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Dear Readers,

Welcome to the last issue of the year of *Science & Technology Studies*. In this issue, we are excited to publish a special theme issue focused on "Alignment Work for the Movement of Knowledge". This issue was guest edited by Corinna Kruse, Jenny Gleisner, and Hannah Grankvist. The theme's exploration of knowledge and knowledge movement are central to STS and we hope you enjoy the five contributions.

As the year comes to a close, I would like to extend a thank you to our editorial team, including the new members that started in 2023 and our assistant editor Heta Tarkkala. The dedication and hard work of our editors have been instrumental in working with the journal. I would also like to thank all of our anonymous peer reviewers who have contributed their time and effort to ensure the scholarly rigor and high standards of STS.

This issue also marks the conclusion of our 36th volume, meaning it is the 35th anniversary of the journal. We are currently gathering statistics and facts about the journal, which we look forward to sharing in the first editorial of next year.

In the meantime, I wish everyone a joyous and relaxing holiday period!

Your sincerely,
Antti Silvast

Introduction: *Alignment Work for the Movement of Knowledge*

Corinna Kruse
Linköping University, Sweden/corinna.kruse@liu.se

Jenny Gleisner
Linköping University, Sweden

Hannah Grankvist
Linköping University, Sweden

Knowledge moves through society in a number of ways: Students are taught scientific "facts" in class, health care practitioners explain diagnoses and treatments to patients, experts of different backgrounds collaborate, popular media bases stories on medical or forensic procedures – and viewers form their understandings of these procedures (at least in part) from these stories.[1] In other words, knowledge produced in one context moves – or, rather, is moved – to a succession of other contexts; not necessarily the contexts that were envisioned by the original producers of the knowledge. In addition, knowledge may change as it moves, perhaps to the point of being difficult to recognize.

The point of departure for this special issue is that the movement of knowledge, more so the *stable* movement of knowledge, is work that deserves detailed and systematic analytical attention. Knowledge in different forms and shapes is a – if not the – central concern in STS. The everyday work of producing knowledge has received in-depth attention from the beginning (e.g., Latour and Woolgar, 1979; Lynch, 1985; Knorr Cetina, 1981, 1999). The movement of knowledge has also been been studied for a long time, albeit under different names – for example as the *exchange* (e.g. Galison, 1997), the *transmission* (e.g. Lambooy, 2004), the *circulation* (e.g., Raj, 2007; Östling et al., 2018), the *dissemination* or *travel* (Howlett and Morgan, 2011) of knowledge. However, while this body of work has mapped the routes of how knowledge is moved across different kinds of communities in interesting ways, the everyday work of moving knowledge has not received as much explicit attention as that of its production. That is, while the movement of knowledge is a central concern in STS, this concern has rarely been studied at the same micro level as has the production of knowledge, leading also to fewer theoretical notions that focus explicitly on the everyday work of moving knowledge. A notable and well-known exception is ANT where, however, the production and movement of knowledge sometimes are indistinguishable (e.g. Latour, 1983, 1987).

Implicitly, the movement of knowledge figures in several STS notions. Galison's trading zones (1997), for example, draw parallels between the exchange of knowledge across scientific (sub-)

disciplines and the trade of goods between different and not necessarily friendly ethnic groups – he even speaks of trading with "the enemy" (Galison, 2010). While his focus is on how these metaphorical trading zones facilitate the moment of exchange, the exchange also implies knowledge moving to a new site to be used there. Similarly, the collaboration of very different social worlds that Star and Griesemer's (1989) boundary object makes possible entails at least some knowledge being moved, even though, like the knowledge exchanged in Galison's trading zones, this knowledge may mean rather different things to the inhabitants of the different worlds.

From an STS adjacent perspective, the contributions to Howlett and Morgan's (2011) edited volume discuss how (well) facts travel from one place to another, in particular how they can "travel with integrity" (Morgan, 2011: 12) and "fruitfully" (Morgan, 2011: 18), that is, travel unchanged and be used – as opposed to only noted – in their new context. In other fields than STS – predominantly in management and organization studies – scholars grapple with similar questions from a practical point of view, asking for example which factors and processes affect how knowledge can be moved from one department in a company to another, in particular knowledge in the form of innovation; their work often is quantitative (e.g., Szulanski, 2000). A notion particular to this strand of research is the 'stickiness' of knowledge – a term that refers to the cost of its replication and transfer (e.g., von Hippel, 1994) – that must be overcome or at least mitigated for knowledge to be moved (see also Szulanski, 1996). In other words, this scholarship acknowledges and strives to understand the difficulties of moving knowledge between collaborating communities.

An implicit aspect of this movement is that quite some collaborations – the criminal justice system that Kruse (e.g., 2016, 2021) has studied is an example – require that knowledge moved between collaborators remains at least somewhat stable during the move. In the comparatively extreme case of the criminal justice system, forensic evidence must be (understood as) unchanged from the trace the crime scene technicians recovered at the crime scene, through the analysis at the forensic laboratory, its integration into the pre-trial investigation, and its presentation in court. But also in less demanding contexts, a measure of stability is desirable. When for example medical experts, like the midwives in Gleisner's contribution in this volume, give advice to patients, they want them to understand and follow this advice without misunderstandings or modifications.

What makes such stability, be it rigid or more flexible, more difficult are the different understandings of the "same" knowledge in the different communities. To take an example from Grankvist's contribution, to an occupational health services provider, adjustable desks are the best solution to office workers' lower back pain, whereas they can be an impossible or undesirable expense to an employer. Similarly, to a forensic scientist a probabilistic evaluation of a DNA match is a careful of inescapable uncertainty, while a prosecutor may either not perceive any uncertainty at all or wonder what makes the evidence so "weak" (Kruse, 2013). In other words, what may look, on the surface, like the same thing – a solution to an occupational health problem or an expert statement – can mean quite different things to different sets of people – due to different expertise, backgrounds, and priorities.

Karin Knorr Cetina (1999) has discussed such different meanings in terms of different 'epistemic cultures,' that is, different cultures of producing and, in consequence, understanding knowledge. Her notion is based on two scientific disciplines – molecular biology and experimental high energy physics – and focuses on their very different "machineries of knowledge construction" (Knorr Cetina, 1999: 3), without an interest for how they might interact or exchange knowledge.

However, her notion can be usefully widened into a broader understanding that draws attention to how disparately different communities relate to and understand knowledge. Kruse (2016) has earlier discussed the Swedish criminal justice system as a collaboration of different epistemic cultures with different ways of contributing to and understanding the production of forensic evidence; but one can easily also conceptualize the meeting between a midwife and a pregnant person as a meeting of different epistemic cultures – the midwife's medical way of understanding

and relating to a pregnancy and the pregnant person's rather personal relation, embodied and embedded in personal history, relationships, emotions, and practicalities.

Thus, with this special issue, we build on and develop existing STS awareness of and sensibility for epistemic differences and the work required for bridging them. Specifically, we want to add to the study of knowledge a sensibility for the work associated with aligning the different understandings that can make its movement challenging. Different understandings in different epistemic cultures can make the movement of knowledge between them difficult – this becomes particularly visible in current debates on the relevance and intelligibility of expertise (e.g., Åkerman et al., 2020). We build on the notion of *alignment work* (Kruse, 2021) to draw systematic analytical attention to the continuous work that, we argue, is an integral part of resolving tensions (cf. Star and Ruhleder, 1996) between different communities and thus a prerequisite for moving knowledge between them.

Alignment Work

A central point in this special issue is that the movement of knowledge and in particular the stable movement of knowledge between different epistemic cultures requires the alignment of different communities, actants, and knowledges, at least temporarily. The pivotal notion of 'alignment work' (Kruse, 2021) is inspired by both the 'articulation work' described by Anselm Strauss (Strauss et al., 1985: chapter 7; Star, 1991: 275), and Janet Vertesi's (2014) work on 'alignment' and 'seamlessness.' Articulation work as a concept draws attention to the often invisible work that makes the work perceived as the core work possible. Even though articulation work is essential for the work of others, it is thus not necessarily seen or acknowledged by these others, especially as long as it is performed as expected (Star, 1991: 275 ff).

Vertesi (2014) on the other hand draws attention to the gaps or 'seams' between infrastructures with different standards – seams that are akin to the 'tension' between different sites that infrastructure studies discuss. As Star and Ruhleder put it, infrastructures resolve *"the tension between local and global"* (1996: 114; italics in original) that makes the movement of people, goods, and knowledge difficult. In order to function, an infrastructure must resolve these tensions – and if it does, its users do not notice that there was tension. To return to Vertesi, tensions are resolved or seams bridged by actors' producing "a shared experience of seamlessness" (Vertesi, 2014: 277) through "moments of alignment between and across systems" (Vertesi, 2014: 268) in environments that rely on multiple, overlapping infrastructures. Even though she does not elaborate on its production, her work underlines that seamlessness is a fleeting state that must be repeatedly produced.

This repeated production, then, can be called alignment work – a form of articulation work that (at times, temporarily) aligns different epistemic cultures to attain an experience of seamlessness in the movement of knowledge (Kruse, 2021). Thinking in terms of alignment work makes it possible to capture the continuous work that enables knowledge to be moved from one site or epistemic culture to another; what is more, to be moved with integrity and fruitfully (cf. Morgan, 2011) despite the tension caused by epistemic differences such as potentially different understandings of the "same" knowledge.

The concept of alignment work ties into and develops themes that other STS scholars have hinted at or discussed in different terms and with different foci and analytic concerns. Galison, for example, speaks about the "coordination" (Galison, 2010: 32) of trade in his trading zones, i.e., trading partners agreeing on which goods to exchange. Star and Griesemer talk about boundary objects as "anchors or bridges" (1989: 414) that (temporarily) tie different worlds together in collaboration. ANT, finally, speaks of making dissent costly (Latour, 1990: 41 f) and of convincing others of one's perspective (Callon, 1986; Latour, 1987) – in other words, of creating homogenous understandings. Conversely, Gröndal and Holmberg (2021) use the term alignment work, albeit in a different way to Kruse, to draw attention to discursive strategies that "harmonize different demands, interest and risks" (Gröndal and Holmberg, 2021: 5). Like the concept at the core of this issue, their notion draws attention to the constant work that

coherence requires. Unlike the alignment work in this issue, their alignment work is discursive work; in addition, it is work that is largely done within a profession (and thus presumably within an epistemic culture) to reconcile conflicting values.

By centering a special issue on alignment work, then, we want to bring detailed attention to the continuous, everyday work of – perhaps fleetingly – aligning different understandings so that knowledge can move smoothly across the seams between them. We argue that paying attention to the everyday work of moving knowledge and to the relationships with which this movement is intertwined is as important to STS understandings of knowledge as is paying attention to the work of producing knowledge and to the relationships with which it is intertwined. Alignment work, we posit, is a core part of this everyday work of making knowledge move.

Based on empirical material from different contexts, the articles in this issue develop different aspects of alignment work. They ask when and by whom alignment work is being performed, to whom it is visible or invisible, what seams it smooths over or makes visible and for whom, and which relations are created and maintained.

The Contributions

The contributions in this special issue illuminate the work of alignment in a variety of contexts and practices – literature and early childhood education, midwifery, the criminal justice system, and occupational health services. What these different contexts and practices have in common is that knowledge in some form is expected to move across a seam formed by epistemic differences, facilitated by alignment work. The contributions also all focus on relationships in some way; relationships between humans and non-humans, health care provider and patient, service provider and customer, or within a profession.

Emilie Moberg's contribution discusses potential asymmetries in alignment work and the relationships it implies. Alignment work, she points out, is not immune to power, politics, and privilege. When humans produce and move knowledge about non-humans, they do so from a human-centered position and thus privilege human understandings: aligning human-centered and non-human-centered worlds to produce knowledge requires empathy, Moberg argues, and this empathy is typically achieved by ascribing human traits to non-humans. However, this alignment at the same time opens up for destabilizing this same anthropocentrism, for example by highlighting the interconnectedness of ecosystems. In other words, she underlines how alignment work both rests on existing power relationships and has the potential to destabilize them; alignment work, so to speak, affects the ecological balance between epistemic cultures.

Jenny Gleisner's article points to a different affective dimension of alignment work. To bridge the tension between sites – in her case, between the midwives' medical expertise and the expectations of parents-to-be – it is not enough to stabilize knowledge as it is being moved, its intended recipients must also want to receive it. Accordingly, emotion work and will work are an integral part in aligning pregnant persons and parents-to-be with the standardized antenatal care program of check-ups and parental education that the health care system offers. Thus, the willingness of parents-to-be to participate in antenatal care and parental education – cultivated by the midwives' emotion work – smooths the seam between the two.

Hannah Grankvist's contribution shows that alignment work is contingent on relationships. Where Gleisner's study took place in sites with firmly established relationships – relationships between health care providers and patients are regulated and institutionalized – occupational health services providers must establish relationships with potential customers before knowledge can be moved. Conversely, when the relationship has progressed to the movement of knowledge, this movement is intertwined with and shaped by maintaining and, ideally, developing an asymmetric relationship. In other words, in order to align different epistemic cultures, occupational health services providers must align different *interests*. Thus, Grankvist's contribution underlines that when alignment work cannot rely on already defined relationships, establishing them is part of and intertwined with alignment work.

Corinna Kruse's paper shows that alignment work does not only affect the intended recipients of knowledge but also those performing the alignment work. She shows how alignment work, while not necessarily visible to or appreciated by others, can be a source of professional pride and identity. That is, the ability to perform alignment work and thus to salvage a possibility for forensic evidence is part of crime scene technicians' self-understanding, thus forming a different affective dimension than the emotion work and relational work discussed by Gleisner and Grankvist, respectively.

Finally, the concluding piece by Corinna Kruse and Antti Silvast highlights how the notion of alignment work complements Karin Knorr Cetina's STS classic *Epistemic Cultures* (1999). Pairing Knorr Cetina's attention to epistemic differences with attention to how the seams caused by these differences can be bridged, they argue, offers a theoretical tool set to think about collaborations between different experts or professions, especially where it is important that knowledge moves without (too much) change.

Together, these contributions paint a diverse picture of alignment work in different locations and contexts. By tracing and discussing these different incarnations of alignment work, this special issue aims to show that alignment work makes moving knowledge over seams possible; paying systematic analytical attention to the continuous work of aligning communities, knowledges, and standards has potential for new insights into issues at the core of STS.

This alignment work might of course look quite different in other cultural contexts and other parts of the world – all of the empirical contributions build on cases from Sweden, most of them, moreover, on cases from or near Sweden's public sector (the exception being occupational health services). Thus, the different instances of alignment work are performed against a backdrop of similar understandings. This similar context might mean that the discussions of alignment work in the empirical contributions might downplay the variability of such work.

Still, the contributions contribute new and different dimensions to the concept of alignment work. For one, they underline the role that relationships, emotions, and identities play in the movement of knowledge. Alignment work can be intertwined with professional pride and identities; as such it can be a core part of a profession's work or be the prerequisite for being able to do this work. Alignment work is shaped by and maintains existing power relationships and privileges – both in terms of who does the work and to whom it is visible and in terms of the alignment itself – but it can also contribute to questioning the status quo.

These affective dimensions are not encompassed in Kruse's (2021) original notion; she developed the notion based on empirical work in the Swedish criminal justice system. More precisely, she focused on professional practitioners moving knowledge between them – a movement that does not involve emotions[2] and that relies on comparatively equal institutional and institutionalized relationships. In such a setting, there is not the same need for the appeal to empathy that is part of the alignment work studied by Moberg, the will work described by Gleisner, or the careful aligning of interests discussed by Grankvist in this issue. In other words, applying the notion to new empirical fields has also made it possible to widen its scope and add further dimensions to what alignment work can look like and how it may fit into larger relationships and communities.

Another contribution to the notion is how alignment work shapes the knowledge that is being moved. As Moberg's study highlights, how well educators manage to align the human and the non-human affects the production and movement of knowledge; the same applies to the crime scene technicians, midwives, occupational health services providers in the other articles in this issue. Conversely, unsuccessful alignment work means the movement of less or less nuanced knowledge: The alignment work occupational health practitioners perform directly affects which knowledge they (attempt to) move, and a pregnant person that the midwives do not manage to align with the standard antenatal care program will miss out on the knowledge offered within the program.

In other words, alignment work – which is in turn shaped by the relationships and structures it is embedded in – contributes significantly to shaping not only the movement of knowledge

but also knowledge itself and thus our understanding of the world. Tracing alignment work and the forms it takes in more contexts should make it possible to add more dimensions to that shaping and thus to understanding knowledge – a central STS concern that, moreover, fits in with and complements classic STS notions very well. With this special issue, we would therefore like to invite the STS community to join a conversation on the everyday work of facilitating the movement of knowledge across the seams between epistemic cultures as a part of the conversation on knowledge in society.

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Notes

1 An example are offenders' understandings of DNA technologies being shaped by, among other things, popular television crime shows (Prainsack and Kitzberger, 2009; Machado and Prainsack, 2016).

2 For a discussion of the work of creating (the appearance of) rationality and emotionlessness in other parts of the criminal justice system, see Bergman Blix and Wettergren (2016).

Attributing Human Traits to Other Species as Alignment Work: Exploring Possibilities of a Terrestrial Knowledge Production

Emilie Moberg

Department of Child and Youth Studies, Stockholm University, Sweden/ emilie.moberg@buv.su.se

Abstract

Against the backdrop of human-induced climate change and severe biodiversity loss, feminist technoscience scholars stress the need for movements towards less anthropocentric knowledge production processes. The present paper delves into the alignment work involved in striving to coordinate and align human-centred epistemic cultures and epistemic cultures centring other species. In an early childhood education site, children, teachers, materials, imagination and the attribution of human traits to snails are elaborated on as key actors. In a literary fiction site, also referred to as environmental imagination, texts, choices of literary style, scientific facts and the attribution of human traits to eels, are featured as actors accomplishing alignment work. The paper argues that adding the concept of the terrestrial to the analysis of the alignment work, as proposed by feminist technoscience scholar Donna Haraway, makes other aspects and versions of non-anthropocentric or less anthropocentric knowledge production processes visible. The paper adds to STS-discussions on alignment work through highlighting alignment work processes as political, power-producing processes, which privilege certain interests while downplaying others.

Keywords: Anthropocentrism, Knowledge production, Alignment work, Feminist STS

Introduction

The species richness on earth is acutely diminishing. One million of the earth's 8 million species are threatened; 500 000 plants and animals and 500 000 insects (IPBES, 2019). Feminist technoscience scholars, among others, have pointed out the inherent anthropocentric standards at work in knowledge production on bio-diversity, morphology and inter-species relations (Haraway, 2016; Tsing et. al, 2017; Åsberg, 2017). For example, Anna Tsing and Donna Haraway call for a greater acknowledgement of local knowledge production in which intimate relations between technology, humans and other species are played out (Tsing et. al, 2017, Haraway, 2016). Similarly, scholars drawing on critical animal studies and post-humanist theories claim that anthropocentric standards in for example educational contexts, contribute to objectifying animals (Geerdts, 2016a; Pedersen, 2021; Spannring, 2017). Pedersen (2021), for example, borrows Haraway's (2008) term 'human exceptionalism' to describe how the infrastructure of Western formal education works through anthro-

pocentric standards privileging human interests while marginalising other animals and species. In this paper, I will delve into the alignment work involved in coordinating a human-centred epistemic culture and an epistemic culture centred on other species (Knorr Cetina, 1999; Kruse, 2021). In particular, I will focus on the common habit prevalent in early childhood education as well as fiction literature of attributing human traits to other species and examine the question of whether this could be conceptualised as part of the relational work aligning the epistemic cultures.

Two empirical sites are chosen as particularly productive and relevant when elaborating on the attribution of human traits to other species as alignment work. The first site considered is a Swedish early childhood education site. In early childhood education practices, the attribution of human traits to animals is a daily occurrence, whether applied as a teaching strategy or evolving in children´s informal encounters with worms, ants and currant snails in places in and around the preschool (Moberg and Halvars, 2022; Thulin, 2011). The second site considered is adult fiction literature mixing scientific knowledge on animal morphology with fictional, personal accounts added by the author. The literary style of applying human traits to animals, and recently also plants, is well-known within the genre of children's books but is also recognised as an adult literature genre, which has expanded in recent years (Candeias, 2021; Carson, 1952, 1952, 1956; Svensson, 2019; Wohlleben, 2016). In the paper, I will focus on the fictional and scientific descriptions of eels in the book 'Under the Sea-Wind' written by marine biologist Rachel Carson (1952). Carson could be seen as a pioneer in the field of literary fiction that has been referred to as environmental imagination (Slovic et al., 2019).

Drawing on feminist STS, I will pose the question of what happens to the analysis of alignment work when adding the concept of the terrestrial to the analysis. Haraway (2020) brings forward the concept of the 'terrestrial', which means 'earthly' or 'earthbound'. The concept points to the way humans have become increasingly alienated from earthly and ecological processes. Moreover, it directs attention to the need for humans to "get down to earth" in terms of considering the unique and particular living conditions of species other than the human (Haraway, 2020). The concept of the terrestrial is not focused on eliciting what works to keep epistemic cultures aligned with one another, but rather has a feminist, political edge to it. Ultimately, the concept acts to show that alignment work is never value neutral. In the paper, the concept will be used to shed light on the way human needs and viewpoints become privileged in knowledge production processes.

I will argue that the alignment work I analyse, in which the attribution of human traits to other species works as a crucial component, is activated in (at least) two ways in the empirical sites. First, the alignment work is accomplished through *keeping a human-centered position intact*, where the human superiority and the human power to act in relation to other species is stabilised as a springboard for the knowledge production processes. Second, through putting the concept of the terrestrial to work, the analysis shows that the alignment work is performed through *altering a human-centered position*.

The altered human-centered position suggests that human vulnerability and dependence in relation to other species is stabilised as the basis for knowledge production processes. In previous studies, blurring the boundaries between the human category and other species is taken as a necessary component of non-anthropocentric knowledge production. The present paper troubles and expands this argument through claiming that a terrestrial knowledge production rather relies on re-centering the human category while exposing its vulnerability and dependence on the world's ecological systems.

Theoretical framework: alignment work, seamlessness and the terrestrial

The concept of alignment work (Kruse, 2021) will be used in the present paper to shed light on the coordination and formation of infrastructures striving to align a human-centered knowledge culture/world with a world populated by other species. Kruse (2021) draws on the concept of infrastructure sensibilities to grasp the way the criminal justice system supports and enacts the

stability of knowledge objects' across epistemic cultures. The theoretical framework put to work in the present paper relies on Kruse's (2021) conceptualisation of alignment work in terms of sensitivities to infrastructures and what these infrastructures accomplish in terms of the coordination of epistemic cultures. She notes that the stable movement of knowledge "is the result of infrastructur*ing*, of its continuous creating of conditions that facilitate movement and create and re-create stability" (Kruse, 2021:14).

Kruse (2021) describes three sensibilities she wishes to focus on. The first is the sensibility to standards. Kruse (2021) argues that standards require work of maintenance and this work of maintenance is what she refers to as 'alignment work'. Along the same lines, Vertesi (2014: 277) emphasises that sites of knowledge production most often turn out to be 'multi-infrastructural environments'. The concepts of seams, seamfulness and seamlessness could then help, she argues, in addressing "actors' work to produce a shared experience of seamlessness, despite each infrastructure's unique and even conflicting distinctions". In order to address this work, Vertesi stresses, the analyst must focus on the micro activities which assembles actors in 'moments of alignment' (Vertesi, 2014: 268). The point of this is not, she notes, to outline stable assemblages but rather to "suggest that there are many possible ways to patch multiple systems together into local alignment" (Vertesi, 2014: 269).

In the present paper, I will conceptualise alignment work as the maintenance work carried out by many different entities to allow for moments of seamlessness or alignment to become produced in relation to different epistemic cultures (Kruse, 2021; Vertesi, 2014). Importantly, as Vertesi notes, when it comes to studying and analysing 'infrastructural seams', "the analyst witness things come together, and apart, and together, and apart again" (Vertesi, 2014: 269). Pointing to the precarious nature of these seams, Vertesi (2014: 277) further notes: "As a guiding metaphor, seams draw our attention to those places where multiple infrastructures are stitched together to achieve fleeting, nonstable, even ephemeral moments of alignment". Vertesi (2014) adds to the theoretical framework of the paper through her focus on the micro activities, as exemplified in the paper through the two examples of human encounters with other species. The focus on micro activities makes more and other actors visible as part of performing alignment work. Moreover, the focus on micro activities makes it possible to shed light on nuances in the alignment work.

As part of the conceptualisation of the attribution of human traits to other species as alignment work and moments of seamlessness, I will use Donna Haraway's (2020; see also Bruno Latour, 2017, 2018) concept of the terrestrial. The notion of terrestrial means 'earthbound' or 'earthly'. Haraway (2020) argues that humans for a long time have viewed themselves as close to independent of nature, which implies that the whole range of human vulnerability and dependence has been denied. The concept of the terrestrial highlights the need for humans to "get down to earth" in terms of considering and acting from the unique and particular living conditions of species other than the human (Haraway, 2020). The concept of the terrestrial will be used to calibrate how movements *away from* or *towards* the earth could work as components of the alignment work in the specific sites activated in the paper. Thus, Haraway presents the concept of the terrestrial as a methodological tool to point to the ways in which humans could be seen as becoming increasingly alienated from earth. Haraway (2020) notes that the terrestrial involves acknowledging the living conditions of all species, not the least the human species, in relation to questions of life and death. Ultimately, she argues, this makes it necessary for the human species to learn to live with the insights and knowledges about their own mortality and vulnerability in the ecological system.

The concept of the terrestrial has encouraged me to include bodily movements as well as experiences of dependence and relevance as actors that become active in the alignment work through different compositions. Using the concept of the terrestrial in analysing the knowledge infrastructures in the two empirical sites moreover reveals what is produced in terms of (non-) anthropocentric knowledge production in ways that point *both*

to human alienation from earth and movements towards the earth and the terrestrial.

In contemporary versions of feminist theory and feminist STS, the critical studies of categories of man and woman have been complemented with studies of other categories. Categories such as nature and culture help direct critical and analytical attention towards the ways in which animals, plants and fungi are considered as less important actors in relation to the taken-for-granted centered human (Åsberg, 2017). This analytical position allows me to show that alignment work is never value neutral in terms of whose interests and privileges are reproduced or stabilised. This political and feminist edge of the analytical approach also calls for epistemic terrestrial cultures that produce a human position that realises and acts from its vulnerability and dependence on other species (Haraway, 2020). In this sense, the concept of the terrestrial adds to STS-discussions on alignment work through highlighting alignment work processes as political, power-producing processes, which privilege certain interests while downplaying others.

Previous research: pedagogic and literary strategies of aligning epistemic cultures

In relation to the two empirical sites chosen for the paper, I draw on previous research from the disciplines of literature studies and education studies. Previous research in literature and education has approached the study of inter-species relations and the attribution of human traits to animals from different methodological and theoretical angles. The phenomena have been addressed in terms of children's early biological reasoning, children's connections with animals as well as educational strategies for making children 'become-with' animals and other species. The first group of studies presented in this section are performed in an early childhood education context. These studies pay attention to pedagogic strategies in terms of attempts of aligning a human-centred epistemic culture with a knowledge culture where other species are the main protagonists. This group of studies will be referred to as post-humanist studies. Next, I have chosen to include a group of studies that attend to anthropomorphic descriptions of animals as literary strategies of aligning epistemic cultures in children and adult literature. This group of studies will be referred to as part of the fields of ecocriticism and environmental communication.

