun
Technical University of Darmstadt
64289 Darmstadt, Germany
sb@devbraun.de

Michael Friedewald
Fraunhofer Institute Systems and Innovation Research
Breslauer Strasse 48
76139 Karlsruhe, Germany
michael.friedewald@isi.fraunhofer.de

Govert Valkenburg
Maastricht University
Faculty of Arts and Social Sciences
Maastricht, The Netherlands
g.valkenburg@maastrichtuniversity.nl

Philippe Sormani. Respecifying Lab Ethnography: An Ethnomethodological Study of Experimental Physics. Surrey, England: Ashgate Publishing Limited. 2014. 278 pages.

What could another lab ethnography of physics research teach STS scholars? In his new book, Philippe Sormani takes on a branch of experimental physics known to practitioners as "STM" of "CSC" to showcase what he believes it can teach us. For the uninitiated (like your reviewer), STM refers to Scanning Tunnel Microscopy and CSC refers to Complex Superconducting Materials. One lesson Sormani offers has to do with a critique of an earlier generation of lab studies (i.e. Collins, 1985; Latour & Woolgar, 1979; Pickering, 1984; Pinch, 1986; Traweek 1988). Sormani (2014: xiii) argues that his book "delivers [...] a critique of analogical shortcuts in the 'laboratory studies' tradition". The analogies here are comprised of analytical concepts central to STS, including but not limited to "construction" and "inscription". Sormani treats the use of these concepts as a "shortcut" in order to underscore his argument that earlier lab ethnographies have analyzed lab work with second order concepts rather than the first order concepts (Schutz, 1973) that lab members themselves use to organize lab life. In the case of STM of CSC, physicists use the first-order terms "measurement", "tip-sample approach", and "local spectroscopy". In a fascinating discussion, Sormani also describes in great detail how he learned these member relevancies. He does this by adopting Wieder's (1974) policy of doing ethnography and treating what members do with the ethnography and ethnographer as opportunities to learn about the setting and its members. This opens the door to additional and related problems, Sormani argues, when analysts assume from the outset that a fact is "constructed" rather than beginning with the practical challenge and research question "how do lab members recognize facts?". For decades, ethnomethodologists and ethnomethodologically-informed sociologists have urged scholars to examine members' common sense knowledge of social structures. Building on these efforts to reinvigorate sociology, Sormani has encountered a paradox. Sormani argues that he contributes to STS discourse by analyzing members' common sense knowledge instead of importing the concepts popular in STS. But in order to do this, he has to use and analyze concepts that are probably unfamiliar and/or unimportant to the anthropologists and sociologists who maintain an interest in lab studies. Thus, emphasizing member relevancies poses the risk of estranging the scholars whose work it challenges and who are in a position to describe and circulate its contributions to STS discourse. As a sociologist informed by some ethnomethodological ideas, I am very sympathetic to this trapped position stuck between a rock and a hard place. While the focus on member relevancies can pose this challenge, Sormani's writing posed few challenges for this reviewer. When he does develop second order concepts, his choices seemed reasonable to me. For example, he describes his book as offering a "practice-based video analysis", a video analysis that

incorporates the practices of the analyst into the analysis.

Sormani's second argument is related to, but also distinct from the first one. Sormani provides a critique of video analysis in ethnomethodological inquiry. Surveying ethnomethodological studies generally (and not just ethnomethodologically-informed STS research), Sormani argues that the ways they deploy video analysis tend to ignore or discount the analysts practical experiences with the activity documented in the video or the work of producing video documentation of the activity. To address this, Sormani includes descriptions of his practical experiences struggling through the work of microscopic experimentation alongside screenshots from videos he has made.

The old relationship between talk and action rears its head here. While Sormani stakes out his contribution in terms of displaying the member relevancies as talk, he doesn't make the analytic mistake of reducing member relevancies to talk. Instead, lab work is both symbolic and material, tacit and manifest. Lab work is symbolic because it is recognized and done, in part, through lab members' and ethnographers' talk. It is material in the sense that it is only done through a set of material practices, practices of the body and practices that operate on material things. It is also tacit because as Sormani and Lynch (1984) found, lab members rely on background knowledge to make sense of talk, and this background knowledge is typically unspoken and difficult for users to describe. Lab work is also manifest because although lab members do not talk about their background knowledge, they do swap short stretches of talk as they go about doing lab work. Although the relationship between talk and action is an old concern of sociology, Sormani's approach offers a new vantage point on this old problem. For STS, there are some neglected resources. Inspired by Lynch's (1985) discussion of "incipient talk", or talk that is interrupted with longer silences and that does not require repair sequences like other spates of talk because members are engaged in silent activities, Sormani describes some speech norms on the shop floor. For example, lab members do not expect others to ask them questions as they are working. Members common sense knowledge of language, then, could be a useful means for STS scholars to examine technoscience settings where scientists and engineers do not appear to be "compulsive talkers" (Amann & Knorr-Cetina, 1989).

While Sormani's book features a number of strengths, it also leaves an important unanswered question. The question concerns what lab members do with writings. While lab members may refer to a number of different kinds of writings such as scholarly writings, textbooks, popular writings, and their own writings, Sormani only refers to lab members' dissertations, a textbook he uses to learn lab work, and very briefly, a published article recounting a discovery. The dissertations are referred to in a discussion of discovery and the ethnographer, and the published article is described within a discussion of discovery. But there are few other references to writings, and so we are left wondering why? Sormani does not offer an account for this. As a reader and reviewer I expected complex, multivariable equations like the "model equation" which outlines the ideal workings of the lab's research to be encountered and explained with recourse to a scholarly article and/or textbook.

Setting this unanswered question aside, there is a lot to like about this book. Unlike the challenging writing choices of earlier ethnomethodologists, Sormani has produced a well-written book. It is thoughtful, carefully reasoned, and very well organized in terms of sections and ongoing

"conclusions" detailing what he makes of what he has found. Based on Sormani's arguments, STS scholars interested in lab studies, ethnography, ethnomethodology, visual methods, and the relations between talk, science, and technology should read this book.

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Matthew J. Cousineau
Department of Sociology, Anthropology, & Social Work
7022 Haley Center
Auburn University
Auburn, AL. 36830
MJC0035@auburn.edu

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