Kajsa Kuoljok

In the Tracks of the Reindeer: The Emotional Effects of Digital Information on Reindeer Herders

Abstract

Through a story about a reindeer that wandered off from its grazing area, this article explores the emotional effects mediated by digital technology. It concerns the way in which reindeer movements are made visible through the use of digital tools. As reindeer movements are documented by GPS (Global Positional Systems) technology and transformed into inscriptions, the movements become easier to observe. It makes a difference when herders can follow reindeer movements from above, instead of from the ground. New knowledge emerges with increased amounts of information. As GPS data makes reindeer movement visible, it creates a new, partial relation between seeing and knowing. The strong emotional effects that are induced by this relation on the herder are observed and described through a narrative of the reindeer that wandered into another Sámi community.

Keywords: reindeer husbandry, digital technology, GPS collars, global positional systems, arctic livelihoods

Introduction

It was in the winter of 2016 when a reindeer with a transmitter wandered from the winter grazing area, away from the herd, and crossed the river. This happens many times during a winter. Sitting in the kitchen together with the reindeer owner and her husband, I followed the history of the reindeer's movement on the GPS map shown on their computer. Ellen, the reindeer owner, pointed at the red line and explained, "She crossed the river and headed straight into the residential area on the other side." By crossing the river and walking eastwards, the reindeer left the Sámi community it belonged to and wandered into another, neighbouring Sámi community.

The above is part of a story about a reindeer that wandered away from the grazing area. Sometimes when I met Ellen, I had received an update on where this reindeer was. It was clear that it was a matter of concern for her. Our conversations about the reindeer were filled with worries. This made me realise that this is an illustration of how digital technology, with its constant stream of information, has the ability to affect us. Before this, I had mostly perceived positive views about digital technology within husbandry[1].This story was empirically documented through interviews with reindeer herders and reindeer owners[2] in the Jokkmokk area in northern Sweden. In most herding districts, a migratory husbandry system is practiced between the summer grazing grounds in the Scandinavian mountains on the border with Norway and the winter-grazing grounds in the forest lowlands east of the mountains (Horstkotte 2013). The reindeer husbandry system constitutes an extensive, complex and unique land-use form carried out by the Indigenous Sámi people across Sápmi, an area covering much of northern Sweden, Norway, Finland and Northwestern Russia (Sandström 2015). The research area is geographically located in a mountain herding community in Norrbotten, Sweden. There are 51 reindeer herding communities in Sweden (Sámi Parliament 2020). A reindeer herding community is both a large geographic area and an administrative and financial organizing association for the Sámi reindeer herder's companies (Sandström 2015). A minority of the Sámi are full-time herders[3]. The right to

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1 This article is a part of a compilation dissertation. The four articles in the dissertation follow the research's empirical foundation of the research, with the GPS collar's role in husbandry examined from different angles (Kuoljok 2020).

2 The difference between reindeer herders and reindeer owners is the rate of activity in the reindeer forest. There are approximately 4,600 reindeer owners. Within a Sámi village there are several reindeer husbandry companies. There are more than 1,000 reindeer husbandry companies in Sweden. It is estimated that around 2,500 people depend on income from reindeer husbandry (Sámi Parliament, 2020).

3 As reindeer herding transformed into a market economy business, the herding industry turned into one person's business. There were a separation between the family and the reindeer herding industry (Nordin 2007, 56). However, as reindeer herding today is

keep and herd reindeer is institutionalized belonging collectively to the Indigenous Sámi, and it is protected in the Swedish constitution and considered a usufruct based on rights prescribed since time immemorial (Allard 2006).

In reindeer husbandry[4], seasons steer the organization of time and space, as the reindeer roam free and migrate between summer and winter grazing lands (Johnsen et al. 2017). The reindeer are always on the move, and the herders follow their tracks. The Sámi herding life depends on seasonal movements of the reindeer from winter grazing grounds in the forest area to summer grazing grounds in the mountain area. Reindeer husbandry is based on collaboration, you cannot live alone as a reindeer herder. The reindeer herder must cooperate, not only within the Sámi community but also with surrounding stakeholders. Reindeer herding is conducted in collective controlled spaces that are divided into more private or family spheres. During winter the community's large herd of reindeer is divided up, in a specific separation event, into smaller groups that represent family groups or groups of families who hold their reindeer together. These are the so-called winter grazing groups, a *sijdda* (Sara 2009, 157). Each group has to keep their reindeer within their territory which is limited in space.