Post-humanist studies within early childhood education

Within childhood and early childhood education studies, children's relationships with non-human species have been addressed in terms of political, methodological and pedagogical concerns (Kraftl et al, 2020; Moberg and Halvars, 2022; Sjögren, 2020). Drawing on two multispecies ethnographies within the authors' Common World Childhoods' Research Collective, Taylor and Pacini-Katchabaw (2015) describe encounters among young children, worms and ants in Australia and Canada. The study aims at illustrating the way these encounters involve paying close attention to inter-species relations and the way human mortality and vulnerability is deeply connected to other species, in this case worms and ants. Ultimately, Taylor and Pacini-Katchabaw (2015) argue that these entanglements and vulnerabilities with other species can work as productive starting points for learning *with* rather than *about* other species. This in turn, the authors argue, can assist us as humans in the necessary endeavour of rethinking our place in the world's ecosystems.

Using the extinction of the species of bees as an example, Weldemariam (2020) raises possibilities of children 'becoming-with bees' in his study performed in an early childhood education setting. The study highlights the way the processes of becoming-with the bees trigger children's response-abilities and emotional, affective responses to the extinction of bees. In the study, Weldemoriam (2020) argues for a shift in sustainability pedagogy from anthropocentric ways of caring for nature as an external object towards perspectives of 'becoming-with-nature', which foregrounds humans as part of nature. Haraway's (2008) concept of 'becoming-with' is connected to the way she points out that being human is intimately tied to multi-species others. Haraway (2008) describe that we, as members of

the human species, are entangled in a biological and ecological web with numerous non-human species. The concept of 'becoming-with' entails an acknowledgement of these co-constitutive relationships between species. In Waldemoriam's (2020) study, the notion of 'becoming-with' pinpoints the interdependence between humans and non-humans. In this sense, his study points to the way humans and non-humans "share agency and become together while influencing each other" (Waldemoriam, 2020: 395).

Ecocriticism and environmental communication

As an example of a study within the area of ecocriticism and environmental communication, Hübben (2017) investigates the visual and verbal representations of animals in a selection of commercial picture books for preschool children. Using a theoretical framework grounded in Human Animal Studies (HAS), and more specifically literary animal studies, Hübben (2017) analyses the representation of human-animal interactions and relationships in the different literary contexts. She specifically notes the function of anthropomorphism and how it matters for how the reader values the animals in the books. Hübben (2017) concludes her study by claiming the potential of the human features in the books to challenge species boundaries and disrupt human-animal dichotomies.

On a similar note, but in the field of cognitive psychology, Geerdts et al. (2016a) have performed a study of children's storybooks about animals and the way these books present animals and biological facts. The study asks whether these books and their depiction of animals may support early developing biological reasoning or support anthropocentrism through human-centred, psychological information. They concentrate on types of causal explanatory information that are provided to children in relation to two biological concepts; biological inheritance and the transmission of illness. Geerdts et al. (2016a) conclude, contrary to Hübben (2017), that the information in the books almost exclusively focused on social-emotional experiences as opposed to biological explanations, which they argue may encourage children´s anthropocentric reasoning. In an experimental intervention study Geerdts et al. (2016b) focus on storybooks featuring animal characters (frog, butterfly, and bird) designed to teach children about camouflage. In this study, however, they conclude that the presentation of anthropomorphic animals that more closely resemble real animals may enhance children's connection with and attention to animals. This, in turn, might lead to an increase in factual biological reasoning.

Also within the research area of ecocriticism and environmental communication, Beudel (2019) presents an analysis of Rachel Carson's mission of conveying scientific knowledge to a broad audience. Beudel (2019) underscores the importance of wonder in the writings of Rachel Carson and delves into what it meant for Carson's texts.

> For Carson, wonder was many things: an ethical orientation; a mode of enchantment; a method of analysis demanding a special kind of attention to ecologically driven relations; a mode of critical intervention into more conventional practices of science that separate subject and object in experimentation and have proved environmentally disastrous (not least, atomic science and its ethos of mastery over nature); and a pathway to a sense of individual wellbeing. (Beudel, 2019: 265)

Beudel (2019) notes that Rachel Carson´s writing contained a close interrelationship between wonder and scientific enquiry. Her mission was to introduce non-scientific audiences to a world that natural scientists already recognised to "be full of wonder" (Carson, 1953: 95). A vital part of her role as a writer, then, was to not only translate but also facilitate the same mode of curiosity about the world for non-specialist and non-scientific audiences.

> If facts are the seeds that later produce knowledge and wisdom, then the emotions and the impressions of the senses are the fertile soil in which the seeds must grow. ... Once the emotions have been aroused—a sense of the beautiful, the excitement of the new and the unknown, a feeling of sympathy, pity, admiration or love—then we wish for knowledge about the object of our emotional response. (Carson 1952: 95)

Moreover, Beudel (2019: 292) notes that Carson's writings lean towards a mode of 'enchantment'

but also a loyalty with modern science's mission to bring order into the causes of things or to make "investigation into the unknown" (Oreskes, 2003: 699). In this sense, as Beudel (2019: 296) points out, Carson insisted on "a very particular fusion of scientific accuracy and vivid imagination, which was quickened in a strikingly visual way by scientific fact".

To conclude, the above selection of previous research points to different theoretical and methodological ways of studying inter-species relations and the attribution of human traits to animals as phenomena in literature and education. A common theme in the studies is that they in different ways propose more dissolved boundaries between humans and other species (Beudel, 2019; Geerdts et al., 2016b; Hübben; 2017; Taylor and Pacini-Katchabaw, 2015; Waldemeriam, 2020). Adding to these above presented approaches to inter-species relations and the attribution of human traits to animals, the current study will address the phenomena in terms of alignment work. Through applying the concept of alignment work together with the concept of the terrestrial, the present study aims to highlight the multiple and seemingly contradictory possibilities involved in the phenomenon of attributing human traits to animals in education and literature. This involves possibilities of *both* promoting and suppressing anthropocentric reasoning.

Methods: tracing the alignment work striving to accomplish the coordination of epistemic cultures

The empirical materials for the present paper consist of examples from two specific empirical sites chosen due to their particular relevance when it comes to activities of attributing human traits to other species. The empirical materials in each site consist of texts, however produced through different means. In the early childhood education site, the empirical material consists of cut-outs from the transcripts from my and two co-researchers' participation as researchers in a group discussion on climate change and didactic strategies in a Swedish preschool context. The group discussion was not arranged by us as researchers but was a part of a series of meetings on the theme of didactics, weather and climate arranged as a cooperation between a university and local preschools. Due to the situation with Covid-19 these conversations took place on the e-meeting service Zoom. The 15 participants were divided into three breakout rooms on Zoom, and me and the two other researchers participated in one room each. Sound recordings of 45 minutes were made from each room and the transcripts made from these recordings add up to 50 A4 pages.

For the literary site, the empirical materials consist of text vignettes picked out from a book written by Rachel Carson. I have chosen cuts from Rachel Carson's (1952) book *Under the Sea-Wind*. There were other potential texts to use as empirical materials, such as Patrik Svensson's book *The Gospel of Eels* (2021), Peter Wohlleben's book *The secret life of trees* (2018) and Matt Candeias book *In Defense of Plants* (2021). For example, in the book *The secret life of trees,* Peter Wohlleben describes trees' abilities to feel, smell, taste and communicate, with the specific help of underground mushrooms and underground branch systems. The particular qualities of Rachel Carson's text in the book *Under the Sea-Wind*, in relation to the aims of the present paper, is that she combines her scientific knowledge as a marine biologist with imaginative, fictious textual descriptions. This is particularly interesting in relation to the concept of alignment work. Carson's texts provide possibilities of analysing the way these different kinds of knowledge formations, i.e. the scientific and the imaginative, work as effects of this combination.

I am not using the concept of a site to claim an objectively identified place that exists outside of my researcher engagements or outside of the aims formulated as part of the present paper. Rather, the concept of a local site refers to the particular cuts in terms of texts and transcripts that I have chosen to use in order to render the alignment work in relation to the two epistemic cultures in these sites visible (Barad, 2003; Bodén, 2017). In the Swedish early childhood education site, I took an active part of the discussion in my role as a researcher. I was thus present as a researcher in the conversations, through bodily expressions, gestures, mimics and verbal input. In the previous group discussion meeting, the participants had read and discussed texts written from

a post-humanist perspective, troubling anthropocentric forms of knowledge production in an early childhood setting. These texts and the participants responses and discussions triggered by the text also took part in producing the empirical materials (Moberg and Halvars, 2022).

The first site: snails, children and teachers in Swedish early childhood education

Since 1997 the Swedish preschool institution marks the first step in the Swedish school system, which makes it a key arena for the provision of children's first encounters with science knowledge content. In this context, science knowledge content, unlike disciplinary knowledge, refers to science in terms of a teaching content in Swedish preschools, regulated by the Swedish preschool curriculum (1998/2018) and formed by teachers and children in local preschool settings.

The Swedish Preschool Curriculum (Skolverket, 2018: 15) urges preschools to provide each child with the conditions to develop "an understanding of relationships in nature and different cycles in nature, and how people, nature and society affect each other". In spite of this call for children and teachers to attend to nature and non-human species, the curriculum text is an intrinsically anthropocentric document, due to the strong focus on teachers, children and human learning.

The Swedish preschool curriculum is also a non-standardised document, by international comparison. This means that the broad goals, such as the one referred to above, in the curriculum needs to be discussed, interpreted and enacted by preschool teachers in local preschool settings. Thus, the preschool teachers become crucial actors in this creative work of translating the curriculum text into practical didactic choices and activities (Moberg, 2017, 2018). In the current paper, the Swedish preschool institution will be addressed in terms of a material and discursive site for science subject knowledge production in general and knowledges of the living conditions of snails in particular.

In the group discussions among preschool teachers and preschool leaders that I took part in as a researcher, the question of what seems to be especially relevant issues for children when it comes to weather and climate, was raised. One of the preschool leaders describes an activity in a preschool that comes to mind.

> This makes me think of a project at a preschool that I came to hear of. A group of children were studying and exploring snails. Then they saw that there were snails being run over by cars and started thinking, like how could we save the snails? What can we do? The children were about 2-3 years. And they started thinking about the snails, what could you do and so on. And then the children came up with the idea that they could put up small signs for the snails, because they wanted to make the snails attentive to the danger of the cars. And they made the signs and put them up at the place where they had found the dead snails.

The preschool leader goes on to talk about children´s experiences of action competence, about moving from observation to action.

> This thing about action competence, to experience that you have action competence, to experience that you are allowed and can make a difference. I think that is an important experience and knowledge that children need. To get the experience as a child that you could do things and make a difference. To feel satisfied as a 3-year-old, I put those signs up, this makes questions about weather and climate become relevant for children. The situation with the snails triggered feelings in the children and made it feel relevant for them. Because I think if children don´t find questions of weather and climate and nature relevant, it does not make sense for them to work with these issues in the preschool, it does not feel urgent for them.

Beside the relevance needed the preschool teachers also raise the ability needed by preschool teachers to listen to children's questions and challenge them towards actions:

> This is what is so fundamental, in my view, in order to hold on to issues that engage children and get them to understand and so on. Because if it isn´t relevant to them, why should they be doing it at the preschool? So, it´s really important that we find out and listen to their questions. And then it´s also important to note that children get experiences from acting and making a difference. And I´m thinking that is important as they grow

> up and become adolescents and encounter all the difficult questions, that you can make a difference in small matters, to bring with you that you have a competence.

Apart from emphasising the ability to listen and respond to children's questions, the quote above also stress children´s experiences of relevance and of making a difference.

Alignment work through an intact human position

To begin with, I will focus the analysis on the way the snails in the first excerpt described above become attributed with human traits. The description of the children and the snails above made by the preschool leader could be claimed to illustrate the position of describing nature in human-like terms. When relating to the snails as non-human species, human abilities are used as starting-points - the cognitive, affective and bodily abilities of fear, the ability to read and produce memories.

The description of children´s activities of making signs to save the snails could be seen to materialise a distance between humans and non-human species. The ideas and actions by teachers and children involved in attributing the snails with human abilities could be interpreted as keeping the human-centred epistemic culture intact. This means that human-like abilities become privileged in the knowledge production process, which simultaneously renders the unique species-specific capacities of snails invisible. Drawing on Kruse (2021) and Vertesi (2014) these micro activities could be described as achieving an alignment of the human-centred epistemic culture and the epistemic culture centring other species. In this case, the alignment is accomplished through the reinforcement of the human-centred position.

Thus, the attribution of human-like qualities to the snails could be interpreted as aligning the epistemic cultures through allowing the human to remain as the main protagonist. This could be considered as an example of alignment work that reinforces a human-centred epistemic culture while at the same time creating the impression that the position of the snails has been altered and even centred. The human category and the human agency are still used as the starting point for the actions described in the example. However, the attribution of human traits to other species makes it appear as if the different epistemic cultures work together in a way that make the seams (Vertesi, 2014) between them hard to detect. Consequently, the reinforcement of the human-centered position produces moments of 'seamlessness' (Vertesi, 2014: 277).

Alignment work through an altered human position

Adding the concept of the terrestrial to the analysis forced me to consider other actors and moments as part of the alignment work. This makes for other kinds of effects in terms of possibilities of non-anthropocentric or at least less anthropocentric knowledge production processes. For example, Haraway's (2020) insistence on how bodies and materiality become active in a terrestrial knowledge production becomes important in the analytical work. To start with, teacher's movements of directing their visual, bodily and emotional attentiveness towards the snails need to be considered as actors in the alignment work.

Moreover, children's activity of making the signs for the snails could be analysed as micro activities where actors produce experiences of getting closer to the living conditions of snails. For example, children´s bodily actions of placing the signs on the ground level, closer to the earth than needed if the signs were aimed towards other humans, are actors that need to be considered. In this sense, the analysis of the alignment work involves the human attention to and empathy with the snails' vulnerability and living conditions. In the cuts describing children and teacher´s engagements with the snails these existential questions of life, death and vulnerability become actualised as part of the alignment work coordinating the epistemic cultures.

However, unlike the alignment work described in the previous section, the aligning efforts by different actors focused in this section changes the human position. This change consists in embracing human vulnerability and dependence on other species. Thus, when adding the concept of terrestrial to the analysis, the attribution of

human-like qualities to the snails could be interpreted as aligning the epistemic cultures through changing the human position.

In addition, the notion of relevance is crucial in the teacher's story of children wanting to save the snail. As the teacher refers to the notion of 'relevance' this could be conceptualised as children´s intuitive feeling of being humans depending on the earth and on the snails. This intuitive feeling connects to feelings of vulnerability and dependence, potentially providing the bodily imperatives to rescue the snails. This changes the human position through creating new associations to human agency and the exceptionalism of the human. The concept of the terrestrial directs attention to the possibilities of altering the category of the human into also acknowledging questions of their own vulnerability and dependency in relation to nature and other species. This unsettles the assumption of the human as all-knowing, powerful and the obvious center point of attention.

This could be seen to imply a movement towards a terrestrial science teaching content in early childhood education centring the living conditions and agency of snails while also centring the vulnerability of human actors (Haraway, 2020; Kruse, 2021).

The second site: eels in literary fiction

The attribution of human traits to foremost animals in children´s literature is renowned, to such an extent that it is difficult to find a children's book that does not in any way involve human-like animal characters, such as ants sleeping in bunk beds or going to school. However, the same feature in adult fiction literature is not nearly as visible and widespread.

Sometimes referred to as a genre of environmental imagination, the American author and marine biologist Rachel Carson can be said to be one of the pioneers in the genre and in her book *Under the Sea-Wind* from 1952 she depicts marine animal characters in the first person. Carson's literary ambitions are not only to depict animals in human and fictive terms. She uses her marine biological scientific knowledge to try to combine this knowledge with imaginative accounts of the marine animals. In this sense, she uses anthropomorphism as a literary method.

Svensson (2019: 99) points out that the eel in Carson's book is "a creature that feels and experiences events, who remembers her past, who suffers and loves". Moreover, Svensson (2019: 99) notes that within the scientific discourse of marine biology the method of anthropomorphism is a controversial enterprise. The method is frowned upon by 'real' marine biologists because it is associated with a fear that real and imagined animal traits become mixed up. In the preface to the first edition of *Under the sea-wind*, Carson (1952) writes that even though she has spoken of a fish who is afraid of its enemies, she does not believe that fishes actually sense fear in the same way as humans. However, she writes, in order for the living conditions and behaviours of the fish to make sense to us as humans, we must describe it through words belonging to the psychological state of humans.

In Carson's book the reader is invited to follow animals living in or close to the sea through three different parts. The first part focuses on animals living along the sea shore, the second part focuses on animals living in the sea and the third part on animals living in the deepest part of the sea. Each part introduces a lead animal character and through the narrative the migration habits of these species over the span of a year unfolds. In the third part we are introduced to an eel female named Anguilla. Anguilla is ten years old and lives in a small lake called Bittern Pond thirty miles from the sea. She has lived there for the whole of her life.

The following excerpts from *Under the Sea-Wind* all, in different ways, contain elements of human vocabulary related to human experiences, memories and feelings. The first excerpt I will raise is taken from Carson's (1952) description of Anguilla's journey to the Sargasso sea where the eels reproduce.

> Anguilla had entered Bittern Pond as a finger-long elver ten years before. She had lived in the pond through its summers and autumns and winters and springs, hiding in its weed beds by day and prowling through its waters by night, for like all eels she was a lover of darkness. She knew every

> crayfish burrow that ran in honeycombing furrows through the mudbank under the hill. She knew her way among the swaying, rubbery stems of spatterdock, where frogs sat on the thick leaves; and she knew where to find the spring peepers clinging to grass blades, bubbling shrilly, where in spring the pond overflowed its grassy northern shore. She could find the banks where the water rats ran and squeaked in play or tussled in anger, so that sometimes they fell with a splash into the water—easy prey for a lurking eel. She knew the soft mud beds deep in the bottom of the pond, where in winter she could lie buried, secure against the cold—for like all eels she was a lover of warmth. (Carson, 1952: 88)

In describing Anguilla's life conditions in the pond, Carson attributes Anguilla with the ability to love and in this case the love is directed towards warmth and darkness. Moreover, Carson attributes Anguilla with the ability of remembering, which makes her able to remember her previous experiences and whereabouts. As autumn comes, Carson notes the way Anguilla is caught by a restiveness.

> Now it was autumn again, and the water was chilling to the cold rains shed off the hard backbones of the hills. A strange restiveness was growing in Anguilla the eel. For the first time in her adult life, the food hunger was forgotten. In its place was a strange, new hunger, formless and ill-defined. Its dimly perceived object was a place of warmth and darkness—darker than the blackest night over Bittern Pond. She had known such a place once—in the dim beginnings of life, before memory began. She could not know that the way to it lay beyond the pond outlet over which she had clambered ten years before. But many times that night, as the wind and the rain tore at the surface film of the pond, Anguilla was drawn irresistibly toward the outlet over which the water was spilling on its journey to the sea. When the cocks were crowing in the farmyard over the hill, saluting the third hour of the new day, Anguilla slipped into the channel spilling down to the stream below and followed the moving water. (Carson, 1952: 89)

In this excerpt, Carson attributes Anguilla with feelings of restiveness and intuition. Moreover, she lets Anguilla be guided by these feelings as Anguilla begins her journey back to the sea.

Alignment work through maintaining the human category

In what follows, I will highlight Carson´s literary strategies of featuring Anguilla as a focaliser while attributing her human traits. I will analyse this in terms of strivings to align a human-centred epistemic culture, associated with the scientific discourse of marine biology, and an epistemic culture centring other species.

In addressing Anguilla's state of restiveness, Carson creates associations to the human vocabulary of feeling impatience or uneasiness. As Anguilla enters a shallow pool, Carson describes another feeling triggered in her: fear.

> Anguilla came to a shallow pool formed when an oak had been uprooted in a great autumn storm ten years before and had fallen across the stream. Oak dam and pool were new in the stream since Anguilla had ascended it as an elver in the spring of that year. Now a great mat of weeds, silt, sticks, dead branches, and other debris was packed around the massive trunk, plastering all the crevices, so that the water was backed up into a pool two feet deep. During the period of the full moon the eels lay in the oak-dam pool, fearing to travel in the moon-white water of the stream almost as much as they feared the sunlight. (Carson, 1952: 92)

The strategy of using Anguilla as a focaliser in the story adds to the attribution of human traits to the eel, as the main characters in literary fiction are most often human. Carson´s choice to describe Anguilla as the leading character acts to create a sense of Anguilla as an individual being, cognitively conscious of the way she moves and where she moves and highly attentive to changes in the stream compared to when she last visited it.

The human written language intrinsically takes part in infrastructures promoting and centring human bodily, cognitive and affective capacities. The use of human written language to describe Anguilla with human features could then be analysed as a strategy of aligning a human-centred epistemic culture with an epistemic culture centring animals. This could be analysed

as activating and stabilising anthropocentric epistemic cultures regarding the morphology of non-human species, which has been critiqued by feminist technoscience scholars (Tsing et al., 2017).

Along the same lines, the genre of environmental imagination and the human written language could be interpreted as actors working to activate and underline the human alienation from nature and the earth. In this sense, the alignment work can be described as becoming accomplished through the reproduction of clear boundaries between species.

Alignment work through a changed human category

As I note above, Carson (1952) has commented on the choice of describing animals as fearful in stating that this choice should not imply that she believes animals to sense fear in the same way that humans do. Rather, Carson uses the genre of environmental imagination as a playful, imaginative method of thinking and writing 'as if', in this case 'as if' the eel senses fear.

Adding the concept of the terrestrial to the analysis, the genre of environmental imagination could also be viewed as producing knowledges on the living conditions of eels. In turn, this could be conceptualised as infrastructures promoting alignments between human-centred epistemic cultures and epistemic cultures centring other species (Haraway, 2020; Latour, 2018). This points to other compositions of actors and moments producing other versions of alignments between the different epistemic cultures.

In this sense, the analysis directs attention to Carson's text in terms of infrastructures working beyond the traditional scientific terminology that relies on a separation between humans and other species. In other words, environmental imagination in Carson's text works as a literary strategy to describe animals and plants 'as if' they were resembling humans. In this sense, Carson's (1952) text about Anguilla deliberately causes a clash between the conventional scientific hallmarks of presenting valid and systematically processed information and the literary imaginative method of 'as if'.

As such, Carson's literary strategy of attributing human traits to animals could also be conceptualised as alignment work allowing humans to think *with* animals through the means of human-shaped language. Carson's marine biological knowledge, produced in a scientific context centred on systematic studies of eels, is vital to the literary method of approaching the living conditions of animals with the imaginatively directed question of 'what if'. Thus, both traditional scientific knowledge and imagination must be considered as actors taking part in producing moments of seamlessness in terms of an epistemic culture promoting terrestrial movements (Haraway, 2020).

When considering the concept of the terrestrial in the analysis of Carson's texts, the genre of environmental imagination could also be viewed as altering the human position into embracing considerations of vulnerability and dependence on other species. This could also be said to twist the role distribution between humans and other species in a way that recasts other species as powerful and all-knowing. Hence, human-shaped language takes part in changing the human category and forcing the human to consider other species as agentic. This makes room for Anguilla as a proper actor along with human actors rather than as a back-drop for human activities.

Concluding discussion

The results of the paper show that the attribution of human traits to other species is part of the alignment work making a human-centered epistemic culture and an epistemic culture centering other species work together. This alignment work, where the attribution of human traits to other species is considered a crucial component, is performed in (at least) two ways. First, the alignment work is performed through *keeping a human-centered position intact*, where the human as all-knowing and the human power to act in relation to other species is stabilised as the starting point for the knowledge production processes. Second, the alignment work is performed through *altering a human-centered position*, where human vulnerability and dependence in relation to other species is stabilised as the basis for the knowledge production processes. The concept of the terres-

trial (Haraway, 2020) has helped in widening the range of actors taking part in the strivings to align the epistemic cultures. Adding the concept of the terrestrial has encouraged me to include bodily movements as well as experiences of dependence and relevance as actors that become active in the alignment work through different compositions.

In line with Taylor and Pacini-Katchabaw (2015) I have argued that encounters between humans and other species can create insights into the human vulnerability in relation to ecological processes and other species. This in turn, can be a productive starting-point in the much-needed endeavour of radically rethinking our role as humans in the world´s ecosystems. Focusing on human vulnerability forces humans to not only learn about other species but also learn about and become aware of how our way of living drastically affects the living conditions of other species. At the same time, the paper argues that a non-anthropocentric knowledge production does not solely rely on 'becoming-with' other species (Weldemoriam, 2020), or challenging the boundaries between humans as other species (Hübben, 2017) as articulated in previous research. While the concept of 'the terrestrial' highlights the human dependence on nature and other species, it is important to note that the concept calls for humans to learn to live with the insights of their own mortality and vulnerability in the ecological system. In this sense, the concept points to the unique role and responsibility of humans, which is not compatible with the idea of blurring or even wiping out the boundaries between humans and other species (cf. Malm, 2019).

The results of the study supports Hübben's (2017) and Geerdts et al. (2016b) in their argument that the attribution of human traits to animal characters in storybooks sparks children´s ability to imagine what animals may be experiencing, as well as creating experiences of empathy with other species. Even though the concept of empathy is not highlighted in the results of the present study, Hübben's (2017) argument could be related to the notion of relevance as experienced by the children wanting to save the snails. In this sense, empathy could be referred to as another way of describing children´s intuitive feeling of being humans depending on the earth and on the snails.

In line with this, Beudel´s (2019) results point to Rachels Carson´s attempts to facilitate fascination and engagement with other species. In these attempts, the role of environmental imagination is to spark a human interest in the living conditions of other species. The results of the study adds to Beudel´s (2019) results through highlighting the human in need of gaining insight into their own vulnerability and dependence. The marine biological knowledge about, in this case, eels is of course an important component for humans to gain insights in their vulnerability. However, as the concept of the terrestrial points to, there is also an acute need for humans to develop and act from an insight into how we affect the ecosystem and how that makes us vulnerable. In other words, we need to be able to grasp the way we ourselves act to produce our vulnerability and also embrace our complicity in our own vulnerability.

Adding the concept of the terrestrial to the analysis of alignment work brings a feminist and political edge to the analysis. The feminist approach that comes with the concept of the terrestrial is not primarily aimed at studying categories of gender in terms of how masculine and feminine subjectivities are constructed. Rather, the use of a feminist perspective in the study is motivated by the aim to critically study the knowledge produced about animals as other species in the face of power-producing human-centered norms (Åsberg, 2017). In this sense, the paper contributes to STS discussions of alignment work in terms of highlighting the power-producing forces that always come to be a part of the work invested in aligning different epistemic cultures. Along these lines, the paper points to how alignment work processes are never value-neutral and always act to promote and privilege some perspectives over others. Thus, the feminist STS approach activated works to underline how alignment infrastructures are always political and asymmetric in terms of whose interests and whose interpretative prerogative is reproduced or stabilised. This is articulated as a critique towards the human position as the main protagonist, whose needs and characteristics gets to shape and dominate knowledge production processes.

