"Pollution Pods" by Michael Pinsky | Photo: Michael Pinsky

NORDIC JOURNAL
of Science and Technology Studies

Volume 5, issue 1

EDITORIAL

Unsung Heroes and Multiple Practices

by Tomas Moe Skjølsvold

A few weeks ago, the city of Trondheim hosted the Starmus festival, an event celebrating science, the universe, life and rock music. The festival gathered an impressive collection of older white males, in the form of esteemed scientists, Nobel laureates and astronauts, with the goal of celebrating the "true heroes" of enlightened knowledge and exploration. Starmus was draped in rhetoric about brilliance, genius, excellence and courage, cultivating metaphors where scientists emerged as athlete-rockstar-superheroes faced with the messianic challenge of educating the ignorant masses of lay-people through the gospel of capital "S" science in singular form. Stephen Hawking was the festival headliner, but could not attend due to health issues. Nevertheless, the moment of peak-festival for many was when Mr. Hawking over video-link declared that humanity has no more than 100 years left before we need to evacuate the planet and colonize another world to survive.

Commercially and in terms of publicity, the festival was a booming success. Parts of the program was broadcast on Norwegian television. The Norwegian royal family were in the audience. The festival sold many tickets. Despite scattered criticism, mainly concerning gender issues, price, and the absence of social science and humanities perspectives, the national and international media coverage was positive. At some point, the bi-annual festival deserves full-on empirical or theoretical STS-scrutiny (NJSTS would love to publish that, so consider this an open invitation). This, however, is not the time or place.

Instead, I want to address how the festival actualizes a distinction between an STS-gaze at the scientific process, and the way science tends to be framed by the media, by science funders, politicians, university management, and sometimes by scientists themselves. The latter kind of accounts portrays science as a fact-producing machine, as a unified force against medieval ignorance and a guiding star for modern societies. Science supposedly knows all, sees all, and is free of values, history, culture, politics, drama and all the things that otherwise plague our societies. Thus, it can also produce "objective" policy advice, of which I suppose Hawking's conclusion that we should "evacuate the planet!" is meant to be an example.

As STS scholars, we have heard such stories in the past, and we have read countless studies with different narratives about the production of scientific knowledge. From such accounts, STS scholars learn that knowledge-production takes place in, and is shaped by specific historical and cultural contexts. That it involves a range of specific skills and methods, that it is fraught with controversy. From Donna Haraway STS have learned that what she calls the "God-view", seeing everything from nowhere, is just a trick. Every scientist is situated in a social setting, a geographical space, a historical time, a cultural milieu. Every scientist has a work process, which is also situated. Every work process involves tools, skills, thoughts, all of which are all distinctly parts of place, time, and culture. STS knows that humans write scientific articles, and that the position from which these humans write their articles, is not trivial.

There are many things to be said about all of this, but in light of the current issue of NJSTS, some things deserve specific mention. The first is the ability of STS to highlight the distributed character of techno-scientific practices. Brilliant minds do not move the world on their own; they depend on un-sung heroes like technicians, assistants, curators, peers, publishers, editors. In many disciplines, they also rely on the many animals who populate laboratories, trials and experiments. In this issue, Ane Møller Gabrielsen illustrate how important animals are, by highlighting the centrality of creatures like rats, dogs and dolphins to the history and development of seemingly human-centered disciplines like psychology. Gabrielsen studies dog training, but deals with more than dog-human interaction.

Animals shape knowledge about the human, but the influence is not unidirectional. The discipline of psychology, as interpreted, translated and advanced by different practices and technologies of dog training, changes what Gabrielsen calls the very dogness of dogs, in other words, what dogs are and how they respond to practices and technologies of dog training. Science, animals, and humans then, become together.

Dog training in Gabrielsen's study is a set of technologies, but also a practice. The notion of practice is also a key to Roger Søraa, Lina Ingeborgrud, Ivana Suboticki and Gisle Solbu's article in this issue. The authors address a practice intimately familiar to those who work in academia: writing. Writing is a skill required to be a scholar, but we do not necessarily reflect enough on how this skill is acquired. Thinking about this as knowledge transfer from teacher to student is obviously too reductionist, and the authors discuss how the skill can be cultivated collectively in a group of peers. Here, writing becomes one element in a more collectively assembled skill-set, which includes reading, commenting and discussing academic output.

The third article in this issue deals with energy. Torgeir Kolstø Haavik, Jens Olgard Røyrvik and Catharina Lindheim highlights how the seemingly technical task of producing a new energy central and rendering it functional, is just as much a matter of power, trust

and social relations, as it is a matter of nuts and bolts. Thus, they stress how technology and politics are intertwined, as well as how making "it" work is a distributed, social accomplishment.

"Science" is not one thing; it is a whole multitude of practices, technologies and collectives enacted in so many different sites that reducing it to a singular idea will likely do "it" more harm than good. Research is clearly important, and its role in society should not be underestimated. However, we also need a realistic understanding of the role of science in society, rooted in what actually goes on in universities and research institutions. If nothing else, events like Starmus serves to highlight the continued need to probe the practices of science from an STS perspective, to elevate the status of the countless multi-species unsung heroes of everyday research, and the multiple practices that constitutes the process of producing scientific facts.

TRAINING TECHNOLOGIES

Science, Humans and Dogs in the Age of Positive Dog Training

by Ane Møller Gabrielsen

The practices of dog training influence the lives of numerous dogs and dog owners, but have not received much academic attention in terms of empirical studies. Both humans and dogs are shaped through these practices, but as the conditions are partly determined by already established networks, it is not simply a matter of the trainer's personal choice. In order to explore the entanglements of technology, gender, humans, and dogs in dog training practices, this article applies a material semiotic perspective inspired by John Law and Donna Haraway. Taking the changes towards "positive training" and the technology of clicker training as its point of departure, the article explores the emergence and effects of different training practices and the networks that provide their conditions.

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Introduction

How should one train a dog? The different answers to this question tend to cause heated debate, possibly because dog training practices are by no means constricted to teaching specific behaviors at a training class. Dog training also aims at ensuring that a dog responds to a person's wishes and obeys commands in everyday life. In this way, decisions relating to how one should train a dog and how one should respond when a dog fails to follow orders form the basis of the dog–human relationship. As there is an estimated 500,000 dogs in Norway, alone (Norsk Kennel Klub 2012b), dog training practices impact the lives of a considerable percentage of the Norwegian population. Still, hardly anything is known about dog owners, their practices, or their dogs. This lacuna is not unique to Norway; dogs in general – and dog training in particular – have received little attention within academia and practically none within science and technology studies. The latter gap is particularly striking, as science and technology play important roles in dog training practices.

Historically, dog training has often implied a certain degree of force and punishment. But since the 1990s, European and American dog training has turned towards reward-based practices that are often referred to under the umbrella term "positive training" (Fisher 2009[r]; Hiby et al. 2004[r]; Irvine 2008[r]). As the American behaviorist Karen Pryor writes in her book, Reaching the Animal Mind (2009[r])[1]:

> Now we have a new way of dealing with animals. Out of real science we've developed a training technology. Like any good technology it's a system that anyone can use. The basics are easy to learn. It works with all animals (and that includes people). It's fast. What used to take months, the traditional way, can now happen in minutes. It's completely benign; punishment and force are never part of the learning system. And it produces real communication between two species. (Pryor 2009[r], 2)

Pryor is known as the woman behind "clicker training" – a popular and widely used form of non-violent, or "non-aversive," dog training. The above quote, in which Pryor claims that dog training is a technology, serves as the point of departure for this article. The combination of the terms "dog training" and "technology" may bring to mind electric shock collars and similar devices; but if technology is defined as "the organization of knowledge, people, and things to accomplish specific practical goals" (Edelbach et al. 1999[r], xi), then dog training technologies must also include assemblages of tools,

techniques, and knowledge that are applied through practice in order to make dogs behave in a desired manner.

Further, Pryor states that new dog training technology is based on "real science"; that is, the behaviorist learning psychology that was developed by Burrhus Frederic (B. F.) Skinner in the 1930s. The route of Skinner's experimental science from the laboratory to modern-day Norwegian dog training practices will be the main focus of the first part of this article. What events took place in order for this to happen? What new relations needed to be established?

Finally, Pryor asserts that the new training technology can also be applied to humans. In other words, clicker training does not seem to presuppose a fundamental difference between humans and other animals. However, differences within humans are emerging. As I have argued elsewhere, there is an assumed gender divide in the choice of training methods (Gabrielsen 2016[r]). The idea that something uniquely feminine leads women to choose "positive" training methods, such as clicker training, is compelling. However, instead of arguing that women are more likely to choose methods that do not involve pain and punishment due to their soft and feminine nature, I will explore the way in which gender has become part of the training network and is produced and performed through training technologies.

In other words, this article will focus on the entanglements of science, technology, humans, and dogs in dog training practices. How have different dog training practices come about and how have these various methods enabled the enactment of particular dogs and humans? The article is based on my PhD thesis, Makt og mening i hundeholdets konfliktsoner ("Power and Meaning in Conflicted Zones of Dog Keeping") (Gabrielsen 2015[r]), in which I explore different dog training practices and their effects in a Norwegian context. The material consists of Norwegian dog training literature, online texts from dog training websites, and interviews with dog owners and dog trainers. All of the quotes from this material have been translated into English from Norwegian. In the first part, "Translating Behaviorism," I will focus on the science of behaviorism and the construction of a new Norwegian dog training network. In the second section, "Training Technologies as Performative Practices," I will pay closer attention to the humans and dogs that emerge from specific training technologies.

A Material Semiotic Approach

Animals are no strangers to science and technology studies (STS), and especially not to actor-network theory (ANT), due to its notion of symmetry and its inclusion of non-human actors (Law 2009[r]). One famous example of the inclusion of animals in this field is

Michel Callon's classic text about the domestication of scallops in St. Brieuc Bay (1986[r]), wherein the symmetrical approach includes the scallops as actors, along with the fishermen and scientists. More recent works in ANT have abandoned the rather narrow

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1 Translated into Norwegian and published by Canis publishing in 2012.

focus on the construction of networks in favor of a more performative material semiotic approach, wherein entities are given form and meaning through enactment:

> Active entities are relationally linked with one another in webs. They make a difference to each other: they make each other be. Linguistic semiotics teaches that words give each other meaning. Material semiotics extends this insight beyond the linguistic and claims that entities give each other being: that they enact each other. (Law et al. 2008[r], 58)

In the material semiotic practice approach of the sociologist and STS scholar John Law, animals are understood as the effects of practices (i.e., heterogeneous patterned sets of relations extending beyond the site) (e.g., Law et al. 2012[r]; Law et al. 2011[r]; Law et al. 2008[r]). As Law and Mara Miele state in their chapter "Animal Architextures": "[A]nimals are an effect of different, complex, and uncertainly related logics of materially heterogeneous practice. That is what an animal is in a performative theory of practice, nothing more and nothing less" (Law et al. 2011[r], 59). Through these patterned sets of relations, the characteristics of both animals and humans emerge:

> Animals are not in and of themselves furry, scaly, elusive, prone to sickness, endowed with a life-cycle, loyalty, and all the rest. They develop attributes such as these in relation to people who are also, and at the same time, being given form and endowed with relational qualities and attributes. In short, practices enact people and animals together. (Law et al. 2012[r], 335)

It seems uncontroversial to claim that dogs are the effects of diverse and materially heterogeneous practices. For instance, the notion of "pure-breeding" hinges on a complex system of practices that includes dog showing, breeding, registering, microchipping, blood sampling, and so on. The effects of these practices are "purebred" dogs of various types. These dogs are modelled after breed standards that depict an imaginary ideal, but emerge as living, breathing beings. However, according to material semiotic practice theory, these living dogs are also enacted through practice – for instance, the practice of dog training. And it is quite obvious that this practice also does something: through the practice of training, a dog learns how to interact with its surroundings in ways that humans find adequate.

Both humans and dogs come into being through practice, but the conditions for what and whom are allowed to become are partly determined by established networks, and are not simply a matter of the trainer's personal choice. As feminist STS scholar Karen Barad notes, "[p]erhaps intentionality might better be understood as attributable to a complex network of human and nonhuman agents, including historically specific sets of material conditions that exceed the traditional notion of the individual" (Barad 2007[r], 23). In order to map the networks that constitute the conditions for contemporary dog training practices, I will turn to the origin of material semiotics: actor-network theory. Inspired by the aforementioned text by Callon, I will describe the formation of a new dog training network using the notion of "translation": "all the negotiations, intrigues, calculations, acts of persuasion and violence, thanks to which an actor or a force takes, or causes to be conferred on itself, authority to speak or act on behalf of another actor or force" (Callon et al. 1981[r], 279). Callon divides these processes into four phases, or moments: "problematization," "interessement," "enrollment," and "mobilization." Through these phases, actors assemble networks by establishing themselves as indispensable, defining other actors, and speaking on behalf of these actors (Callon 1986[r]). By examining the formation of new relations between elements – including dog owners, science, and dogs – I will explore the conditions for the current enactment of dogs and humans through dog training practices.

Law's approach to material semiotics does not distinguish between living beings and inanimate objects. However, it is usually the human subjects who ultimately define the terms for meaning-making, and the embodied consequences for both human and non-human actors are seldom given much consideration. In order to enrich my material semiotic analyses, I will apply the feminist philosopher of science Donna Haraway's concept of "becoming with" from her book When Species Meet (2008[r]), as it captures the lived stakes of practices involving living beings: "If we appreciate the foolishness of human exceptionalism, then we know that becoming is always becoming with – in a contact zone where the outcome, where who is in the world, is at stake" (Haraway 2008[r], 244, emphasis in the original). Further, "becoming with" also takes the embodied materiality of enactment into account: "Partners do not pre-exist their relating; the partners are precisely what come out of the inter- and intra-relating of fleshly, significant, material-semiotic being" (Haraway 2008[r], 165).

Translating Behaviorism

Clicker training is often presented as a scientific training method, with terms such as "operant conditioning," "conditioned reinforcer," "reinforcement frequency," and "stimulus control," frequently used in the literature (e.g., Egtvedt et al. 2006[r]). The scientific origin of this training method is behaviorist learning psychology, which emerged at the beginning of the twentieth century as an attempt to position psychology as a "purely objective experimental branch of natural science" (Watson 1913[r], 158). According to its founder, John B. Watson, psychology should only concern itself with two things: predicting a response to a given stimulus and identifying the stimuli that has caused a certain response (Teigen 2015[r]). However, in the 1930s, Skinner claimed that organisms do not simply passively react to external stimuli. On the contrary, behavior often aims at achieving certain effects: organisms actively

operate on their environment in order to receive certain stimuli and to avoid others. Behaviors that lead to pleasant consequences are more likely to be repeated, and Skinner termed stimuli that increase the frequency of a behavior "positive reinforcers" (Skinner 1938[r]).