One of the reasons why the reindeer herd is divided is that it is easier to handle, and to monitor a smaller reindeer herd. Wintertime is the period when access to grazing resources is most critical. Having control of the herd is important over this period. Herders share the responsibility to monitor the movement of the herd and to check the grazing conditions during the winter. Caring for the reindeer and looking for the best grazing opportunities are important tasks for the herder.

In the reindeer herding community, just like in the rest of society, technological developments have expanded during the last decades, and digital tools

more viewed as a meat production rather than a traditional way of life, women´s input and their role are made invisible according to anthropologist Solveig Joks (2001). As highlighted by Sámi scholar Rauna Kuokkanen, the process of incorporating indigenous societies into the capitalist economy was highly gendered and it had many gender-specific consequences (2009, 503). For the Sámi women, it not only signified loss of visibility and status for work in their livelihood, but also meant an increase of workload for the women. Today, women's contribution to reindeer herding has in many ways changed. Many reindeer households are dependent of women working outside reindeer herding and contributing to the family economy (Amft 2000, 57).

4   In this article, the term 'reindeer husbandry' is used in general when herding and husbandry activities are both included. The term 'herding', according to Robert Paine is about control and nurture of reindeer, the day-to-day work, while 'husbandry' is more to do with the reindeer herd as a harvest resource for the owner (Paine 1994, 19-20). Reindeer pastoralists are referred as 'herders', irrespective of the distinction between husbandry and herding (Tyler et al. 2007, 192). The term 'practice' refers to day-to-day herding practices.

are now implemented. Today, reindeer monitoring can be done either physically in the reindeer forest or digitally on a screen. Global Positioning System (GPS) devices have given herders the ability to follow reindeer fitted with GPS collars from almost any location. The Global Positioning System is a global geolocation system that the U.S. Department of Defence developed for military applications, comprising several satellites flying in orbits above Earth's surface (Milla et al. 2005). GPS satellites broadcast radio signals that provide their location, and GPS devices at ground level receive these radio signals (ibid.). The monitoring system used in husbandry comprises heterogeneous technological devices: A portable device, called a GPS receiver, is mounted on a collar attached around a reindeer's neck and reports the animal's position, then the network (satellite or phone) transmits the data, and a mobile phone application or a PC retrieves and stores the data and visualises it for reindeer herders. Several different GPS collar brands are available, each of which can provide various kinds of data, depending on the collar's features, offering different advantages and disadvantages. Different brands use different methods to transfer data, either through VHF radio telemetry, a GSM network or satellite systems. The GPS trackers have not been viable for anyone other than researchers previously. The technological development has made GPS collars smaller and lighter and more affordable even though they are still considered expensive. Besides a high purchasing cost, there are also operating costs.

The herder does not necessarily need to be in the same location as the reindeer, but instead can monitor the reindeer remotely. This is part of a new technical arrangement for herding. The GPS collar plays an important role in generating information about reindeer movement across geographical distances, which is visualised on a GPS map. The information from the collars has become an important tool in the daily work of reindeer herders (Kuoljok 2019a). The use of GPS collars for individual herders and Sámi communities started in 2005, to help improve the delimitation of key and core areas identified as important areas for the reindeer (Sandström and Wedin 2010). Today, almost all Sámi communities have adopted the use of GPS collars[5]. The interviewed herders have been using the GPS collars for less than five years. The herders own just a couple of GPS collars, but even a small number of collars can give an accurate picture of herd movements because the reindeer within a group generally do not move independently and are known to synchronize their behaviour among group or herd members (Pape and Löffler 2015, 1893).

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5 Some herders have chosen not to use GPS collars. There can be many reasons for choosing not to use this technology. Some reasons mentioned by the participants were concerns about how the collar will affect the welfare of the animal, high costs of purchase and technical difficulties connecting to the equipment.

Aim of the study

The aim of this paper is to explore the emotional effects that the GPS data from tracked reindeer can evoke on the herder. This will be explored through a story about a reindeer that wandered off from its grazing area.

In reindeer husbandry, the GPS collar is a tool that provides digital data as the reindeers' movements are recorded with the help of the tracker. In husbandry research, current approaches to the evaluation of the GPS collar focus almost exclusively on the collar as a tool to collect data about reindeer movements, grazing preferences, reactions to different disturbances and so on (Skarin et al. 2010, Verma et al. 2016, 2017). Little attention has been paid to how people engage with and emotionally relate to this technology. Through the lens of actor-network theory (ANT), the article describes the use of digital technology within husbandry and how the technology affects herders.