Even so, the results of the study point to the nuances and contradictions inherent in the power production of a human-centered position. On the

one hand, the study shows how the stabilisation of a human-centered position hides and neglects the unique species-specific capacities of snails and eels. On the other hand, the current paper shows that the stabilisations of a human-centered position does not necessarily exclude the possibility of an altered human-centered position. The altered human-centered position, as argued in the study, recognises human vulnerability and dependence in the ecological system. Such an altered human-centered position embraces and encourages human bodily movements 'towards the earth' and towards the unique living-conditions of non-human species. In this sense, the study also adds to feminist STS through attending to and even foregrounding the ambivalence and multiplicities inherent in power-producing knowledge practices with regards to inter-species relations (Tsing et al., 2017).

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Between Standards and Voluntariness: Midwives' Alignment Work in Antenatal Care

Jenny Gleisner

Linköping University, Sweden/jenny.gleisner@liu.se

Abstract

Antenatal care in Sweden is voluntary but offered to all pregnant persons. It is organised in accordance with a standardised programme where midwives do pregnancy check-ups and inform about pregnancy, childbirth and becoming parents. But a standardised programme can be difficult to apply to the varying individuals' wants and needs.

Through interviews with midwives and observation of parental education, the article attends to the tension that arises between standards and voluntariness in antenatal care and the often-invisible alignment work done by midwives to make knowledge attractive and palatable to parents-to-be. It does so by showing that the recipients wanting the knowledge becomes important for it to be moved with stability and integrity without losing meaning. The article contributes to ongoing discussions about how scientific knowledge is turned into practice by elucidating the affective dimensions of alignment work and how feelings may facilitate or hinder the movement of knowledge.

Keywords: Alignment work, emotion work, knowledge, standards, antenatal care, midwifery

Introduction

Antenatal care in Sweden is voluntary but offered to all pregnant persons. It is part of the public healthcare system and thus is expected to be offered in the same way regardless of one's geographical location, socioeconomic situation or language skills; antenatal care should be offered and be accessible to everyone (SOU, 2008: 131). These norms and values also mirror the Swedish healthcare policy as a whole (Lundberg, 2018); a policy that calls for "the need for common standards" (Star and Ruhleder, 1996: 112) that make "medicine more accessible, cost-effective, and democratic" (Timmermans and Berg, 2003: vii).

In a local medical context, such standards are encoded into formalised routines of how to plan patients' treatments based on their diagnosis and on how the medical staff's work is coordinated at the clinic. The standardised programme for midwives' work is encoded in a national report given by the Swedish Society of Obstetrics and Gynecology (2016) – referred to by midwives as "The Blue Book" because of its blue cover – and establishes routines for antenatal care.

Antenatal care, including pregnancy check-ups and parental education classes, has two aims: to monitor the normal pregnancy progression and detect divergences, as well as to offer knowledge and support that prepare the parents-to-be for going through pregnancy, childbirth and becoming parents (The Swedish Society

of Obstetrics and Gynecology, 2016; Bredström and Gruber, 2015). The knowledge and support offered by midwives in antenatal care is expected to empower parents-to-be and help them follow the pregnancy trajectory and prepare for parenthood.

The knowledge and support also reflect cultural expectations and sometimes idealised norms about 'normal birth' and 'good parents' (Gleisner, 2013). For example, a vaginal birth is explained as a better choice than a caesarean section for both mother and child, and breastfeeding as more beneficial than formula. Midwives also promote a healthy lifestyle including exercise, a balanced diet, no alcohol, a limited amount of caffeine, and gender equality in the partners' roles (The Swedish Society of Obstetrics and Gynecology, 2016; The Swedish Association of Midwives, 2018). Some of these topics are discussed during individual pregnancy check-ups, some in parental education classes, and some in both settings.

In this work, the standards in the Blue Book aim to make antenatal care and support to be accessible and equal to everyone by providing a programme, including pregnancy check-ups and parental education, to be implemented in all regions all over Sweden. However, while guidelines can be seen as a collective way of perceiving and handling various kinds of situations; ultimately, standards are constructed to be applicable to not just one specific situation, but to many.

This main characteristic condition of standards also constitutes their limits. Susan Leigh Star (1990) describes this vividly in her story about being allergic to onions and ordering a hamburger at a fast-food restaurant. In a fast-food restaurant, standards make it possible to speedily and reliably deliver 'the same' meal, that is, a hamburger of predictable taste and quality within a specified (very short) time frame, all over the world. In such a standardised system, any special orders, such as a hamburger without onions, becomes a disruption, as it requires the restaurant staff to make a time-consuming exception from the streamlined work at the restaurant. For the allergic customer, that means that their company will have finished their meals by the time the special order arrives, which is disruptive to a shared (and quick) meal. Star's solution was to order a standard burger and scrape "the offending onions" off (Star, 1990: 35), making the point that misfits inevitably occur when "individuals, organizations and standardized technologies meet" and that often invisible and continuous work needs to be done around standards (Star, 1990: 34).

Similarly, a standardised antenatal care programme does not easily apply to every individual's wants and needs. In antenatal care, there are no hamburgers to be delivered, of course, but knowledge. Still, I will argue, midwives are the ones who "scrape off the onions" in the form of making the standardised and voluntary antenatal care and the knowledge offered applicable and appealing to parents-to-be. By analysing material from interviews with midwives and observations of parental classes in Sweden, I explore how midwives reason about the following: their everyday encounters with parents-to-be, when individuals and the standardised antenatal care meet, and how emotions matter for knowledge to be moved. I will discuss how feelings towards knowledge and how it is communicated may be seen as hindering or facilitating its movement, and how handling both one's own feelings and the feelings of others are part of midwives' work.

This article contributes to ongoing discussions in Science and Technology Studies (STS) about the work associated with applying and maintaining standards to facilitate the movement of knowledge. STS scholars have, for example, pointed to the difficulties in maintaining standards (e.g., Latour and Woolgar, [1979] 1986; Mol and Law, 1994, 2001) and that work is needed continuously, and not only when misfits appear (Star, 1990). Further, that standards are used to facilitate knowledge to be moved with stability and integrity without losing meaning. However, the movement of knowledge between different contexts is not done easily and requires work (e.g., Bowker and Star, 1999; Kruse, 2016; Morgan, 2011; Star and Ruhleder, 1996). I contribute to this field in STS by further developing the concept 'alignment work', as developed by Corinna Kruse (2021). The concept broadens analytical focus; "[i]t aligns, for example, standards and specific circumstances or different understandings with each other" (Kruse, 2021: 10). I add a sensitivity to emotion work (Hochschild, 1979) that further develops the

concept by also including how emotions matter for the movement of knowledge, here exemplified through midwives' work in antenatal care.

Alignment work and the movement of knowledge

In her conceptualisation of alignment work, Kruse (2021) brings together Anselm Strauss' articulation work that emphasises the continuous and necessary but often invisible work that makes the 'real' work possible (Strauss et al., 1985) with Janet Vertesi's work on how actors align heterogenous infrastructures "to produce a shared experience of seamlessness" (Vertesi, 2014: 277f).

Invisible work, such as building relationships and offering emotional support, is often underpaid, low status and typically found in female-dominated and caring professions (Star, 1990; Allen, 2014; Björklund, 2004; Lydahl, 2017). Studies of invisible work also illuminate its complexities: that work can be more or less visible/invisible and that not all work should be made visible (Bowker and Star, 1999; Lydahl, 2017). Articulation work is about facilitating and coordinating others' work (Strauss, 1988: 164), such as making sure that patients do not have to wait too long between several appointments at a clinic (Jonvallen, 2009: 350) or preparing patients for medical examinations (Strauss et al., 1985: 156). Articulation work is carried out by different actors, but in health care, often by nurses.

The concept of alignment work draws upon this body of research to think about the work of making standards work in practice while also recognising the work done to bridge the gap between different contexts that may hinder knowledge to be moved with stability. Kruse has developed the concept in the context of her research about the movement of forensic evidence, from traces at the crime scene to the laboratory and later as evidence in court. Alignment work, according to her, "is not always noticed or acknowledged as part of the primary work" and "is performed around interprofessional standards … supporting and complementing them" (Kruse, 2021: 4). She illustrates this with crime scene technicians' alignment work at the crime scene to make fruitful laboratory analysis of the traces they recover possible. Despite there being interprofessional standards in place that "are meant to resolve the tension between the laboratory and the crime scene" and to make traces move with stability (Kruse, 2021: 10), these standards are not always easily applicable to every individual crime scene. That is, the unstandardised and unstandardisable crime scene "must be harmonized with the laboratory" (Kruse, 2021: 10).

Alignment work therefore also brings a sensitivity to work done to bridge different understandings as part of making knowledge move with stability. These different understandings or epistemic cultures (Knorr Cetina, 1999) become more clear in another of her examples, namely crime scene technicians' being summoned to court to explain something in a crime scene report that may be self-evident to the technician but not to others. In other words, they perform (very visible) alignment work in court to facilitate evidence being understood in the intended way (Kruse, 2021: 11f). This alignment work mitigates the gap between the different epistemic cultures (Knorr Cetina, 1999) as it temporarily aims at "creating an experience of seamlessness between different sites in the criminal justice system" (Kruse, 2021: 5).

Kruse borrows the concept of seamlessness as the aim of alignment work from Vertesi's (2014) work on the interaction in and between heterogeneous systems. The gaps between them are what she calls 'the seams' that, perhaps similar to Star's (1990) misfits, cause tensions between different perspectives and understandings among the actors involved (Vertesi, 2014). When work is done to "produce a unified sense of digital space", that is, when the different systems can be made to work together in such a way that the gaps between them become invisible to the users of the digital space, it is experienced as seamless (Vertesi, 2014: 268).

In antenatal care, instead of aligning heterogeneous digital systems or different professionals' understandings of 'the same' evidence, alignment work is done to align a heterogeneous group of parents-to-be with the pregnancy care programme. The gaps, or the seams, can be recognised between the goals of antenatal care, the different check-ups, and parental education that

parents-to-be are supposed to move through while also being monitored and given advice and information. Thus, there are many different "edges" and "endings", where the seams may become visible (Vertesi, 2014: 269). That is, midwives perform alignment work to increase participation and to be able to present knowledge to parents-to-be in a way that makes it understandable and applicable to all of them without losing its meaning. Midwives aim at making national and regional guidelines work in the local context and in the encounter with the various parents-to-be – in other words, to resolve "*the tension between local and global*" (Star and Ruhleder, 1996: 114, italics in original) so that knowledge can be moved and moved with stability (Kruse, 2021).

However, Kruse's concept of alignment work alone does not sufficiently help understand the movement of knowledge when the recipients may not want it. In her work, someone not wanting the knowledge never becomes a matter of discussion – moving forensic evidence through its different professions is required of the criminal justice system and thus not a matter of individual choice. She however touches upon people's reluctance to share their knowledge since they may not "trust strangers with classified information" (Kruse, 2021: 13). As I will illustrate with my material from antenatal care, alignment work can, however, also include emotion work that aims at affecting others (cf. Hochschild, 1979, [1983] 2012; Driessen, 2018; Davis, 2019) into wanting the knowledge offered. How midwives reason about and manage the voluntary aspect of antenatal care offers a way to think about how and when feelings may hinder or facilitate knowledge to be moved. I bring work on emotions and emotion work to the concept of alignment work to make it possible to acknowledge and understand the affective dimension of alignment work and thus of the movement of knowledge.

Emotion work as part of alignment work

Emotion work, or emotion management, as Arlie Russel Hochschild also describes it, is about "trying to feel the right feelings for the job", i.e., to evoke or suppress feelings in line with job requirements but also to manage the feelings of others (Hochschild, 1979: 561). I focus on the second of these aspects, how midwives work to affect the feelings of parents-to-be.

Feelings can be recognised as being experienced and expressed in relation to someone or something else (Björk, 2017; Leavitt, 1996) while being context dependent, intertwined with normative understandings, and simultaneously an individual and collective process (Gleisner and Siwe, 2020; Gleisner, 2013; Cottingham and Erickson, 2020; Lindén, 2020).

In Hochschild's (1979) famous study of flight attendants, she shows how they both learn the skills of the profession as well as how to manage their feelings in line with expectations for their professional role: to be in control, to offer service, and to "be nicer than normal". The flight attendants' emotion work also aims at affecting the passengers' emotions in situations where problems may arise, e.g., making passengers who fear flying feel calm, safe and content, but also affect the passengers' will to follow rules and norms about how to behave, so that they do not cause troubles or disturb fellow passengers (Hochschild, 1979: 564). As pointed out by Hochschild (1979: 564), there is a direction to what emotion work aims at and an aspect of duration, as a continuous work carried out within a professional role.

Emotion work has been analysed in many different settings and particularly in health care and caring professions (e.g., Allan, 2001; Bolton, 2000; Gleisner and Johnson, 2021; James, 1992; Kerr and Garforth, 2016), showing that handling emotions is central to caring jobs but often invisible and that it includes both learning to maintain a professional approach and emotionally support the patients (Fineman, 2005; Hunter, 2001).

I also draw inspiration from Annelieke Driessen's (2018: 115) research on caregivers' work with residents in dementia care that shows that emotion work is also about affecting the will of others and that this work is done in sociomaterial interactions. She writes that "rather than coercing residents into doing whatever task is at hand, care workers attempt to align what residents' want with what they themselves want (for them)", rather than merely trying to convince or force them

(Driessen, 2018: 115). She further explains that what the caregivers want is not static and could also be aligned in relation to what is considered to be in the best interest of the residents.

I argue that it is productive to add a sensibility to emotion work as part of alignment work as it elucidates the relational aspects between midwife and parent-to-be and how emotions matter for the movement of knowledge, for example, to affect the recipients' willingness to receive and adhere to the knowledge offered (e.g., Hochschild, 1979, [1983] 2012; Gleisner, 2013; Björk, 2017; Cottingham and Erickson, 2020; Driessen, 2018; Davis, 2019).

That the relationship between midwife and parent-to-be is one between expert and layperson also affects the movement of knowledge and the emotion work carried out. In this relationship, the midwife becomes a mediator of scientific knowledge while also being the caregiver. On the one hand, the expert's training and their professional role give them a degree of professional discretion, but on the other hand she still has to conform to the standards and guidelines that govern her profession (Cook et al., 2020). However, while midwives are obliged to inform about certain matters prescribed by the standardised programme (The Swedish Society of Obstetrics and Gynecology, 2016) parents-to-be can choose whether or not to participate or listen. That is, the relationship between midwife and parent(s)-to-be is regulated for the midwife but voluntary for parents-to-be. What is at stake in antenatal care, in the midwives' view, is the parents-to-be resisting the expert knowledge and perhaps endangering their child.

The relationship is further shaped by quite overt power aspects. Being in the expert role puts the midwife in a position to promote normative understandings about, for example, the normal (vaginal) birth, a healthy lifestyle, and breast feeding. In addition, if the midwife suspects that a child is at risk of neglect or abuse, she is obliged to notify the social services (The National Board of Health and Welfare, 2022), which parents-to-be may perceive as a constant threat hanging over them. As STS studies have shown, the tensions of the complex expert position "[shape] the relations between medical professionals and patients" (Åkerman et al., 2020: 4) as well as the mediating role of the expert (Egher, 2020).

Material and methods

I apply an ethnographic approach, which means striving towards capturing actions, reflections and perspectives as they enable analysis of meaning in work practices as well as emphasising the importance of their contexts (Emerson et al., 2011). I have aspired to capture midwives' perspectives on their work, and their reasoning on how to make knowledge and guidelines accessible and palatable to parents-to-be.

The empirical material for this article was gathered in 2018-19 and includes in-depth interviews of midwives and shorter observations of their work. I conducted thirteen semi-structured interviews with midwives working in three different regions in Sweden and observed four parent education lectures in two of these regions. These specific regions were chosen to include a variety of catchment areas including smaller -, midsize- and large cities. The midwives interviewed had 2 to 39 years of work experience in different regions or clinics. The selection of regions and participants aimed at gaining a rich material on midwives' perspectives on how antenatal care and parental education are organised, as well as on their reflections on meeting parents-to-be with different backgrounds. The empirical material also includes documents, such as national guidelines and reports that guides midwives' work (The Swedish Society of Obstetrics and Gynecology, 2016; SOU, 2008:131; The Swedish Association of Midwives, 2018).

The interviews were conducted at the midwives' workplaces and lasted between 60 and 90 minutes. The interviews included open-ended questions about the midwives' everyday work, its organisation, meeting with parents-to-be, and introducing and talking about different subjects. I aimed to get insight into their reasoning about how to present research-based knowledge to parents-to-be, and which knowledge to include in the parent education classes in relation to organisational guidelines and to parents' feelings and requests. All interviews were audio recorded and transcribed.

While on site, I wrote fieldnotes that I soon after rewrote into rich descriptions (Geertz, 1973). In my notes, both from interviews and observations, I included not only what was said and done, but also how and in which context (cf. Agar, 1996).

During my observations of parent education classes – mainly offered to first-time parents and lasting approximately two hours at a time – I focused on how the midwives presented knowledge to parents-to-be. During classes they spoke of this as recommendations, information, research-based or evidence-based knowledge. Calling it information I believe to some degree underestimates the complexity of it and why it may be difficult to mediate, which is why I refer to it as knowledge.

I have been inspired by Grounded Theory (Charmaz, 2014) throughout the research process, from formulating research questions, gathering data, and coding to analysis, looking for patterns as well as contradictions, and basing theoretical work on them.

In an earlier study of mine I conducted extensive fieldwork at a midwifery education programme in Sweden and carried out two shorter periods of fieldwork at a delivery ward, studying midwifery students' learning and how guidelines and institutional- and cultural contexts shape norms and emotions in everyday practice (Gleisner, 2013). The midwifery students described working with parent education classes as sometimes challenging and frustrating and I became curious of why. This was not what I focused on then, but the topic stayed with me and informed this project. Early on, a theme that caught my attention was how midwives reasoned about different obstacles or challenges that may prevent or hinder how knowledge is moved throughout antenatal care – from midwife to parents-to-be. In particular, they highlighted these challenges or obstacles when talking about what they described as potentially sensitive subjects, such as a pregnant person's weight or attitudes towards breastfeeding.

Aligning parental education

According to the midwives I interviewed, essentially all pregnant persons register at a midwifery clinic and participate in the programme consisting of approximately six to ten check-up visits and one or two ultrasound scans. Even though antenatal care is voluntary, regularly seeing a midwife for pregnancy check-ups becomes "the normal way", and not attending the pregnancy care programme becomes a choice that deviates from that norm. Attendance at parental education, however, does not seem to be as self-evident. Thus, even though both pregnancy check-ups and parental education are voluntary, the voluntariness – or the willingness to participate – differs between the two. This voluntariness, however, seems to be perceived as a little problematic by midwives. As one of them said, "With first-time parents, we probably think that they should go even though it is voluntary". This opinion was voiced in all of the interviews: even though parental education is voluntary, first-time parents really should participate. In the midwives' eyes, the parents-to-be exercise of their voluntariness becomes a problem as individual check-ups and parental education are developed in relation to each other. In other words, what the midwives conceptualised as a package of knowledge that needs to be moved in its entirety will only move in this manner if (first-time) parents choose to take part in both.

Accordingly, midwives strive to get parents-to-be to want to participate in parental education – in other words, they perform alignment work to align parents-to-be and their wishes with the programme in its entirety. When discussing this alignment work, I will argue that adding a sensitivity to emotion work to the notion of alignment work makes it possible to capture how alignment work can be a matter of affecting others to *want* to align themselves with what may not originally have been their choice (cf. Hochschild, 1979: 564; Driessen, 2018: 115). Adapting the format of parental education is one way of doing this.

Midwives continually study and discuss how to organise the parental education, which content to include in them, and how to improve participation (Jordemodern, 2016; Fabian et.al., 2005; Andersson et. al., 2012; Alhdén et. al., 2008, 2012; Bariami et. al., 2015). That also means that the activities they offer may vary between different places as well as over time.

Traditionally midwives organise parental education during pregnancy in smaller discussion

groups that meet on one or several occasions. This group model builds on the participants being active and interacting with each other, sharing experiences, fears and expectations. The midwives named as the benefits of smaller groups that they allow parents-to-be to share their experiences and to get to know the other participants. This was also the incentive when introducing parental education in Sweden, besides providing information about pregnancy, birth and caring for the new-born baby (Fabian et al., 2015). There is, however, nowadays often one lecture about giving birth as an addition to the group-based activities, which is run by midwives working in delivery care. This group model was applied in two of the regions in my study.

In the third region, parents-to-be can pick and choose from a so-called smorgasbord of lectures on different topics. The different lectures are based on PowerPoint presentations and focus on the following areas: being pregnant and having a healthy lifestyle during pregnancy, as well as exercise and food recommendations; giving birth, pain relief methods, breastfeeding and how to care for the new-born baby; and parenthood and relationships. The subjects discussed in the group model are consistent with the content of the lectures in the smorgasbord model but are introduced in a less structured way.

Organising parental education as a smorgasbord of lectures was described by midwives working in the third region as an incentive to increase attendance by them fit more easily into people's presumably busy lives and thus making attending them more appealing. That is, time, or rather the expectant parents' lack of time, makes frequently offered single lectures more accessible. The smorgasbord model was also thought to be reaching groups that partake less in parental education, such as young people, people who are not comfortable in social gatherings where they are expected to interact with strangers, and people with immigrant backgrounds (e.g., Bredström and Gruber, 2015; Fabian et.al., 2004). I however, focus on the content of the lectures and how it relates to experiences and knowledge accessed. The midwives' point of departure for the lectures was, as one of them explained, "When we started planning these lectures, we thought about what women need to know and what they want to learn."

The midwives working with the smorgasbord model then highlighted the lectures by often referring to them when a topic or question was raised by the parents-to-be at a pregnancy check-up, telling them that it would be discussed thoroughly there. This may create a sense of exclusiveness, that knowledge presented at the lectures cannot be gained elsewhere (cf. Davis, 2019) and thus making the lectures more attractive. In this way, the midwives do emotion work by affecting the willingness to participate in parental education (cf. Björk, 2017; Leavitt, 1996). Once the parents-to-be are in the class, the midwives can present what the parents-to-be ask for, what they as midwives perceive as necessary knowledge as well as inform about matters that they are obliged to. In other words, by seemingly encouraging parents-to-be to pick and choose, the midwives hope to entice them to pick the package of knowledge in its entirety.

In my interviews, the midwives also pointed out another benefit of the large lectures in the smorgasbord model: through the lectures, they could be sure that everyone is receiving the "same information".

Group-based parental education allows, to a degree, variation in what is discussed based on the interests of or questions posed by the participants or on what the individual midwife chooses to emphasise. But the midwives seemed to worry about failing to inform group participants about something or framing things differently. "You could never be sure that everyone got the same information since there were so many of us involved", a midwife said about her old workplace with group-based parental education. Since these groups are rather small, there are also several midwives involved in leading them. Holding lectures, on the other hand, meant that "We know that if they went to the lecture, they got the same information as everyone else." Similarly, another midwife working with the smorgasbord model explained: "Because we have these lectures that are run by this small group of midwives who show this PowerPoint, I can be certain that this specific piece of information has been given." Both midwives emphasised the necessity of everyone

receiving the same information, implying that knowledge can be delivered in a stable way. Thus, stability is imagined to be maintained by the PowerPoint presentations and by a limited number of midwives running the lectures.

This raises the question of why it is so important for everyone to receive the "same information". I trace this importance to the normative dimensions in maternity care, that care and support should be equally and equitably accessible to everyone from the public health care system, including antenatal care (cf. Bredström and Gruber, 2015). There were, however, also doubtful voices about the lectures among the midwives: "It takes two hours. You go there, receive the information you need, and then you're done. … Whether it is a good thing or not, that I don't know." She pointed out that even though this way of organising parental classes may facilitate the movement of knowledge, the effects were not known. This has been acknowledged as a problem also when assessing the outcome of parental education on a general level (Brixval et al., 2015; Ferguson et al., 2013). Another midwife explicitly criticised this model of large lectures:

> It's a lecture and not an exchange between people. The interaction was the reason to start up parental education back in the seventies, and for the parents to be strengthened in their role as parents. As it is now, it's a lecture about how to behave at the delivery ward. Yes, I mean "First, you will come here, then we will put on an ID wristband, and then this and that will happen. And these are the different kinds of pain relief methods available." So, there is not much said about parenthood.

In other words, the midwife seemed to feel that the interaction between people and the focus on preparing for parenthood have been lost in the smorgasbord model of parental education. But she also pointed out what is gained, even though she did not present it as something unquestionably good; namely the very practical matter of the lecture of explaining to parents-to-be "how to behave at the delivery ward". When I observed lectures about preparing for giving birth, the midwives explained where to park the car, what to bring to the delivery ward (a snack, baby clothes, nappies), knowing when it is time to go – and most importantly, to call first before coming to the delivery ward. They also discussed the kind of support a midwife can provide during birth, such as pain relief and helping with breathing techniques, as well as what the midwife cannot do. Such limitations referred to, amongst other things, when certain pain relief is not appropriate and the midwife's lack of time since she often cares for more than one birthing person at the same time.

However, parents-to-be who do participate and receive "the same information" may not necessarily embrace the information offered to them, or interpret it as intended. As I have shown in an earlier study (Gleisner, 2013) the midwife's perception of normal birth may not always correspond with the expectant parents' understanding. But the midwives want to align the parents' expectations and attitudes towards the birth with that of midwives. They want the pregnant person to be in active labour when arriving at the delivery ward, not, as a midwife put it, "dilated only one centimetre". If the latter is the case, they may be sent home again (and will probably be disappointed). Hence, these lectures include instructions that are meant to shape the behaviour of the parents-to-be but also their expectations so that they know what they can request and expect when giving birth.

Even so, while the lectures enable the same knowledge to be presented with stability it simultaneously undermines the stability of how knowledge is understood by the recipients. To the midwives, presenting knowledge during lectures that follows a PowerPoint presentation and a script enacts stability through making sure that everything they agreed to include will be addressed.

However, the kind of mutual alignment work that captures misunderstandings or ambiguity through back and forth questions and answers so that "understandings are in alignment" (Kruse, 2021:12) is not possible during the lectures with their very limited time for questions, only during individual pregnancy check-ups.

Even though pregnant and birthing persons are expected to follow a prescribed trajectory (Gleisner, 2013), they are all different. Some of them fit into the standardised antenatal care and some do not. While standards make equal care

over time and in different places possible (cf. Bowker and Star, 1999), it is the midwife's job to handle the limitations of standards (cf. Star, 1990) and to make the journey through antenatal care as smooth as possible. Or, as discussed here, to make parental education appealing to attend so that as many as possible choose to participate, which would resolve the tension between standards and voluntariness in antenatal care. This is why adapting parental education is a form of will-work (Driessen, 2018); emotion work that is done to increase the willingness among parents-to-be to embrace the knowledge embedded in the programme and thus a part of midwives' alignment work.

Aligning the feelings of parents-to-be

The alignment work midwives do, is not only about parents-to-be accessing the knowledge offered through participating in parental education but also about managing their feelings so that they *want* to adhere to it. I will illustrate the complexity of this work through discussing midwives' work around affectively charged issues.

I asked the midwives if they found certain topics as difficult or sensitive to talk about. All of them mentioned breastfeeding and weight issues. One of the midwives working with the smorgasbord model described both why weight may become a sensitive topic and the difficulties in approaching it like this:

> I think it is easier to talk about it [weight issues] now since we got the PowerPoint presentation, compared to before. Then, during the first individual meeting, we were expected to talk about their lifestyle. If it was a woman with a BMI of 35, it was much more difficult because I don't want to step on anyone's toes. Some of them made clear that "I know my weight. You don't have to inform me about it. I know about the risks. I don't want to hear it". Well, because antenatal care is voluntary, we can't inform them about something they don't want to be informed about. But during the lectures, we have information written down, showing statistics and research saying, "This is a normal weight gain during pregnancy, in relation to your BMI". We can talk about it in an easier way. I don't look at specific individuals when I say, "This is important to think about because this and that". And then, you tell them about the risks.