Skinner was primarily interested in the potential application of behavioral psychology to human behavior, and believed that the principles he discovered were universal (Skinner 1963[r]). However, his findings were generally derived from rat experiments, which occurred in purpose-built "Skinner boxes" in the laboratory. These experiments did not involve direct human–animal interaction, but when Skinner and some of his students were involved in training pigeons to lead missiles during World War II, they discovered that they were able to shape new and complex behaviors using a "conditioned reinforcer" (Skinner 1958[r]). The principle behind the conditioned reinforcer originates in the Russian physiologist Ivan Pavlov's famous experiments, in which he caused dogs to salivate by connecting seemingly neutral stimuli (a ringing bell) with food. This process was labelled "classical conditioning" (Teigen 2015[r]). By associating a certain signal with food and using this signal to mark behaviors that resembled the desired ones, Skinner and his students managed to train pigeons to perform complex behaviors such as playing ping-pong with each other (Skinner 1958[r]).

Skinner described dog training using a conditioned reinforcer in his 1951 article, "How to Teach Animals" (Skinner 1951[r]). Still, it was another science of behavior that would influence dog training. In the 1950s, the American behaviorists were challenged. While the behaviorist psychologists had been experimenting on animals in laboratories, European zoologists had been studying animal behavior in nature. In 1935, the Austrian zoologist Konrad Lorenz published his famous work on instinctive behavior in geese, and for this reason, 1935 has since been regarded as the year in which the science of "ethology" was born. According to the ethologists, ethology – and not behaviorism – was the real biological science of behavior (Burkhardt 2005[r]). The European ethologists claimed that true knowledge of animal behavior could never be obtained from experiments with a couple of species in the laboratory (Tinbergen 1963[r]), and they worked hard to distance themselves from what they condescendingly termed the "rat psychologists" (Burkhardt 2005[r]). Their efforts were successful; by the beginning of the 1960s, behaviorism was more or less forgotten, while Lorenz received the Nobel Prize in 1973.

Dog Training as Applied Science

Ethology soon made its way into dog training; the first book on dog behavior for a general audience is said to have been Lorenz's Man Meets Dog (Lorenz 2002[1949][r]). In this book, Lorenz claimed that the special bond between humans and dogs was the same as between a wolf and the pack leader, and explained how an owner could punish a dog the natural way by shaking it by the neck (Lorenz 2002[r]). Lorenz's ideas about dogs and wolves were further developed by his student, Eberhard Trumler, and were frequently reproduced in popular books on dog training. In Norway, these ideas remained present in much of the literature on dog training published between 1970 and 2000 (e.g., Nordenstam 1979[r]; Steen et al. 1987[r]; Trumler 1975[r]). In this literature, the human family was presented as the equivalent of the wolf pack and the owner was guided to assume the position of pack leader in the eyes of the dog. In other words, the owner was to become a dog – or rather, to become a wolf. As Johan B. Steen and Erik Wilsson wrote in their dog training manual: "The more 'wolflike' we are able to act, the greater possibility of achieving calm and harmonious dogs that cooperate with us and are obedient because they view us as the most competent" (Steen et al. 1987[r], 24). The best way to achieve this, they continued, was to display power in the shape of pain and punishment: "Some dogs need to be really shaken before they are willing to accept that they have lower status than the trainer" (Steen et al. 1987[r], 131). The correction and punishment used in these training practices thus served a double function: correcting unwanted behavior and reinforcing the owner's leadership by using language dogs were thought to instinctively understand – aggression, force, and dominance.

Although this type of dog training has been categorized as brutal and baseless by its opponents, it is grounded in the scientific knowledge of animal behavior generated by the twentieth century ethologists. In contrast to the behavioral psychologists at this time, the ethologists were concerned with innate instincts. Lorenz, in particular, highlighted aggression as a necessary instinct for survival (Lorenz 1966[r]). The social organization of animals was understood in terms of aggression and dominance hierarchies, and although these assumptions have since been debunked and revised (e.g., Mech 1999[r]), they represented the dominant scientific views of the time. Thus, ethology-based dog training techniques, with their references to wolves, dominance, and leadership, were attempts at training dogs according to the ethological view of nature. Although the principles of positive reinforcement were known, they were only considered adequate for teaching new behaviors. When obedience was the issue, only the proper display of leadership was thought to suffice (e.g., Nordenstam 1979[r]; Steen et al. 1987[r]).

In 1993, the domestic dog was reclassified as a separate species (Canis familiaris) from a subspecies of wolf (Canis lupus familiaris) (Wilson et al. 1993[r]). Dogs were thus scientifically recognized as wolves. One might assume that this reclassification would have supported existing training practices. However, around this time, Skinner's non-aversive reinforcement principles resurfaced in the dog training discourse. In other words, while biology reclassified dogs as wolves, wolves started to disappear from dog training.

In *When Species Meet* (2008[r]), Donna Haraway lists Karen Pryor as the most important single person for spreading "positive" (i.e., non-aversive) training methods to both amateur and professional dog training communities (Haraway 2008[r]). In the beginning of the 1960s, Pryor and her husband founded an oceanarium in Hawaii, where she was responsible for training dolphins. For this task, she received a training manual based on Skinner's principles of operant conditioning, and she managed to teach the dolphins to perform advanced and complex behaviors on command (Pryor 2009[r]). In 1984, Pryor tried to advocate the Skinnerian principles of positive reinforcement to the public through her book *Don't Shoot the Dog*. While the book was not about dog training, the title attracted the interest of dog owners and Pryor discovered a potential market. In the 1990s, she and a dog trainer collaborated to give classes and lectures using a "cricket" – a toy that made a metallic "click" when pressed. Soon thereafter, they produced their own "clickers" for dog training, and clicker training was born (Pryor 2002[r]).

Assembling a Positive Network

In 1998, Norwegian dog trainers Cecilie Køste and Morten Egtvedt founded the company Canis and launched a new dog training magazine of the same name (Køste et al. 2001[r]). In 2001, they published a book, *Klikkertrening for din hund* ("Clicker Training for Your Dog"), based on Pryor's principles, and in 2002, they published their own Norwegian translation of Pryor's Don't Shoot the Dog (Pryor 2002[r]). These events marked the beginning of a new era in Norwegian dog training. According to the ethnologist Bjarne Sverkeli, one of the rare scholars who has written about Norwegian dog training practices, the Norwegian dog training landscape of the 1990s was characterized by a division between "soft" and "hard" schools (Sverkeli 1998[r]). These schools differed in regards to level of force, but agreed on the importance of leadership and "natural" wolf behavior (Sverkeli 1998[r]). Still, Køste and Egtvedt were able to establish Canis as an important and powerful actor by forging new relations between people, technology, and dogs.

The process of translation requires actors to make themselves indispensable, define other actors, and speak on behalf of these actors (Callon 1986[r]). Canis proved to be skilled in all three tasks. In 2003, the company launched an instructor training program, and by 2014, approximately eighty Canis instructors were running franchise branches of the Canis dog school in Nordic countries (Canis. no 2014[r]). A professional Canis clicker training network was thus stabilized through formal agreements and financial transactions. However, Canis soon managed to create an even larger alliance by establishing a structure for dissemination that was also available to other actors. Through Canis Magazine, Canis publishing, and Canis.no, the company managed to enroll and mobilize dog training actors who opposed the brutal – but popular – methods of the "hard" school.

Canis Magazine aimed at being the leading dog magazine in the Nordic countries, and it featured articles written by academics and professionals (Køste et al. 2001[r], 121). However, the biggest advantage of Canis was its dominance in another medium. Karen Pryor once commented that the rapid spread of clicker training in the 1990s was due in large part to the Internet (Pryor 2002[r]), and Canis.no would go on to become the largest Norwegian website for dog owners. On the website, Canis marketed its training classes, its books, and its magazine, but it also provided free articles about dog training and behavior, an expert panel that answered users' questions, and an online discussion forum.

The most important part of the translation process was that Canis managed to enroll and mobilize dog owners. On the Canis. no web forum, a large number of "regular" dog owners managed, discussed, and disseminated knowledge about dogs, behavior, and dog training. According to online statistics, Canis.no was by far the most popular dog website in Norway in 2014, with more than 150,000 visitors and 800,000 page views per month[2]. Canis also practiced what it preached: when users registered an online account, they would receive small rewards in the mail – usually clickers with the Canis logo. Further, taking part in discussions was rewarded with clickers or gift certificates for the Canis online shop. In other words, active participation was rewarded and reinforced, and knowledge was spread in the name of Canis through web and clicker technology.

Through the network, Canis not only came to represent clicker training and behaviorism, but it also became a node for all kinds of non-aversive practices under the umbrella term "positive training." According to cultural theorist Mieke Bal, meaning is always open for interpretation when concepts travel between fields (Bal 2002[r]). When "positive reinforcement" traveled from psychology to dog training and became "positive training," it gained normative value. Skinner used the term "positive" simply to denote that something was added to the situation; but when "positive" is used in dog training, it denotes something desirable. From signifying the presence of rewarding stimuli, "positive" thus became a measure of a lack of "aversives," and this was again presented as a positive thing for both dogs and owners. In this way, ethics and animal welfare became part of the positive training discourse. While Egtvedt and Køste pointed out that the use of aversives (i.e., pain and punishment) came with a range of undesirable side effects (e.g., fear, stress, and aggression), their main reason for avoiding them was their belief that aversives lessen the effect of rewards (Køste et al. 2001[r]). In other words, they avoided aversives because they felt aversives

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2 urlmetrics.no 15.03.2014.

were ineffective, not unethical: "Ethics is something you should keep in the back of your mind when choosing how to train their dog. But just as important is what is effective. We do not practice clicker training in order to be kind to dogs, we do it because it is effective" (Egtvedt et al. 2006[r], 28). Still, Egtvedt and Køste managed to align their interests with and speak on behalf of a range of actors who

advocated non-aversive dog training due to ethical reasons, thus merging ethics and behaviorism. Although Canis founder Egtvedt explicitly stated that he was opposed to several of the "ethical" practices that were described as "positive" (Egtvedt 2006[r]), Canis came to represent practices associated with animal ethics, and was thus also able to speak on behalf of dogs.

Producing Difference

In the process of translation, Canis soon managed to establish itself as the obligatory passage point (Callon 1986[r]) – that is, "the position that defines and manages what is perceived as true knowledge about the field, and that becomes the translator of and for all the other actors in the network of relations that is built" (Johnsen 2004[r], my translation). The field in question was not simply clicker training or dog training, but the entire domain of dog behavior. Although clicker training was presented as a generic training method that was not species specific, Canis.no published several online articles presenting new scientific knowledge about dogs and wolves. The main message of these articles was that dogs were not wolves, wolves were not the brutal savages we once thought they were, and, finally, humans were neither dogs nor wolves and should not try to behave as either (Gabrielsen 2015[r]). Thus, the image of dogs changed from wild wolves to domesticated and peaceful beings, and the foundations of the traditional training practices were effectively undermined.

While the image of dogs was reconstructed through scientific information, the clicker training principles changed the relation between dogs and humans. In the first edition of Klikkertrening for din hund, the authors presented the so-called "training agreement." The first paragraph of this agreement stated: "When the dog gives you what you want, you give the dog what it wants" (Køste et al. 2001[r], 40). In other words, the dog was presented not as a wild animal that must be tamed and forced to submission, but as an active agent in a transaction in which the distinction between animal and human was less important.

While the boundaries between dogs and humans were blurred, new differences emerged. Currently, there is an interesting assumption of a gender divide in relation to dog training practices. As one of my informants explained: "The stereotypes are different; the discipline-oriented dog trainer is a large man with beard and army clothing, while the clicker trainer is a naïve little girl" (Kate, interview). Kate did not think that these stereotypes necessarily corresponded with reality, but others, such as the clicker training instructor Atle, did believe that such a gender difference existed:

> [I]t's amazing how many women are drawn towards "super positive" and reward-based training, and I think that it certainly has something to do with empathy and such, but perhaps it is just as much about physique. It's much easier for me [as a man] to throw a dog around than it is for a little girl. (Atle, interview)

At first glance, there seems to be a glut of women participating in positive dog training. For instance, of the forty clicker training instructors teaching Norwegian dog owners today, only eight are male (Canishundeskole.no 2017[r]). However, upon closer inspection, it turns out that women outnumber men more generally in dog training, at both professional and amateur levels, regardless of the methods used (Gabrielsen 2016[r]). This is an interesting point, as modern dog training practices originated in the military and Norwegian dog training has traditionally been disseminated by men with experience in the army, the police, or hunting.

The increase of women in dog training is connected to a range of factors, including an increased focus on gender equality in Norway and the dog's transition from "man's best friend" to family member (Gabrielsen 2016[r]), and is probably not due to the "softness" of positive training methods. First, there is nothing soft about clicker training; if anything, it can be interpreted as a rather positivist and mechanical practice characterized by strict observation, timing, and self-discipline on the trainer's behalf. As one of my dog trainer informants explained:

> [T]here are people who think they are doing positive training as long as they throw in a "good boy" from time to time, and of course, in a way they are, but at clicker training level, with the number of repetitions, timing, and frequency of treats, it is … [makes the sound of a machine gun] … you know, you are on a totally different planet. (Turid, interview)

Second, the clicker training promoted by Canis was presented as completely gender neutral. Biology, physique, and personality had nothing to do with the result, only competence, patience, and practice. As Egtvedt and Køste wrote:

> Many say that good clicker training is an art. Well, there are some who claim that football is art too. But football, painting, music, and clicker training are first of all a matter of mechanical skills. That means that you do not need any special talents to learn dog training. You do however need to practice! The more you practice to train your dog, the better mechanical skills you will get. (Egtvedt et al. 2006[r], 7)

However, Canis also defined what and who should be excluded from the new training network, such as the former "hard school" and its practices. These practices were categorized as "traditional

training" and presented an uninformed mixture of punishment and reward. When Canis defined and marginalized "traditional" dog training practices, it explicitly distanced itself from the typical "traditional" dog trainer, who in many cases happened to be male. Canis did not marginalize men, per se, but training based on an explicitly masculine discourse of alpha males and pack leaders, which was often advocated and managed by men with a certain type of experience (Gabrielsen 2016[r]). As a result, several "old-school" dog trainers founded the organization Hundefaggruppen in 2009 in order to oppose clicker training and promote "traditional" training practices (Nordenstam 2009[r]). They argued that it was exactly this marginalized experience that was necessary. As dog trainer John Henriksen exclaimed in one of his articles on the Hundefaggruppen website: "Leadership is something that must be taught by someone who knows it. People engaged with dog sledding, working dogs and hunting are especially known for long traditions and great success in this field. This is a practical skill that one cannot learn by reading" (Henriksen 2013[r], 44, emphasis in the original).