Relationship is a central notion within ANT, and an actor is viewed as an actor within a particular relationship. A reindeer herder is a herder within his or her relationship to the reindeer. They have, in the words of John Law, 'relational materiality' (Law 1999, 4). By empirically analysing the relationships between people and their technologies, we can learn how people discuss matters of value (Pols 2017, 5). However, it is hard to predict exactly how technologies will work out, what relationships will be established and what values will be encouraged (Pols 2017, 6). Therefore, studying the interactions between herders and GPS technologies empirically facilitates an understanding of whether a technology is working as intended, as well as of the emotional effects that the technology may have on the herders.

Methods and research materials

Actor-network theory (ANT) emerged in the 1980s, within the sociological subfield of science and technology studies, as a theoretical perspective on the study of scientific knowledge production. ANT suggests that we 'follow the actors' (Latour 2005, 179). An actor[6] is defined by Latour by what it does, by its performances (1999, 303). An actor makes a difference (Law & Singleton 2013, 491); it is a mediator. These actors can include humans and nonhumans, and we must follow the traces left by the actors as they go about their work, assembling actors into an actor network (Law 1999, 4).

Reindeer herding can be understood as an actor network, a heterogeneous system composed of different entities such as technology, reindeer, herders,

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6   Latour introduces the term actants to create a term that also includes nonhuman actors in the definition (Latour 1987, 84; 1999, 303). With the word actant he wants to highlight just that even the non-human has agency. In this study, I choose 'actor' as a working concept due to its well-known nature (cf. Knuts 2006).

knowledge, and regulations. When the GPS collar transmits information, the herder can react and act based on the information. In this article, I concentrate on the emotional reactions. Feelings of anxiety and stress connected to the movements or absence of movements on the GPS map is an effect that is rarely discussed. The interpretive work in this article is informed by an ANT sensibility (Law & Singleton 2013). Law and Singleton argue that ANT is a form of methodological sensibility; it is a way of asking *how* it is that people, animals and objects are assembled in practices and as a way of *mapping* the relationships among these elements within practice (emphasis in original, 2013, 491). This matter is investigated through ethnographic research in the form of interviews and participant observations. As Jeanette Pols argues, devices do not speak, and their doings can only be observed and spoken about (2012, 20).

The analysis is based on interviews conducted with reindeer herders and reindeer owners in the Jokkmokk area in northern Sweden. Most of the material collection took place between 2015 and 2018. The material was generated through informal conversations, formal interviews and observations. Most of the participants are active reindeer herders; some are not. The interviews can be described as semi-structured and they lasted between one and two hours. The interviews were digitally recorded, with the permission of the interviewees, and later transcribed by the author. All the informants have been anonymised and been given pseudonyms.

I conducted interviews, first with Ellen, the reindeer owner, and Per, her husband, both born in the 1940s. I then interviewed three active reindeer herders: Johan, Susanna and Erik. Johan and Susanna were born in the 1950s, and Erik was born in the 1970s. Since much has happened in reindeer husbandry over the last 50 years, the herders from different generations have grown up in different circumstances. The older generation of herders was brought up without the use of digital tools while the younger generation was brought up with digital technologies. The interview with Ellen and Per was different because we followed the movements on the GPS map as we talked about the incident with the lost reindeer. I tried to obtain insights into how they adhered to the data documentation, as well as the emotions and thoughts they reflected upon and experienced following the reindeers' movements. The other interviews were more general discussions about the use of GPS collars.

Before starting my research, I had limited experience of GPS collars. In previous research, I have discussed the use of GPS data and mainly been focused on what the data contributes to husbandry (Kuoljok 2019a; Kuoljok 2019b). My experience of the topic discussed in this article occurred as I entered into fieldwork connected to the use of GPS. At first, I did not take notice of the information, as I was still learning about digital technologies; however, once

I was a bit further into my research process, I acknowledged the importance of including this aspect in my work.

I am not a reindeer herder and I lack knowledge of the daily life of reindeer herding. This was both an obstacle and an asset during my work. Kvernmo and Stordahl (1990) argue that it can be a challenge for a Sámi researcher, who is a member of and a participant in a local community, to assume the position of an observer. My relationship to the research field contained both insider and outsider dimensions. I have an insider's perspective, being a Sámi and conducting research in my home area. However, not being a reindeer herder gives me an outsider's perspective. Within ethnography, researchers are encouraged to do research in their own backyard, and I was in the right place to pick up information about GPS collars, as many make their living from reindeer husbandry in Jokkmokk.