The other midwives interviewed similarly described weight as "not only about weight" but often linked to affectively charged experiences that an individual may carry with them, such as a history of eating disorder. While there are normative perceptions of normal weight in broader society, there are also medical risks for the progression of the pregnancy and for the health of the mother and foetus in relation to overweight, underweight and excessive or insufficient weight gain during pregnancy (Chang et al., 2013; de Jersey et al., 2018).

In the quote, the midwife compared talking about health-related issues during individual pregnancy check-ups with discussing them during lectures in the smorgasbord model. To talk about weight in terms of statistics and research-based knowledge during the lectures with many people in the audience made the topic, in the midwives' view, less personal and thus easier to inform about.

The midwives I interviewed also spoked about developing strategies for talking about breastfeeding during the check-ups and based on the individuals' wants and needs. "You have to be flexible", a midwife said when explaining to me how she introduced issues to discuss depending on the person in front of her. When I asked another midwife to describe how she introduces a potentially sensitive topic in a conversation during pregnancy check-ups she laughed and said,

> I have worked out this strategy when it comes to breastfeeding. The first time we talk about it I ask, "Is it ok with you if I tell you about the positive health-related effects of breastfeeding?". If they say no, I have to respect that.

In this rather cautious approach, the midwife described the first step in her (assumingly at least to some degree successful) strategy towards informing parents-to-be about the benefits of breastfeeding. Another midwife had also put a lot of thought into introducing breastfeeding as a topic to discuss in group-based parental education:

> I begin by asking them what they have read and heard about breastfeeding and any questions they may have. Then we talk about that, and I give them some facts. It is always good to have some facts. But it is their choice, and we have to be sensitive to that. But we also have to … we are obliged to talk about the benefits of breastfeeding, and also the benefits in the long run. Meanwhile, we are not supposed to demand anything from them. We are supposed to inform, and then it will be an informed decision where they can decide what they want to do.

That is, she first asked the participants to present what they know about breastfeeding so that she thereafter could relate it to what she mentioned as "facts".

The midwife also addressed the tension between midwives' being obliged to inform while listening is voluntary. When she talked about the parents-to-be making "an informed decision", she implied that, to her, the choice whether to breastfeed should be made in a particular way: It should also be "informed", that is, be grounded in a certain kind of knowledge – research-based knowledge. This was mirrored by another midwife:

> I think it depends on the person's attitude and if her decision is based on ignorance. It also matters if she has already decided what she thinks is good, or what she has heard her mother say was good. I find it hard to respond to that.

She illustrated her words with the example of a woman who wants to breastfeed but brings a bottle and formula to the delivery ward to give the baby during the first days before breastfeeding has been established: This is rather discouraged if the mother wants to breastfeed as it is considered to make breastfeeding more difficult (e.g., Häggkvist et al., 2010; Melin et al., 2018). In this example, the midwife's expertise about how to best stimulate and establish breastfeeding stands in conflict with what she perceived as the knowledge and attitude of the parent-to-be. In the light of the other midwives' strategies and experiences, one might suspect, however, that the midwife may find it difficult to address the topic with the parent-to-be, fearing that they would not want to listen to or follow her advice.

Another factor is that midwives are obliged to aim for increased levels of breastfeeding at a general societal level. They are expected to do so by informing about the practical and health-related benefits of breastfeeding (for both mother and child) based on recent research, as well as by supporting women through establishing breastfeeding and through any problems that may arise (The Swedish Society of Obstetrics and Gynecology, 2016: 76ff). Through access to such knowledge and support, from the midwives' perspective, parents-to-be will be able to make "an informed decision".

It might seem like the expected outcome of that decision is a given; after all, the midwives make it clear what is considered as "best" for the baby, the mother, and the family as a whole – the Blue Book presents research-based knowledge that supports breastfeeding and promotes motivational interviewing (MI).[1] However, the Blue Book also emphasises that individual experiences affect choices and the importance of the midwife and midwifery care being supportive without being judgemental (The Swedish Society of Obstetrics and Gynecology, 2016: 77). In addition, some babies cannot breastfeed, and sometimes breastfeeding is not recommended – and a midwife ought always to work in the best interest of the mother and baby (The Swedish Society of Obstetrics and Gynecology, 2016: 30, 64, 67). Hence, the midwives are to support those who want to breastfeed – for their own sake and as well as for their babies' – but recognise the individual choice of whether or not to breastfeed.[2]

Rather than ignore or dismiss the expectant parents' wants and needs, the midwives create conditions for them to adhere to the knowledge offered. One of the midwives working with the smorgasbord model explained that she finds parents nowadays rather demanding because they "have read so much", which has affected how she thinks about how they as midwives talk about different topics. She said,

> If you're passionate about breastfeeding, you should be the one lecturing about it. Because then you will deliver it in a completely different way… If you're not certain, then you can just go home because they won't trust you at all.

That is, offering knowledge, encountering different knowledge claims and attitudes are done simultaneously with striving to appear reliable and convincing. Offering research-based, reliable and stable knowledge – in the midwife's words "facts" – is given importance for the movement of knowledge. But it is also important to speak of breastfeeding with passion to be able to affect the feelings of parents-to-be so that they will want to breastfeed. Such affectively charged topics may affect the relations between midwife and parent-to-be in a negative way and may cause tensions that hinders the movement of knowledge (cf. Davis, 2019; Hillersdal et al., 2020; Egher, 2020).

Thus, the midwives' alignment work is not merely about "getting the job done" (Driessen, 2018: 113), it also matters *how* they get it done; in other words, the midwives' emotion work is a central part of their work and their alignment work.

Their emotion work is reminiscent of the caregivers in Driessen's work who do what she calls sociomaterial will-work in order to get the residents out of bed or into the shower by "sculpting moods and emotions" (Driessen, 2018: 118). By smiling and being cheerful, the caregivers encourage the residents to want to get up, instead of coercing them. In Driessen's words, this constitutes as "… the relational nature of will-work: if a care worker gets along well with a resident, aligning wanting becomes easier to do" (Driessen, 2018: 223). This specific form of emotion work that Driessen focusses on aims at aligning the will of others to get the job done. Likewise, in Hochschild's (1979: 564) study of flight attendants, they manage the feelings of passengers by inducing trust, and by calming those who fear flying or are concerned about delays by making them feel calm and safe. The smile was presented to the flight attendants as the "biggest asset" to manage many kinds of situations and troublesome or worried passengers (Hochschild, [1983] 2012: 105).

The emotion work that appears in different ways in the examples presented show that trust is important in making knowledge appealing to parents-to-be. Inducing trust in the knowledge offered and in midwifery and its expertise appear as a prerequisite for aligning the feelings of parents-to-be and thus for the movement of knowledge in antenatal care (cf. Davis, 2019).

To parents-to-be, successfully aligned antenatal care and parental support appear seamless. They do not see the work midwives do in reorganising parental education to make it more accessible, or the many ways midwives work to present information about e.g., breastfeeding or weight issues. Nor do they see the flexibility in how midwives introduce these subjects during the individual pregnancy check-ups, adapting to the pregnant person's knowledge, experiences and emotions. Midwives work to make the seams between the Blue Book's standards and their personal situation invisible by providing information in such a way that the parents-to-be engage in the different activities and adhere to the information given to them in the expected way and are prepared for the subsequent steps of the journey, such as knowing when labour has started, how to care for the new-born baby, and how to become good parents.

In Driessen's work, will-work becomes visible when what a resident wants stands in opposition to what a care worker wants. The care workers' will-work aims at encouraging – not forcing – residents in dementia care to do what the care givers believe is best for them (i.e., getting out of bed if it means they will eat better even though the resident may not want to). In other words, will-work addresses the "tension between opposing desires" that aims at aligning the will of residents with the care givers' wanting so that "good care" can be provided (Driessen, 2018: 111f). In her example, just as in the case presented by one of the midwives, the caregiver/midwife engages in will-work by explaining how breastfeeding is stimulated and established in "the best way", according to research.

In other words, the Blue Book's standards have to be complemented by (alignment) work: applying, maintaining and adapting standards to each and every person a midwife meets where there is a tension between the goal of antenatal care and the wants and needs of individual parents-to-be. As Star (1990) has argued, this is a common problem with standards: to make them work smoothly, this often-invisible work must be done – over and over again.

Conclusion: Emotion work as part of alignment work

In this article, I have built upon STS literature about the work associated with applying and maintaining standards to facilitate the movement of knowledge. I have attended to the tension that arises between standards and voluntariness in antenatal care and analysed the often-invisible alignment work done by midwives to make knowledge attractive and palatable to parents-to-be. I have shown how emotions matter within antenatal care and the relation between alignment work and emotion work.

The importance of and rationale behind the shared standards in midwives' work reflects the goals and values of Swedish health care policy: equal care should be accessible to everyone, no matter where one lives, one's socioeconomic situation, or language skills (Lundberg, 2018; SOU, 2008:131). However, while standards in medicine make equal and accessible care possible (Timmermans and Berg, 2003), there are also limitations to these standards.

The midwives themselves often spoke of knowledge as *information* or in terms of an action – of *informing* parents-to-be. They also spoke of advice – all of it based on research and turned into standards for antenatal care. But as discussed by Kruse (2021), when knowledge is moved between contexts, recipients may not understand it in the way they are expected to. In my study, gaps between different knowledge cultures (Kruse, 2021: 11f) appeared when parents-to-be brought their own experiences and what they have read or heard from others into parental education. Their understandings of (valid) knowledge differed from those of the midwives, which makes the stable movement of knowledge challenging (Kruse, 2021: 2). In addition, not only can parents-to-be choose whether or not to see a midwife or to join the parental education, they can also choose whether or not to adhere to the knowledge offered to them. Hence, even when parents-to-be participate in the pregnancy programme, this does not necessarily mean that they will embody the information offered to them or interpret it in the intended way.

This article adds to research on the stable movement of knowledge by further developing the concept of 'alignment work' (Kruse, 2021) that emphasises the work of making standards work in practice while also recognising the work done to bridge the gap between different contexts. I argue that adding a sensitivity to emotions (Hochschild, [1983] 2012; Davis, 2019) elucidates that the recipients *wanting* the knowledge becomes important for it to be moved with stability and integrity without losing meaning (Kruse, 2021).

My analysis shows that the midwives' obligation to inform and prepare pregnant persons and their partners in becoming parents in a voluntary form of support creates a tension, perhaps best described in Bowker and Star's (1999: 15) words as "… the slip between the ideal standard and the contingencies of practice". As illustrated through the empirical examples in this article, the midwives are the ones scraping off the onions (cf. Star, 1990). If the antenatal care does not easily match an individual's wants and needs, it is the midwives' job to manage this. They are the ones continuously doing alignment work, bringing together the global and the local, making global standards fit in the local context (Star and Ruhleder, 1996) and aligning parental education, the knowledge offered there, and the wants and needs of individual parents-to-be. The parents-to-be are constantly replaced by new ones, which means that the midwives' continuous and often invisible alignment work never stops (cf. Bowker and Star, 1999). In other words, midwives are the experts who mediate knowledge to individuals from all over society, with one thing in common: they are parents-to-be.

My analysis also shows that midwives' work to align the feelings of parents-to-be includes how they introduce knowledge and themselves as reliable experts (cf. Driessen, 2018: 113; Egher, 2020). I have discussed how midwives induce parents-to-be to attend parental education by talking about the knowledge being offered there as exclusive and impossible to be gained elsewhere. I have also discussed how they present themselves as reliable and their knowledge as trustworthy by referring to research and statistics. They furthermore engender trust and shape expectations by familiarising parents-to-be with the practicalities of their local delivery ward. Hence, the midwives align standards with the specific circumstances and understandings (cf.

Kruse, 2021: 10) of each set of parents-to-be, but also with their feelings.

To conclude, I argue that alignment work includes emotion work that aims to align the feelings of others in line with the goals of antenatal care (cf. Hochschild, [1983] 2012; Driessen, 2018; Björk, 2017; Leavitt, 1996) to create, at least temporary, moments of alignment to make standards run smoothly (cf. Kruse, 2021; Vertesi, 2014). This, I claim, is important for understanding the affective dimensions of alignment work and that feelings may facilitate or hinder the movement of knowledge, which may be useful also in other contexts, especially in caring practices and when experts and laypersons meet.

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Notes

1 The method, initially introduced by Miller and Rollnick (1991), aims at facilitating changes of behavior and is developed to accomplish this even when time is constrained (Lindhardt et al., 2015). Through this conversation technique the midwife step-by-step guides the parents-to-be through the process, from introducing a topic, for example the risks with smoking during pregnancy, to supporting a change of behavior. Specific for this method is that the parents-to-be will be the ones taking the initiative to formulate the problem, present solutions and take responsibility for their lifestyle changes (Hassel and von Rahden, 2007).

2 This complexity of midwives' work with, for example breastfeeding, is continuously discussed and researched among midwives (Jordemodern, 2012; Bäckström et al., 2010; Gustafsson et al., 2017). It also resonates with how Cook, Turnhout and van Bommel (2020) discuss how experts must follow societal goals and be objective and simultaneously recognizing subjective dimensions of expertise.

Facilitating the Movement of Knowledge in Occupational Health Services:
Building and Aligning Relationships

Hannah Grankvist

Department of Thematic Studies – Technology and Social Change, Linköping University, Sweden/hannah.grankvist@liu.se

Abstract

This article examines *the establishment and maintenance of structures and relationships within interorganizational collaborations, specifically focusing on occupational health services in Sweden. It investigates how these collaborations are adjusted to existing structures to facilitate the movement of knowledge.* The study draws attention to the gaps or seams (Vertesi, 2014) that arise when occupational health services providers and employers have different interests and objectives concerning occupational health and safety, and explores the continuous and often unnoticed relational work (Zelizer, 2012) undertaken by occupational health services providers to make their expertise and services relevant and appealing to customers and employers. This article contributes to the ongoing discussion on alignment work (Kruse, 2021, 2023) by highlighting its current limitations and underscoring the importance of relational work in creating the necessary conditions for moving knowledge.

Keywords: Relational Work, Alignment Work, Good Relations, Occupational Health Services, Sweden, Interorganizational Collaborations

Introduction

This article examines the establishment and maintenance of structures and relationships within interorganizational collaborations and investigates how these collaborations are adjusted to existing structures to facilitate the movement of knowledge. By employing occupational health services in Sweden as a case study, this article contributes to the existing discussion on alignment work by highlighting its current limitations and underscoring the importance of relational work in creating conditions that enable the movement of knowledge.

Occupational health services in Sweden operate in a market-driven environment, where customers decide which services to procure and utilize. The relationship between occupational health services providers and employers is complex, given that employers are the customers of occupational health services providers. Thus, their independent position, as defined by the legislation, becomes challenging and their ability to act as a neutral party between employers and employees has been called into question (SOU, 2004). The relationship between the patient

(i.e., the employee) and the occupational health professional is influenced by the involvement of the employer. Even though many assignments and interactions occur directly between the employee and the occupational health professional, the presence of the employer is implicitly acknowledged. This dynamic creates a triadic relationship, wherein the occupational health professionals find themselves in a challenging position. On the one hand, they are expected to provide care and support to the employee; however, they are also compelled to generate profit for the occupational health services provider and rely on the employer's commission to achieve this goal.

As I will illustrate with material from occupational health services, the discrepancy between occupational health services' "core" mission and their everyday work raises concerns. Many assignments undertaken by occupational health services providers involve individual-level rehabilitation or other issues, even though their primary mandate primarily focuses on organizational and preventive approaches. To fulfil the mission of preventing and mitigating health risks in workplaces, it becomes imperative to broaden the perspective beyond the individual level. Moreover, occupational health services are frequently expected to function as general healthcare providers for their customers (i.e., employers) and individual employees, contrary to their intended role as specialists within the field of occupational medicine and health. Thus, the challenge for occupational health services providers and occupational health professionals resides in effectively harmonizing an individual perspective with an organizational one, while concurrently conveying to customers that this integration embodies the core mission of occupational health services.

Speaking with Janet Vertesi (2014), this discrepancy between the legal mission and self-understanding of occupational health services providers, on the one hand, and customers' understanding of and demands on them, one the other hand, could be called a seam between the occupational health services provider and the customer. In this context, a 'seam' should not be understood as the physical connection that binds different pieces of fabric together. Rather, Vertesi's seam refers to the gaps that arise between different systems and infrastructures due to technical incompatibilities. When efforts are made to seamlessly integrate different systems to create "moments of alignment", the gaps between them become invisible to users, and a state of seamlessness is experienced (cf. Vertesi, 2014: 268ff).

One way of achieving – or at least striving for – seamlessness between different sites or epistemic cultures (Knorr Cetina, 1999) is through the practice of alignment work – a notion introduced by Corinna Kruse (2021). The notion synthesizes Vertesi's research on how actors align heterogenous infrastructures to create a unified and seamless experience (Vertesi, 2014) with Anselm Strauss's concept of articulation work, which highlights the continuous and essential yet often invisible efforts that enable the accomplishment of the work perceived as the core work (Strauss et al., 1985).

Kruse has developed the concept within the framework of her research on the movement of forensic evidence through the criminal justice system, using the notion to capture how for example crime scene technicians align the standards for recovering different kinds of traces with the specific circumstances of each crime scene to ensure the traces' seamless movement from the crime scene to the laboratory. She employs the notion of alignment work to trace the process of facilitating the movement of knowledge by reconciling and resolving tensions between different sites (cf. Star and Ruhleder, 1996: 114) or epistemic cultures (Knorr Cetina, 1999).

The concept of alignment work[1] has been used to examine the movement of knowledge between different epistemic cultures or sites (Kruse, 2021) or between experts and laypersons (Gleisner, 2023), capturing the often invisible or unacknowledged work of reconciling standards with individual situations or circumstances. Alignment work can also contribute to the movement of knowledge in indirect ways, for example by shaping professional identities and fostering interprofessional relationships (Kruse, 2023). In other words, it is a concept that makes it possible to draw attention to the continuous work of bridging the gaps between different sites.

However, the concept of alignment work alone, as proposed by Kruse (2021), is insufficient for understanding the establishment and maintenance of structures and relationships within the context of market demands and business relations, as well as the associated efforts to create the necessary conditions for moving knowledge. Kruse developed the alignment work concept based on empirical data collected from an organization characterized by clearly structured and institutionalized relationships among the professions involved in the movement of knowledge between them.

However, I argue that the movement of knowledge begins earlier within less organized structures, such as occupational health services, where interorganizational collaborations occur among occupational health services providers, customers[2] (i.e., employers), and employees. Within this context, the creation of structures and relationships necessitates the practice of relational work. I seek to expand the scope of alignment work beyond the immediate movement of the knowledge object in question. As I will illustrate with material from occupational health services, the movement of knowledge and the relational work, which strives to establish the necessary conditions to be able to move knowledge, is intertwined with alignment work. Relational work endeavours to build trust, foster collaboration, and generate value for all involved parties (Zelizer, 2005, 2010, 2012). This entails creating a sense of shared purpose and fostering a culture of collaboration.

How occupational health professionals navigate the complexities of market demands and business relations within occupational health services offers a way to gain insights into how different perspectives and understandings among the actors can be patched together into local alignment; and how relationships can function as infrastructures. The success of the patchwork can either hinder or facilitate the movement of knowledge. Thus, I introduce the concept of relational work to enable the recognition and understanding of the continuous creation of conditions that facilitate the movement of knowledge.

This article contributes to studies on the movement of knowledge across different epistemic cultures or sites (Kruse, 2021, 2023) or contexts (Morgan, 2011), and the challenges involved in translating knowledge into practice (Timmermans and Berg, 2003; Mol, 2008; Sager, 2011; Gleisner, 2023). Additionally, it contributes to the ongoing discussion on alignment work by shedding light on its current limitations. By emphasizing the significance of relational work, I underscore the relational nature of structures and the continuous creation of conditions that facilitate the movement of knowledge. In other words, I argue that relationships and the relational work that nurtures them provide the foundation that makes it possible to perform alignment work.

Material and methods

My analysis draws on 14 semi-structured interviews conducted as part of a research project that examines the role of mediators in the movement of knowledge from its production to its application in practice, focusing on occupational health services providers in Sweden. The sample consists of two types of occupational health services providers: external occupational health services providers (the most common ownership structure for occupational health services), and in-house occupational health services units used by regions, county councils, municipalities, the Swedish Armed Forces, and large companies, particularly in the industry sector. In 2017 and 2018, I visited two large external occupational health services providers and two in-house occupational health services units located in different geographical regions in Sweden. During these visits, I conducted interviews with various professionals, including occupational health physicians, occupational health nurses, physiotherapists, psychologists, behavioural scientists, organization consultants, and environmental engineers. Many of these interlocutors held managerial positions within their respective workplaces, such as managers, heads of units, consultant managers, and business development managers. Although they did work with patients, not all of them did so on a daily basis.

My sampling strategy aimed at capturing a range of perspectives within the same occupational health services provider, as well as perspec-

tives from external occupational health services providers and in-house occupational health services units. The objective was to obtain diverse opinions and rich accounts of occupational health professionals' experiences of translating medical guidelines into practice and moving knowledge between contexts against the background of market economics. Additionally, I sought to explore the negotiations and compromises they faced in balancing professional expertise, customer needs, and workplace demands, considering their dual role of assisting employees while being dependent on employer commission. This approach allowed me to gain insights into their descriptions and reasoning about their work. However, it did not provide an opportunity to observe their actual work, thus constraining my ability to compare their statements with their actions.

All interviews were conducted in person at the workplaces of the occupational health professionals. The duration of the interviews ranged from 45 minutes to 90 minutes. With the consent of the interlocutors, obtained in writing prior to the interviews, the sessions were audio-recorded and later transcribed. The interviews covered topics such as the occupational health professionals' work, the services commissioned by occupational health services providers, the services utilized by customers, and the application of scientific knowledge and evidence-based guidelines in different assignments.

To ensure the anonymity of the two external occupational health services providers and the two in-house occupational health services units, I have omitted their names in this article. Likewise, to protect the identities of my interlocutors, they are referred to as occupational health professionals or by their specific profession or work title.

For the analysis of the interviews, I employed a thematic approach (Braun and Clarke, 2012). This involved coding the interviews and categorizing the codes into potential themes, while paying attention to patterns, similarities, and differences both within and between the interviews. Throughout the analysis, my specific focus was on the translation of medical guidelines into practice, examining how knowledge moves from occupational health professionals to customers and employees.

Occupational health services in Sweden

The commissioning of occupational health services in Sweden is regulated by the Work Environment Act (SFS, 1977). Although the Act defines the role of occupational health services, the utilization of these services is not specifically regulated by law. According to the Act, employers are responsible for preventing work-related ill health, ensuring a favourable work environment, and organizing work adjustments and rehabilitation activities as needed. Thus, it is the employer's responsibility to ensure the availability of required occupational health services for their employees (SFS, 1977). In Sweden, access to occupational health services is based on voluntary contracts between employers and occupational health services providers[3]. In other words, it is not mandatory for employers to have a contract with an occupational health services provider or offer these services to employees (SOU, 2004). Further, the extent to which employees have access to occupational health services varies significantly across different business sectors and is further influenced by the size of the company. Employees in the state and municipal sectors, as well as large companies, typically have access to occupational health services, while employees in companies with fewer than 50 employees often do not (SOU, 2011).

According to the Work Environment Act, occupational health services are considered independent expert resources in the fields of work environment and rehabilitation. Their role is to prevent and eliminate health risks in workplaces, possessing the expertise to identify and describe the connections between work environment, organization, productivity, and health (SFS, 1977). Through risk assessment, prevention measures, health surveillance, and rehabilitation support, occupational health services contribute to the well-being of employees and the overall productivity of the workforce. Referring to occupational health services as expert resources underscores the state's emphasis on employers utilizing their knowledge about the interaction between work environment and health, which is regarded as unique and difficult to replace. However, the primary services provided by occupational health services providers include health check-ups,

addressing individual lifestyle concerns, administrating medical treatments, facilitating work-life oriented rehabilitation, as well as providing healthcare services unrelated to work, promoting health initiatives and wellness programs.

Relational work

Relational work has been analysed in many different settings and particularly within the field of economic sociology (Zelizer, 1994, 2005; Bandelj et al., 2017; Kim, 2019; Chen, 2020), showing that handling and negotiating social, economic, and emotional dimensions in relationships are important factors in explaining various practices, such as egg donation (Haylett, 2012), surrogacy (Toleando and Zeiler, 2017), interorganizational cooperation (Whitford, 2012), consumer behaviour (Bandelj and Gibson, 2019), and financial investments (Hayes and O´Brien, 2021).

Relational work, a concept initially rooted in the negotiation of social relations encompassing intimacy and economic transactions, takes place when individuals try to manage the connections across social relations, economic transactions, and media of exchange (Zelizer, 2005, 2010, 2012). According to Viviana Zelizer, in all economic activities, "people engage in the process of differentiating meaningful social relations" (Zelizer, 2012: 145). Thus, relational work extends beyond mere social interaction, as the connection to economic activity is paramount, making the relational efforts goal driven (Bandelj, 2012). Relational work is an ongoing process that includes efforts to establish, maintain, negotiate, transform, and terminate personal relations. It also involves the continuous maintenance, matching, repair, and negotiation of relations as new challenges and opportunities arise.

In using the concept of relational work, I adopt Zelizer's (2006: 307) perspective that the objective of relational work is to find viable matches – those that get "the economic work of the relationship done and sustains the relationship". Similarly, people engage in these efforts to understand the nature of their social relationships and the expectations they have on each other. Nina Bandelj (2012, 2015, 2020) expands on Zelizer's concept by emphasizing the importance of meaning-making by actors involved in relational work, as well as the significance of emotional embeddedness and power asymmetries. She argues that part of relational work involves gathering information, responding to emotional impulses, and building trust, all of which shape the unfolding of the economic relationship (Bandelj, 2015). Thus, relational work encompasses an affective dimension. According to Feldman and Khademian , relational work is about creating "connection between people in ways that legitimize perspectives and create empathy for participants who represent different ways of understanding and addressing the problem" (Feldman and Khademian, 2007: 306) and that "connections between people based on feelings are important in the ability to legitimize different perspectives and to create a community of participation" (Feldman and Khademian, 2007: 312). Thus, relational work is fundamental to the development of trust. Moreover, the issue of trust in central in economic exchanges (Granovetter, 1985, 2017).

I will employ the concept of relational work to scrutinize the strategies adopted by occupational health services to create conducive conditions and viable business relationships that enable the movement of knowledge to customers and employees. As my analysis will demonstrate, the establishment and maintenance of relationships within occupational health services are foundational for the execution of alignment work. An integral part of relational work involves navigating a complex practice characterized by interconnected customer demands and expectations, alongside endeavours to ensure profitability in a market-driven environment, all while adhering to commission regulations mandated by legislation. In other words, the entwined nature of alignment work is intricately linked with the realm of relational work.