According to its website, Hundefaggruppen was founded by "experts within obedience training, hunting dog dressage, working dog dressage, and dog sledding" (Hundefaggruppen.no 2012[r]) – practices that are still associated with men and masculinity. The photos on the website, hfg.no, show (mostly male) dog trainers posing with hunting dogs or packs of sled dogs. While Hundefaggruppen mainly appealed to people with experience in hunting and dog sledding, Egtvedt described the typical "Canis disciple" as "an intelligent dog owner who has read one or more of our books about clicker training, tried it with their own dog and had a revelation regarding the possibilities of training the dog through positive reinforcement and voluntary behavior" (Egtvedt, interview). In other words, Hundefaggruppen targeted people with practical experience in male-dominated areas, while Canis targeted educated people who liked to read about theory. Thus, the two organizations reproduced an existing gender divide in Norwegian higher education, where women have been outnumbering men since 2001 (Aftenposten 2011[r]; Folkehelseinstituttet 2014[r]). In this light, it is understandable that Canis advertisements often featured women succeeding at clicker training while several men watched with disbelief (Canis. no 2015[r]). Hundefaggruppen, on the other hand, often presented clicker trainers as naïve young girls (e.g., Henriksen 2013[r]). However, the assumed gender difference was an effect, and not a cause, of the new network. Canis and Hundefaggruppen reinforced the distinction between the methods by associating them with different discourses and groups of people, thereby both implicitly and explicitly gendering the practices.

Training Technologies as Performative Practices

So far, I have described the way in which Canis entered the Norwegian dog training arena and established a new dog training network by defining both human actors (positive dog trainers, educated owners) and non-human actors (non-wolf dogs), linking some together and marginalizing others (traditional trainers). Today, Canis is no longer a visible part of the Norwegian dog training landscape, but the effects of its previous activity are still present[3]. Canis's slogan was: "We are changing the Norwegian dog community." In many ways, the company succeeded at this mission. Non-aversive training has more or less become the norm in Norway: dogs are no longer simply perceived as wolves in dogs' clothing, humans are not required to become pack leaders, and the previous distinction between "soft" and "hard" training has become one of "positive" versus "traditional."

However, the network of relations not only affects the way in which dogs and owners are presented and perceived, but it also has concrete and material effects. The practices and technologies of dog training and the networks of materiality of meaning they are embedded in can be termed "apparatuses of bodily production" (Barad 2007[r]) – historically situated assemblages that enable certain bodies and behaviors to emerge as relational effects. In the second part of this article, I will take a closer look at the effects of actual training practices. In order to illustrate the differences between traditional training and clicker training, I will use examples from two influential Norwegian dog training books: Geir Nordenstam's NYE Du er sjefen ("NEW You are the Boss"), from 2005[r], and the 2006[r] edition of Egtvedt and Køste's Klikkertrening for din hund.

In order to teach a dog to sit on command, Nordenstam writes that a trainer should pull the leash up and press the dog's hindquarters down while saying the command out loud. Correct behavior should be rewarded with praise, and after some repetitions, the dog should understand the connection between the command and the action. However, in order for the dog to learn, leadership must be in place. According to Nordenstam, it is crucial that the dog perceives the trainer as its "hero" and not as a "sissy" (2005[r], 61). He warns against using treats as rewards, as doing so turns the trainer into a "sissy" and a "feeding machine" in the eyes of the dog. Further, the use of praise and cuddles should be limited in training situations, as frequent usage lessens its effect. Still, during training, praise – in combination with the right attitude – is important: "Give of yourself with body and soul when the dog performs the correct action instead of giving sausages or meatballs. Also: You should reek of confidence (2005[r], 72, emphasis in the original).

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3 Canis never hid the fact that it was a business selling dog training classes, magazines, books, and even dog training equipment through their online shop. This commercial aspect eventually became its downfall. In 2012, Canis established a giant store in Trondheim, Canis City, and in 2013, the company went bankrupt. Although the dog training schools and the magazine still exist, Canis, including Canis.no, is today only a shadow of its former self.

When the position of "hero" is fulfilled, the dog should never feel the urge to disobey; if it does, it must be corrected through verbal scolding or physical punishment (Nordenstam 2005[r]).

The training techniques of clicker training are very different. According to Egtvedt and Køste, four criteria characterize "genuine" clicker training:

1) reward of desired behavior (positive reinforcement);
2) voluntary behavior (the dog should not be forced, pushed, or lured into performing the behavior);
3) use of a conditioned reinforcer (a clicker); and
4) focus on observable factors only (i.e., not on what the dog might be thinking) (Egtvedt et al. 2006[r]).

All of these principles are from Skinner's writings, where they derived from his experiments with pigeons and rats. The emphasis on voluntary behavior means that instead of pushing or luring the dog into the correct position, a trainer must wait for the dog to sit by itself, then click and reward. When the dog becomes used to getting rewarded for sitting, the command is added. Finally, the dog will learn to sit when the command is given. Correct behavior is marked by the clicker, which means that the dog must first learn that the clicking sound means that a reward will follow shortly. The simple technology of the clicker, the conditioned reinforcer, allows the trainer to communicate the exact moment when the correct behavior occurs. Clicker trainers are advised not to use praise or cuddles as rewards during training, as these are thought to be of less value to the dog than food. Ultimately, though, the dog will decide what it is willing to work for, as the reward must have an actual reinforcing effect on the desired behavior. Failure to perform is not interpreted as disobedience and hence not punished in any other way than by a lack of reward. As a Skinner quote still featured on the Canis.no website states: "Organisms do not misbehave."

Performing Gender

The question is not why women opt for "positive" methods, such as clicker training, because non-aversive methods have become the norm in dog training, and so have women. Still, there might be something to the assumption of gender difference. According to theories of gender as practice, gender is not something one has, but something one does according to cultural conceptions of what is considered masculine and feminine (Beynon 2001[r]; Butler 1990[r]; Connell 2005[r]). This means that instead of assuming that men and women do things in certain ways because of their gender, we might acknowledge that masculinity and femininity are enacted in certain ways through various practices. And the practice of traditional dog training seems to be linked to masculinity. Like clicker training instructor Atle stated: "When you want it to be a bit tough, when you want some testosterone and action, then you go for the traditional methods". He further said that: "I think it is easier for men to buy into the idea about leadership and dominance and that stuff, because it sounds so reasonable, you know" (Atle, interview).

Reasonable or not, traditional dog training practices might enable men to feel more comfortable in a field in which women are in the majority. Dog training has historically been a masculine space, but the people who manage dog schools, attend training classes, win competitions, and disseminate knowledge about dogs and dog training today are mostly female. As NOVA researcher Rannveig Dale writes, men entering spaces coded as feminine might discover that they lack symbolic capital due to the fact that the spaces are managed by and associated with women (Dahle 2004[r]). This gendering of spaces might mean that men are less exposed to changes that have occurred. One of my male informants told me, for instance, that he had attended a training class with his first dog about thirty years prior, but that he did not feel the need to do it again. "In these classes, you have to do this and that, and that is not for me. I do things the way I think is right, and I have done that since then. I follow my own common sense" (Truls, interview). The gendering of dog training might be one reason why men have not been exposed to new methods and thus have come to rely on "common sense" and the methods they were taught thirty years ago.

However, the gendering of dog training spaces might also be a reason why some men explicitly choose traditional practices over new ones. It has previously been shown that some men working in female dominated occupations emphasize the similarity between men and women, while others accentuate gender difference (Nordberg 2002[r]). Performing the role of pack leader certainly appears as a good strategy for those who take the latter viewpoint. First, traditional dog training allows for the display of physical discipline and force. Second, the notion of leadership and the hierarchical dominance discourse it is embedded in are loaded with masculine symbolism that strongly resembles hegemonic masculinity associated with power and control (Connell 2005[r]). Performing the confident alpha male thus becomes a powerful strategy for accentuating gender difference and masculinity. In other words, gendered assumptions might influence the application of science and technology through dog training practices, but dog training practices also influence the ways in which gender is performed and reproduced.

Enacting "Dogness"

Practices and the heterogeneous networks of matter and meaning in which they are embedded thus allow for specific performative interactions, wherein the actors are enacted as men and women, but also as humans and dogs. According to the sociologist Jessica Greenebaum, dog training methods reflect existing understandings of dogs (Greenebaum 2010[r]), and traditional dog training and clicker training clearly operate with two different understandings of what a dog is. The methods, based on ethology and the idea of leadership, understand dogs as wild animals driven by instincts. Nordenstam writes, for instance, that "the dog's pack instinct points toward the fact that it is advantageous for it to obey" (Nordenstam 2005[r], 66). Køste and Egtvedt, on the other hand, make no attempt to understand how a dog's instincts work. Rather, they claim that dogs, like all other organisms, behave according to the universal law of reinforcement:

> It is a common misunderstanding that dogs do things "because we want them to", "because it works for us", "because we have leadership/is the boss" and so on. The dog works either 1) to achieve something it wants, or 2) to avoid something unpleasant. Other alternatives do not exist! (Køste et al. 2001[r], 19)

However, if one thinks of animals as performative effects, then one might ask not what a dog is, but rather how dogs are performed, or enacted. According to a material semiotic practice approach, dogs are not "dogs," in themselves, but become dogs through their meetings with humans. As feminist scholars Lynda Birke, Mette Bryld, and Nina Lykke argue, the "animality" – or "dogness" – of dogs might be understood as a performative effect that emerges as a result of dog–human relations:

> If we speak of the "animality" of, say, a dog, we draw partly on multiple cultural representations of dogs and other non-humans. But we also infer an embodiment of the lifelong intra-action of dog with human: from its very first breath, a puppy is usually engaging in a combined doghuman world. (Birke et al. 2004[r], 175)

In traditional training practices, the primary goal is a submissive dog that obeys its master without hesitation. Disobedience is understood as a challenge that must be dealt with, accordingly. Interestingly, several studies have demonstrated that dogs trained with aversives show an increased tendency for aggression, disobedience, and problem behavior (Arhant et al. 2010[r]; Blackwell et al. 2008[r]; Casey et al. 2014[r]; Herron et al. 2009[r]; Tillung 2006[r]). In other words, it seems as if the wild and aggressive animal might be produced through the very same practices that are meant to tame it; thus, the wild nature of dogs might be a performative effect.

In clicker training, there is an implicit contradiction regarding the aim of the practice. On the one hand, the descriptions of clicker training point towards complete human control over the body and the mind of the dog. For instance, when asked how much a dog could and should decide for itself, Egtvedt answered: "A well-trained dog can 'decide' everything for itself, since it 'wants' the same as the dog owner" (interview). Skinner, himself, dreamt of a society shaped by positive reinforcement, as expressed in his utopian novel Walden Two (Skinner 2005[1948][r]), and Egtvedt's answer echoes this quote from the founder of the Walden Two community: "By a careful cultural design, we control not the final behavior, but the inclination to behave – the motives, the desires, the wishes" (Skinner 2005[r], 246).

On the other hand, clicker training may produce a "clicker smart" dog:

> Clicker training really starts becoming fun when you have been training for some months. You eventually get what we call a "clicker smart" dog. A clicker smart dog has really understood the game, it loves to train, it offers behaviours in abundance and is really creative. (Egtvedt et al. 2006, 18)

A clicker smart dog is a creative and smart dog that takes initiative and tries out new behaviors:

> It will often take some time before the dog starts to try new things, but when it understands that you will click and reward when it offers behaviours, it will soon get a lot better at trying things on its own initiative. In a way, it is like getting better at playing "hunt the thimble". Should I sit? Lie down? Not that either? Turn around! Yes! My goodness, how fun it is with dogs like this. (Egtvedt et al. 2006[r], 14)

In practice, clicker training seems to lead to creative, rather than brainwashed, dogs. As one of my dog trainer informants noted, some clicker trained dogs get so creative that they actually became problematic for inexperienced owners (Turid, interview). Or, as a dog owner on the Canis online forum wrote in a discussion about stupid things users had taught their dogs:

> The most stupid thing I ever taught Schenda is to play dead. Now, she does it whenever she feels that she does not get the attention she deserves and is entitled to. Like when we were going on a trip and were waiting at the train station for the next train and I was having a cigarette, suddenly I hear laughter and applause, and there she is, playing dead, falling to the ground again and again ... (Canis.no 2010)

According to the Hungarian dog biologist Adam Míklosí, different training methods provide different environmental conditions, which influence the way in which dogs think (Míklósi 2007[r], 25). Because these thought patterns influence dogs' behavior, different training methods enable different ways of doing "dogness." Understood in

this manner, the "dogness" of dogs is not their essence, but something that is done – by dogs and humans, together.

In "The Actor-Enacted: Cumbrian Sheep in 2001," Law and Mol emphasize that the meaning and existence of actors is created through mutual enactment (Law et al. 2008[r]). In this regard, it is important to note that both training methods work. One can teach a dog to follow commands by rewarding correct behavior or by punishing incorrect behavior, and by working, both methods

may reinforce the behavior and the self-perceived meaning of the trainer. The pack leader, in many cases, is rewarded by an obedient dog that seems to respect the leadership, or by the satisfaction of a successful power display. Likewise, the clicker trainer's careful observation of the dog is rewarded by a clicker smart dog trying to figure out how to get treats. The response of the dog thus enacts the dog trainer, and the two training methods provide different conditions for becoming with each other as "hero" and submissive pack member, or clicker trainer and "clicker smart" dog.

Shifting the Power

Anthropologist David Graeber once pointed out that violence is a way of influencing behavior that requires absolutely no understanding of the being one is trying to influence (Graeber 2006[r]). Pain works without language and reasoning, and it is something that dogs, as well as humans, seek to avoid. Pain thus becomes a powerful training tool, and it has been used in many forms to bring dog behavior under human control. Effective reward-based training, on the other hand, demands more from the trainer. As Egtvedt and Køste write: "As a clicker trainer, you will get good at observing behaviour, reading the dog, dividing training into small units and slowly increasing the demands" (Egtvedt et al. 2006[r], 18). In their clicker training book, tables guide trainers to pay attention to the dog's behavior and to maintain steady progress. In addition to requiring large doses of practice, patience, and self-control, this meticulous attention to the dog potentially facilitates a new type of what philosopher Vinciane Despret terms "availability": "With the notion of 'availability' the signs that mark the world and that mark the subject are redistributed in a new way. Both are active and both are transformed by the availability of the other. Both are articulated by what the other 'makes him/her make'" (Despret

2004[r], 125). This is not to say that dog and owner become equals; rather, the relationship is one of domination (Tuan 1984[r]). Still, in order to do clicker training "properly," humans must discipline themselves to become available and attuned to the dog's responses, thus shifting some of the power from themselves to the dog. As Egtvedt and Køste write in the humorous paragraph "For the dog":

> Our owners have many things we want. They have treats, toys and other fun things. They control when we get to go for walks, run off leash, play with other dogs and pee on lampposts. They can even decide when we get attention and maybe a little cuddle. But this era is about to end! Clicker training has come to town, and it is our chance to finally take control of what we desire. (Egtvedt et al. 2006[r], 10)

In clicker training, the dog decides what counts as rewarding and is allowed the agency to try out new behaviors in order to achieve desired results. Thus, this seemingly mechanical and positivist training practice potentially enables an animal–human relation in which the trainer is the one subjected to discipline.

Concluding Remarks

Skinner's training principles emerged in the laboratory in the 1930s and reached Norwegian dog training practices around the year 2000, as a result of the dedicated efforts of Canis founders Cecilie Køste and Morten Egtvedt. By forging new relations between entities – including trainers, experts, dog owners, and dogs –through business agreements, clickers, and web technology, Canis thoroughly changed the Norwegian dog training landscape. Old differences in relations and interactions were erased, and new ones were produced. The old dispute between the instincts of ethology and behavioral psychology resurfaced, but this time as a distinction between punishment and reward, traditional and positive, and, finally, men and women.