The reindeer connect people. People meet and talk about the reindeer, where they are and how the grazing conditions are. These reports on the locations of the reindeer used to be a central topic, especially before separations of the herd. The discussions about the reindeer and the GPS collars were affected by the time when the interviews were conducted, and, thereby, mirrors the working year of reindeer husbandry, whether it was spring, summer, autumn or winter. The interviews reflect the rhythms of the year for reindeer husbandry. If it is winter and there are poor grazing conditions, a large part of the reindeer herder's attention will be focused on weather conditions. Further, they must spend more time out in the reindeer forest. By contrast, the herder could show me how small movements on the GPS map mirrored good grazing conditions during the winter.

Emotional effects

During the material collection, things took an unexpected turn: The information transmitted through the GPS collar about a certain reindeer turned out to be disturbing to the reindeer's owner. The reindeer had moved from the grazing area and I got an update on what happened with that reindeer every time we met. It was clear that it was a matter of concern for this person; it was an ever-ongoing conversation about this reindeer. It made me realise that this illustrated another side of how the technology affects us, and I had to document this. I tried to recall the moments in which I heard about the missing reindeer, and I wrote down notes on the diverse comments. Sarah Pink emphasises that we must be aware of and alert to the roles of digital technologies in people's lives, as well as to how these technologies may become part of the ways in which we do research and create entry points through which to learn about other people's sensory experiences and environments (2009, 137).

Reindeer owners do not typically have thousands of animals, so every loss is tangible. Before, when I asked herders about their feelings when reindeer went missing or were found dead, the response had been that it is just something that must be accepted. It was more of a statement, as Erik, a younger herder expressed, "Reindeer disappearing is part of Sámi life". Worries and anxiety were rarely directly expressed in the interviews. The narratives were however diverse and there were sometimes a sadness in their stories about threats and dangers towards the animals and an uncertain present and future for reindeer husbandry. There were also expressions of a desire for control and a change for these uncertain conditions. Reindeer herders are adaptable; they adapt to the reindeer, nature and society around them. Several herders told me that they are at the limit of what is possible, in terms of adapting by maneuvering for space to pursue reindeer husbandry, as they are constantly limited by the surrounding society.

An exploration of feelings of anxiety connected with the move to the networked monitoring of reindeer can be discussed with inspiration from surveillance[7] research. The monitoring activities of the reindeer can be seen as parts of a larger societal context where a surveillance culture is emerging. The setting for this development is the digital modernity where monitoring and coordinating social activities in space and time are achieved by courtesy of tracking devices and computers (Lyon 2017). The means and motif for the growing use of surveillance in the society can be understood as risk management and security (2017). This idea is applicable, considering the conditions for husbandry.

In a study of city surveillance political scientist Ola Svenonius shows how emotions have become a tool for addressing security concerns and legitimatizing surveillance practices (Svenonius 2011, 8-52). Svenonius discusses how surveillance practices become possible and are legitimised by providing an imaginary sense of protection (2011, 6 ff). Emotions become an important way of understanding feelings of insecurity that are not generally reflected upon but are nevertheless felt (43). In short, emotion becomes an arena for the legitimisation of security through surveillance (2011, 52). I draw on Svenonius´ perspective that emotion is a concept that can help us to analyse feelings of security achieved through GPS transmitters. Similarly, emotions

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7 A definition of surveillance by David Lyon (2001): "it is any collection and processing of personal data, whether identifiable or not, for the purpose of influencing or managing those whose data have been generated". Torin Monahan (2010) broadly defines surveillance systems as: "those that afford control of people through the identification, tracking, monitoring, or analysis of individuals, data, or systems. Surveillance systems modulate experiences of the world and the technologies shape social practices in non-neutral ways" (2010).

are also helpful for analysing the loss of certainty and the loss of control. By being attentive to different ways herders and reindeer owners spoke about the reindeer with the GPS collars, ambivalent effects came up to the surface.

Following the reindeer

In my observations, together with those of herders and reindeer owners, I have been following the traces of reindeer to get an understanding of the herders' interpretations of the activities on the GPS map. During my field observations and interviews, I participated both in the "real" world, at the grazing sites, and the "virtual" world, looking at a screen as the herder showed the different tracks of the monitored reindeer.