Within occupational health services, numerous crucial relationships exist. These encompass the connection with the customer/employer as well as the link to the patient/employee. The latter association becomes complicated due to the circumstance that the patient's employer serves as both the customer and the payer for the occupational health services provider's services. Thus, the triadic dynamic involving the occupational health services provider, the patient/employee, and the customer/employer not only shapes the

provision of occupational health services but also influences the knowledge that can be conveyed. In this article, my emphasis is on the relationship between occupational health services and their customers, given its paramount importance in establishing the prerequisites for facilitating the movement of knowledge.

Identifying viable matches and building trustful relationships

In occupational health, the movement of knowledge depends on occupational health services providers' ability to establish functional relationships with their customers, i.e., the employers that commission their services. Specifically, customers must want the knowledge the occupational health services provider has to offer. Thus, a recurring theme among my interlocutors when discussing their work and interactions with customers was cultivating "good relations" with customers. From their perspective, these relationships were characterized by open and effective communication, along with the customers' genuine interest in their recommendations. The concept of "good relations" with customers also encompassed the customers' comprehension of the overarching mission of occupational health services, namely preventive and workplace-level intervention rather than reactive individual-level assistance – that is, aiding individual employees after an issue has occurred.

One part of cultivating these good relations involved identifying the potential customers who would constitute a 'viable match' (Zelizer, 2012), that is, determining which customers to establish business relationships with and which relationships to deepen. On the one hand, there are, as a consultant manager and psychotherapist at a large external occupational health services provider explained,

> customers who only have contracts with us because the trade union demands it or because the Work Environment Authority has been there, and it's clear for us that a customer who expects nothing more than a contract to show the trade union, there we will never be able to work in a consultative or preventive manner. (Interview)

That is, some customers turn to occupational health services to fulfil the bare minimum the law requires of them. In the words of another interlocutor, these customers were "primarily concerned with costs rather than outcomes." Their expectations revolve around minimal services at the lowest possible price (cf. Husman and Husman, 2006; Antonsson and Schmidt, 2003). In the opinion of my interlocutors, this translated into these customers placing their main emphasis on "fire-extinguishing" measures; in other words, on reactive services addressing illness or accidents after they have already taken place. Additionally, they might not show much interest in the proposals put forth by occupational health services providers regarding preventive measures aimed at minimizing the risk of recurrence.

In such cases, my interlocutors clarified that they limited their services to a basic scope, exclusively catering to specific requests and refraining from recommending additional interventions. It was deemed unprofitable to invest substantial efforts in forging more than a surface-level business relationship with a customer solely interested in receiving services mandated by legal regulations. In addition, persistent attempts by the occupational health services provider to introduce supplementary measures would invariably lead to friction in the existing relationship. In other words, these customers were not the viable matches (Zelizer, 2012) the occupational health services providers were looking for. Instead of expending effort to persuade them to engage in services surpassing legal mandates, my interlocutors concentrated on more viable (and profitable) matches – i.e., customers more open to exploring extended initiatives related to work environment enhancement and employee health.

Customers, on the other hand, who displayed a willingness to actively seek occupational health services expertise were regarded as significantly more inclined to evolve into collaborative partners, engaging in long-term contracts and partnerships. According to my interlocutors, such customers perceive the occupational health services provider as an engaged and appreciated partner identifying the interconnections between the work environment and health. They highly value the occupational health services

provider's contributions, suggestions, consultative approach, and support in development and improvement of the work environment. This sentiment was captured by a customer manager and psychologist who portrayed these customers as individuals who "possess an understanding of the enhanced value derived from such collaboration." It was with these viable matches that occupational health services providers strove to establish the "good relations" they considered crucial for the successful execution of their work. In such instances, services were custom-tailored in dialogue with these customers, empowering occupational health professionals to concentrate on preventive measures aimed at enhancing work environments.

That is, to identify potential customers that would qualify as a 'viable match' (Zelizer, 2012), occupational health services providers engage in differentiation between relationships, such as distinguishing between customers interested in genuine collaboration and those adhering solely to legal mandates. This differentiation also extends to the marketing of the boundaries of the relations, encompassing customers who seek either closely interwoven partnerships or more distant affiliations. Put differently, occupational health services providers engage in relational management, a focal point identified by Bandelj (2012), as the primary objective of relational work. This part of relational work bears certain resemblances to boundary work (cf. Gieryn, 1999). It is worth noting, however, in accordance with Bandelj (2012: 182), that "the focus of boundary work is on differentiation between entities... In contrast, relational work squarely centers on relationships."

The discrepancy between the legal mission and self-perception of occupational health services providers, juxtaposed with customers' interpretations and expectations of them, gives rise to gaps, or seams, between occupational health services providers and their customers. Thus, various 'edges' and 'endings' emerge, where the seams become visible (Vertesi, 2014: 269). Occupational health services providers work at the seams, endeavouring to bring together diverse organizational and conceptual perspectives to attain specific objectives. Thus, their role encompasses engaging in relational work to find viable solutions that benefit both parties in the business relationship. This approach remains consistent regardless of whether the customer seeks a closely interconnected partnership or a more distant affiliation[4]. Occupational health services providers work to enhance the appeal of their expertise and offerings to customers, encouraging investment and contractual agreements. As described above, one strategy to attain this goal encompasses aligning their business relationships in accordance with the specific demands articulated by the customers.

By aligning the business relationship in accordance with the customers' preferences, occupational health services providers acknowledge the 'seamfulness' (Vertesi, 2014) that exist between different organizational and conceptual perspectives – i.e., incompatibilities and constraints making customer interests a pivotal consideration in their engagement within business relationships. That is, the services offered to customers deemed as not viable matches are confined to a basic scope, whereas for customers perceived as viable matches, occupational health services providers endeavour to enhance and intensify the business relationship. This underscores the fact that the seamfulness between occupational health services providers and customers exerts influence not solely on the nature of the business relationship, but also on the level of engagement and exertion expended by occupational health services providers.

Another, related part of cultivating these good relations was getting to know the customer, not only in terms of whether or not they constitute a viable match but also in terms of their needs and capabilities. My interlocutors used the term *kundskap*, derived from the combination of "kund" (customer) and "kunskap" (knowledge), as a creative play on the concept customer knowledge, and described as

> …to know about the platforms the customers have for various matters, the conditions they operate under, to understand the resources available, how financially constrained they are within their industry, and all the factors that need to be considered when providing advice. (Interview)

However, acquiring such customer knowledge demands not only the engagement of the occupational health services provider but also the customer's confidence in disclosing information about the company – data concerning both financial matters and work safety, along with the work environment, may encompass sensitive content. This information is indispensable for occupational health services providers to effectively utilize their expertise in occupational health and safety. It allows them to identify the specific needs of the customer in collaboration with the customer, and consequently, to be able to propose appropriate solutions to work environment issues. Thus, building trust is an important part of establishing the "good relations" that are the foundation for moving knowledge within occupational health services.

Relational work, and thus, by extension, the movement of knowledge finds support in the continuous dialogue between occupational health services providers and customers. These persistent dialogues establish "points of contact" that act as bridges, legitimizing diverse perspectives and fostering mutual understanding among actors with different approaches to addressing work environment problems. In these points of contact, knowledge is also shaped through various processes such as making it attractive, explaining it, and adapting it. By gaining understanding about one another's perspectives and understandings, the seam between them can be bridged more easily.

Managing matters related to profitability and dependencies

Schmidt et al (2015: 233) use the idiom "it takes two to tango" to describe the process of establishing a collaboration between an occupational health services provider and a customer. However, while it indeed requires two parties to engage in the collaboration, it is still ultimately the decision of the customer and the company to purchase and utilize occupational health services. In other words, it is the customer and the company that must initiate and decide on the scope of the collaboration with an occupational health services provider.

This dynamic shapes both the scope of alignment work achievable by occupational health services providers and the nature of the relationship itself. This is especially pertinent for external occupational health services providers, who are reliant on marketing and selling their services. Thus, as one of my interlocutors pointed out, occupational health services professionals do not,

> get up in the morning, thinking about occupational health services as "Today, I'm going to be an independent expert resource." That's not how you think! You think you're going to work out February's budget. (Interview)

That is, for him, economic considerations occupy a central position in his work, not his legally mandated role as an "independent expert resource" (SFS, 1977; my translation) – i.e., delivering expertise according to professional standards. Within the market-oriented context, prioritizing the fulfilment of customer demands constitutes a much more rational approach than adopting the stance of an "independent expert," whose advice might diverge from the (paying) customer's interest. In other words, putting the employer in the role of a customer also puts the occupational health services provider into a specific relationship with them, and part of that relationship is the occupational health services provider's dependence on the customers good graces.

That is, the relational work conducted by occupational health professionals operates from a position of significant dependence. This dependency is particularly pronounced in smaller towns, where the loss of even a single customer among a limited pool could not only endanger the occupational health services provider's profits but also its overall existence. Therefore, the emphasis placed by my interlocutors on cultivating "good relations" needs to be understood in the context of this dependency. It involves the endeavour to turn a viable match into a trustful relationship, a crucial step in establishing a productive and enduring collaboration.

This observation is particularly evident in the case of external occupational health services providers. In-house occupational health services units – like the different professions in the criminal

justice system described by Kruse (2021) – already have a relationship with their "customer" through being part of the same organization. Thus, it is not surprising that an occupational health nurse operating within an in-house occupational health services unit might contrast her current situation favourably against a previous experience with an external occupational health services provider:

> Sure, we are required to create billable hours and things, too, but it's not quite like …. we don't discuss at every meeting "but how are we going to bring in money doing this?" (Interview)

In other words, from her perspective (though she did not explicitly phrase it in these terms), concerns related to budgets and profitability held a less prominent position within the in-house occupational health services unit compared to their significance for an external occupational health services provider.

For her, the in-house occupational health services unit offered her greater latitude to do her job well. However, at the external occupational health services provider, balancing the proficient execution of her duties with contributing to the company's profitability was not always compatible. The pursuit of excellence in her role could potentially demand more time than was financially advantageous or fell within the scope of what the customer was willing to pay for.

In all the examples above, the occupational health professional in question was confronted with the requirements of being efficient and profit oriented. This places the occupational health professional in a challenging position. On the one hand, they aim to uphold medical expertise, while on the other hand, they need to generate profit for the occupational health services company.

The pursuit of profitability prompts some of my interlocutors to explicitly seek positions within in-house occupational health services units. However, even in-house occupational health services units remain constrained by allocated resources. This might render it equally challenging to propose certain measures, address specific inquiries, or raise issues that could benefit the employees. In other words, the customer's control over the available resources for occupational health services empowers them to shape the encounter as well as the movement of knowledge between occupational health professional and employees. This effectively provides the customer with the final say, particularly in matters concerning workplace adaptations.

To illustrate this, an occupational health nurse recounted an assignment she had recently completed, where the customer showed reluctance to make investments based on her recommendations. She elaborated, "I was tasked with conducting noise measurements at a company and assessing the presence of hazardous noise levels. However, the customer chose to provide individual employees affected by these levels with ear protection, rather than investing in new, quieter machines that would prevent the recurrence of the workplace issue." In this case, the customer opted not to follow the occupational health professional's guidance, potentially waiting until the existing machines were worn out and needed replacement. In other words, the professional knowledge of the occupational health nurse clashed with the customer's willingness to allocate their company's financial resources for the recommended interventions.

As previously stated, the relationship between occupational health professionals and their customers is complex. The occupational health professional assumes the role of an expert equipped with specialized knowledge in occupational health and safety. The customer, i.e., the employer, on the other hand, typically holds a layperson's perspective (though possessing vital insights into their company and its operations), placing them in a relatively less authoritative position. As demonstrated by research in STS, the intricate tensions inherent in the complex expert position influence the relations between medical professionals and patients (Åkerman et al., 2020), in addition to shaping the mediating role of the expert (Egher, 2020). This clear division of authority in favor of the occupational health professional lends weight to their words and has the potential to foster trust. Thus, this inherent inequality might, in theory, facilitate the movement of knowledge. However, given that the employer also assumes the role of the customer in occupational health services, the occupational health professional is tasked with offering not just expertise and

occupational health services, but also a service experience. Coupled with the financial dependency of occupational health services providers on their customers, this situation further tilts the relationship in favour of the customer. In other words, the relational work conducted by occupational health professionals is deeply entwined with power dynamics (cf. Tilly, 2006; Bandelj, 2009, 2012; Roscigno, 2011) as well as with emotions, i.e., the customer's willingness. As Bandelj (2012: 180) asserts, power is an integral part of relational work. Although occupational health professionals work at the seam between their defined mission and financial dependencies of their customers, it's important to acknowledge that in certain instances, the misalignment between these two aspects makes it impossible to achieve successful alignment. That is, there are cases where certain gaps cannot be bridged due to the customer's lack of interest in the knowledge being offered, consequently impeding the movement of knowledge (cf. Davis, 2019; Egher, 2020; Hillersdal et al., 2020).

Thus, it is important to acknowledge that the occupational health professionals' relational work does not always contribute to positive outcomes. To elaborate, the central requirement for occupational health services providers to be financially profitable, coupled with their reliance on customer satisfaction, gives rise to inequalities and dependencies that significantly influence which knowledge is moved or not moved. Ultimately, these factors contribute to shaping the knowledge that in the end reaches the employees.

Relationships and the movement of knowledge

As previously mentioned, the relationship between the occupational health services provider and the customer provides a foundation for the movement of knowledge. According to my interlocutors, a good – i.e., deep and trustful – relationship made it possible to move knowledge in a way that a superficial relationship cannot achieve. As a business development manager and psychologist at a large external occupational health services provider explained,

> It happens that we receive requests like, "We need conflict management." Then, when we start asking questions … it might emerge that the main issue isn't necessarily the conflict itself but perhaps the manager's struggle to clarify their role as both a leader and a manager. There's ambiguity about what this group should work on, uncertainty about when they have achieved their goals, and then we might say, "But step one isn't conflict management; step one might be to reflect on how you, as a manager, ensure that this group knows what they need to do. Because the foundation of what you perceive as a conflict might be that they don't know what they're supposed to do, for instance." (Interview)

In other words, a good relationship enables the occupational health services provider to offer knowledge that the customer may not explicitly ask for. In this specific case, conflict management is not the primary emphasis. Instead, the emphasis is on how she and her colleagues can strengthen and support the manager's leadership, possibly through measures such as a management course. This is rooted in the recognition that the leader or manager serves as the central figure in matters of health, work environment, and rehabilitation. Thus, providing support to the manager contributes to facilitating employees' task execution, thereby enhancing the work environment.

Another example provided by the business development manager and psychologist was that customers frequently ask for interventions that she and her colleagues had previously implemented and which had yielded results that the customers had found satisfactory. However, the same interventions may not inherently align with effectively addressing the current problem. "I have the expertise to ascertain what the customer needs in this specific issue," she explained, and "through a dialogue with the customer, we frequently come to agreements regarding the most effective approach in each individual case". What made these agreements possible, the examples illustrate, was the "good relation" with the customer. In other words, as previously mentioned, the movement of knowledge relies on establishing a relationship of trust with the customer. In this case, the customer felt trust in the knowledge provided by the occupational health professional

and her expertise. This trust could be attributed to emotional factors, as previous research has indicated that perceiving empathetic responses from another person tends to foster greater levels of trust in that person (Ickes, 1993).

In both cases, the "good relation" allowed the occupational health services provider to perform alignment work. The customer's trust was what made it possible to align the customer's perception of the issue with the occupational health services provider and the occupational health services provider's expertise with the customer's circumstances. That is, the customer trusted the occupational health services provider to solve their problem efficiently.

The relational work undertaken by the occupational health professional in these cases shares similarities with the concept of emotion work observed in Gleisner's (2023) study involving midwives. Gleisner highlights how midwives engage in emotion work by adapting parental education to "increase the willingness among parents-to-be to embrace the knowledge embedded in the program" (Gleisner, 2023: 34), thus enhancing the attractiveness of attendance and fostering greater receptiveness among expectant parents to the knowledge integrated within the antenatal care program. Likewise, Arlie Russel Hochschild ([1983] 2012) and Annelieke Driessen (2018) explore the utilization of this specific form of emotion work to align the will of others (Driessen calls this work sociomaterial will-work), whether it entails managing challenging or concerned flight passengers or attending to the moods and emotions of individuals in dementia care. Emotion work, will-work and relational work thus address the inherent "tension between opposing desires" (Driessen, 2018: 112).

Thus, relationships have the capacity to resolve tensions that arise between different sites and opposing desires, thereby contributing to bridging the gaps (cf. Vertesi, 2014) between them. Through establishing trust in the individual offering knowledge, the knowledge becomes more trustworthy, rendering it more amenable to mobility (cf. Davis, 2019). While relational work might not directly facilitate movement of knowledge, it does create conditions conducive to the movement of knowledge. Thus, relational work cultivates positive emotional associations and interpersonal connections, prompting the intended recipients of knowledge to develop a desire for the knowledge being offered. In other words, a well-established and positive relationship contributes to facilitating a smooth and seamless movement of knowledge.

However, the facilitation of the movement of knowledge in occupational health services is not solely contingent upon a good business relationship. That is, the act of moving knowledge, particularly when it is carefully aligned to the customer's requirements, contexts, and preferences, can also serve as a means of fostering and deepening the relationship with the customer. This is achieved, in part, by the careful selection of which knowledge to move or not to move. In other words, the movement of knowledge in occupational health services and the relational work (Zelizer, 2005, 2010, 2012) of establishing and maintaining good relations is intertwined with alignment work.

My interlocutors underlined the importance of giving the customer the feeling that their services were useful to them. To be perceived as valuable, the advice and services offered must align with the customer's capacity and willingness to implement changes: that is, advice perceived as unhelpful has the potential to undermine a previously good relationship.

For example, a behavioural scientist talked about tailoring services and advice to accommodate the financial situation of individual customers. As she explained, "many evidence-based methods are costly, making them less affordable for smaller companies." To circumvent this, she adopted a modified strategy by integrating components from diverse methodologies, offering a solution she thought more financially viable for the customer. This, she acknowledged, diverged from standard protocol. Nevertheless, prioritizing alignment with the customer's financial constraints took precedence for her.

Such accommodation could also extend to refraining entirely from suggesting standard measures. A physiotherapist, for example, described this in relation to an assignment for a company whose employees were suffering from lower back pain. In such cases, standard protocol is to issue employees with adjustable desks,

as alternating between standing and sitting is deemed the most efficient strategy for addressing lower back pain in office settings. However, the physiotherapist was well aware that the customer lacked the resources to procure new desks for the entire workforce. As a result, she proposed a more cost-effective alternative: advocating for regular physical activity and stretching among the employees. In other words, she adapted her recommendations in accordance with her knowledge of the customer's circumstances and constraints, to avoid coming across as offering unhelpful advice.

In this way, occupational health professionals engaged in relational work by aligning their recommendations and interventions with the financial circumstances of their customers, thus rendering them valuable and beneficial. This relational work, in turn, enabled occupational health professionals to perform alignment work – to resolve the discrepancies between standard protocols and the unique circumstances of individual customers. Aligning services to each customer's specific situation entails working at the seam of standard protocols and the financial constraints faced by customers. More specifically, occupational health professionals combine, adapt and patch together various methods and strategies to accommodate the customers' financial limitations, resulting in the creation of "fleeting moments of alignment suited for particular tasks" (Vertesi, 2014: 268). Thus, when occupational health professionals resolve the tension between the standard protocol and the individual situation of the customer, they perform alignment work that rests on their relationship with and knowledge about the customer. However, it should not be overlooked that the movement of knowledge within occupational health services is closely intertwined with commercial considerations: occupational health services providers, much like their customers, are also driven by the need to maintain profitability. That is, when occupational health services providers cultivate and sustain "good relations," they facilitate not only the movement of knowledge and workplace well-being but also their own sales. A customer who trusts their ability to propose effective solutions is more likely to invest further in their services. This process facilitates the establishment of momentary seamlessness between different operational aspects, enabling the provision of services even when customers encounter financial constraints.

Establishing and maintaining a good relationship may also involve providing services that the occupational health services provider feels lack justification but are desired by the customer. For example, a company might express the intention to provide comprehensive health check-ups for all its employees. While this gesture is indeed generous, the occupational health nurse who discussed this scenario admitted that there was no medical imperative for such evaluations. Nevertheless, by accommodating the customer's demand and conducting the check-ups, even if she considered them unnecessary, the occupational health services provider underscore their amicability and willingness to collaborate, thereby strengthening the relationship.

Even though occupational health services providers' work of establishing and maintaining relationships rests on relational work and on being perceived as useful, it resembles the flight attendants' emotion work (Hochschild [1983] 2012) to be accommodating and complaisant. In Hochschild's example, the flight attendants' primary asset is their smile, which helps them manage situations involving passengers who fear flying or those who are anxious about delays, thereby creating a sense of calm and safety. Similarly, occupational health services providers leverage their ability to align services with each customer's unique situation and their willingness to offer services that may deviate from their core mission, all with the aim of being accommodating and cooperative.

Similar to what the occupational health nurse mentioned in the previous example, other interlocutors recounted instances of providing services that deviate from their core mission of improving work environments and preventing health issues and accidents. These instances encompassed medical treatments or counselling typically offered by public primary health care, aiming to avoid potential delays; the promotion of health initiatives and wellness programs; addressing individual lifestyle concerns; and the delivery of rehabilitation and other interventions linked to sick

leave. While these measures may yield benefits for employees, they do not directly contribute to the occupational health services core mission of workplace safety and the work environment, nor do they align with the occupational health services' mission to work preventively.

However, even though my interlocutors did not see a medical value in these services, they still saw value in them. As a consultant manager put it, "We wouldn't get assignments within our core mission, unless the other things worked." In other words, demonstrating to customers the efficacy of the occupational health services provider in addressing concerns deemed important by the customer – the "other things" she mentions – lays the groundwork for persuading them that the occupational health services provider can be useful in identifying and managing issues related to work environment and workplace health.

Thus, occupational health services providers compromise certain aspects of their core functions to establish the favourable relationships they anticipate will pave the way for shaping future collaborations with customers more in line with their mission. This may involve activities such as preventive ergonomic assessments before acquiring new machinery, evaluations of workplace environments, leadership development initiatives, and management support.

In other words, the movement of knowledge and the alignment work it requires in occupational health services is deeply intertwined with the relationship between the occupational health services provider and the customer – the relationship is both the foundation on which the movement of knowledge rests and is shaped by that movement. However, good relations and the relational work that nurtures them does not replace alignment work in occupational health services – they provide the foundation that makes it possible for occupational health services providers to align standard protocols for occupational health with each customer's desires, needs, circumstances, and capabilities.

To achieve this, occupational health services providers engage in patchwork as they tailor contracts and align services according to each customer's specific demands. They skilfully combine and 'mend' different perspectives and goals, bridging the gaps, working at the seams, shaping that fleeting seamlessness between sites. Recognizing customers' needs and expectations and, more importantly, responding to these needs and expectations by aligning contracts and services is thus crucial for achieving successful collaborations (cf. Schmidt et al., 2012, 2015). By attentively addressing customers' demands, occupational health services providers can maintain the smooth operation of their work and attract customers who value their expertise and services.

Conclusion: Relational work, alignment work, and the movement of knowledge

The occupational health services providers' relational work is not only about establishing and maintaining structures and relationships between occupational health services providers and their customers by dealing with the seams (Vertesi, 2014) between the legal mission and self-perception of occupational health services providers, on the one hand, and the customers' interpretations, expectations, and unique circumstances on the other. It is about creating the necessary conditions for the movement of knowledge. One aspect of relational work involves identifying 'viable matches' (Zelizer, 2012) – customers interested in genuine collaborations – and cultivating trustful relationships with them. Further, relational work acknowledges the influence of the market-driven context in which occupational health services providers operate, engendering a dependence on their customers. This dependence is crucial in cultivating productive and trustworthy relationships. In other words, "good relations" and the relational work that nurtures them provides the foundation that make it possible to perform alignment work. To put it differently, the movement of knowledge, relational work and alignment work is deeply intertwined with each other.

Thus, I argue that the concept of alignment work needs to expand its analytical scope beyond the knowledge objects themselves, encompassing the structures and relationships that constitute the foundation facilitating their movement. Kruse (2021) introduced the concept of alignment work within a framework characterized by clearly defined relationships among professionals, under-

pinned by mutual institutional trust in the criminal justice system. In the Swedish criminal justice system, there are well-defined institutionalized relationships between groups of professionals. These relationships delineate distinct expectations for each professional role and delineate its interconnectedness within the broader criminal justice system. Further, clearly delineated pathways exist for the passage of forensic evidence-to-be, and interprofessional standards are in place to facilitate this process. The movement of knowledge through the criminal justice system necessitates concerted effort, including alignment work (Kruse, 2021), but there are well-defined roles with well-defined relationships to each other that facilitate this movement. Further, within the framework of the criminal justice system, all professionals share a common goal: ensuring the lawful and reliable movement of forensic evidence. However, Kruse's concept of alignment work does not sufficiently help understand the movement of knowledge in less organized structures.

In less organized structures, like occupational health services, which involve interorganizational collaborations while also operating in a market-driven environment, the business relationships between representatives of different companies must be established and maintained for knowledge to be moved. In other words, in occupational health services there is a need for the occupational health services provider to establish a working relationship to their customer for a movement of knowledge to become possible. Further, in interorganizational collaborations, the involved parties do not always share the same goal with the collaboration. As I have demonstrated in my analysis, in occupational health services the occupational health services provider and their customers frequently harbour different objectives regarding the collaboration. They are also both driven by the need to maintain profitability.

Looking at the movement of knowledge in occupational health services through the lens of relational work makes it possible to see how structures and relationships facilitate and shape the movement of knowledge in a different way than alignment work. My analysis shows that relational work operates to shape the structures and relationships that support and facilitate the movement of knowledge across the seams between different interests, goals, and conflicting demands. Thus, I contend that relationships possess a pivotal function in bridging the seams, and through the promotion of shared objectives facilitated by custom-tailored contracts and services, the cultivation of "good relations" and conducive conditions can be achieved. In other words, I argue that recognizing the primacy of relationships and the continuous endeavour of relational work in upholding these relationships is paramount when discussing the movement of knowledge.

This article contributes to STS discussions on the movement of knowledge (cf. Kruse, 2021, 2023; Morgan, 2011; Gleisner, 2023) by emphasizing the crucial role of relationships in establishing the necessary conditions for facilitating the movement of knowledge. It highlights the relational nature of structures and emphasizes the continuous creation of conditions that enable the movement of knowledge. The argument put forth is that relational work, aimed at building trust, promoting collaboration, and creating value for all parties involved (Zelizer, 2005, 2010, 2012), is essential for facilitating the movement of knowledge.

The importance of relationships and the contributive role of relational work in making the movement of knowledge smooth, suggests that relationships can function as infrastructures. Scholarship *within the field of* STS has highlighted that infrastructures are not solely composed of material elements, such as rails and power lines, but are constituted through relationships (e.g., Bowker et al., 2009). In fact, the relationships between human and non-human actants are as important, if not more, to the functioning of an infrastructure as its physical elements. As demonstrated in this article, the structures and relationships between occupational health services providers and their customers hold greater significance for the collaboration's effectiveness than its tangible elements. That is, the relationships and structures that sustain and harmonize interorganizational collaboration, thereby rendering it functional, hinge on continuous relational work and

may fluctuate in line with factors like willingness and capability to engage in such work.