Not only is gender produced and performed through these entanglements, but dogs are also enacted through these practices. The new assemblages of knowledge and training technologies not only change the way in which people view dogs, but they also change

the dogness of dogs, in terms of how dogs respond as concrete, material beings that enact specific humans. Further, power is redistributed in the new choreography of communication enabled by clicker training. With clicker training, it is not obvious who the trainer is and who the trainee is; who the subject is and who the object is; and who is in control and who is being controlled.

The choice of training method thus plays a crucial role in determining which dogs and humans are allowed to emerge from the contact zones of dog training. However, these choices can never be fairly described or understood without taking into account the relational webs of matter and meaning that stretch through time and space. Clicker training technology is embedded in a larger network of relations shaped by histories of encounters between a range of human and non-human animal actors (e.g., Pavlov's dogs, Skinner's rats, Pryor's dolphins). And as the world is still being made, dogs and humans continue to enact each other through the technologies of dog training.

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A QUESTION OF POWER

The Politics of Kilowatt-Hours

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This article builds on long-term, ongoing studies of energy efficiency governance and development projects, and reports from one recent case study of a multi-use area development combining local heating/cooling and district heating. We approach the subject matter with a particular interest for the heterogeneous, sociomaterial substances and processes at play in realising an engineering project. With a particular focus on controversies and framing, we analyse the achievements of energy efficient solutions as processes of transformation, translation and exchange. Power is relational, and successful energy efficiency lends support from careful exploi-tation of those relations, both within and across material-technological and socio-political domains. This is discussed as the politics of kilowatt-hours. The article revolves around Energeo, a Norwegian energy central developed to make buildings in the project area – restaurants, shops, offices, hotels, scenes and residential blocks – self-sustained with heat all year. This area is covered by municipal energy regulations requiring new buildings to connect to the district heating network. Therefore negotiations had to take place, and compromises had to be made – particularly between the developer and the district heating company. Our study of the energy central and the controversies surrounding it reveals a heterogeneous landscape of mixed physical and social aspects in which standards and framing play important roles. We explore the processes of transformations, translations and exchanges, and argue for this approach to understand, articulate and make transparent the techno-political heterogeneity of such processes in order to facilitate better energy governance.

Introduction

Understanding how energy efficiency works is a tedious task. Studying energy and the methods and rationales for energy efficiency will inevitably send you to many different locations that accommodate many different processes and materials in order to explain how energy efficiency works in society. You might give up on finding any baseline logic or prime mover. However, this is the best start you can get for such studies; the sooner you give up the search for *one* logic, or *one* driving force, the better, because then you can start looking for the multitude of actors and interests at stake in energy efficiency.

Our study is based on cases of energy efficiency measures and initiatives in Norway. In Norway, the usage of energy is very much related to geographical and climatic factors which make the needs vary a lot through the weeks, months and year – as well as a host of local conditions making temperatures and weather conditions very different throughout the country. Another characteristic is that in sparsely populated areas, population is often centred around cornerstone companies constituting the major local energy consumer. Many of those cornerstone companies are located where they are because of the easy access to cheap hydropower, making the efficiency of hydro-power a central political question when talking about energy efficiency in Norway. There is currently a great political will to invest in this kind of energy efficiency, as it is seen as a way to make both industry and society at large "greener" and simultaneously strengthen the economy for both local communities and industry.

Parallel to policy initiatives concerning energy efficiency, there was a clear increase in the use of the term in Norwegian publicity from 2006 and onwards[1]. Although the usage of the term *energy efficiency* has somewhat straightforward and unproblematic connotations in the public domain[2], this changes when one starts looking into the details. There is no way of avoiding the details if the task is to understand the technopolitics of energy efficiency, given how deeply these details are woven into the social and material fabric that provides us with heat, cooling, light and darkness through the days and nights.

In this article we seek to portray the phenomenon of energy efficiency as it appears in three different cases from the building and industrial sector – all typical in a Norwegian setting. In particular we explore the case of Energeo – an energy initiative that serves a multi-use area of seven buildings with local heat – situated in an area where regulations require a connection to the energy provider FarFetched's district heat network[3]. Our take on this is inspired by Science and Technology Studies (STS), in particular the sociology of translation and uncertainty associated with Latour (2005[r], 1987[r]) in combination with the perspectives of framing and overflowing (Callon 1998[r]). The sociology of translation and the processes of framing and overflowing in energy efficiency in built environments in particular has been topicalised and made relevant by Hojem et al. (2014[r]) and Solli and Berker (2014[r]), and in general STS-related approaches to energy research have proven to be fruitful (e.g. Skjølsvold and Lindkvist 2015[r], Goulden et al. 2015[r], Ryghaug and Sørensen 2009[r], Johansen 2012[r], Johansen and Røyrvik 2014[r]).

Our aim is to bring to light the rich repertoire of the energy efficiency discourse and cut across domains of technology and politics that are often conceived as self-sustained and clearly demarcated. This repertoire is well-known piece by piece; our ambition goes further than simply listing them. The aim of the article is to explore how the different technological and political aspects of the repertoire are interwoven, and thus to portray a realm of energy efficiency that is less simplistic and more ambiguous than the straightforward appearance of kilowatt-hours may suggest. The article hence contributes to conceptualising the mechanisms of exchange between the technical-material and socio-political domains of energy efficiency.

Our aim is to think aloud on energy efficiency in ways that supplement the technological and positivist views that dominate the political and technical energy research discourses. Through conceptual exploration we follow the processes of transformations, translations and exchanges to understand the politics of energy efficiency. By theoretically supported conceptual reflections, the findings are suitable for indicating directions and orientations for further and empirically grounded research.

Theoretical approach

A considerable deficit of social science research on energy has been documented by Sovacool (2014[r]) and Sovacool et al. (2015[r]). In an extensive literature review of publications in Energy Policy, Electricity Journal, and The Energy Journal showed over a fifteen-year period that the social sciences are grossly underrepresented. In addition,

when social sciences do engage with energy research, they typically bring in behavioural science aspects relating to barriers and drivers for adoption, and a clear distinction between the technical and the social (Shove 1998[r]). The integration with physical science are very limited, such as the bringing in of meaningful references

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1 The database A-tekst has registered a maximum of 132 articles per year using the search word *energy efficiency* (in Norwegian: *energieffektivisering*) in Norwegian newspapers until 2005 (before the year 2000 not more than 20), from 2007 the lowest registered number of articles is 1615 (2015), and the highest 3812 (2009).

2 As Aune et al. (2016) and Godbolt (2015) show, there is not one unified understanding of the term in the public discourse – but the term is used *as if* there is no conflicting understandings.

3 The name has been changed to ensure anonymity.

to common physical units for energy analysis (Cooper 2017[r]). Sovacool (2014[r]) and Sovacool et al. (2015[r])'s call for interdisciplinarity should thus be seen as a call both for more social science and more relevant social science in energy research. While this is a problem related to energy research in general, Hojem et. al (2014[r]) show that this is especially problematic related to the field of energy efficiency. The STS approach adopted in this article seeks to respond to both these issues. The aim is to address sociomaterial systems without factorising them in ways that conceal the very relations that are foundational to these systems.

Energy efficiency and the sociology of uncertainty

A central advice of STS is that of engaging with controversies, referring to, "situations where actors disagree" (Venturini 2010[r], 261), or as Macsopol formulates:

> "...every bit of science and technology which is not yet stabilized, closed or 'black boxed'... we use it as a general term to describe *shared uncertainty*. (Venturini 2010[r], 260, citing Macospol)

The relationship between controversies and uncertainties is thus intimate, and Latour's (2005[r], 2004[r], 1987[r], Latour and Woolgar 1986[r]) take on STS can be conceived as a methodology for exploring controversies. Here we will highlight in particular four central tenets.

First, when referring to *actors*, the scope of STS is wide and includes more than *social* individuals and groups. Rather, agency is also ascribed to non-human entities that make a difference, and particularly so those that can be counted as mediators and not only intermediates – adding momentum and direction to courses of action that are not fully predictable (Latour 2004[r]). Consequently, there may be humans or human roles that act in a fully predictable manner, and hence count as intermediaries, but not as full-blown actors. Hence, in STS there is an initial uncertainty with respect to who counts as an actor. Thus, when accounting for action in the field of energy efficiency, there is not necessarily any fundamental difference in the way we treat project leaders, kilowatt-hours, plumbers, technical standards, politicians or heat exchangers. Following the actors means also following the kilowatts circulating through the complex technical system of, let's say, an energy central.

Second, we should be aware to not take ready-made, given groups as relevant units in our enquiries. Rather, our interest is towards the different, and not always foreseeable groups that are under formation, and the processes at work to form and stabilise these groups. Thinking of the demarcation of groups in terms of networks instead of in terms of borders is useful in order to visualise groups that transcend obvious "homogeneous" groups that are more practical and swift to orient between, such as "public", "electricity companies", and "left wing politicians". Keeping in mind the

first characteristic (above), non-humans are very likely to have roles in the group formation that we are interested in.

Third, accounting for the actions at work in the realm of energy efficiency, as in other enterprises that STS researchers may find themselves in the middle of, requires a readiness to travel to places not planned in advance. That "action is overtaken" (Latour 2005[r]) means that actors never act alone and hence tracing the actions means always being open to adding new actors to the list of the uncertain source of action.

Fourth, pragmatism is a valuated virtue in STS, and this is what makes us able to distinguish adequately between matters of fact and matters of concern. In the realm of energy efficiency and environmental soundness, truth is highly relational. What counts as energy efficiency and environmental friendliness depends on a range of premises that may be more or less contested, such as definitions, standards, technological alternatives, weather fluctuations, regulation, and many more.

The best way to understand the uncertain nature sociotechnical development is to engage with the associated controversies, since they form cracks through which light flows and makes visible otherwise black-boxed, uncontroversial "truths".

Framing and overflowing

There is an obvious relationship, based on the interest in controversies, between the type of uncertainty that Latour is speaking of, and that which Callon (1998[r]) labels as *hot situations*. Consider his description of hot situations below with the four sources of uncertainty above:

> In 'hot' situations, everything becomes controversial: the identification of intermediaries and overflows, the distribution of source and target agents, the way effects are measured. These controversies, which indicate the absence of a stabilised knowledge base, usually involve a wide variety of actors. The actual list of actors, as well as their identities, will fluctuate in the course of the controversy itself and they will put forward mutually incompatible descriptions of future world states. (Callon 1998[r], 260)

While Latour warns against the use of fixed frames in the exploration of the controversies[4], Callon offers a description of how the fluctuating frames of hot situations actually work, and occasionally overflow. "Framing", says Callon, "demarcates, in regards to the network of relationships, those which are taken into account and those which are ignored" (Callon 1998[r], 15). That frames are not given, and that they may actually leak, is a valuable guidance for exploring controversies. Actually, overflowing may be considered the rule rather than the exemption, and the framing is therefore

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4   "To settle scale in advance would be to one measure and one absolute frame of reference only when it is *measuring* that we are after; when it is *traveling* from one frame to the next that we want to achieve" (Latour 2005, 186).

a very costly enterprise (Callon 1998[r], 252). This would be as true for the actors and actions taken into account by those bureaucrats formulating the terms and mandate for a distant heating system, as for those entrepreneurs developing a local heating initiative.

Standards and boundary objects

An important part of the work and costs to ensure relevance and viability of the frames – or the system definitions, including all relevant actors and processes – as the context in which the energy activities take place, is the production of fixed parameters and scales that defines which actors are relevant to the system, and how their contributions should be evaluated. Standards play a special role in such occasions, contributing to the many conventions we live by (Thevenot 2009[r], Bowker and Star 2000[r]). Although standards afford coordination better than most other means, they do so in sometimes unintuitive ways, as they may be related, not as decontextualised and inert entities guiding action in a uniform manner, but rather as boundary objects (Star and Griesemer 1989[r]) that allow for flexible interpretation and thus may arrange for coordination of a much larger and heterogeneous circumference.

Method

The article draws on a series of research projects that took place over a period of more than five years. In close collaboration with industry and technical research[5], we have studied the realisation of energy efficiency concepts and systems. In other projects, we have focused on political frame conditions, market and consumer changes related to the so-called green shift[6].

The studies have been of an explorative nature, based on extended case studies (Bernard 2011[r]). As energy efficiency is systemic by nature, we have relied on central actors that can both function as a door opener to these systems, and allow us to continue exploring the relevant actors, documents, artefacts and relations, thus in parallel to produce the system of the study. In order to understand these cases we have sought to trace the networks of actors, political schemes, rules and regulations that come in to play when such systems are to be realised.

From these projects, two particular cases have been important for developing a background understanding that have helped frame the study highlighted in this article – the Energeo case[7]. The first case study – Kviamarka – is one of energy collaboration in an industrial cluster (Johansen and Røyrvik 2014[r], Johansen 2012[r]). In this cluster of heterogeneous enterprises, outputs (waste) from one production company function as an input (resource) for another so the three entities heat, cold and CO_2 circulate between the different activities in the cluster in order to minimise the overall energy use and waste production. A characteristic of Kviamarka is that there is no central facilitator or coordinator for the project or its creation; it was established through a collective effort by individuals who found each other through common interests that all could be realised in a win/win fashion. Another characteristic is that the improved utilisation of energy and waste was established in a brownfield cluster, with the accompanying limitations that involves.

The second case of importance was a passive-house programme administered by Enova, a governmental agency for energy efficiency. The programme ran in the period 2010-2013 as a time-limited funding scheme in the portfolio of Enova's incentive instruments to propagate energy efficient building materials and technologies, where Enova provided economic support to rehabilitation of old and realisation of new buildings that would adhere to the Norwegian standards NS 3700 and NS 3701 for passive and low energy buildings for residential and commercial use respectively (Røyrvik et al. 2015[r]).

While we draw on experience from the above-mentioned studies, we focus on one particular case in this article: the Energeo case. This is a case that shares many characteristics with Kviamarka, but that is also distinguished from this case through significant differences. Energeo is an energy central that – in cooperation with FarFetched, the city's concessionaire of district heating – serves local heat and cooling to an area with mixed activities such as hotels, schools, offices, food market hall, restaurants and bars, residential blocks and premises for cultural activities such as concerts, dance and sports. In contrast to Kviamarka, Energeo was, from the start, initiated by a single developer of urban spaces and properties, who in turn recruited developers and tenants, and coordinated the development phase, as well as the subsequent operating phase.

Our empirical findings are based on interviews, location visits and document studies including consulting reports and newspaper articles about the project. Due to its innovative character, the Energeo project drew substantial attention from politicians and the media, and this documentation represented a useful entry to the case and the discourses surrounding it. All the empirical work was undertaken by two researchers.

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5 In projects headed by SINTEF Energy, we have focused on the socio-technical and socio-political dimensions of energy efficiency in industrial clusters. First in the NRC projects CREATIV and INTERACT – and now in the FME centre HighEFF.