Observations that are created in a digital format on the GPS maps, can be viewed through a telephone or on a computer. Moving between different sites, on and offline, helps to explore how herders use and experience the technology, as well as what a GPS map adds. The reindeers' movements are digitally mediated and materialised on the GPS map; the view can be described as a scatter of dots, each representing a reindeer, and lines that are traces of reindeer in movement. Visualisation does not speak for themselves, they need to be situated and explained (see also Hine 2015), but how can they be described? Grint and Woolgar (1997, 78) explored the relationship between technology and its users with the metaphor of technology as text. The text is embedded in the context. With inspiration from this, the metaphor "reading" the technology is used in this article to explore how the herders interpret a GPS map. Grint and Woolgar (ibid.) emphasise that the relationship between readers and writers is understood as mediated by the machine and by interpretations of what the machine is, what it is for and what it can do. The GPS map offers one visualisation of the movements, and the description by the participants offers another visualisation, one that includes a sensory aspect.

How the herders "read" the data and how data makes sense is through relating the data to the context in which they are generated (Lupton 2018). Herders´ interpretation gives insights into the embodied everyday experience and reveals how different problems can arise. The GPS maps become dynamic as the herders interpret the information mediated through the map with their traditional knowledge and their experiences of the land and the animals (Kuoljok 2019a). The individual herder is experiencing the map in their own personal way. Maps do not emerge in the same way for all individuals (Kitchin 2008, 214). The map rather emerges in context and through a mixture of practices that are affected by the knowledge, experience, and skill of the individual that applies the maps in the world (ibid.).

The herders have an embodied relationship with the places in which the reindeers move; they know how it feels to be in those places. They have learned

the seasonal patterns of the reindeers' movements, and they have organised their work around these patterns. Because the reindeer move in a repetitive pattern, the herders have learned what will likely happen, when it will happen and how to act when it happens. A phenomenological approach to the perceptions and environment of the herders is expressed by Tim Ingold, who refers to herders as "wayfaring"; their movement "is continually responsive to his perceptual monitoring of the environment that is revealed along the way" (2007, 78). As wayfarers, Ingold argues, humans are constantly moving along lines that lead us from place to place, and we inhabit a "meshwork" of lines caught up with other lines (80). According to Ingold, "[I]n storytelling as in wayfaring, it is in the movement from place to place—or from topic to topic—that knowledge is integrated" (91). Following the lines on the screen with the guidance of knowledgeable people offers me rich descriptions. The experience becomes related to other phenomena and stories about special encounters and happenings that were connected to certain places that often came up and made the GPS maps come alive. When the herders describe what they have experienced, the present and the past are linked together.

Mapping and analyzing the information from the GPS collar

In interviews, herders expressed the uncertain conditions surrounding reindeer husbandry. Reindeer husbandry shares the winter grazing area with other interests, such as forestry, tourism, industries such as hydropower and wind power, and more, which means that competition arises over the use of the land. In recent years, there have been great changes in the weather across the region, which has varied between cold winters and warmer periods. Unpredictable weather is of great concern because it is outside the reindeer herders' control. The cumulative effects of land area fragmentation together with changes in the weather put great pressure on reindeer husbandry. The reindeer are negatively affected by the disturbances and react by becoming more mobile rather than remaining in one area to graze. The reindeer herders do not have the opportunity to control these external disturbances, but must adapt to the prevailing conditions. With these challenges, technological tools are becoming increasingly important for meeting many of the threats.

To gain information on and visualisations of the reindeers' movements, herders have adopted the use of GPS collars that are attached to the reindeers' necks. The GPS collar sends location data at regular intervals, via satellite or GSM, to the herders. The data comes in a digital format. The reindeers' movements can be played in sequence, and you can choose which time period you want to see. The monitoring is done by human actors: the individual reindeer owner/herder or the Sámi community. The GPS collar helps the herders over-

come spatial obstacles by connecting them with their herds across vast geographic distances. Looking at the GPS map allows one to travel both in space and time. Locating reindeer and tracking their movements are the key functions of the GPS network, and these functions empower the herders to overcome their previous insecurity and lack of control. They help to determine how the reindeer herders focus their attention and how they act. The GPS data gives them room for preparedness. The information is used as a basis for decisions that affect both the reindeer herder, who can enjoy positive outcomes by coordinating their work, and the animal, whose well-being is desired by the herders. This way of monitoring brings economic benefits as well, such as reduced costs of snow mobile operation.