To conclude, while the relational work discussed in this article is specific for occupational health services in Sweden, it draws attention to how underlying structures and relationships not only shape the movement of knowledge but also the knowledge itself. Using the notion of relational work to capture how knowledge is moved (or is not moved) across different contexts, locations, or epistemic cultures enables an understanding of the interplay between inequalities and dependencies, and their interconnections with the movement of knowledge. Thus, I argue that it is important to understand the conditions under which knowledge can be successfully disseminated or encounter obstacles, not only in this context but also in other contexts.

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Notes

1 An alternative conceptualization of alignment work exists, which builds upon Joan Fujimura's (1987: 258) notion of 'doability'. This conceptualization emphasizes the active alignment of different 'levels' within an organization, where problems doability depends on the effectiveness of alignment efforts. The core of such work lies in adequately meeting the demands of different stakeholders or actors (see for example Grankvist, 2011). Gröndal and Holmberg (2021) utilize the concept of alignment work to describe the discursive strategies employed in managing interventions related to antimicrobial resistance policy, their impact on professional practices, and patient-doctor relations. Steven Jackson and colleagues (2011) emphasize the need to reconcile diverse temporal structures or 'rhythms' arising from different organizations, infrastructures, phenomena, and researchers' individual biographies. They term these actions as alignment work, aiming to bring disparate rhythms together in heterogenous and locally feasible forms of collaborative research. Similarly, Helene Sorgner (2022) applies the concept of alignment work to examine the construction of doable doctoral dissertations within experimental high-energy physics settings. Thus, the concept of alignment work offers a framework for understanding how multiple considerations are simultaneously managed, emphasizing the necessity of aligning disparate organizations, infrastructures, elements, and actors with one another.

2 Throughout this article, the term "customer" (as used by my interlocutors to refer to their customers and where their obligations lie) will be used to denote the dependence of occupational health services providers on their customers, namely the employers.

3 Access to occupational health services is governed by the European Council Directive 89/391/EEC, which stipulates that employers have an obligation to ensure the safety and health of employees in all work-aspects. Employers are also required to consult employees and their representatives, allowing them to participate in discussions regarding workplace safety and health. If the employer lacks the necessary expertise, they must engage competent external services (Council Directive 89/391/EEC, 1989).

4 It is important to underscore that the success of a collaborative endeavor does not hinge upon a particular ownership structure of the occupational health services. This holds true regardless of whether these services are provided by an external occupational health services provider or managed internally through an in-house occupational health services unit (Schmidt et al., 2017).

Swabbed Dogs and Beaches in Pizza Boxes: Crime Scene Alignment Work and Crime Scene Technicians' Professional Identity

Corinna Kruse

Department of Thematic Studies – Technology and Social Change, Linköping University, Sweden/Corinna.Kruse@liu.se

Abstract

This paper discusses the alignment work that Swedish crime scene technicians perform at the crime scene. It takes as its point of departure the understanding that the criminal justice system is a collaboration of very different epistemic cultures with at times different understandings of "the same" forensic evidence and its production. Nonetheless, the collaboration and the legal security of forensic evidence depends on knowledge in the form of forensic evidence(-to-be) moving easily and stably through it, despite epistemic differences. One way of attaining such stable movement, the article argues, is the crime scene technicians' alignment work when they recover and package traces from the crime scene – for example body fluids, fingerprints, and fibers – for transport to the forensic science laboratory. Their crime scene alignment work, it shows, is not only a core part of the crime scene technicians' contribution to the collaborative production of forensic evidence, it is also a source of professional pride, identity, and community for them. Thus, the crime scene technicians' alignment work is not only important for the movement of knowledge through the Swedish criminal justice system, but is also an integral part of their professional self-understanding.

Keywords: alignment work, crime scene technicians, crime scene work, professional identity, movement of knowledge, forensic evidence

Introduction

This article examines Swedish crime scene technicians' recovery of traces from the crime scene and their movement to the forensic laboratory through the lens of alignment work (Kruse, 2021). This lens makes it possible to see not only the work of moving traces stably but also how this work is intertwined with and shapes crime scene technicians' self-understanding.

Alignment work is the work that makes it possible for knowledge – in this case, the traces that are to become forensic evidence – to be moved stably from one context to another. The notion takes its point of departure in thinking about the movement of knowledge across different epistemic cultures (Knorr Cetina, 1999) in terms of infrastructure and infrastructuring, that

is, in terms of continuously bridging the gaps and resolving the tension between different sites (cf. Star and Ruhleder, 1996: 114) to create "an experience of seamlessness between different sites" (Kruse, 2021: 5). These 'seams' between sites are not the connections that hold together different pieces of fabric, but the gaps between different systems and infrastructures caused by technical incompatibilities (Vertesi, 2014: 268ff).

In the criminal justice system, such seams are caused by different epistemic cultures making up the collaboration; this article focuses on the seam between crime scene technicians at the crime scene and forensic scientists in the forensic laboratory. These epistemic cultures differ in focus – for example, crime scenes in the context of an investigation compared to analyzing traces or sets of traces and evaluating the result (Kruse, 2016) – in working conditions – unpredictable crime scenes compared to a laboratory environment that can be subjected to order – and in understanding forensic evidence and its production. The traces' move from the crime scene to the laboratory is thus not only a move from one site to another but also from one epistemic culture (Knorr Cetina, 1999) to another: from the crime scene technicians' "machineries of knowing" (Knorr Cetina, 1999: 2) to those of the forensic laboratory with a different way of contributing to and understanding forensic evidence (Kruse, 2016: chapter 6, 2020a and 2020b).

However, for the criminal justice system to be able to produce as much and as nuanced forensic evidence as possible, traces must move seamlessly from the crime scene to the laboratory. In the interest of legal security, forensic evidence in court must be perceived as "the same" as the trace at the crime scene it originated from. In consequence, the traces that are moved from the crime scene to the laboratory must be understandable as unaltered, despite having changed shape from, for instance, a drop of what is presumed to be blood on a floor to a forensic swab tipped with dried blood and sealed into a paper bag. In addition, the traces must remain physically stable; that is, they must not be allowed to deteriorate, since deteriorated traces mean less detailed and thus less strong evidence. Finally, the traces' decipherability must remain unaffected by their recovery and transport; in other words, they must be recovered and transferred in a way that enables (or at least does not preclude) the subsequent laboratory analysis. To put it differently, forensic evidence in the making has to be moved across the seams (Vertesi, 2014) between epistemic cultures; more so, it must, in the interest of legal security, be moved stably or "with integrity" (Morgan, 2011: 12).

To ensure the traces' stability as they are moved between the crime scene and the laboratory, the National Forensics Centre[1] (NFC), Sweden's only and state-run forensic laboratory, has developed and continuously teaches standards for how different kinds of traces are to be recovered, packaged, and transported. These standards are meant to make it possible to treat the movement of traces from the crime scene to the laboratory as a practical matter: if the crime scene technicians follow the recommendations, the recovered traces will fit seamlessly into the laboratory's work.

In practice, however, standards cannot and do not bridge all seams in crime scene work (or other enterprises). For one, the standards must always be actively applied to each particular crime scene and its circumstances. Secondly, standards have their limitations – as for example Susan Leigh Star (1990) has famously and eloquently discussed, it is impossible to devise standards that accommodate all possible variety. In her words, "there are always misfits between *standardized* or *conventional* technological systems and the needs of individuals" (Star, 1990: 36; italics in original). To (try to) design standards that accommodate every possible crime scene would be as futile as trying to devise standards that accommodate every possible body. In other words, the standards that are meant to bridge the seam between epistemic cultures – and do so most of the time – will, inevitably, on occasion, encounter a crime scene whose circumstances they will not fit. The misfits Star discusses are about fast-food standards facilitating a smooth restaurant meal for most people but making the seemingly same meal difficult for those with unusual allergies; in crime scene work, such misfits mean that the standards cannot resolve (or wholly resolve) the tension between the crime scene and the laboratory.

This is where the crime scene technicians' alignment work comes in. Their alignment work at the crime scene is the work that complements and completes the NFC's standards, allowing the traces to move from the crime scene to the laboratory and further to the investigation smoothly and seamlessly when standards alone are not enough. When the technicians recover and package traces – for example body fluids, fingerprints, and fibers – for transport to the forensic science laboratory, they at the same time align the standards for recovering traces with the circumstances at the particular crime scene; that is, they align the crime scene and the laboratory to facilitate the traces' stable movement from one to the other.

By making it possible to perceive the traces and, by extension, the forensic evidence produced from them as stable, the crime scene technicians' alignment work thus contributes to the validity of the forensic evidence produced by the criminal justice system and to its legal security. One could, cynically, say that by performing alignment work, the crime scene technicians prevent the seams between the crime scene and the laboratory from being noticed and their consequences being discussed. A less cynical understanding is that, just like misfits, seams are inevitable in a collaboration between different epistemic cultures, and alignment work is what makes it possible for the criminal justice system to produce useful forensic evidence at all.

But, I will argue, this alignment work not only facilitates the stable movement of traces from the crime scene to the laboratory, it also is a source of professional identity and pride. When crime scene technicians talk about what they call "difficult cases" – i.e., cases that require extraordinary alignment work to result in potential forensic evidence – they simultaneously share crime scene experience and narrate themselves as competent, inventive, and dedicated members of their professional community. Thus, their crime scene alignment work is not only essential for the movement of knowledge (in the form of forensic evidence) through the criminal justice system but is also an integral part of their self-understanding.

Material

The main part of the empirical material for this article comes from an ethnographic study of Swedish crime scene technician training at the NFC, a site where two of the criminal justice system's epistemic cultures – forensic scientists and crime scene technicians – meet for half a year's course work on forensics spread out over a year. My fieldwork at the NFC's training facility took place with the class of 2013, consisting of ten men and ten women. With few exceptions, I observed the lectures, practical exercises, and crime scene examinations, listened to and participated in discussions over coffee and lunch, and conducted informal interviews with both teachers and students. Studying crime scene technician training means that the students' identities as crime scene technicians were still under formation – however, the issue of identity may conversely also be more prominent during its formation than later in the technicians' career. In addition, through their preceding and parallel work at a crime scene division, they were not complete novices; nor did they perceive themselves as such.

Apart from this study, the article also draws on material from an earlier ethnographic study in the Swedish criminal justice system as a whole. Between 2008 and 2012, I studied its collaborative production and use of forensic evidence (Kruse, 2016), moving between a public prosecution's office, a criminal investigation division, a crime scene division, and three units of the NFC. I also observed a number of trials in district court and conducted formal interviews. This earlier study provided valuable insight into the criminal justice system's different epistemic cultures and the seams between them.

Together, the two studies provide a rich material with which to think about the seam between the crime scene and the forensic science laboratory and about how practitioners deal with this – highly undesirable – seam. To do so, I have focused the analysis on the parts of my material dealing with the recovery of traces and their movement from the crime scene to the laboratory as well as on crime scene technician's perspectives on that movement and their role in it. Inspired by Grounded Theory (Glaser and Strauss, 1967), I have analyzed not only broader themes but also

patterns and contradictions of how this recovery and movement was discussed in different contexts and by different people in order to trace both the seams between the two sites and the alignment work they necessitate. The connection between alignment work and crime scene technicians' professional identity that this article discusses emerged through that analysis.

Crime scene technicians and their work

In the Swedish criminal justice system, the scenes of suspected severe crimes are examined by specialized police officers, called crime scene technicians (*kriminaltekniker* in Swedish; literally, forensic technicians). Unlike in other countries, Swedish crime scene technicians are almost exclusively police officers with police training and backgrounds;[2] typically, they begin their careers as police officers – civilian crime scene technicians are very rare – first working in uniform on the street, and then moving on to different specializations. From there, they apply to transfer to a crime scene division and receive both apprenticeship-like training from colleagues and formal training from the NFC (see Kruse, 2015, 2020a).

Crime scene technicians thus occupy an in-between position in the Swedish criminal justice system: Through their police backgrounds, they bring an understanding of police work and in particular investigative work to their crime scene examination; their training at the NFC gives them insight into the epistemic culture of forensic science and the forensic science laboratory. Organizationally, they are similarly in-between. The NFC – which is formally part of the police but whose employees have civilian, predominantly science backgrounds – is responsible for crime scene work, not only for the crime scene technicians' training but also for crime scene examinations and their quality. The crime scene technicians themselves, however, are under the responsibility of their respective police region.[3]

Like their counterparts in other countries, Swedish crime scene technicians examine and document crime scenes and recover materials and traces that they – on the investigation leader's decision – send to the forensic laboratory for analysis. Crime scene work has garnered only little scholarly attention (exceptions are, e.g., Kruse, 2016: chapter 5; Ludwig et al., 2012; Williams, 2007). Often, scholars have focused on very specific aspects such as how crime scene examiners deal with difficult or disgusting situations (Gassaway, 2007), how they are trained for crime scene work (Wyatt, 2014; Kruse, 2020a), or their personal attributes (Kelty et al., 2011). An exception is Robin Williams and Jason Weetman (2013) who have studied how the results of crime scene work fit into the overall investigation.

In addition to the documentation of crime scenes and the recovery of traces, Swedish crime scene technicians also mediate between the different epistemic cultures of the criminal justice system. This mediation or alignment can be necessary because the different epistemic cultures entail at times different understandings of the forensic evidence. For example, for crime scene technicians, forensic evidence is the result of their crime scene work, each piece of it to be seen in the context of the crime scene and contributing to reconstructing what happened there. For the forensic scientists at the NFC who analyze the traces from the crime scene, forensic evidence is a probabilistic assessment for single or sets of traces; for police investigators and prosecutors, forensic evidence is a tool in assembling more evidence and, eventually, a case that can be prosecuted; and for judges, forensic evidence is one bit, and not in all cases a central bit, in the whole of a case. Also the degree of familiarity with forensic methods and processes differs between epistemic cultures; after all, their collaboration on forensic evidence depends on their different contributions and qualifications. However, this can also sometimes lead to friction – precisely because members of the different epistemic cultures sometimes understand "the same" forensic evidence differently (Kruse, 2016).

To facilitate the collaboration, then, crime scene technicians translate questions from the pre-trial investigation into requests for laboratory analyses, "explain" (as they put it) laboratory results to police investigators and prosecutors, or give them advice on which analyses of which traces from the crime scene could provide useful answers to the investigation's open questions (Kruse, 2020a). In other

words, they align the laboratory and the investigation by mediating or translating between them.

Similar phenomena in other criminal justice systems have been reported only implicitly and only from Britain. There, crime scene examiners seem to perform work that could be conceived of as alignment work away from the crime scene. For example, Paul Millen speaks about British crime scene investigators being "the glue between two surfaces" (Millen, 2000: 126), namely those of forensic science and the police investigation, and Dana Wilson-Kovacs mentions how crime scene examiners synchronize and coordinate different actors within an investigation (Wilson-Kovacs, 2014: 771).

The alignment work at the crime scene that this article focuses on has not been discussed in the scholarly literature at all. This scarcity probably has to do with the scarcity of social science studies of crime scene work in general. In addition, different criminal justice systems with different rules for the admissibility of evidence may also regulate crime scene work to different degrees. The Swedish criminal justice system practices freedom of evidence; that is, all evidence is admissible and the court decides whether it is relevant to the case. A criminal justice system with stricter admissibility rules and thus more standardized evidence might conceivably regulate also crime scene work more strictly, granting crime scene investigators less freedom and discretion in their work. This may make alignment work at the crime scene specific for the Swedish criminal justice system (as the NFC, personal communication 2021, thinks); it is also possible that alignment work in other criminal justice systems takes different and perhaps less noticeable forms, contingent on the particular criminal justice system's organization and circumstances.

In other words, the alignment work that Swedish crime scene technicians perform at the crime scene is shaped by the Swedish criminal justice system's specific epistemic cultures, the crime scene technicians' position, and how and against which background their cooperation is organized. The need for comparable alignment work may be present in other criminal justice systems or co-operations, as well – the need to deal with different epistemic cultures interacting and the limitation of standards can hardly be unique to the Swedish criminal justice system – but *who* performs this alignment work *why* and *how* are shaped by the specific criminal justice system. This alignment work, however, not only facilitates the seamless movement of traces from the crime scene to the laboratory, but is also part of forming and maintaining crime scene technicians' professional identity.

Professional identity

I use the term *professional identity* very loosely here. I do not aim at a discussion of whether or not Swedish crime scene technicians constitute a profession or an occupation but want to focus on how the crime scene technicians' alignment work contributes to their sense of work-related identity. Identity, even if understood broadly as a sense of self in relation to others, is a somewhat elusive concept. Much more visible when it is contested or in upheaval (Lawler, 2014: 1ff; see also Elliott, 2015), it always harbors contradictions and tensions: It presupposes inclusion at the same time as exclusion, for example through demarcating the ones entitled to claiming an identity against an 'other' (e.g. Hall, 1996); there is tension between how a person perceives themselves – be it in terms of gender, ethnicity, class, or occupation – and how others "read" them (Lawler, 2014: 17f) as well as between identities that are understood as made versus given, for example through kinship (Lawler, 2014: chapter 3) or other characteristics; and a person's multiple roles and identities raise the question of authenticity and the self (Lawler, 2014: 116ff). Identity is also simultaneously individual and collective: The individual constructs and performs (and presumably perceives) their identity in relation to a community and to existing structures and order (e.g., Elliott, 2015; Lawler, 2014: 160ff).

Here, I want to focus on the positional (Hall, 1996) aspect of doing or performing identity (see also Goffman, 1959; Butler, 1990). I understand identity as a continuous process, as "something achieved rather than something innate, as done rather than 'owned'" (Lawler, 2014: 4). Performing identity has been connected to speech – for example in the use of sociolects – and narrative (e.g., Ochs and Capps, 1996; Lawler, 2014: ch 2;

Antaki and Widdicombe, 1998; for an overview, see Bamberg et al., 2007) as well as to bodily expression (famously, Butler, 1990) or habitus (Bourdieu, 1977). That is, identity is always under construction, as its performance and its construction are inseparable.

A professional identity, then, is continuously constructed, maintained, and performed in relation to one's work and professional community. Professions as a way of socially organizing and controlling work have been discussed for a long time in the sociology of work (for a comprehensive overview, see Barley et al., 2016: 126-129), in particular in terms of boundary work (Gieryn, 1983) between occupations and the more prestigious professions, with semi-professions (Etzioni, 1969) in between. There seems to be a bit of disagreement about what constitutes professionalism or a profession, but core characteristics comprise restricted admittance to the profession; special (and valued) expertise, also called a 'jurisdiction' or core activities and competencies (Abbott, 1988: 59ff); a connection to science; standardized methods and formalized training; credentialing or licensing; discretion and autonomy; and, typically, the power and status bestowed by a monopoly on valued expertise (e.g., Barley et al., 2016; Evetts, 2013).

Swedish crime scene technicians exhibit some of these characteristics: Access to the occupation is restricted through the requirement of being employed by the police (which in turn typically means having been accepted into and graduated from the police academy) and having been sent to and completed the NFC's course. Through the course, crime scene technicians' training and subsequent work is standardized across the country, and the NFC's recent development of a model for crime scene work (Kruse, 2020b) connects this work with science in the form of mathematical-statistical models. Finally, crime scene work at the sites of suspected severe crimes[4] is only performed by crime scene technicians; thus, they have a jurisdiction in Abbott's sense.

On the other hand, the technicians' training as well as their crime scene work is the responsibility of the NFC; thus, even though crime scene technicians are involved in the training, their autonomy is limited. In addition, the NFC's responsibility means that the professionalization of crime scene technicians through the increasing standardization and connection with science is one from the outside.[5] This is not unique to the Swedish criminal justice system; Wilson-Kovacs, for example, speaks about British crime scene examiners' "professionalisation from above" (Wilson-Kovacs, 2014: 774), i.e., through outside and superior institutions. This, she argues, affects both their autonomy and their self-image or identity – the crime scene examiners she interviewed were content with a supportive position "in the back" (Wilson-Kovacs, 2014: 770), namely a "place ... as technicians, facilitators, practitioners, and (less formally acknowledged) collaborators" (Wilson-Kovacs, 2014: 773). Others have described crime scene examiners as part of and subordinate to (the profession of) forensic science (Robertson et al., 2014). Parallels can be drawn to other groups of technicians (e.g., Barley and Bechky, 1994; Bechky, 2021; Orr, 1996) who also are understood as supporting others' work but not professions in their own right.

However, another strand of scholarship on professions and professionalism argues that the concept of professions in many respects functions as a gatekeeping or rhetoric device for practitioners rather than a useful analytic tool (e.g., Watson, 2002). As for example Christel Backman and Anna Hedenus (2022) demonstrate in their study of recruiters, 'professional talk' – i.e., talk that positions the speaker and their occupational group as professionals – can be a rhetoric strategy for adding weight to one's assessments and enhancing one's position. In this context, the distinction between contextual and formal knowledge and the subsequent secondary status of technicians despite their crucial role in for example producing scientific knowledge (Barley and Bechky, 1994) can be understood in terms of a struggle for power and recognition.

When I speak about crime scene technicians' professional identity, then, I do so loosely and closer to the second strand of scholarship than the first. Unlike Backman and Hedenus's interlocutors who explicitly called themselves "professional," the crime scene technicians I studied did not refer to professionalism – nor may they be, strictly speaking, classifiable as a profession – nonethe-

less, I argue, it is useful to speak about crime scene technicians' *professional identity* (as opposed to, for example, occupational identity) in connection with their alignment work. Their alignment work is, after all, one aspect of their core competence comparable to Andrew Abbott's jurisdictions (Abbott, 1988: 59ff) and an area of (relative) discretion. That is, I want to highlight that this part of crime scene technician identity is not only related to what crime scene technicians *do* at the crime scene but also to how their skill at and understanding of alignment work creates a space that is at least akin to a profession's jurisdiction and discretion. This identity was conveyed and acquired gradually in relation to both the professional community as crime scene technicians and the criminal justice system as a whole.

Performing crime scene technician identity through talking about alignment work

Professional identity can be – and is – shaped, transmitted, performed, and reinforced (as well as changed) in a number of different contexts and conversations. One way is through a shared frame of reference or repertoire – for example embodied in the expertise, methods, and training that constitute some of an occupation's core characteristics. This shared frame of reference can also be established and conveyed through textbooks, for example through the presentation of historical figures (Traweek, 1988: 77ff). One could argue that also scholarly journals are a site where a professional community shapes and negotiates its identity.

Professional identity can also be shaped, maintained, and reinforced through narratives (e.g., Bamberg et al., 2007; Antaki and Widdicombe, 1998). A well-known example are the stories with which, Julian Orr argues, photocopier technicians share experiences and reflect on their work (Orr, 1996). On the surface, these stories are a way of sharing experience (Orr, 1996: chapter 8): by being turned into stories about photocopiers – and the customers that operate them – the individual technician's experience becomes circulatable and thus shared. But, Orr continues, telling stories of particularly difficult repairs is also a way for a photocopier technician to demonstrate their expertise, "a celebration of being a technician, able to cope with anything that either machines or customers or both can do" (Orr, 1996: 139). In other words, the photocopier technicians' stories are not only a means of exchanging knowledge but also a way of building professional identity and community.

In more theoretical terms, the photocopier technicians narrate *themselves* in their stories. As linguistic anthropologists Elinor Ochs and Lisa Capps point out,

> Personal narrative simultaneously is born out of experience and gives shape to experience. In this sense, narrative and self are inseparable. … We come to know ourselves as we use narrative to apprehend experiences and navigate relationships with others. (Ochs and Capps, 1996: 20f)

That is, through telling stories, the technicians both order their experience and place themselves in relationship to the machines, the customers, and each other.

In the same way, the crime scene technicians I studied narrated themselves both individually and collectively when talking about the cases they called "difficult." Analytically speaking, these "difficult cases" were cases that required alignment work out of the ordinary. The crime scene technicians often turned such cases into highly entertaining stories, much like the stories the photocopier technicians studied by Orr (1996) told among themselves.

One such story – a story about a presumed rape – was told by a crime scene technician student taking the NFC's training. The story was told during a break, in the hallway outside of the classroom, to an audience of her fellow students (and the visiting anthropologist), vividly describing how she and a colleague had been dispatched to an outdoor site. A dog trained for sniffing out semen was brought to the site to help look for traces, and it indicated a possible stain on the foliage of a bush. However, the student continued, the dog got somewhat overexcited at its success and proceeded to lick at the leaves, lapping up the potential evidence-to-be. "So," she concluded, "we swabbed the dog," mimicking pulling out the dog's tongue with one hand and applying a forensic swab to it with the

other. Her performance was met with laughter and questions for details.

There were more stories told during this and other breaks, most prominently one about another presumed rape case with which I have illustrated the necessity of alignment work elsewhere (Kruse, 2021), a case that also involved a dog. This dog had been brought to the site of the suspected crime – a beach – and marked a spot that was much too large to recover with forensic swabs. So, the technicians scooped up the sand in question with pizza boxes from a nearby restaurant piled the boxes in the back seat of a car and drove them across the country to the NFC. Again, the story was received with laughter.

To the students, these and other stories of difficult cases were clearly highly entertaining. They were met with laughter and appreciation – and, like the photocopier stories discussed by Orr (1996) as a way of collectivizing experience and skill, they led to a discussion of how to handle such difficult cases more generally. But the stories did more than share and discuss experience in an entertaining manner. They were also, I argue, a way of shaping, conveying, and reinforcing individual and collective professional identity.

By telling 'war stories' (Orr, 1996: chapter 8) about extraordinary cases – and the tellers' animation as well as the listeners' amusement made it very clear that these were cases out of the ordinary – and about ways of dealing with the difficulties they posed, the crime scene technicians also narrated themselves and their listeners as a community. In these and other stories about difficult cases, the crime scene technician protagonists managed to salvage a possibility of forensic evidence despite the extraordinarily difficult circumstances – in other words, the stories celebrated crime scene technicians' alignment work. In the story of the overexcited dog, swabbing the dog's tongue was the punchline, accompanied by lively gesturing; the story situated on the beach culminated with scooping up sand and chauffeuring the pizza boxes across the country.

What made the stories so entertaining, then, was the combination of an especially unfavorable crime scene and the technicians' unconventional actions; they were an exaggeration, so to speak, of an everyday issue that members of the community could relate to. Even if the listeners did not have personal experience of stains being eaten by dogs or spread out on sandy beaches, they were still familiar with suddenly coming up against unforeseen and unfavorable circumstances. At any crime scene, traces can overlap or intermingle, conditions can be adverse, or other circumstances can make it difficult to put the forensic scientists' recommendations into practice.

None of the stories reported how the traces were received or whether a laboratory analysis had yielded any usable results. None of the listeners asked – all they wanted to hear, laughingly, were details from the crime scenes. What the stories did, then, was to highlight – in a community of knowledgeable peers – how the crime scene technicians had handled adverse circumstances and managed to preserve a possibility for obtaining forensic evidence further on in the process. Moreover, they did so despite particularly unfavorable circumstances.

Through their extraordinariness, the stories illuminated the limitations of the standards taught by the NFC and highlighted the alignment work of the crime scene technician protagonists. It is probably no coincidence, either, that both stories were of a severe crime that, like other crimes that affect people's life, health, or safety, is given priority and thus warrants extraordinary effort. This does not make the standards obsolete or questionable in any way – nor did the students question them, neither in their discussions of the stories nor on other occasions. Even in cases that certainly are not "difficult," crime scene work of necessity contributes to resolving or at least decreasing the tension between the crime scene and the laboratory. In the stories, however, circumstances were so unusual and difficult that they also highlighted the technicians' alignment work as unusual and extraordinary: The protagonists of the stories turned an initially hopeless situation into at least a possibility of forensic evidence later in the process.