6 This was especially true in the evaluation of the Norwegian program to promote passive houses, and now in the EU project ECHOES.

7 The name has been changed to ensure anonymity.

Interviews were undertaken with key stakeholders from the development side of the project. Before the first interview with a representative from the developer, we had a guided tour in the energy central where we got a visual impression of the energy production and circulation facilities, along with a presentation of the project's history. We continued to the informant's office for a more formal interview, and thereafter continued with interviews with representatives from the consulting company and the company responsible for VVS.

The interviews were carried out in a semi-structured manner, guided partly by some broad themes and some more detailed questions prepared in advance – pertaining to the process of establishing and carrying out the project, political regulations and processes, negotiations and adjustments, technological choices and solutions, but apart from that, largely followed trajectories resulting from the informants associative reasoning. This openness was deliberate and important for our approach, allowing us to follow the historical recapitulation and the lines of reasoning as seen from our informants' perspectives. Our objective was to find out what elements and relations are made relevant to and shape the achievement of energy efficiency. In that work, we explicitly sought to restrain ourselves from thinking in socio-political and techno-material categories.

All interviews were tape recorded and transcribed shortly after arrival back in our offices. Through several rounds of interpretation – aided by an incremental and theoretically inspired coding of statements into categories that gradually got the shapes that later will be recognised as transformation, translation and exchanges – the material was arranged and discussed in a way that served to illustrate not only the techno-material – but also the socio-political – aspects of energy efficiency and kilowatt-hours. While the process of producing a meaningful account of what Energeo really is a case of surely has been an open and iterative process, in ways that bear resemblance to grounded theory (Glaser and Strauss 1967[r]), our empirical study and data interpretation were also framed by central insights from previous projects, implying special attention being paid to standards and their role in black-boxing – if not settling – energy controversies.

The case of Energeo

In earlier years, Energeo housed an iron foundry and a mechanical workshop that established by the river in 1873. After the industrial activity ended in 1968, the buildings were used for storage and craft businesses for several decades, until initiatives were made in 1999 to revitalise the area. Today, only two of the older buildings are left, integrated with the rest of the new, urban landscape (Lusiani et al. 2013[r]).

The area development
The new Energeo area was established in 2010 in a coordinated effort to develop a brownfield area of 55,000 m² into a self-sufficient energy area with respect to heating and cooling. With one single area developer with control of the building plot and a vision for energy supply and consumption, important framework conditions were in place to realise the plans.

The core of the energy system at Energeo is the energy central. This energy central coordinates and regulates all energy flows within the system boarders to insure that all actors get their needs covered for heating and cooling. This energy system holds four different sources of energy; surplus heat from cooling processes, solar heat, heat from geo-wells and finally, heat from an external district heating network. The energy consumers are local buildings that accommodate different activities. A schematic illustration of the energy system is presented in Figure 1.
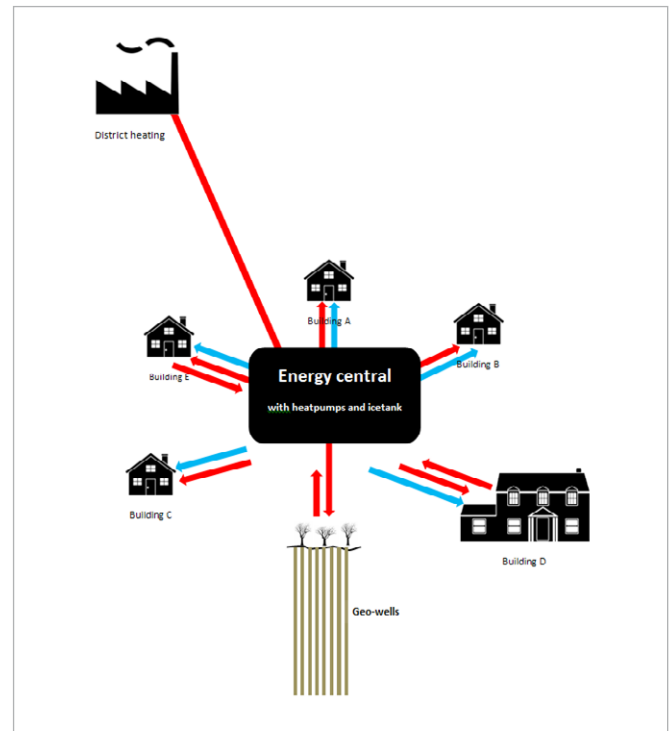

Figure 1. Schematic illustration of the Energeo energy system.

During an iterative development process involving four steps, 64 geo-wells were drilled into the ground underneath the area. These geo-wells are mainly used as the primary energy source, where water is used as the medium to transport the heat from the ground to the energy central. During warm periods the geo-wells are also used as storage for surplus energy.

There are several buildings in the area that receive heat and cold through this energy system. The buildings house different activities (e.g. restaurants, shops, offices, hotels, scenes and residential blocks), which cause differences in the patterns of energy consumption. Most buildings only receive energy and their connections to the energy central are therefore illustrated by two arrows only: one for the receiving heat and one for the cold energy flow (cooling). Each of these arrows might as well be illustrated by a separate circle – a closed loop of heating or cooling medium exchanging heat between the building and the energy central. In this article the main interest is the flow of energy and its direction, and the arrows cover this. Other buildings, namely building D and one office building, in addition to being energy consumers, also supply the energy central with heat. The office building is clad with solar collectors at the façade that faces south, gathering heat on sunny days. The heat from these collectors is delivered to the energy central for distribution as a part of the overall energy supply. In addition to being an extra source for heat production, the visibility of solar collectors – in contrast to the wells that are practically invisible – renders them as public eye-catchers. This was an added value for the environmental protection organisation that was to be the user of that particular building, also lending the whole Energeo area integrity as an environmentally friendly project. Building D accommodates around 30 restaurants, food producers and the like, where cooling and freezing is a major requirement. Cooling and freezing produces much heat, and normal practice for such enterprises is to let excess heat out in open air through dry-coolers at the roof-tops. At Energeo, the heat produced in the cooling processes is seen as an energy resource instead of a waste material. The excess heat from building D is fed back into the energy central and used for heating in other buildings.

The district heating is the actor that is least integrated with the rest of the Energeo energy system. The only interconnection with the rest is through heat exchangers that transfer heat from the district heating system to the local system when there is a need for external energy supplies. There is no flow of energy from the Energeo energy system to the district heating.

The variations in energy consumption between the different buildings are not the most challenging fluctuations the energy central has to handle. What makes the system especially complicated are the 24-hour periods of high fluctuations in external temperature during spring and autumn when the difference between night temperatures and mid-day temperature sometimes exceeds 20°C. The peak of surplus heat from food storage is congruent with the peak of need for cooling which makes the regulation of the system even more difficult. To handle these short time fluctuations, an ice-tank is installed inside the energy central, which is charged (cooled down) during nights and used to handle the peaks of need for cooling flows during especially hot days. It is a simple arrangement – a container with piping filled with a cooling medium that can freeze the water that fills the open space of the container into ice. The ice-tank has the capacity to deliver rapid freezing over a few hours (200 kW), enough to cover the most critical periods during the day. During the night, the water in the ice-tank is frozen again to function as a backup the next time it is needed.

The Energy Central

The energy central (Figure 2) is located in the basement of Building D (Figure 1), where three heat pumps with a total effect of 11kW and two cooling aggregates of 85 kW each stand for all heat and cold production for the Energeo area. The energy central delivers 3375 kW of heating and 1814 kW of cooling, and a total of 5.4 GWh/yr. From this room all the heating and cooling flows described above are regulated. Since the first "version" of the central that was operating in 2010, the process has been subject to a number of upgrades, resulting in today's central that is almost fully automated. This automation is due to a large number of sensors that are used to continuously diagnose and adjust the system, processes that are much more aligned with the capacity and modus operandi of computers than of humans.

Figure 2. A view of the energy central, seen from the middle of the room. The rather sparsely equipped "work station" hints at the level of automation – necessary human intervention is reduced to a minimum.

The control system is partly a stepless one, making all the small adjustments in response to the external conditions, and a stepwise control, switching between a finite number of working modes depending on seasonal variations.

While Energeo may initially seem uncontroversial, providing renewable energy to the multi-use area, there are other actors, energy schemes and interests that – in the name of the same overall goal – complicate the picture. In the following, we shall see how kilowatt-hours and energy classifications are drawn into a controversy where arguments pertain as much to their associated framing of the world as to appeals to an "objective world".

Controversies

With a power efficiency of 300%[8], the heat pumps represent a power source that is competitive with most other relevant power sources. However, the situation was that a particular energy provider – FarFetched – had the licence to deliver district heating in that area, and all new building projects of certain categories – within which the Energeo project was considered – were obliged to connect to this district heating network[9]. As a concessionaire by regulation with a monopoly on district heating – and a commercial, publicly listed company – FarFetched had the arguments and rationale necessary to dictate connection to the district heating network without further discussions or compromises. However, having rights and getting rights are not the same; *right* is subject to constant negotiation, and several processes pushed the balance of arguments in Energeo's direction:

As the rationale for the existence of the district heating concept and FarFetched's concession rights is grounded in environmental friendly heat, FarFetched's refusal of the local heating alternative at Energeo generated debates in the media[10] that portrayed the monopoly of district heating as a barrier against new, energy friendly solutions and buildings. The argumentation was supported by a consulting report (Aamodt 2012[r]) that stated that the local energy solution project would result in a 60% reduction of energy use compared to district heating as the single heating source. The report also concluded with advice to grant exemption from the obligation to connect to the district heating network in cases where net energy supply meets the requirements of NS 3700 or NS 3701 and there is no use of fossil fuel for heating.

This report and the media debates were brought into meetings between the Plan, buildings and properties department of the municipality and FarFetched, and between the Plan, buildings and properties department and Energeo respectively. The bureaucrats faced a challenging situation with a number of arguments for the same objective – an environmental friendly energy scheme – but through different means – district heating and local heating respectively. The legitimacy of the licence regime was important both to the municipality and FarFetched, and as a result FarFetched changed its position and offered Energeo a compromise: Energeo was granted partial exemption from the

district heating obligation but made a deal using district heating to secure peak load.

Requirements were also posed for the connection and subscription regime: for the Energeo area, six connection points would have to be made to the district heating network. This was counter to the solution preferred by Energeo – to have only one connection point from which they could distribute the heat to the end users.

> "FarFetched used its power as a concessionaire for all it was worth, no doubt about that. They could have shown more goodwill, but they probably saw it as a threat against their deliveries." (Informant at Energeo)

According to our informant, Energeo's solution would have reduced the complexity and investment costs of the technical system. As it now became, with the six connection points, Energeo would also have to pay for six subscriptions instead of one, requiring a more expensive solution for them – and in parallel, a more economically favourable solution for FarFetched.

Another regulative requirement that affects the technical configuration of the local energy system is the requirement that limits the upper number of buildings one heat pump may provide with heat to five, to be able to be classified in energy class A. This has great significance for how buildings are classified in terms of energy efficiency, and evokes several philosophical-scientific themes such as the function of standards, and the social construction of buildings. Consider this perspective:

> The regulations for energy classification of buildings are related to net energy delivered across the building border. The Energy labels spanning from A to G depend on kWh/m² supplied. Hence you have two extreme points: district heating produced outside the building border means that you need to provide 1 kWh from the outside to spend 1kWh inside, whereas if the building has its own heat pump, you need only provide 0.3 kWh. Hence, buildings with heat pumps will automatically get a better energy label than buildings using district heating. (Informant at Energeo)

When allocating energy classes to buildings, two foundational issues are of particular importance: 1) How do we measure the quantity of energy? and 2) Where do we draw the boundaries for what counts as one building? Since the answer to 1) by definition of the current classification scheme in Norway is net energy supply, buildings using heat pumps will automatically obtain a better energy classification than buildings supplied with district heat, since using 1 kW to run a heat pump will provide the building with

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8 Efficiency of 300% undoubtedly sounds weird, and reflects the compromises between conventions and practical reality one has to deal with in order to stick to the chosen frames and standards.

9 Vedtekter til bygningsloven for Oslo by 25.mars 2009 nr 433 til §66a https://lovdata.no/dokument/BV/forskrift/0000-00-00-1/KAPITTEL_8-1#KAPITTEL_8-1

10 E.g. Teknisk Ukeblad (http://www.tu.no/artikler/her-har-de-bade-solfangere-og-geobronner-likevel-ma-de-ha-fjernvarme/236207)

2.5-4 kW heat depending on the heat pump and the surrounding conditions, while the energy provided to the building from district heating still equals 1 kW. Had one chosen to answer 1) by saying that the energy quantum should be measured in terms of consumption inside the buildings, then there would be no difference between heat pumps and district heat.

Given the way the regulatory regime currently relates to 1), the significance of 2) is that the more buildings that are allowed to be connected to one central heat pump that provides local heat, the more favourable it will be in terms of energy efficiency given the classification scheme. According to our informants, there is a breakpoint of 3-4 buildings, below which district heating will often be more favourable, and above which local heat pumps often will be most favourable. To ensure that district heating still can be competitive in terms of energy efficiency, a limit of 5 buildings

connected to one heat pump has been established. Such an absolute number does not mean that there is no more room for negotiation, since the definition of what is a building may also leave some room for manoeuvre; anyone walking around at the Energeo area guessing where the borders around which building is drawn, may be surprised to see that this is not obvious:

> This counts as one building, this as four (our informant pointing to shapes on the floor plan of Energeo). This is very complicated – what is a building? You could say that these (pointing to another shape) are four, but in terms of district heating they are seven. The conditions for that definition are hopeless! There shouldn't have been any such limits (upper limit of 5 buildings connected to one heat), the whole limit should have been removed. (Informant at Energeo)

Discussion

From the first law of thermodynamics, we learn that *energy can only be transformed from one form to another,* but cannot be created or destroyed. Turning from theory to practice, the aspect of transformation becomes ever more obvious, and not only that energy *can* be transformed from one form to another, but that it lies in the very nature of energy to transform, and that is the way energy makes a difference. In ways that will be revealed by the following discussion, the story of Energeo may be told as a story of transformation, translation and exchange of power, from the early planning phase, through the project phase and further into the operational phase.

In the energy central in the basement, five heat pumps that produce hot and cold water make up the technical backbone of the energy scheme in the operational phase. As our informants made very clear, this is a complex technical system, but it is not, in any respect, rocket science. The components and cycles are well-tried technology put into a new, site-specific constellation. Through the working of the heat pumps and the fundamental physics of temperature increase and gases being compressed, the thermal heat from the geo-wells, the solar collectors and the cooling processes is transformed into water suitable for heating the buildings at Energeo. Hot water from the district heating company is also channelled into the energy system to handle peak loads.

While the technical functioning and material appearance – of which Figure 2 provides a glimpse – of the energy system is perhaps the most striking for a visitor, one needs to also look to the socio-political aspects of the project to find the real innovation. In the following, we will elaborate on some central aspects of this, and their significance for the Energeo project.

Transformations

The energy processes at Energeo rest on a number of transformation processes, both techno-material and socio-political. While

energy resting in rock media and radiant energy from the sun is transformed into hot water through technical arrangements, these arrangements are infiltrated by extensive socio-political arrangements. Some of these are the classification schemes resulting from standardisation processes. These will be discussed under the heading of translation. Other socio-political arrangements are those resulting from negotiation processes addressing the legitimacy that is at stake when different solutions to common objectives threaten to disrepute each other. That was the case in the discourse that evolved around the controversy between the concessionaire of district heating and the local initiative of Energeo.

Since district heating works at – and is dependent on – a large scale to ensure efficiency, sustainable local energy initiatives may be perceived as both negative and positive initiatives at the same time: negative since they threaten the scaling ambition of district heating; and positive since they represent a competitive alternative to district heating in terms of price and environmental friendliness.

The discussions that took place between different constellations of the three main actors – the district heat concessionaire, the local heat developer and the local authorities – have not been possible to reconstruct or review, so the content of those is not known. What we do know, however, is that these negotiations resulted in transformation of the politics of all three parties. The outcome of that particular case illustrated a transformation that has proven to also be of a more durable character. Through the compromise that was arranged, the district heating company transformed from being an insistent concessionaire that was challenging the initiative, to being an active partner that embraces heterogeneity and enters into partnerships with former opponents. With reference to Callon's (1998[r]) perspective on framing, one could say that from being ignored, the district heating company must now – in what can be seen as a re-framing – be taken into account.

According to our informants, "FarFetched has changed its policy" in the wake of the Energeo project. The development of such new consolidations echoes the dynamic group formation that Latour (2005) is so concerned with. A similar movement can be observed for the developer. The development of the Energeo project started without contacting the district heat concessionaire. That frame was soon to overflow. A strategy of late involvement proved to be more challenging than necessary. They later changed their routines to include concessionaires in future projects at an early stage to negotiate agreements that benefit all parties, indicating that the re-framing process in this particular case proved to be of a more durable character.

Also, the councillor for urban development, representing the municipality that once allocated the district heat company its licence as a monopolist of heat, argued later for more dispensations from the obligation to connect to the district heat, and also indicated a possible need to reformulate the regulation associated with district heating.

Although materiality and technology speak, to some extent, for themselves, they need spokespersons who can take over and reformulate the arguments of kWhs as they travel from the energy centrals in basements to other arenas such as meeting rooms, newspapers and city halls. These processes both within and between the social and the material complement our understanding of energy efficiency as a phenomenon that is far from objective and stable, but is subject to numerous transformations in order to stay efficient.

Translations

Although it is fairly easy to comprehend the meaning of energy efficiency, the way of formally accounting for it is not through perception or prose, but through *standards* and *classifications*. For the developer, energy efficiency entered into the vision for developing and marketing the area, and having an energy system that would allow for buildings to get the energy class A was important. Through the translation of *a building and its energy system* into *Energy class A*, the original entity and processes are being black-boxed, hiding any controversies and uncertainties. However, to understand how energy efficiency works, it is necessary to understand the context in which such translation processes take place. We particularly want to bring attention to the pragmatics of such translations.

There is an interesting tension in these translations, as they reflect the dual adoption of standards for the purpose of neutral governance (Thevenot 2009[r], Bowker and Star 2000[r]), and the flexible use of these standards, which turns them into sometimes efficient, sometimes goal-displacing coordinating devices with

characteristics resembling those of boundary objects (Star and Griesemer 1989[r], Bowker and Star 2000[r]).

The energy class is based, among other parameters, on the buildings' net energy supply. Among the entities and processes that are concealed by the classification, are the framework conditions for the calculation of the energy supply, or the convention for calculating efficiency, favouring heat pumps to district heating as described above. While it may seem strange that different conventions may provide different results, given the inescapability of the first law of thermodynamics, it gets much clearer when the difference is expressed as a difference in what we – through social negotiation processes of standardisation – establish as legitimate to include in the network[11] of energy forms. This illustrates the different working of conventions, such as standards in society and "laws" of nature: the working of standards in practice is far more flexible than that of "laws" in theory. While net energy supply from district heating includes in the network and the calculation the energy conserved in the combustion material producing the heat entering the buildings, net energy supply from heat pumps by convention excludes from the network and the calculation the energy extracted from the water from the geo-wells. To fully understand energy efficiency and how it looks in, for example, district and local heating in the Energeo case, it is crucial to understand the workings of these conventions in terms of their different limits of reach.

To take seriously the political aspect of the first law of thermodynamics' reference to the *isolated system*, for instance, is to acknowledge that an isolated system in this context represents the imperative to trace – in infinity – the energy streams and all the translations that take place through the resulting network, which is possible only in theory. While *isolation* and *infinity* are passable entities in the world of theories, they are not so in any pragmatic take on the real world. Not even inside laboratories, where the resources needed to construct and uphold the preconditions required for theories to work are substantial, and still, never safe as long as there are social constellations available to raise money for even larger laboratories (Latour and Woolgar 1986[r], Latour 1983[r]).

The real world *leaks* – or as Callon would say, "overflows are the norm; framing is expensive and always imperfect" (Callon 1998[r], 252) – and we intentionally allow some leakages but not others. That is the *politics* of energy efficiency, in the translation processes of energy streams into classification schemes, we isolate some parts of our systems but not others; we include some energy considerations but not others. This pragmatic is a virtue of necessity for two reasons; first, since the imperative of following all energy paths in infinity would require us to constantly deal with the whole world, which is not practically possible, and second, since representing the whole world in a 1:1 fashion is the opposite

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11 Network is preferred over system as a term. While *system* too easily brings to mind images of a geographically enclosed area that can be contained within one shape, *network* is a term that is better suited to imagine connected sites across the borders of many different shapes, or geographical locations.

of framing, and would implicate a substitution of flexible, political boundary objects that may coordinate parties with different goals and perspectives with essentialist, tyrannical theories that leaves no room for negotiation. Still, such pragmatics can only be defended if the politics that are involved in the translation processes and the resulting classification of the energy efficiency is adequately accounted for.

Furthermore, having illustrated the pragmatics of net energy supply for buildings, there is also the question of *what is a building*? This is brought into question as the limit of five buildings per heat pump in the energy classification scheme is reached; that is another way the politics of translations affect energy efficiency. While that limit is well defined, what counts as a building is still open for negotiation. Could complexes of connected buildings count as one building? Should one large multi-use building be considered as several buildings? These questions can stand as representatives of the politics of energy efficiency.

Exchanges

Whether an energy scheme is based on district or local heating, heat exchangers are important devices to bring the heat from its source into a usable state for the end user. Heat exchangers level out temperature differences between separate media, and they are important safety measures to build stability and decrease vulnerability. As we have seen from our case, exchanges between media are not reserved for the technical domain – remember how the travelling of kWhs between energy centrals, meeting rooms, newspapers and city halls was portrayed above. But the conditions for exchange need to be right; if the temperature difference between the hot water stream for Energeo surplus heat and the water in the district heating pipes is too large, those two systems are incompatible and cannot be connected. Compatibility is also necessary in the social sphere. In the development of Energeo, there are a few individuals that stand out as important *exchangers*. One is the responsible person from the consulting engineering company, who is mentioned by several informants not only as a highly skilled engineer, but also as a person with a large professional and personal network. Within this network this individual enjoys considerable trust and is mentioned as a crucial actor for making the Energeo project come into being, which can be portrayed as arranging for a framing that enjoys sufficient stability to scaffold the project in the construction phase. So if we, at this point, still believe that an energy central is held together solely by nuts and bolts, we should now hurry to add *trust*.

There are others as well. For not only do kWhs find their way from the energy central to the town hall, but the councillor for urban development also travels from his office and down to the energy central basement to officially open the central. Such exchanges are more than symbolic. It is from down there, in the midst of

aggregates and pipes, he indicates in public a need to go through the regulations. And with the circulating speed of news, the argument soon flows over and finds its way into so many other media, expanding the frames of the now, obviously not merely technical, but techno-social – or in the STS terminology, *sociomaterial* – system of an energy central. So is the work of techno-social exchangers.

Energy efficiency as a techno-political construct

In addition to being a *technical* term, kWh articulates reality *technologically* (Røyrvik 2012[r]), thus aspires to belong to the realm of certainty, controlled by the rigid procedure of calculation and entification. A control founded in that reality is precisely that which is *already* known[12], *precisely* known and *absolutely* known.

As we have seen, energy efficiency in general – and energy calculations in particular – are not already, precisely or absolutely known. The engineering communities working with rationalisation of energy know this and handle this pragmatically. In these contexts kWh refers to measured usage of energy and calculations that are conducted in order to know, predict or improve energy usage *as accurately as possible.*

A technologically articulated entity such as kWhs black-boxes the uncertainties and skilled considerations made by those performing and producing that articulation. When the function of kWh is to legitimate decisions, allocate or award money or certify buildings or systems, this is done on the basis of the numbers being objectively true and not subject to human consideration[13].

Energeo, the area as well as the energy infrastructure, has come into being by transformations, translations and exchanges; of social, technical, political and scientific processes. The system, infrastructure and even the district is hard to delineate, define and clearly separate. But who said that framing was easy? It is all about who is taken into account by a system structured around kWhs and energy classification, but calculations depend on the construction of the consuming entity and hence it may vary between types of buildings, number of buildings, production systems, system components, population and more, depending on the purpose and function of the kWh to be calculated. Therefore, the entification (Larsen 2009[r]) and calculation procedures define the objects to be measured and thus controls the function that kWh holds relative to such political constructs as environmental certificates or energy-saving building categories, leaving us constantly wary of the collapse of tautologies (see e.g. Røyrvik et al. 2016[r], Røyrvik et al. 2015[r]).

Within the world of energy efficiency two different sides of the presumably standardised parameter of kWh give rise to settling controversies in practice. On one side uncertainties are somewhat

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12 Heidegger and the realm of calculation (mathematics and physics) (Heidegger and Lovitt 1977).
13 This is the same mechanism of legitimizing overhead by concealing how overhead is produced (Marx 1995).

calculable, and they are pragmatically handled and operated within, and on the other side – and simultaneously – the kWhs are seen as objective and precisely representing reality. This in itself muddles the numbers, kWh-as-indicators and kWh-as-defined are mixed together with kWh-as measured and kWh-as-calculated – a mixing without which they might not play the role of boundary

objects as they do today. Having said that, kWh as a central parameter for Enova is currently being challenged by kW[14], which may indicate that a new framing process may be in the making implying the taking into account of new actors and processes when shaping energy efficiency and viable projects in the future.

Conclusion

Power is relational. That is surely a daring statement[15], considering the absoluteness expressed by first law of thermodynamics: *the total energy of an isolated system is constant; energy can be transformed from one form to another, but cannot be created or destroyed*. We don't have to challenge any physical laws, however, to pragmatically address their application in the real world. One important aspect that distinguishes the real world circumstances from theory is the social and political influence on events. In theory, such as in the laws of thermodynamics, the reference to isolated systems implies physical isolation to prevent energy leakages, but it also implies the isolation of any social influence on the events. The world that we live in is social and relational through and through; however, and in the *pragmatics of thermodynamics,* it cannot be left out of the equations.

In this study we explore presumably isolated systems, and the leakages we find are leakages that cannot be prevented, and that are not desirable to prevent either, since they permeate the merely theoretical border between the material and the social. These circumstances may be more generically referred to as framing and overflowing. Establishing and running an energy central is co-achieved by material and social actors and processes, and the

stronger the requirements are for particularly effective energy configurations, the more social and political it becomes[16].

Power being relational, successful energy efficiency lends support from careful exploitation of those relations, both within and across material-technological and socio-political domains. To fully understand the conditions for succeeding with energy efficiency one needs to understand the functioning of sociomaterial[17] networks and the framing and re-framing processes that take place within them, under the imperative of the formal and often highly standardised technical system classifications. We call this the politics of kilowatt-hours.

Our study of the energy central and the controversies surrounding it reveals a heterogeneous landscape of mixed physical and social aspects in which standards and framing play important roles. Through conceptual exploration we follow the processes of transformations, translations and exchanges to understand the politics of energy efficiency. We argue that understanding the techno-political heterogeneity of such processes, and developing ways of articulating them in ways that make them more transparent, is necessary to facilitate better energy governance.

Acknowledgements

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14 This may seem a minor change – merely rhetoric – but as Solli and Berker (2014) shows, the impact of rhetoric on practice should not be underestimated.

15 Especially taking into account the associations that are often made between *relationism* and *relativism*. We underscore that we mean relational, however, and not relative, and refer the readers that are not familiar with the important distinction between these terms that is made in the STS literature to e.g. Latour (2004).

16 A nice illustration of this is to ask people what images come to their mind when they think of the development of river power in Norway, for example the Alta dam case (Briggs 2006). The most prominent collective memory of this is probably one of activists, politicians, policemen and the parliament building.

17 En passant: the problem of conveying sociotechnical or sociomaterial phenomena, without reducing them to a decomposable composite of social and technical/material factors, may be due to a lack of suitable or imaginable referents from our physical world – despite good and much used expressions such as *imbricated, entangled* or *intertwined* (Orlikowski 2009, Leonardi 2012, Østerlie, Almklov, and Hepsø 2012, Barad 2007). We therefore suggest that the social, technical and political aspects of sociotechnical and sociomaterial phenomena are *emulsed*, to draw attention towards the processes of different substances more or less irreversibly draping each other up in the same way that oil/water emulsions come into being. This also offers us an opportunity to point out nuances of the sociotechnical/-material, as – to use the same analogy – oil-in-water emulsions have different characteristics than water-in-oil emulsions.

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COMMUNITIES OF PEER PRACTITIONERS

Experiences from an Academic Writing Group

by Roger Andre Søraa, Lina Ingeborgrud, Ivana Suboticki, Gisle Solbu

Learning academic writing is important for communicating research and participating in scholarly debates. This learning is traditionally conceptualized through a hierarchical teacher-student relation or individual accomplishment. However, in this paper we ask how we might understand the development of academic writing skills as a collective practice within a writing community. We draw on experiences from our own departmental writing group of PhD candidates and highlight our specific peer community as a tool and the draft texts we deliver as boundary objects through which we develop and broaden our academic skills.

Introduction

Academic writing is one of the most important means of communicating research and participating in the academic community. For PhD candidates, the development of writing skills is imperative for engaging in the publishing realm of academia and its ongoing debates. In Norway, PhD candidates in the social sciences and humanities – who often have little or no prior publishing experience – must write either a monograph or a minimum of three publishable articles during their doctoral work. Our own university recognizes the need for fostering writing skills in PhD candidates by, for instance, providing writing courses and faculty-organized writing groups with supervision. While these resources may help PhD candidates to become better writers (and we have ourselves experienced some direct benefits from such courses and groups), learning to write is predominantly focused on language, structure, and other aspects of communicating results, and it does not necessarily see academic writing as an integral part of the research process itself. Moreover, learning to write is conceptualized in terms of knowledge transfer from the skilled to the unskilled. In this paper, however, we explore our own journey of developing writing skills in a self-organized writing group for PhD candidates.