Thus, the stories of difficult cases were a way for crime scene technicians to narrate themselves (Ochs and Capps, 1996); that is, to convey, maintain, and reinforce their identity as precisely crime scene technicians. Furthermore, they illustrate that alignment work – although the crime

scene technicians did not and would not call it that – is part of the community's self-image and a source of pride. Being able to deal with difficult cases – at worst salvaging a chance for forensic evidence and at best producing "a shared experience of seamlessness" (cf. Vertesi, 2014: 277) – seems to be an appreciated and admired skill within the community.[6]

Even though these particular stories were told by comparative novices – the students on the course had worked for at least a year at a crime scene division but were far from seasoned crime scene technicians yet – they demonstrated that they already at this early point in their career could narrate themselves as proper crime scene technicians. That is, by telling stories about a core activity, they demonstrated their understanding and appreciation of alignment work.

The alignment work in the stories seemed to have a very personal component, both in terms of skill and in terms of taking pride in the work. It depended on the crime scene technicians' quick reaction (when catching the dog's tongue) as well as their creativity (when using pizza boxes) and dedication (when driving the boxes to the laboratory). Judging from how the stories were told and received, the crime scene technicians performed alignment work willingly, aiming for the common goal of solving crimes, and taking pride in their skill, dedication, and inventiveness. Paraphrasing Orr (1996: 139), the crime scene technicians' stories of difficult cases thus can be said to be a celebration of being a technician, able to cope with any kind of crime scene.

Crime scene technicians not only perform – skilled, dedicated and inventive – alignment work at the crime scene when standards are difficult to apply but also when there are no clear standards for the crime scene technicians to follow. This can happen with orders for uncommon analyses, such as the request for a DNA profile from a glass jar of urine that had come in while I did fieldwork at the NFC. This was a highly unusual trace – clearly surprised, the forensic scientist unwrapping the jar spent some time figuring out what to do with it. Since urine is not a frequently processed trace – probably due to its rarity at a given crime scene as well as its marginal usefulness – there were no standards for how to prevent bacterial growth and thus preserve a chance of producing a DNA profile. Accordingly, the technician presumably (I was not present at their crime scene examination and thus could not observe and ask them) had recovered the trace as best they saw fit with the equipment they had at hand. It also turned out that there was no other potential evidence in the case (a burglary), and the technician had tried to make the best out of rather bleak prospects to align the crime scene with the laboratory with the resources at hand.

An uncommon question does not always require a lot of alignment work and inventiveness, however. In one investigation during my fieldwork at the NFC, the investigative question was whether the stains on a bed sheet could corroborate (or contradict) a plaintiff's statement about being sexually assaulted. The crime scene technician had sent the sheet to the laboratory, together with the salient points from the plaintiff's and suspect's statements. This case was even more disruptive for the laboratory – the forensic scientist assigned the case spent quite some time working out whether and how they could possibly find an answer – but the disruption was due to the uncommon question, not the recovery and transport of the sheet. There, the crime scene technician could extrapolate from existing and familiar standards: when recovering and transporting clothing stained with body fluids, crime scene technicians are taught to let the garment dry before packaging it, so that the fluids containing the potential DNA traces do not rot and the DNA does not deteriorate. In this particular case, the question was not about DNA evidence, but by treating the bed sheet in the same manner, the crime scene technician preserved the stains that the question was about. That is, for them, the bed sheet was in all probability much more routine than it subsequently was for the forensic scientists – the crime scene technician could apply familiar standards.

In all of these cases, the crime scene technicians in question were confronted with a crime scene that did not lend itself easily to the routine recovery and transport of traces. In addition, in all of the cases, the stakes were high: they were severe crimes or there was a paucity of traces, making the few possibilities for forensic evidence

more important. This also placed the crime scene technicians in a key role: the result of their (alignment) work was the foundation of much of the criminal justice system's subsequent work – and thus success – with the case.

Like in the stories of difficult cases, fulfilling this key role required, besides inventiveness, also perseverance and skill. This ties in with other stories that crime scene technicians have told me about what they called "interesting" or "fun" cases, i.e., cases of which they were particularly proud. One case I was told about, by crime scene technicians respectively a prosecutor on separate occasions, was about finding specks of the victim's blood on a black piece of the suspect's clothing where they were very difficult to see: the technician's perseverance and skill had produced evidence that was crucial for achieving a conviction.

A case that only crime scene technicians talked about was one in which they had performed alignment work in the form of putting their knowledge of and skill with a forensic technology to an unusual use in order to produce evidence. In this case, an ambulance had been called to a residence to see to an unconscious woman. The woman later died in hospital, and a medical examination found, among other things, peculiar marks on one of her temples. The examination arrived at the conclusion that her unconsciousness and subsequent death were due to brain injury that in turn was caused by violence to the temple. Her partner was suspected, but there was no evident weapon. So, the crime scene technicians had searched the house and had found a pitcher whose rim pattern reminded them of the marks on the body. The way they told the story, it took quite some time to find the pitcher, not because it was hidden – it was in plain sight on the nightstand – but because there were, like in every household, many more likely objects for inflicting harm on a person.

However, it was one thing to suspect that the pitcher was the weapon and another to turn this suspicion into evidence. This was where the technicians' perseverance and imagination were coupled with their inventiveness: They brushed the pitcher's rim with fingerprint powder,[7] pressed it against a volunteer's temple, and photographed the sooty marks left there. One of the photographs, they said, had been used in court and had critically contributed to convicting the partner of killing the woman. In other words, the crime scene technicians had used their forensic skill and knowledge in new ways to solve a particular problem in a specific investigation – just as the technicians in the students' stories had done.

These were not narrated as difficult cases that had required extraordinary alignment work with uncertain outcomes, but as cases in which perseverance and inventiveness had been instrumental for convictions. Still, the qualities the narratives celebrated were the same as in the stories about the difficult cases, namely the skill, inventiveness, and dedication that make alignment work successful.

With their stories, crime scene technicians thus narrate themselves and their colleagues as skilled, inventive, and dedicated professionals who can salvage a possibility of forensic evidence and, by extension, of a legally secure conviction even from a seemingly hopeless crime scene. In other words, the ability (and willingness) to perform alignment work is narrated as a core component of their professional identity. Through focusing on a part of work that is left to the crime scene technicians' judgment and initiative, the narration also emphasizes their profession-like discretion as a part of that identity.

Unlike the invisible work in mitigation of the inevitable misfits between standards and individual needs or circumstances that Star (1991) discusses in terms of suffering – in her narrative, the misfits between for example a restaurant's standardized food and the consumer's individual body are dealt with through the allergic person's additional work of monitoring the food and scraping off onions to produce a passably seamless restaurant experience – crime scene alignment work does not appear to be dispiriting to practitioners. Here, misfits between standards for the recovery of traces and the circumstances of individual crime scenes do lead to additional work for the crime scene technicians, but misfits are also opportunities for demonstrating one's skill and performing oneself as a competent crime scene technician. Particularly difficult alignment work can be shared and celebrated (cf. Orr, 1996: 139) collectively through stories.

The same alignment work, however, is not always visible to or appreciated by others in the criminal justice system. As I will discuss in the next section, the appreciation in relation to the non-appreciation of alignment work is also a way of creating or maintaining a community – a community of those who are familiar with the challenges posed by the misfit between recovery standards and unstandardizable crime scenes, and who thus appreciate and are entertained by stories about alignment work out of the ordinary.

The (non-)appreciation of alignment work

As Stuart Hall (1996) points out, the inclusion inherent in a particular identity or community always goes hand in hand with the equally inherent exclusion of others who do not belong. To put it differently, identity work also has a dimension of boundary work (Gieryn, 1983), that is, of demarcating what or who belongs or does not belong.

In the case of the crime scene technicians I studied, crime scene alignment work and its appreciation constituted one such area of demarcating belonging: The crime scene technicians' inventive alignment work at the crime scene is not always appreciated by others, and thus this appreciation is something that is shared within the profession but not necessarily with others. In addition, the friction that at times arises around this alignment work, especially when it does not quite succeed in achieving seamlessness, might emphasize the boundary.

To be clear, the inventiveness itself that crime scene technicians celebrate in their stories about difficult cases seems to be a defining and valued quality for Swedish crime scene technicians also in the eyes of others. One crime scene technician, for example, who was retired by the time of my fieldwork, was famous (i.e., known to people in the criminal justice system other than his immediate colleagues) for inventing and developing some of the routinely used forensic products. He was known and referred to by his nickname – a diminutive of his first name – and was talked about with admiration by both the crime scene technicians and forensic scientists I met when studying crime scene technician training. One forensic scientist for example described him with clear appreciation as "a real Gyro Gearloose." That is, by likening him to the Disney character, the speaker acknowledged him as an inventor and demonstrated her appreciation for his inventiveness and his contributions to forensics and, by extension, to criminal justice. While the students were not expected to become inventors on a par with him – he was clearly considered exceptional – they were expected to be able to cope with the unexpected at a crime scene and to adapt tools and methods if necessary. In other words, a certain amount of crime scene alignment work (although my interlocutors would not use the term) is not only accepted from but also appreciated and sometimes celebrated in crime scene technicians.

This expectation seems particular for the Swedish criminal justice system (NFC, personal communication 2021); in a different criminal justice system, if alignment work is at all possible and accepted, it may play a different role for its crime scene investigators' self-understanding, such as the British crime scene examiners who described themselves as "backroom boys" who happily "let somebody else take the glory" to Wilson-Kovacs (2014: 770). However, the *degree* to which crime scene alignment work is appreciated seems to vary between epistemic cultures. That is, when it comes to inventiveness, the crime scene technicians' self-image seems to be at least in part picked up by others and ascribed back to them, as for example in the Gyro Gearloose remark. However, when it comes to inventive alignment work, the appreciation the crime scene technicians showed for stories of handling difficult cases would not necessarily have been shared outside the profession.

One factor in the non-appreciation of highly inventive crime scene alignment work is its relative invisibility,[8] especially when the crime scene technicians succeed in achieving seamlessness. As long as the traces arrive at the laboratory in the expected form, the forensic scientists who receive the traces may never know or suspect that there has been a need for alignment work. To other epistemic cultures in the criminal justice system, successful crime scene alignment work is similarly invisible: when crime scene technicians deliver traces or evidence that fit seamlessly into

others' practices (e.g., the photograph of the sooty mark), other practitioners in the criminal justice system only see the results of the technicians' work – and may have an opinion on these results – but not the work itself.

This invisibility has to do with crime scene work being performed out of view. But it also has to do with the criminal justice system's different epistemic cultures: forensic scientists, police investigators, and prosecutors have – not surprisingly – little experience of crime scenes, especially of crime scenes that have not yet been processed by crime scene technicians. Thus, they may not be aware of the variability of crime scenes and of the work required to align that variability with the laboratory. When the crime scene technicians' alignment work has been successful in producing a shared experience of seamlessness it renders the seams invisible and thus also the necessity of the alignment work itself. Seeing the technicians' alignment work requires intimate knowledge of crime scene work, or at least close contact to the particular case (the prosecutor who talked about the blood specks had led the pre-trial investigation of that case).

In consequence, both the performance of and the necessity for alignment work are largely absent from official descriptions and understandings of crime scene technicians' work, as well as from their training (see Kruse, 2020a), making crime scene alignment work both unofficial and solely the crime scene technicians' concern. This invisibility also means that the ability to see and appreciate alignment work at the crime scene is, if not exclusive to crime scene technicians, at least distinctive to them. This may also play a part in why the crime scene technician students told their 'war stories' about crime scene alignment work in the hallway during a break: This way, they told the stories to an audience of connoisseurs as well as in a context that was just as unofficial as this particular kind of alignment work itself.

The non-appreciation of highly inventive alignment work is not only due to its invisibility, however. It also has to do with a concern that too much inventiveness – i.e., departure from standards – may jeopardize legal security. In its capability of being responsible for crime scene work, the NFC wants, in the interest of quality and legal security, this work to follow the standards it has developed. These standards have been developed because traces recovered in accordance with them are best suited to laboratory analysis and traces recovered in a different way may result in inferior or less evidence. In addition, the NFC emphasizes that minimizing variation between technicians – i.e., standardizing crime scene work – is also a matter of quality and legal security and thus not a matter to be taken lightly.

In other words, the NFC has reasons to emphasize adherence to rules also when crime scene technicians encounter crime scenes that resist rules. In addition, one person's successful alignment work may well turn into another one's problem. In the case involving the pizza boxes, for example, the misfits (cf. Star, 1991) between the standards and the circumstances of the crime scene were not only glaringly obvious to the crime scene technicians, but they were also so severe that the standards could not resolve all the tension between this particular crime scene and the laboratory. That is, even with alignment work, the crime scene technicians could not fully attain the experience (or perhaps illusion) of seamlessness (cf. Vertesi, 2014): Even though the student telling the story did not mention the NFC's reaction to the boxes, it is reasonable to assume that the forensic scientist receiving the boxes noticed that they did not conform to the standards for recovering presumed body fluids.

This remaining seamfulness then affected the forensic scientists and the laboratory: Transforming traces into DNA profiles is usually a highly automated and high-throughput process – a process that is facilitated considerably by traces arriving in standardized form. Traces that arrive in non-standard form disrupt laboratory routine and turn the usually quick and routine work of entering – properly recovered – traces into the automated process into time- and thought-consuming work. In other words, if the boxes were to result in a DNA profile, they must have required quite some alignment work of the forensic scientist.

Also, the jar of urine clearly disrupted routine work at the NFC: Since it didn't correspond with the standard for DNA traces, either – that would be a forensic swab in a paper bag – it also required alignment work to be brought into the to a large

part automated (and thus highly standardized) trajectory for DNA traces. In addition, the forensic scientist assigned to the case wondered about the potential usefulness of the urine as a source of DNA – there are not a lot of cells in urine, she explained, so, at least at the time of my fieldwork, success required either "a bucketful of urine," as she put it, or the "good luck" that the donor suffered from a urinary tract infection. Also, she added, by now there probably had been bacterial growth that had "eaten up" any DNA that might have been present. Accordingly, she telephoned the crime scene technician in question to discuss the case and, as it turned out, its lack of other traces before doing anything with – i.e., spending resources on – the jar.

In other words, the remaining seam between the crime scene and the laboratory requires the forensic scientist assigned the trace to perform alignment work of their own to align the trace with the laboratory process. The resources this consumes, mainly in the form of the forensic scientist's time, are then not available for other work in the already pressed for time laboratory. Thus, crime scene alignment work that is perceived as too inventive – i.e., departing too far from standards – may lead to frictions.[9]

In other words, different epistemic cultures may perceive crime scene alignment work quite differently – in one context, it can be celebrated as an inventive and dedicated practice of salvaging a possibility of forensic evidence in the face of very adverse circumstances, while it in another can be perceived as a disruption of the collaboration and a danger to legal security. Both perceptions are equally true, but their incompatibility also underlines the different epistemic cultures of the criminal justice system. The occasional frictions around recovered traces may be a contributing factor to telling stories about difficult cases without outsiders present – the other crime scene technicians could be expected to enjoy the stories, whereas the forensic scientists might have reacted differently. This may also have contributed to the stories' ending with the recovery and transport of the traces – both tellers and listeners must have been aware that mentioning or asking for the NFC's reaction might have detracted from the celebration of alignment work. Instead, the listeners, through showing their appreciation and asking the right questions, provided a knowledgeable and supportive audience, placing the stories and the alignment work they celebrated in a professional community.

In this way, crime scene alignment work and its appreciation can delineate a rather clear boundary between otherwise close epistemic cultures. Thomas Gieryn (1983) discusses boundary work in terms of demarcating 'science' from 'non-science' and securing resources as well as authority and prestige. Here, the boundary is connected to identity rather than to more tangible resources, but since identity is (also) constructed and performed through encountering and relating to others (e.g., Hall, 1996; Lawler, 2014: 138ff), the friction around alignment work at the crime scene can further strengthen professional identity: Crime scene technicians can thus be described as not only members of a community that is skilled at this kind of alignment work but also as members of the community in the criminal justice system that understands and properly appreciates that work – in contrast to those that do not. The occasional friction related to the recovery of traces may further underline differences and thus strengthen this identity – a shared experience of opposition, even if it is occasional and in the form of non-appreciation, can strengthen a community's identity. That is, since identity is relational, occasionally fraught external relationships can lead to increased internal cohesion.

Conclusion: Crime scene alignment work, professional identity, and the movement of knowledge

The crime scene technicians' alignment work at the crime scene is not only a way of facilitating the collaborative production of forensic evidence by dealing with the seams (Vertesi, 2014) between epistemic cultures (Knorr Cetina, 1999) and inevitable misfits (Star, 1990) between recovery standards and individual crime scenes. It is also part of their professional identity; alignment work is also identity work, performing oneself as a skilled member of a professional community.

Alignment work and its entanglement with professional identity are not specific to work at

crime scenes. A connection between a profession's 'jurisdiction' (Abbott, 1988: 59), that is, what is perceived as its central expertise and competence, and its identity applies to many occupations and professions. So does drawing on themes of professionalism (such as skills, expertise, or discretion) to position oneself or one's occupation in relation to others (e.g., Watson, 2002; Backman and Hedenus, 2022). As discussed above, professionals both in- and outside the criminal justice system perform different kinds of alignment work, such as the forensic scientist trying to process the jar of urine. In a similar vein, Olarte-Sierra and Perez-Bustos (2020) and Schwartz-Marín et al. (2015) discuss how forensic geneticists in the Colombian criminal justice system carefully align different epistemic cultures and logics in their work (although they do not explicitly speak of alignment work). Also the contributions to this special issue demonstrate a breadth of alignment work in a variety of contexts. In other words, (an experience of) seamlessness (Vertesi, 2014) may be desirable for many collaborations, and the way in which a collaboration deals with the seams and how dealing with them fits into and affects identities and relationships is specific to each particular collaboration. In the Swedish criminal justice system, the seam between the crime scene and the forensic laboratory is dealt with through formalized standards for recovering traces at the crime scene that are supported and maintained by the crime scene technicians' inventive, informal, and often invisible alignment work.

The crime scene technicians' alignment work at the crime scene demonstrates, for one, that such work may be invisible but can still have a tangible effect on the collaboration between different epistemic cultures. Friction around (too inventive) alignment work can for example, in the short run, cause additional work for others or evoke concerns for legal security or other shared goals. In a longer perspective, these frictions and concerns may negatively affect the relationships that shape the cooperation. The crime scene technicians' alignment work at the crime scene thus also suggests that the movement of knowledge may well depend on and be shaped at least in part by informal and unregulated circumstances and work: Crime scene alignment work is not part of official descriptions and understandings of crime scene technicians' work or their training (see Kruse, 2020a); yet it is a constituent part of their professional identity which, in turn, also shapes the collaboration with other professions. In other words, a rather personal matter – namely one's (professional) identity – is one of the many components that together stabilize knowledge as it is being moved. Other personal or informal matters may be similar components in other contexts of moving knowledge.

My discussion of crime scene alignment work thus contributes to STS discussions of the movement of knowledge through showing how different epistemic cultures (Knorr Cetina, 1999) can collaborate and move knowledge stably (cf. Morgan, 2011) between them despite their differences. It does so through nuancing the notion of alignment work by showing how it not only facilitates moving knowledge but also shapes professional identities and through them interprofessional relationships and makes them part of the movement of knowledge. I thus also show how this movement depends on factors that elude formalization and regulation – professional identity, being (also) a personal process, is both dynamic and difficult to prescribe. In this, the nuanced notion of alignment work provides a lens through which to trace not only invisible alignment work (Kruse, 2021: 5), but also its entanglement with such elusive matters as identities and relationships.

In other words, while the crime scene alignment work discussed in this article is specific for Swedish crime scene technicians, it draws attention to how invisible work associated with the movement of knowledge shapes professional identity and how that identity, in turn, again affects the movement of knowledge, albeit perhaps indirectly. Using the notion of alignment work to trace both the work of stabilizing knowledge and how this work relates to professional relationships and identities can contribute usefully to understanding the movement of knowledge in other contexts, as well.

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Notes

1 Until 2015, it was called the Swedish National Laboratory of Forensic Science (SKL).

2 According to my interlocutors in the Swedish criminal justice system, there are a very few civilian crime scene technicians, most of them with a background in photography. However, current political ambitions to extend the police force may lead to more civilians being hired by the Police Authority – beyond the civilian investigators that today work alongside officer investigators – to fill positions that can be perceived as not strictly requiring a police background. This may also mean more civilian crime scene technicians in the future, which would reasonably change the profession's dynamic and self-understanding.

3 The Swedish police is divided into seven such regions.

4 The sites of crimes such as break-ins into cars or basements are often examined by "regular" police officers to conserve resources.

5 For more about crime scene technicians as a possible profession and their professionalization, see (Kruse, 2020a).

6 The question of whether the swabbed dog tongue or the pizza boxes led to usable forensic evidence was not part of the stories: the stories celebrated the inventiveness of the crime scene technicians at the site. This may have to do with crime scene technicians only rarely finding out what happens in a case after their reports are submitted.

7 Although this was not mentioned in the narrative, it is safe to assume that they did so after the pitcher had been processed for possible DNA and fingerprint traces.

8 Not all alignment work that crime scene technicians perform is invisible; aligning the reading of crime scene reports with their intended meaning by testifying in court (see Kruse, 2021: 12f), for example, is both visible and very public alignment work.

9 These frictions may, for example, take the form of – as a crime scene technician student mentioned having happened in another case she had been involved in – the crime scene technician who sent in the trace getting their "fingers spanked" by the forensic scientist for not conforming to standards. She talked about receiving that telephone call in a light and joking tone, but it was clear that she had been (and still was) a bit embarrassed by the call and did not wish to receive more such calls in the future. A – probably very polite – telephone call may not sound like a harsh consequence, but in a work environment that values smooth interaction and mutual respect of competence, this kind of friction is still uncomfortable.

Alignment Work and Epistemic Cultures

Corinna Kruse

Department of Thematic Studies – Technology and Social Change, Linköping University, Sweden/ Corinna.Kruse@liu.se

Antti Silvast

School of Engineering Sciences – Social Sciences, LUT University, Finland

Abstract

This article closes the special issue *Alignment Work for the Movement of Knowledge*. It argues that the concept of alignment work, through making it possible to think about collaborations of different epistemic cultures, provides a useful addition to Knorr Cetina's (1999) concept, keeping it relevant for current concerns in Science and Technology Studies (STS). The article discusses central issues in STS, namely how different academic and professional cultures exchange knowledge, including trading zones, boundary objects, and aspects of Actor-Network Theory, alongside an interest in epistemic cultures and knowledge production. We argue that and demonstrate how knowledge exchange can be understood through epistemic differences and their persistence in collaborative work.

Keywords: Epistemic Cultures, Alignment Work, Movement of Knowledge

With this paper, we close the special issue on alignment work for the movement of knowledge[1] and set the research papers into relation with a larger STS discussion. In particular, we want to discuss how the concept of alignment work at the core of this special issue constructively contributes to central issues in STS concerning how different academic and professional cultures exchange knowledge, including theoretical tools like the trading zone (Galison, 1997), boundary objects (Star and Griesemer, 1989), and some aspects of Actor-Network Theory (e.g., Callon, 1984; Latour, 1990). n doing so, we are particularly interested in how the concepts of and research on alignment work keeps Karin Knorr Cetina's (1999) notion of epistemic cultures relevant and useful even two and a half decades after its introduction. This closing paper accomplishes these tasks by commenting on the concept of epistemic cultures and its contributions to collaborative work, before summarizing the contributions the contributions of the issue from this vantage point.

Epistemic cultures

The notion of alignment work is explicitly intertwined with that of epistemic cultures and their differences (Kruse, 2021), and attention to different epistemic cultures exchanging or moving knowledge is present to a varying degree in the contributions to this special issue. But even if not all of the contributions explicitly refer to epistemic cultures, they do illustrate how the notion of align-

ment work can constructively contribute to keeping *Epistemic Cultures*[2] relevant and useful to STS.

Based on ethnographic fieldwork in two different laboratories, one in molecular biology and the other in high energy physics, Knorr Cetina first introduced the notion in a journal article (Knorr Cetina, 1991), but the 1999 book *Epistemic Cultures* fleshes out and elaborates the concept into what it is known as today. There, she defines epistemic cultures as "cultures that create and warrant knowledge" (Knorr Cetina, 1999: 1), conceptualizing empirical scientific approaches, instruments, and whole methodologies as machineries of knowledge production. Knorr Cetina's focus on machineries is highly central, since it distinguishes her entire approach: "I am interested not in the construction of knowledge but in the construction of the machineries of knowledge construction" (Knorr Cetina, 1999: 3). In the same vein, she has later (Knorr Cetina and Reichmann, 2015a, 2015b; Knorr Cetina, 2007) called epistemic cultures "cultures of knowledge settings" (Knorr Cetina, 2007: 362). In other words, her point is not simply that scientific knowledge is socially and culturally constructed, but to call for more thorough attention to this knowledge construction via its specific 'machineries' and particularly the construction of these machineries.

These different macineries, then, do not only produce knowledge differently but also different knowledge; the latter not only in the sense of producing knowledge about different phenomena but also in the sense of producing knowledge that is contingent on the machineries of its construction. A different machinery would have constructed different knowledge.

This aspect of the concept has, for example, been widely used in STS to pay attention to the difficulties caused by differences between epistemic cultures in large collaborations, especially collaborations that rely on sharing data or knowledge (Merz, 2002, 2006; Cole, 2013; Brosnan, 2016; Kruse, 2016; Heidler, 2017; Hackett et al., 2017; Cointe et al., 2019; Silvast and Foulds, 2022). For instance, Kruse (2016) uses it to trace the movement of forensic evidence in the making through the criminal justice system. Meanwhile, Silvast and Foulds (2022) have drawn on Knorr Cetina's work on epistemic cultures to understand research practice in interdisciplinary collaborations.

The concept of epistemic cultures has another, less noted aspect. Knorr Cetina explicitly frames the concept as a comment on society in dialogue with Ulrich Beck's risk society (1992), Daniel Bell's (1974) post-industrial society, and Anthony Giddens's (1990) reflexive modernity (Knorr Cetina, 1999: 5f). She seems to aim this comment on society not only at description and analysis, but also at societal transformation, namely at thinking about "whether the idea of a knowledge society would not require the modern organization to become more like a laboratory" (Knorr Cetina, 1999: 242). In other words, *Epistemic Cultures* appears to be conceptualized as a rather far-reaching work, part of the sociological tradition of aiming to not only examine science and technology but situate them as part of new 'epochs' in society and associated social changes. This thought remains tied to epistemic cultures also in Knorr Cetina's later work; there (e.g., Knorr Cetina, 2007; Knorr Cetina and Reichmann, 2015a, 2015b) she emphasizes how knowledge cultures are an integral part of a knowledge society.

This kind of large-scale analysis or "grand diagnosis" has been criticized by others; in fact, it was already discussed shortly after the book's publication (Latour, 2005). Nor does her concept seem to have been used this way often. When Knorr Cetina and Reichmann (2015a) in a recent revisit of the notion map how it has been used, they discuss studies that investigate more fields and their "epistemic characteristics," develop the notion itself, or explain "the difficulties of interdisciplinary research" and optimize organizations (Knorr Cetina and Reichmann, 2015a: 876ff). They only explicitly discuss one study (Jasanoff, 2005) that, in characterizing "the knowledge attitudes, institutional arrangements, and knowledge policies of different societies" (Knorr Cetina and Reichmann, 2015a: 878), touches upon knowledge as a part of society – albeit without using or referring to epistemic cultures. But even without its ambitions of large-scale analysis, we argue that *Epistemic Cultures* still has relevance today, even if perhaps in more ways than originally envisioned.