We started our writing group because we wanted to be more closely engaged with the PhD candidates in our own department – the Department of Interdisciplinary Studies of Culture – with whom we hoped to improve our writing abilities. Inspired by The Agraphia Model, introduced in a rather straightforward "academic self-help book" (Silvia 2007[r]), we started our group in 2015. In preparing this paper, our initial aim was to share some practical tips with other early career researchers who might be interested in developing similar groups; but as we delved into an analysis of our experiences in the writing group, we realized that they might be of interest to a broader audience. Most notably, we found the role of communities in the learning process to be of particular interest. As PhD candidates within the field of Science and Technology Studies (STS), we also noted that perspectives on sociomaterial approaches to community learning were missing in the literature.

Several authors have written about the importance and benefits of writing groups (for an overview, see Aitchison and Guerin 2014[r]). Apart from pointing to the quantifiable advantages of writing groups in the number of papers produced (Page-Adams et al. 1995[r]), scholars have also stressed more qualitative benefits related to the development of members' writing skills. For instance, Aitchison (2009[r]) illustrates how academic learning is facilitated by the practices of writing, reading, and commenting on texts, discussing texts with peers, and redrafting texts. In effect, she argues that writing is learned not only through writing, but also through critiquing text – a point also stressed by Caffarella and Barnett

(2000[r]). Hence, giving feedback on other scholars' work is beneficial for developing one's own writing skills. Furthermore, scholars have also suggested that writing groups may help to demystify the process of writing (Ferguson 2009[r]), enabling writers to better understand the process (MacLeod, Steckley, and Murray 2012[r]) and thus to fear it less and engage in it more actively (Badley 2006[r]).

Moreover, scholars have noted that writing groups are beneficial for reasons that extend beyond the immediate craft of writing. Aitchison and Guerin (2014[r]: 12) stress that writing groups provide an important emotional safe space for doctoral students and early career researchers. Those who are still in the process of developing a researcher identity may find the companionship of a group to impart a sense of connectedness and belonging to an academic community. Aitchison (2003[r]) specifically emphasizes the collegiality amongst group members as an important source of support for PhD students as they form an academic identity. Similarly, Hadjioannou and colleagues (2007[r]) note that the human relationships in writing groups are particularly important in PhD students' lives, which they claim are usually dominated by insecurity and isolation. They describe how the human relationships within such groups empower their members. Likewise, psychological benefits, including a positive attitude, confidence, and motivation, were highlighted in a study of a writing group at Sheffield University (Ferguson 2009[r]), while another study attended to the emotional benefit of such groups, in the form of increased pleasure in writing (Dwyer et al. 2012[r]). We find these insights helpful and recognize them in our own experiences. However, we also see some limitations in these studies.

The literature on writing groups is limited by a predominant focus on supervisor-led groups and a secondary focus on texts, themselves, as the main output of the groups. BBy contrast, we ask: What is the role of writing groups, in early career researchers' academic development? How might such groups, or communities, be created and sustained? Through a critical exploration of our own group, and experiences, we argue that writing groups and the materialization of writing in these groups can be understood as tools for developing skills as academic practitioners.

The article is structured as follows: First, we introduce a theoretical framework in which we draw on a sociomaterial knowing-in-practice approach to learning and employ the notion of Community of Practice (CoP). Second, we provide the methodological background of the analysis of our writing group. Third, we empirically describe the organization of our group and our experiences related to this, following the three pillars of CoPs. Finally, we conclude and elaborate on the findings.

Knowing in Communities of Practice

Within the practice turn in the social sciences (Schatzki, Knorr Cetina, and von Sevigny 2001[r]), learning is considered a situated activity – something that people do together while they are engaged in everyday practices. In this regard, the term "knowing-in-practice" promotes the idea that learning is a practical accomplishment situated in a particular historical, social, and cultural context. This is also referred to through the idioms of "situated learning" and "practice-based theorizing" (Lave and Wenger 1991[r]; Gherardi 2000[r]; Orlikowski 2002[r]; Gherardi and Perrotta 2014[r]). In contrast to cognitive learning theories, knowing-in-practice, and situated learning perspectives share an understanding of knowledge and learning as social and cultural phenomena. In other words, "knowing" describes "what people do every day to get their work done" (Orlikowski 2002[r]: 249). Learning and doing are thus closely connected. In our analysis, we build on this approach, in particular by exploring how it relates to participation in our Agraphia writing group. Thus, we draw attention to situated learning as a community activity.

Several scholars have engaged with learning in communities, and Lave and Wenger (1991[r]) were the first to propose the idea that learning involves engagement in Community of Practice (CoP). Rather than understanding learning as the acquisition of certain forms of knowledge, Lave and Wenger situate learning in social relationships. Their basic argument is that CoPs are everywhere, consisting of groups of people who share a concern or passion for something they do and who improve their skills as a result of regular interaction. A CoP can be defined as a relatively stable community with face-to-face interaction between members who work closely together, wherein participation is central to learning and knowledge generation (Lave and Wenger 1991[r]). According to Wenger (1998[r]), three elements distinguish a CoP from other groups and communities:

  1) Domain: The identity of a CoP is defined
  by a shared domain of interest.
  2) Community: in pursuing their interest in that
  domain, members engage in joint activities and discussions, help each other, and share information.
  3) Practice: members of a CoP are practitioners, and
  they develop a shared repertoire of experiences, stories, and tools. This takes time and sustained interaction.

These elements distinguish the CoP from, for instance, networks or other forms of group organization, by emphasizing collective characteristics and dynamics, rather than personal gains (Wenger 1998[r]). In this paper we explore how these key characteristics have developed and changed over time in our particular community. A more detailed analysis of these three aspects highlights the way in which community learning is facilitated in an academic context.

In this paper we also explore learning between peers as a specific type of learning community, as suggested by Haas (2014[r]). According to Lave and Wenger (1991[r]: 37), participants in a CoP progress from so-called "legitimate peripheral participation" to "full participation" as they gain competency and increase their involvement in the main community processes. For newcomers, the purpose is to learn to talk as the community in order to become a full member (Lave and Wenger 1991[r]: 108–9). By contrast, in this paper we explore how participation and learning can be understood within a community that lacks predefined hierarchies and has more symmetrical relations between members.

The sociocultural perspectives on learning presented so far do not include material aspects in the learning process. Orlikowski (2006[r]), in particular, makes an important contribution to the sociotechnical approach to learning by criticizing previous research for giving too little attention to material and technological aspects of learning practices. In this way, she offers a more symmetrical view of the types of actors involved in CoPs. For instance, Johnson's (2004[r]) study of the integration of simulators as artifacts in new medical learning practices compellingly illustrates a sociomaterial context for learning. Drawing this back to traditional CoP literature, Wenger (1998[r]) explains that CoPs should not be understood as pedagogical methods that can be implemented, and claims that the design of a CoP is unimportant. Practice is thereby not a result of design, but a response to it, as it is subject to negotiation (Wenger 1998[r]: 233). In this regard, Wenger (1998[r]: 235) argues that "design" is a boundary object, rather than a learning method, and describes a boundary object as functioning "as a communication artifact around which communities of practice can negotiate their contribution, their position, and their alignment." Here, we draw on these insights and explore sociomaterial approaches to learning, highlighting the boundary objects that are important in our case.

In sum, we use situated learning perspectives in CoPs to examine learning in a sociomaterial setting. We ask: How might we understand collective learning in CoPs within non-hierarchical peer communities? What learning tools are important and what role do they play in such communities? Before we delve into these questions, we will briefly comment on our method of analytically exploring our own experiences in our writing group.

Researching and Reflecting on Ourselves

This paper is based on our own experiences with a peer writing group at our department. We were inspired by a book on writing by Silvia (2007[r]), titled How to Write a Lot. In this text, Silvia recommends the formation of a so-called "agraphia group." He claims

that writing groups support people who want to write better and faster, on the basis that motivation, goal setting, and social support are crucial for the maintenance of good writing habits (Silvia 2007[r]: 50). As founding members of our Agraphia group, we have seen it grow and develop over the past two years, and this has given us the opportunity to reflect on its processes. We started our group in February 2015 and have since held approximately forty meetings. Since a good deal of time has gone into preparing for these meetings, the group has played a rather considerable role in our PhD journeys. While originally we had no intention of writing a paper about the group, in fall 2016 we determined that our experiences might be relevant for a broader audience.

Initially, each of us created a detailed account of our thoughts about the group structure, the main benefits of the group, and what worked well or was challenging. After reading each other's reflections, we concluded that the group had certain qualities that extended beyond the immediate craft of writing. This made us particularly interested in how we could conceptualize learning within our group. While the reflections in the empirical section of this article are mainly based on our own experiences, we also asked other group members to share their thoughts on specific

issues, such as leaving the group, their motivation for continuing, and aspects of interdisciplinarity. After several new PhD candidates joined the department in spring 2017, the Agraphia writing group split into two smaller groups. The experiences and reflections in this article stem from members of the original group.

Although our initial reflections about the group were quite similar, our process of writing about the group was fairly complex. We wrote the first drafts of this article using Google Docs – a platform on which all four authors could comment on and see their co-authors' edits and suggestions in real time. This was an interesting and enjoyable way to write, but it was also challenging, and manifested a few points that we wanted to make in this paper. Namely, it illustrated that writing is one aspect of a broader and collaborative research process. In our case, it was subject to several discussions in which we had to negotiate, argue, and compromise our points of view and personal writing styles. As researchers within a constructivist tradition, we were aware that this process of writing about and analyzing the group also created and enacted the group, to some degree. In the following section, we explore our writing community in detail, focusing on its establishment, organization, and maintenance.

Assembling Our Own Community

Writing groups can take many forms, but as Aitchison and Guerin (2014[r]: 6) stress, they are perhaps not for everyone. Without support and know-how, many people experience frustration in their attempts to establish and maintain groups. In our case, we were initially unsure of what the group dynamics would be and what we would actually gain by taking part in the community. In this section, we delineate some of our reflections about learning as a CoP.

Developing a shared domain of interest
We started with the same basic aim as most other writing groups – to write more and to write better. We all wanted to practice writing within a safe environment of peers, and this was important for our development of a shared domain of interest. To us, a safe space was a place with no predefined hierarchies, where members would have relatively more authority to engage in discussions than in other academic settings, such as the larger academic department, groups with unfamiliar members from other institutes, and supervisory groups. In a safe space, we would be able to experience and participate in a "tough" but non-judgmental commenting environment. Also, some group members found it challenging to gain familiarity with all of the new faces in the department, and the Agraphia community helped to smooth this transition. The fact that members already interacted on a daily basis made it easier for us to formalize our ties in a group. Becker (1986[r]) stresses that trust is key in academic writing, and that trust is developed by overcoming the struggles and challenges of writing, together. While this was already stressed in Silvia's advice, it gained a different meaning

for us over time. A Peer can be understood in different ways (e.g. relating to age, experience, research topic, etc.). In our case, the title of "PhD Candidate" represented, on the one hand, a formalized set of shared expectations and status; but on the other hand, we attached different meanings to the qualities that we felt should establish us as peers within this community. Namely, creating and engaging in a community of equals was as much a domain of interest that formed the peer group as it was an outcome of our shared identity.

Aitchison (2003[r]) explains that activities surrounding writing, such as commenting on texts written by peers, contribute to improving writing skills. In our group, members have gradually become more involved in other members' writing projects, and this has made it easier for us to discuss members' articles and projects. Our interest in discussing writing was rather narrow at the start, but we soon realized that by interacting with each other's texts we would develop more than simply writing skills. In this way, our shared domain of interest moved from a focus on writing, itself, to collective development as academic practitioners through writing.

Organizing the community
Shared interests not only create a group and hold it together, but they are also constructed once members start interacting around a common interest. The Development of a shared domain of interest in our group was closely intertwined with routines and explicitly stated rules, though these rules were – and still are – subject to negotiation. According to Lave and Wenger (1991[r]), there is no

clear design for interaction in CoPs. In our case, however, clear rules strengthened engagement, predictability, and commitment from the very beginning.

Currently, the group meets every other Friday (from 11:00 am to 12:00 pm) to discuss members' texts and writing progress. Initially, several members expressed frustration when other members failed to submit or read a text, or even forgot the meeting. Regular group hours were thus introduced to avoid misunderstandings and frustration due to differing expectations. We also established a clear instruction: members must be present to read and deliver a text at the agreed time. The meetings themselves were also given a clear structure, which continues to this day. Each meeting begins with coffee and food, in order to relax members and maintain group commitment. Knowles and Grant (2014[r]) point out that food plays a pivotal role in creating a focused, energetic atmosphere in writing sessions and that it can create social bonds through gift exchange (Guerin 2014). Eating and drinking thus draws individuals into a group that looks after its members (Aitchison 2014[r]: 13). Our department solidifies its support of our group by granting "fuel" for our writing.

Following refreshments, the meeting is divided into two main parts. Since sharing academic texts and giving and receiving feedback are the most important objectives of the group, we use approximately 45 minutes of each meeting to discuss a text written by one of the members. For each meeting, two members are selected to do a close reading of the text and to provide constructive criticism on that piece. When submitting a text, the author is asked to define the specific issues on which he or she wants feedback (e.g. the language, argument, use of concepts, structure, etc.). However, the main readers are free to comment on any issue they find relevant. Other group members are encouraged to also read the text, though they are not expected to comment with the same level of detail as the main readers (but often the texts are so exciting that all members read them thoroughly, anyway). When a member receives comments that lead to an interesting discussion about his or her work, that member feels inclined to give the same experience to other members. In this way, reciprocal relationships are constructed, and these relationships form and sustain the community. The remaining fifteen minutes of each meeting are spent monitoring writing progress. Each member reports whether he or she has fulfilled their two-week personal goal and sets a new goal for the next meeting. Although the group supports ambition, we have lately become more aware of the need to set clearly defined and realistic goals. The last few minutes of each meeting are spent planning the subsequent meeting. This includes choosing an author and two main readers. We have our own "Agraphia book" – what Silvia (2007[r]) calls the "Folder of Goals" – which we use to reinforce good writing behavior through a system of butterfly and star stickers: at each meeting, the author gets a butterfly and the two main readers each get a star attached to their names. The stickers work as nice visual rewards, and they also make it easier for us to keep track of group members' activity levels.

Wenger (1998[r]: 235) claims that the design of a practice community is a boundary object, rather than a learning method. By contrast, we argue that in our group, the design (our community rules) serves as an important tool for facilitating learning. From the start, we established clear rules, which have been renegotiated along the way. This has given us predictability, ensured that expectations are fulfilled, and made sure that each member has the time and space to contribute to the group discussion. While the rules were particularly important in the beginning, when the group was forming, over time, they have become routinized practices. Reproduction of these practices is no longer linked to social control, but is generated by the recognition of the benefits we gain from organizing our meetings in this way.

Learning as practitioners

The Agraphia group has become a tool through which we collectively develop academic skills as practitioners. Through meeting regularly, discussing texts, and sharing experiences, we demystify the practice of writing. We have discovered that learning in this setting is multifaceted. Here, we highlight our learning and development of writing skills and – more importantly – our growth as academic practitioners.

We have recognized that being too critical and perfectionist in regard to our own writing may create a deadlock or slow down the writing progress. Thus, we push each other to deliver drafts we consider far from "ready." During our meetings, we comment on the structure of findings and paragraphs, engagement with the reader, and the author's voice in the narrative. More detailed and language-related comments are not given much space; rather, such comments are written directly in the text for the author to review at a later point. If a text is near completion, more time is devoted to concrete textual issues. Usually, however, other topics are prioritized. These practices have revealed something that is perhaps self-evident to many: learning to write is about much more than mere writing. For instance, in the first meetings, we realized that commenting on the structure of a text could not be removed from discussions of the content of the argument, itself. By default, we engaged in a debate about structure, the analytical standpoint of the author, and compelling angles from which to approach the academic debate in question. Opening the "black box" of writing and sharing writing difficulties has thus proved to be closely connected to the difficulties of doing research and analysis, and not least, positioning these within wider academic debates. By engaging with each other's texts and writing, we have learned to be more proficient academics.

Both the texts, themselves, and the meta-language we develop when discussing them, are key to learning in the writing group. According to Aitchison (2003[r]), researchers develop a meta-language and a meta-conscious awareness when they talk about writing processes. In our case, the texts serve as important objects of our developing meta-language. By gathering around the texts, so to speak, we strengthen our academic skills in broader terms.

Thus, the texts can be described as important boundary objects for learning. In a community of peers in which everyone works in different research groups or on specific PhD projects, the texts we share allow us to learn as a community. As mentioned, this learning relates not only to writing, but also a number of other aspects. First, when discussing particular texts, members often suggest new concepts, methods, frameworks, and studies that could help to expand our overall knowledge of the field. Second, this contributes to more affinity for various positions within theories of science. Third, our discussion of writing in progress pushes us to find key points and novelties in our material, often at an early stage, in both our own and other members' material. We have had good experiences with requesting the main author is asked to provide a verbal summary of the material, which forces him or her to explicate the main point to an audience. All in all, the use of texts as central objects of engagement invites our broader engagement in writing as a means of developing as academic practitioners.

Developing meta-languages is also essential for strengthening and managing our interdisciplinarity. All of the group members are employed in the Department of Interdisciplinary Studies of Culture, which is connected to different scholarly traditions, such as anthropology, literature, computer science, and the arts. Also, the group members work on a variety of topics (e.g. energy, gender, transport, robots). Thus, we have had to develop our communication and translation skills in order to come together as a group. This has required us to not only see other members' perspectives but also to be eloquent in formulating our own ideas and our arguments for these ideas. Listening to others formulate their thoughts and experiencing their misunderstanding of a perspective helps members improve and adjust their ways of communicating. We have often experienced misunderstandings and difficulties when readers and authors have approached a text through divergent disciplinary approaches. For example, we have had several discussions about how authors should present and analyze quotes in a text. On one occasion, an author found his quote well described and positioned, but another saw it as

assumed and underexplored. In this case, the author had to critically examine his position and argue why his presentation of quotes was legitimate. While such discussions comprise one of the group's main strengths, we also acknowledge that the interdisciplinarity requires "management," as also recognized by Sørensen and colleagues (2008[r]). For this reason, we usually try to assign main readers whose research foci are closely aligned to the topic of the paper.

One of the main characteristics of our group is that it is comprised of peers, and we learn with and from each other. When several new PhD candidates joined the department in spring 2017, we consciously chose to divide the group in two, in order to avoid new members entering a group that had already developed shared practices and a common domain of interest. We, the members from the original writing group, provided some informal guidelines and advice to the new PhD candidates on organizing a writing community, but they were free to develop their own shared domain and community rules.

According to Lave and Wenger (1991[r]: 37), members in a CoP move from so-called "legitimate peripheral participation" to "full participation" as they gain competency and increase their involvement in the main community processes. In our case, learning occurred as all members became "fuller" participants, developing their skills together with the other members, as a community. By creating an intentionally low threshold for delivering texts from the start and developing relationships of trust, we experienced that comments from peers could feel less dangerous than critical feedback from more senior academics. This perceived safety enabled us to be more outspoken with our opinions, to put more effort into our translation of meanings, and to give more space for co-constructing knowledge. To give an example of the opposite, a very experienced scholar once visited our group to give some pointers. In this meeting, a different type of exchange quickly became evident, due to the senior academic's greater experience and higher academic position. By contrast, we feel that engaging in a peer community gives us more leeway to negotiate meanings.

Conclusion: Learning in Communities of Peer Practitioners

In this article we have shared and reflected on our own practices of creating and sustaining a writing group in our department. We have drawn on a knowing-in-practice approach to learning and employed the concept of CoP to highlight the importance of knowing and learning as collective practices among group members. Moreover, we have adopted a sociomaterial approach to learning in order to draw attention to both human and non-human actors in the learning process. Thus, the article has both an empirical and a theoretical aim: (1) to share experiences from our writing group and reflect on its strengths in relation to other forms of learning, and (2) to use these findings to develop ways of thinking about collective learning through CoPs.

According to Wenger (1998[r]: 226), learning involves the ability to renegotiate new meanings and to engage in boundary work. In our community, renegotiation was enabled by the non-hierarchical peer community. Further, we have stressed how the texts shared in every meeting become important boundary objects and tools for developing academic skills, such as honing an analytical sensibility, giving and responding to feedback, and creating meta-language in order to communicate within and between fields. In other words, writing might not always be the goal, in itself; rather, it might be a means of improving other academic skills. The text serves as an object that is discussed, negotiated, argued, agreed, and struggled over by the

community. Also, the design of the Agraphia group is an important tool for maintaining its practices. Ultimately, the group assembles many actors at every meeting – academic texts, sandwiches, PhD candidates, the Agraphia book, and (star and animal) stickers. Thus, the group helps members improve as academic practitioners and further prepares them to engage in dialogue with other academics.

As expected, the Agraphia group helps members learn not by observing the community, but by actively participating in the community. This finding is in line with Lave and Wenger (1991[f]), who stress that the main goal of community members is to learn how to become full members – to learn how to talk as the community. This resonates with the literature of knowing-in-practice, as it considers learning to be a practical accomplishment. However, this knowing-in-practice is not only an individual development, but also a collective achievement. Thus, the writing group is the entity that learns, grows, and develops.

A novel contribution from our work is the importance of building a symmetrical community of peers with no pre-defined academic hierarchy. In our community, there is no dominant knowledge transfer from senior to junior community members, and no legitimate peripheral participation. Rather, members are expected to actively engage from the very start, and encouraged to give feedback on texts immediately upon joining the group. This skill requires regular practice, and unfortunately, such practice is often neglected in formal doctoral training. To highlight the peer element, we propose an addition to the concept of the CoP, namely what we call the "Community of Peer-Practitioners" (CoPP). This community should not be taken as a substitution for a CoP, but should be understood as reflecting a slightly different – egalitarian – way of practicing a learning community, as befitting the situation and needs of early career researchers. We have highlighted the benefits of engaging in a CoPP and we invite others who are interested in writing communities to further explore peer groups..

Acknowledgments

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BOOK REVIEW

Humans, Animals and Biopolitics: The More-than-Human Condition

Edited by Kristin Asdal, Tone Druglitrö and Steve Hinchliffe

Reviewed by David Redmalm, Department of Sociology, Uppsala University

Michel Foucault's concept of biopolitics captures the way a de-centralized form of governing measures and mobilizes life itself through a number of technologies, such as demographics, surveillance and health initiatives, with the aim to prolong and enhance the lives of a population. According to Foucault, this biopolitical form of governing characteristic of modernity implies a detached and technical stance towards individual lives. In short, biopolitics turns individual lives into life as a mass noun. Interestingly, when human life is treated as a resource, human's self-proclaimed position as the crown of creation is unsettled and humans find themselves part of the same biopolitical nexus as many other animals. The technologies and consequences of the biopolitization of humans and other animals is the subject of the volume Humans, Animals and Biopolitics, edited by Kristin Asdal, Tone Druglitrö and Steve Hinchliffe. It is a book that should be required reading for Foucauldian theorists and human-animal studies scholars alike.

The volume nuances, expands and critiques the theory of bio-politics in nine chapters with fascinating and empirically detailed cases. The chapters illustrate the breeding, management, modification and ending of nonhuman animal life, and the ways humans are entangled in these processes. As shown in several chapters, it is not merely the case that humans are governed by the use of nonhuman animals. Natalie Porter suggests in her chapter on the responses to the avian flu in Vietnam that "biopower also operates on humans and animals collectively, as one social group composed of humans living with animals", and does so "in order to govern the existence of both species" (p. 137). Hence, humans are often transformed through these processes when put at par with other animals. Other chapters raise questions concerning what kinds of humans and animals emerge from biopolitical regulations. For instance, Robert G. W. Kirk underlines in his chapter on the development of regulations for "humane" animal experimentation that human society "relies on encounters with the nonhuman to understand itself" (p. 120). Mapping out a more-than-human biopolitics is a complex intellectual task as these encounters have recursive effects: the way nonhuman life is administered and used in laboratories and food industry reproduces a certain idea of "the human" that has consequences for nonhuman animals, which again effects humans.

Vibeke Pihl's chapter shows a striking example of how the administration of pigs used as model animals in gastric bypass surgery experimentation has repercussions on their human handlers, and even on the notion of the subject. Pihl notes how pigs are named and treated as individuals in the experimental farm, while the researchers performing the operations only use numbers when referring to the pigs. It is a common idea that laboratories employ techniques to "dehumanize" animals in order to facilitate cruel experimentation, but Pihl demonstrates that the naming and individualization of pigs makes it possible to monitor and handle them more efficiently. What is more, Pihl points out, the researchers in the laboratory also find themselves treated as numbers as they are dependent on impact factors, quotations and h-index numbers. Thus, a dynamic of personification and anonymization enables a biopolitical treatment of individual lives, human as well as nonhuman, as resources.

The book's chapters focus on specific cases and empirical studies to show how human-animal collectives emerge from biopolitical strategies. But while the introduction written by the three editors provides the reader with an ambitious survey of different Foucauldian approaches to a biopolitics of humans and other animals, only a few of the chapters engages thoroughly with this theoretical discussion. However, as all chapters focus on different aspects of the biopolitics of human-animal relations, the reader's understanding is often enhanced when chapters are put into dialogue with each other, which shows that the chapters clearly amount to a collective effort. So the questions that Pihl's pigs raise are answered by Martina Schlünder's individualized and collectivized sheep, and vice versa.

There is also an important point made from the focus on empirical detail rather than theoretical abstraction. In the introduction, the editors explain that they do not aim to extract a whole ontology from Foucault's theory of biopower, as some Foucault scholars have attempted. The editors' Foucault is a "methodological" Foucault—a combination of poststructuralist theoretical insights combined with tools developed in science and technology studies and actor-network theory with its flat ontology, giving equal attention to all involved actors, be they human, nonhuman or inanimate object. In a footnote, the editors even suggest that Foucault should be understood as several ongoing discussions, or "biopolitics collectives," rather than as a single individual being (n. 1, p. 27). Foucault—a philosopher who wanted his works to be used as if they were Molotov cocktails, who resisted classifications and who not only predicted but welcomed the death of the author— would most probably applaud this approach. It does not have to be pointed out that among Foucault's most influential works are the books that make use of thorough studies of archive material from

social institutions such as prisons, asylums and hospitals. It would therefore be reasonable to suggest that the most Foucauldian approach to the study of contemporary forms of biopolitics would be to focus on empirical material, rather than on reinterpretations of Foucault's oeuvre.

Although the chapters show how collectives of human and non-humnan animals can be said to challenge biopolitical regimes in various ways, in the end, things remain pretty much the same in our anthropocentric world. Humans continue to be subjected to and to reproduce the biopolitization of life, while also retaining their privileged position relative to nonhuman life. Then again, none of the chapters nurture the illusion that there are easy ways out of the reach of biopolitics. Steve Hinchliffe, in his brilliant biopolitical reading of Michel Serres' meditations on birds, or "avian wisdom," suggests that instead of reproducing fantasies of absolute independence from discursive formations and biopolitical governing, the concept of biopolitics should be used to identify destructive forms of power, and highlight the way humans and animals engage in a "being or becoming sentient together" (p. 159).

This is a constant theme of the book: to show how an attendance to the way biopolitical arrangements always overflows with "liveliness", "noise", or the "more-the-human" can alter those arrangements. This is what happens in Swiss laboratories when dogs are replaced by sheep to reduce the ethical tensions in the laboratory, with the consequence that laboratory workers become attached to the sheep instead (Martina Schlünder's chapter). This is also what happens when the logic of the humane treatment of animals genetically close to humans is transferred to fish, which raises discomfort in the way humans have neglected "fishy sentience" (John Law and Marianne Elisabeth Lien's chapter). Finally, this is what happens when the relationship between a camel and his human traverses territorial and categorical boundaries to transform into "a radical intervention into the isolating and otherwise disempowering structures of normativity" (Susan McHugh's chapter, p. 180). The aim of the book, to introduce a more "lively" biopolitics, is definitely reached, providing the reader with theoretical, methodological, empirical, and hopefully even ethical insights. In other words, it is a work that certainly takes a step toward an alternative biopolitics.

ABOUT THE COVER ARTIST

Michael Pinsky

By Ivana Suboticki

Michael Pinsky is a British artist who is working on numerous international projects by using innovative methods to tackle some of the most challenging subjects that shape and influence the public realm. In his work, Pinsky does not have a predefined agenda and plan for the outcome of his artwork, rather, he approaches his projects in a very explorative and bottom-up way. By taking on the role of an artists, urban planner, activist, researcher and local community members, he works closely with both local communities and resources in a participative manner. Situated physical, social and political environments thereby inform his artwork and shape it through continuous interaction and dialogue.

Pinsky's work has been exhibited in both galleries and publics spaces. Some of the most recent installations include: I'm Laughing at Clouds in Cambridge, L'eau Qui Dort in Paris, A Stitch In Time in Chengu, and Survey, a solo exhibition at MOCA Chengu.

Pollution Pods present his latest installation in Trondheim, Norway. The artwork was commissioned by the Norwegian University of Science and Technology (NTNU) as part of the research project Climart, a multi-disciplinary research project, which explores visualizations of climate change and the role of emotive art on public perception of climate change and other environmental issues. The Pollution Pods consist of five geodesic domes containing air quality from five different cities in the world: Tautra (Norway), Beijing (China), Delhi (India), London (England), and São Paulo (Brazil). Visitors are invited to pass through the different domes and experience the pollution and climate in the different cells. In each, a specifically mixed recipe has been prepared, emulating the presence of ozone, nitrogen dioxide, sulphur dioxide and carbon monoxide. Visitors are thus exposed the tastes, smells, and feel, of the different cities and their environments.

For more information about Climart and Michael Pinsky's work, visit:

- https://www.climart.info
- http://www.michaelpinsky.com
- https://twitter.com/Climart3