Alignment work – bringing epistemic cultures into the future

Epistemic cultures are conceptualized as being dynamic, constantly changing internally and in relation to others, not least in connection with an increasing specialization of expertise fueling increasing diversification. Today, "the disunity of the sciences," as Knorr Cetina (1999: 2) called this diversification,[3] is even more pronounced than in the 1990s. Knorr Cetina and Reichmann have, in their revisit, pointed out that

> Science and expertise are obvious candidates for cultural divisions; they are pursued by specialists separated off from other specialists by long training periods, intense divisions of labor, distinctive technological tools, particular financing sources, and the need to come up with results and display them in public through publishing (Knorr Cetina and Reichmann, 2015a: 874).

However, different epistemic cultures might also, conversely, converge (e.g., Kastenhofer, 2007; Knorr Cetina and Reichmann, 2015a), fusing into new ones and perhaps into whole new scientific (inter)disciplines.

Hence, the notion's relevance for today – especially in connection with the alignment work at the heart of this special issue – can stretch further than to bring into focus differences in producing knowledge and the machineries of that production, developing further the attention to interdisciplinarity and crossing of established knowledge boundaries. Knorr Cetina and Reichmann (2015a, 2015b) point to the difficulty of collaborations across different epistemic cultures. We argue that bringing together this attention to differences between epistemic cultures with the attention to bridging differences that alignment work proposes, makes it possible to think fruitfully about *how* such collaborations can be made to work.

In this issue, the concept of alignment work (Kruse, 2021) builds on Strauss et al.'s (1985: chapter 7; see also Star, 1991: 275) 'articulation work' and Vertesi's work on producing "moments of alignment" (Vertesi 2014: 268) between infrastructures governed by different standards. Strauss et al highlight the often unacknowledged work that supports the work understood as central in a workplace; Vertesi highlights the 'seams' (in the sense of gaps) that separate these different infrastructures, for example through different voltages. Similar gaps can separate different epistemic cultures in a collaboration – there, seams are shaped by different understandings of the knowledge to be exchanged. Alignment work, then, is the continuous work that bridges those seams, aligning epistemic cultures – perhaps temporarily – to make a seamless and stable movement of knowledge possible.

Together, the notions of epistemic cultures and alignment work make it possible to draw attention to the 'seams' (Vertesi, 2014) between different epistemic cultures, the differences that make up these seams, and the work of enabling the (at least somewhat) seamless movement of knowledge. In other words, the combination makes it possible to think about how, for example, different experts or specialists can collaborate meaningfully while retaining their differences.

As the introduction to this issue discusses, the idea underlying alignment work is not new to STS. Many STS notions associated with the movement of knowledge imply dealing with seams and differences. Peter Galison's (1997) trading zone, for example, takes inspiration from the trade of commodities between different groups, arguing that the prolonged contact of repeated trade can lead to the development of trade languages that facilitate communication – in other words his metaphor draws attention to establishing ways of communicating across communities (in his example, subdisciplines of physics).

Similarly, the boundary object (Star and Griesemer, 1989) brings together different social worlds and thus makes collaboration – not necessarily with shared goals – possible in spite of differences. Boundary objects are artefacts, concepts, or methods that lie at the interface of different social worlds, such as politics and the economy. One could also think about boundary objects as lying at the interface of different epistemic cultures if one understands them as special kinds of social worlds made coherent by their members working with the same specialised tools and technologies (Clarke and Star, 2007). By virtue of allowing different understandings or interpretations to

co-exist, the boundary object thus facilitates collaboration in the face of epistemic differences. While this makes collaborations of very different groups possible, such a heterogeneity of meanings would not be feasible in all collaborations. For example, the criminal justice system's core concern with legal of meanings across its epistemic cultures (Kruse, 2021).

Neither the boundary object nor the trading zone, however, offer an analytical lens for capturing how knowledge concretely moves from one community into another, much less what happens to it in its new context. The trading zone focuses mainly on the exchange itself, not on what happens to the exchanged "goods" after the moment of exchange, and the boundary object does not move knowledge as much as gather different communities.

Conversely, Actor-Network Theory's (ANT) notion of 'enrollment' (e.g. Callon, 1984) of others into the production of facts or artifacts constitutes, if not a bridging of seams, an effacement of differences. Similarly, the related STS notion of the 'immutable mobile' (Latour, 1990: 26) that focuses on the movement of knowledge does not offer a way of thinking about epistemic differences between the sites the immutable mobile travels to – after all, the immutable mobile's stable movement crucially depends on the eradication of epistemic differences.

In other words, STS's attention to knowledge being constructed as well as context-dependent implies that movement may be difficult, in particular movement during which the knowledge being moved remains stable[4]. The notion of alignment work at the core of this special issue not only acknowledges the possible difficulty of this movement but offers an analytic lens with which to think about the work of moving knowledge despite differences and difficulties. Moreover, it is an analytic lens that recognizes epistemic differences as not only a source of difficulties but also as an asset. After all, dissimilar expertise is often the reason for a collaboration, and such dissimilar expertise comes with different epistemic cultures. In this way, the special issue aims to contribute to and develop a deeply STS concern.

Having a sensitivity and a vocabulary for capturing and understanding epistemic differences, we argue, makes it possible to go beyond the original scope of the notion and think about how epistemic cultures interact and, possibly, collaborate. While Knorr Cetina initially did not discuss interactions between epistemic cultures, others have.[5] Knorr Cetina herself, in the collaboration with Reichmann mentioned above (Knorr Cetina and Reichmann, 2015a: 877f), highlights several studies that focus on a) conflict between epistemic cultures in interdisciplinary collaborations, b) the "convergence" of different epistemic cultures into new ones when epistemic differences are attended to and reconfigured, and c) the strategic use of understanding epistemic differences in organizational research.

As Knorr Cetina and Reichmann (2015a: 877) notice, the notion of epistemic cultures has been used as an explanatory tool in studies about interdisciplinary research. However, research more loosely dealing with epistemic cultures is even more extensive than the studies they highlight. Decades of research in STS and interdisciplinarity studies have examined how established and distinct academic disciplines relate to and interact with each other and how they come to solve problems and address research questions collaboratively. This interest spans from interdisciplinary education and terminologies (Klein, 1990) to sociological studies of experienced collaborations (see review in Silvast and Foulds, 2022). Here, however, our focus diverges from the usual challenges associated with interdisciplinary research and we would like to highlight the key differences. Our concern is not with how to form multidisciplinary teams, produce interdisciplinary knowledge in collaboration, or conduct transdisciplinary research that transgresses disciplinary boundaries entirely, because inter- and transdisciplinarity presuppose some degree of change as a result of the collaboration. In alignment work, there are no epistemic cultures being imported into others and of necessity changing in consequence, there is only knowledge being moved between them. Thus, our interest is closest to the arguably common form of interdisciplinarity, multidisciplinarity, where different disciplines work together but keep their original identities and epistemic

cultures intact. Of course, epistemic cultures, like all cultures, are still subject to continuous change; we do not rule out internal development and change here.

Revisiting the contributions

Thus, it seems reasonable to assume that attention to different kinds of interactions between epistemic cultures – which are, after all, a consequence of disunity – is meant to be within the scope of the notion. As the contributions to this volume demonstrate, its use can be widened quite fruitfully to address today's questions and concerns of everyday living with collaborations across epistemic cultures.

The contributions to the issue span a breadth of alignment work. Emilie Moberg draws attention to the relation between the human-centered and the non-human-centered; pointing out how the anthropomorphization that educators and writers use to align the human with the non-human both privileges the human-centered understanding of the world and facilitates the empathy that potentially de-centers the human. Jenny Gleisner points to the importance of aligning parents-to-be with the health care system's standardized antenatal care program; the midwives she studied perform alignment work in the form of emotion and will work to prompt pregnant persons and parents-to-be to *want* to receive the knowledge the health care system is offering. Hannah Grankvist's contribution underlines that alignment work requires relation work – and that, conversely, relationships can be shaped by the knowledge that is being moved, for example when occupational health services providers choose which knowledge they offer in order to make sure their customers (continue to) find them useful. Finally, Corinna Kruse's piece shows how alignment work, through being a source of professional pride and identity, can shape relationships within and between professions.

This breadth of alignment work not only illustrates that epistemic differences and the resulting seams can look quite different, it also illustrates that warranting knowledge (Knorr Cetina, 1999: 1) includes specific approaches to the desirability of and trust in knowledge. That is, the alignment work discussed in the contributions not only addresses different understandings of the seemingly same knowledge, it also addresses how its intended recipients relate emotionally to it – midwives nudge parents-to-be to desire the knowledge they are offered, occupational health services providers strive to be appreciated as useful and knowledgeable, and educators and writers use anthropomorphization to appeal to the empathy that fuels engagement with the epistemically different. In other words, attention to alignment work also brings forward affective dimensions of epistemic cultures – how people relate to knowledge is also shaped by emotions and relationships to others. This elaborates on Knorr Cetina's (2007: 362) assertion that knowledge creation is not merely "a matter of rational, cognitive and technical procedures undertaken by scientists." Knorr Cetina (2007: 364) herself has pointed to the embodiment of knowledge through practices; the contributions to this issue add to that an affective and relational dimension.

In connection to this, the contributions to this issue underline that, in addition to the relationships with objects that Knorr Cetina (e.g., 1999: 27ff; 2007: 365) points out as a central aspect of epistemic cultures (varying between different epistemic cultures), knowledge or at least its movement between communities is also intertwined with and co-constituted by relationships to people and communities. In other words, this special issue suggests that not only is the production of knowledge not merely a "rational, cognitive and technical" (Knorr Cetina, 2007: 362) procedure, but knowledge is, rather, a part of epistemic cultures and thus of the machineries of its own making and movement.

Knorr Cetina's addition of the embodied to the cognitive – rather than the addition of the affective to the rational that permeates the contributions to this issue – may have to with her work being founded on enterprises that de-emphasize emotions. Emotions are present in her account – there are, for example, mentions of anger or drama, and of both people and machines being treated as social and moral beings – but they are not centered in her analysis of practices. Nor did her interlocutors seem to find them central to the production of knowledge. In the contri-

butions to this special issue, emotions are part of the foreground. This may have to do with the studied epistemic cultures being professional cultures rather than scientific ones - especially in contexts, and especially in contexts involving laypersons emotions and relationships may be given more room than in a laboratory. Thus, the dimensions the contributions add to the notion of epistemic cultures may also have to do with their rather different empirical foundations. Since Knorr Cetina's ambition was to talk about society as a whole with the help of epistemic cultures, these additions then contribute to the widening of the concept that she proposes.

Bringing the notion of alignment work to Knorr Cetina's epistemic cultures thus makes it possible to analyse disparity and collaboration or knowledge exchange in a way that at least in part realizes Knorr Cetina's aspired relevance of the concept of epistemic cultures for society as a whole. Our point of departure is that bridging different epistemic cultures is essential for interdisciplinary collaborations to be able to function: The disunity of the production of knowledge through more and more specialized experts means that this production relies on knowledge (and knowledge-to-be) being moved between different experts. In addition, the resulting knowledge may have to be moved from producers to intended users. In other words, STS requires a toolbox that makes it possible to draw systematic attention to the epistemic differences between collaborators as well as the work of managing and bridging these differences.

However, with increasing diversification as well as increasing collaborations between epistemic cultures where different experts by necessity bring different expertise to the collaboration, analytic tools are needed for the work of bridging epistemic differences and of striving for seamlessness. Even though prolonged collaboration may lead to epistemic cultures converging (e.g., Kastenhofer, 2007), some collaborations or exchanges of knowledge rely on collaborators or exchangers possessing very different qualifications and type of knowledge – as, for example, the crime scene technicians and forensic scientists, or the occupational health care providers and their customers in this issue. In such cases, the increasing specialization and diversification of professional knowledge (Knorr Cetina and Reichmann, 2015b: 24) is prevented from disjoining the movement of knowledge by continuous alignment work. In other words, alignment work can provide cohesion in a collaboration that is at risk of disruption due to epistemic differences. With its simultaneous sensibility for the triad of difference, movement, and stability as well as its attention to the continuous and perhaps invisible work that maintains the triad, alignment work can be one way of bringing *Epistemic Cultures* into the present and future and underline its continuing relevance for STS.

Conclusion

What, then, makes *Epistemic Cultures* still so relevant today is its contribution to capturing the evolving and increasing epistemic differences that the diversification of knowledge production entails. This is a development of rather than a departure from her own intentions; to Knorr Cetina, the transformation of society into a knowledge society "implies the growing importance of knowledge-related cultures" (Knorr Cetina, 2007: 373) That is, a society that relies on "[p]rofessional knowledge" (Knorr Cetina and Reichmann, 2015b: 24) also will consist of different professions or epistemic cultures that produce that knowledge. In other words, a knowledge society implies different expert cultures with different and diversified specializations.

When Knorr Cetina points out that "science and knowledge may not be as unitary as has been thought" (Knorr Cetina, 2007: 334) this "diversity" and "fragmentation" (Knorr Cetina, 2007: 334) in knowledge production also implies that the knowledge produced in these diverse and separate(d) sites must be moved to other sites with different epistemic cultures and thus different ways of understanding, assessing, and valuing knowledge. Thus, even though Knorr Cetina's large-scale diagnosis of society may feel a bit outdated today, its ambition of drawing attention to the "machineries of knowledge construction" (Knorr Cetina 1999: 3) is not. Her work makes it possible to draw attention to very contemporary concerns, such as to epistemic differences, as well

as to how knowledge fits also into non-scientific enterprises. The latter encompasses questions like making knowledge a commodity as discussed by Knorr Cetina (2010) herself or making it attractive to students, patients, or customers as discussed in this issue.

However, Knorr Cetina does not discuss *how* the knowledge produced in these potentially very different sites or epistemic cultures can be brought into collaborations between experts or into larger society. There, alignment work provides an analytical lens at the same level of detail as the notion of epistemic cultures itself for capturing the work of aligning different epistemic cultures sufficiently and for long enough to enable the movement of knowledge.

Pairing the notion of epistemic cultures with a way of conceptualizing the movement of knowledge that takes epistemic differences into account – like alignment work does – thus adds to the STS toolbox through providing a way of analyzing contemporary disunited modes of producing and sharing knowledge.

At least in our work, this combination further benefits from pairing with ethnographic methods, since an understanding of epistemic culture by necessity builds on both fine-grained detail and on practitioners' understandings (famously, Malinowski, 2014 [1922]: 25) – and their own contestations – of their knowledge production. In other words, we argue that Knorr Cetina's notion still has relevance for STS and, in combination with alignment work, can contribute fundamentally to current and central issues of the field, namely that of producing and moving knowledge. In this special issue, the notion of epistemic cultures has offered a way of thinking about the difficulties and frictions that arise when very different groups collaborate or draw on the "same" knowledge in a fruitful and constructive way – we expect the notion to be as fruitful for STS analysis of other contexts where different communities collaborate or convey knowledge.

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Notes

1 *Science and Technology Studies* Vol 36 no 4 (2023).

2 We use the capitalized and italicized *Epistemic Cultures* to refer to the book, whereas epistemic cultures refers to the concept.

3 The expression sounds like it is in echo of Galison and Stump (1996); however, Knorr Cetina and Reichmann (2015: 875) list other influences.

4 What counts as stable may, of course, be a contentious issue.

5 Curiously, Knorr Cetina (1982) seems to have developed an interest in this theme many years before *Epistemic Cultures*. In her "transepistemic arenas" – notably scientific laboratories – scientific communities do not work in isolation on technical matters, but inquiries are done by involving scientists and non-scientists, as well as technical and non-technical arguments and concerns. However, while this early work is focused on the crossing of epistemic boundaries, its interest is still tightly set on the built-in qualities in scientific inquiries. In contrast, we argue that alignment work is a broader topic about all boundary-crossing activity without presupposing it has to happen in scientific inquiries. In addition, alignment work explicitly does not aim to erase epistemic boundaries but to enable epistemic cultures to cooperate or collaborate while remaining distinct.

Pennington Hugh (2022) COVID-19: The Postgenomic Pandemic. Cambridge: Polity Press. 140 pages. ISBN: 9781509552146

Erik Aarden
erik.aarden@aau.at

What is a pandemic? This may be a peculiar question to ask at this moment in time, when – depending on who you ask – we all just lived through one, or are still in the middle of that experience. At any rate, here in Austria, where I write these words, the first attempts to revise what the experience has been like have already started. The current Chancellor, who fell into the job in the middle of the pandemic, has begun to apologize for the government being too submissive to experts – even though those same experts have long expressed dismay about their advice being ignored in politics. In general, Austria increasingly stands out as a peculiar case in terms of pandemic management. Perhaps the main – and very controversial – issue on which Austria went its separate way (at least in the EU) was by introducing a vaccination mandate into law, which was never executed. The country also established regular testing as a management strategy in a significantly more expansive manner than others – albeit with great variation within its federalized health system. Experiencing this as an expat who continuously had half an eye on what my native country and others were doing, it appeared like 'the same' pandemic looked substantially different depending on where one was looking from.

While this may not be a surprising observation for an STS audience it is not something for which Hugh Pennington, emeritus professor of bacteriology at the University of Aberdeen and scientific advisor to the British government in various capacities, has much use. In the foreword of his book *COVID-19: The Postgenomic Pandemic*, he wastes little time on marking off his territory. He states that his book is "evidence-based" (p. viii) and about "science" (p. viii) for "the non-scientist" (p. vi). To Pennington, this implies that he does not consider different national responses, nor does he want to comment on "the impact of that endemic condition, banal nationalism" (p.viii). Furthermore, he makes a point of saying that "[s]ocial media is avoided like the plague" (p. viii) (both puns presumably very much intended). What the slim, 140 page book does offer across its thirteen brief chapters, is an overview of the past, present and (possible) future of the (micro)biology of the SARS-CoV-2 virus and the associated disease, COVID-19.

Central to Pennington's narrative is the observation that COVID-19 is the first 'postgenomic pandemic'. This is so because various postgenomic techniques – including PCR tests, the use of whole genome sequencing to identify virus variants and the development of vaccines based on messenger RNA techniques – have been central to how we have come to scientifically understand the disease and its causes. Pennington traces both how these postgenomic technologies have been developed in the context of laboratory research and how research on previous pandemics – and on the coronaviruses responsible for SARS and MERS in particular – has informed the rapid identification of the SARS-CoV-2 virus, but also generated certain assumptions about how pandemics unfold that were uprooted by COVID-19. He further

describes how the virus began to get a hold on the world from early 2020 onwards and held that grip until and beyond the time Pennington was writing his book. He clearly and succinctly describes key biological aspects, scientific findings and surprises of the virus and its clinical manifestation, for example in chapters on the early stages of the pandemic and on variants. He combines this with discussions of some of the key technologies that played a role in the pandemic, such as PCR-tests and vaccines. His focus is on assessing the scientific evidence for their utility and the shift they entailed towards a postgenomic perspective on pandemic disease – although one may wonder if and how it would have made a difference if other pandemic technologies – face masks, epidemiological 'dashboards' or contact tracing, to name just a few – would have been part of the equation. Nevertheless, the claim that COVID-19 is a postgenomic affair is made convincingly, and the observation that a quintessentially postgenomic technology – the PCR test – has been central to diagnostics in a way that a test had not been in any previous pandemic provides interesting food for further thought.

As the COVID-19 pandemic will, in all likelihood, persist as a theme for STS research for some years to come, Pennington's observations about the shifting scientific basis of how we recognize health and disease in the postgenomic age, and how postgenomic techniques change biological research and medical diagnosis (see also Richardson and Stevens, 2015), provide a valuable baseline. At the same time, STS research may take this observation to further explore how sociality and the meanings of individual biologies shift in this context (see Reardon, 2017). For example, the observation that "this postgenomic attribute [of the PCR test] makes it fundamentally different from all previous pandemics – influenza, cholera and plague – in which routine case finding and the construction of epidemiological statistics both during and after a pandemic were based on symptoms" (p. 45) has far-reaching implications that Pennington does not further explore. This shift from symptoms to molecular tests first makes it possible to even imagine the category of non-symptomatic cases, a category that many would see as a defining characteristic of the COVID-19 pandemic. Worries about what to do with people carrying the virus without being ill themselves turned into a formidable puzzle for pandemic management, and indeed efforts to keep people who considered themselves healthy while infected from infecting others turned into an important source of discord around pandemic governance. On this point, Pennington has little to say about how this shift from symptomatic to molecular identification of the disease changes the experience of having COVID.

This omission is symptomatic (pun also intended) of what I found to be the book's most significant limitation. The focus in the book is squarely on bearing witness to the awesome scientific achievements in understanding COVID-19 – a kind of witnessing that borders on hagiography, for example in Pennington's decision to make bracketed references to any and all of the Nobel Prizes won by people involved in laying the groundwork for the 'Postgenomic Age'. As such, the book often reads as fodder for an exercise in studying boundary work in action for aspiring STS students (Gieryn, 1999). Yet the very nature of a pandemic as an episode carried forward not only by virus particles jumping from one person to the next, but also by human relations, decisions, actions and inactions, is all but absent (Pickersgill, 2020). This may have been Pennington's intent – the focus is on 'the science' after all – but also fails to do justice to the pandemic – and pandemic research – as a hybrid affair (Anderson, 2021; Löwy, 2020). Pennington himself cannot fully escape this relationality in his descriptions. For example, he writes how New Zealand's remoteness and border controls long kept COVID in check, while "[i]ts application of managed quarantine for all coming into the country, frequent PCR testing, extensive use of WGS, and high-quality public health system had made the country a very useful source of information about the virus" (p. 69). This comes awfully close to considering how different nations have coped with the pandemic, something the author had initially set out to avoid. Yet it proves the point that pandemic research cannot fully be separated from its (social) context. In sum, then, there is a lot to learn in *COVID-19: The Postgenomic Pandemic* about how postgenomic technologies feature in contemporary medicine, yet the book has less to

say about pandemics. It will be up to the books to come -undoubtedly a substantial number – to tell us more about how this one virus caused such different pandemics around the globe.

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Junjie Yang
yangjunjie@stu.pku.edu.cn

On November 11, 1958, Edward Tatum, the laureate of the Nobel Prize in Physiology or Medicine for that year, passionately forecasted during his Nobel Lecture that, "perhaps within the lifetime of some of us here," we could achieve the control and modulation of genetic structures, not only to cure diseases but also to "produce better organisms" (Tatum, 1958). At this juncture, Crick had just put forth his hypothesis of the pathway of genetic information transmission, and the genetic codons remained incompletely deciphered. Fourteen years later, a team led by Paul Berg of Stanford University successfully created the first recombinant DNA molecule, marking the beginning of rapid development in genetic engineering technology. However, the trajectory of this biotechnology did not continue to advance triumphantly under the banner of unswerving optimism; in fact, as Berg achieved experimental breakthroughs, ethical considerations were simultaneously present. Moral issues, whether arising from within the scientific community or from the public, have consistently accompanied the advancement of genetic technology.

Matthew Cobb's book, *The Genetic Age: Our Perilous Quest to Edit Life*, centers on the developmental history of these ethical problems of genetic engineering. It meticulously depicts how concerns about "life-editing" originated, evolved, and became topical issues. The book explores a broad range of topics in many social problems of new genetic technologies, encompassing genetically modified crops (Chapter 8), gene therapy (Chapter 10), human gene editing (Chapter 12), genetic bioweapons (Chapter 15), etc. Moreover, within Cobb's systematic and meticulous examination of the history of genetic engineering technology, he adeptly integrates a broader social and cultural perspective. Cobb precisely captures transformations in public attitudes towards genetic engineering in the context of societal dynamics, employing abundant references from novels, films, music, as well as historical and firsthand materials from media, letters, and interviews with biologists, sociologists, historians, and entrepreneurs. This rich array of sources serves to illustrate the intricate interplay between technology and society.

An especially riveting portion that engages readers can be found in the fourth chapter, where the author delivers detailed examination and penetrating interpretation of the 1975 Asilomar Conference (officially titled the "International Congress on Recombinant DNA Molecules"). Numerous scientists who orchestrated this convention had been actively engaged in campus protests during the 1960s. Against this cultural backdrop, they expeditiously arrived at a

shared agreement regarding the principles and instructive suggestions governing recombinant DNA experiments, albeit without addressing ethical and moral issues, as well as concerning the potential military and commercial utilization of DNA recombination. Their attention was exclusively directed towards the prevention of mishaps linked to biosafety. In fact, this omission sowed the seeds of complicated ethical issues for subsequent genetic engineering endeavors. According to Cobb's interviews, Paul Berg, as one of the organizers, believed that the outcomes of this conference "wouldn't satisfy everybody, but it certainly seemed like a consensus statement" (p. 82).

In this book, Cobb frequently employs the comparison to nuclear weapons throughout the text as a metaphor of public's disquiet stemming from the advancement of genetic engineering. On one hand, people feel enthusiastic about the potential of a new technology to enhance human welfare and generate economic benefits, driving them to eagerly embrace it. On the other hand, the potential or already apparent hazards of the technology spark alarm, resulting in a quandary when it comes to navigating the array of genetic technologies. Cobb leads us to witness the Greenpeace activists trying to kidnap the cloned sheep Dolly (p. 169), and hear the voices of Chinese nationalists labeling GM crops as a Western conspiracy (p. 182). Nevertheless, there still exists a shared aspiration for genetic freedom: the desire not to be controlled by inherited disease genes and not to be helpless in the face of food crises. Throughout human history, the species has consistently molded its genetic surroundings, prompting certain individuals to challenge the ethical constraints on genetic engineering based on the argument of "tampering with nature." For instance, in Cobb's observations, He Jiankui, the architect behind the CRISPR babies, never openly acknowledged the ethical problems of his research (p. 262). Furthermore, as quoted by Cobb, a mother of a child with an inherited disease issues a plea to scientists: "If you have the skills and the knowledge to eliminate these diseases, then frickin' do it!" (p. 251)

The emergence of this dilemma is not solely due to differences in moral intuitions among different individuals. Traditionally, ethics and laws are viewed as acting as brakes (as noted by Cobb, scientists have hit the brakes four times in 1971, 1974, 2012, and 2019, respectively, see Introduction). Cobb transcends this understanding by adopting the lens of the risk society. In the concluding chapter, he astutely highlights that genetic engineering might not always serve as the default solution. As an interventionist technology, genetic engineering not only creates novel forms of life but also shapes new social relations. This technology generates corresponding social consequences within specific social contexts, encompassing both hopes and benefits, as well as risks and crises.

Cobb's analysis inspires science and technology study to pay attention to the gap between cutting-edge innovation and public understanding when reflecting on emerging biotechnologies. This gap cannot be bridged solely through legal regulation; instead, it requires effective communication and dialogue among all stakeholders. Meanwhile, this requires STS scholars to contemplate how, when technology enters the realm of autopoietic life systems, humans should promote epistemic revolution in understanding of the essence of life. The public, as both "warriors and worriers," should reflect on their own living world and scrutinize every step and its uncertainties within the risk society brought about by genetic engineering. Only through these actions can we actively shape a more sustainable Anthropocene future.

References

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