Johan, an elderly reindeer herder, told me that they used to put bells on some reindeer in the herd, as this helped them to locate the reindeer in the forest. "It's almost the equivalent of GPS collars today", Johan said. "We have about 10 GPS necklaces, and in the past we may have had 10 bells. In the forest, you heard where the reindeer with bells were, and that way the herd was located. When you gathered the herds, you also saw if all the reindeer with bells were present. If a reindeer with a bell was missing, then you knew you had more reindeer gone, because where that reindeer with the bell was, you could be sure it wasn't there alone." The difference today when using new digital technology, according to Johan, is the feeling of having somewhat better control over the reindeer herd. "In the daily work in the forest, I do as I have always done before", Johan said. "I drive the track around the reindeer herd with the snow mobile and see that they have not spread outside the area". If some reindeer have left the area, he tracks them and brings them back. In that sense, the herding work has not changed much.

One difference Johan points out today is the use of GPS maps. Herders know the land and can navigate and locate the reindeer without using maps. *In situ*, the herders navigate from below while being attentive to the landscape, to tracks and sounds. As they are using GPS maps *ex situ*, they are, on the contrary, navigating from above. Maps have traditionally been used as static paper repositories for spatial data, but now they are displayed on a computer screen (Dodge, Kitchin & Perkins 2011, x). Maps work, essentially, by providing graphical displays that render a place, a phenomenon or a process visible (ibid. xx). Latour stresses that "We are so used to this world of print and images, that we can hardly think of what it is to know something without indexes, bibliographies, dictionaries, papers with references, tables, columns, photographs, peaks, spots, bands (1986, 13)." Within ANT, there are some concepts that facilitates the discussions of the conditions and the quality of GPS data as representing the reindeer movements. Those are "in-

scription" and "immutable mobile". Latour shows, with an analogy about the ship *La Pérouse* in the article "Visualisation and Cognition: Drawing Things Together", how things and relationships are folded together in seemingly stable entities in the form of maps, an immutable mobile (Latour 1986). Things and relationships are transformed into representations in a mobile format. *La Pérouse*'s map tells a story that is materialised on paper, an immutable mobile that is "presentable, readable and combinable with one another" (Latour 1986, 7). However, because it is never stable, but rather shaped according to the practices in which it is used, it becomes a mutable mobile.

An inscription device translates an entity, such as reindeer movements, into a figure or diagram (see also Latour & Woolgar 1986). The representation of the reindeer movements can be moved from one place to another or be combined with other elements, such as Reindeer Husbandry Plans[8]. Inscriptions contribute to making the GPS data visible by rendering it "flat" and mobile, and thereby phenomena can be seen. As the GPS map enables the visualisation of the movements through the transmission, it participates in mediating, and thereby transforming, relationships (Latour 1999). There are multiple ways of experiencing the information read on the GPS map, just as there are multiple ways of taking action based on the information, which is demonstrated in the following story.

The story of the reindeer that wandered off

We sit in the kitchen in the red house, me, Ellen and her husband Per. The house is next to the lake, a bit away from the community. Here Ellen has grown up and it is close to the reindeer winter pasture land. During much of her and Pers's life they have worked with reindeer. When you have lived with the reindeer, you are familiar with how it behaves, how it moves in the terrain Ellen says. That knowledge is very old. In our conversation, we go back a little to winter 2016 when a reindeer equipped with a GPS necklace left the herd. Ellen is quiet for a while, and then she explains: "I still remember the moment as I followed her walk across the river, to the other side into another, neighbouring Sámi community. With the GPS map we were able to track her movement." The reindeer can move fast. As the reindeer left the area, it became clear how its natural instincts clashed with today's conditions for reindeer husbandry, with the competition for grazing lands, as there is no longer as much space

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8 Reindeer Husbandry Plans (RHP) is a tool for operational reindeer management, but it is also a tool for the community's information of land use in husbandry in communication with other land users (Sandström et al. 2012, 255). RHP consists of data from reindeer herders about important grazing lands for different seasons combined with information from satellite images and data from GPS equipped reindeer (Herrmann et al. 2014, 37).

for a flexible use of land. The reasons why the reindeer wandered off could vary: poor grazing conditions, disruption by other people, predators, and so on. The reindeer itself cannot tell us what its reasons were.

If the reindeer had a calf in the spring, it was not certain if it could be found and marked, and thus it could be lost. It was also uncertain whether the reindeer would come back to the grazing area at all. Ellen looked at the screen and said, "So, she kept walking, let's see what happened next. It looked bad." I asked, "How bad?" Ellen followed the tracks on the map with her finger. She pointed and explained, "Here you can see how she was trying to cross the river and go west, but instead, she stopped on an islet." The ability to put the reindeer's action into a temporary context made the situation worse. Ellen continued to describe how the reindeer left the winter grazing area at a time when the other reindeer were slowly beginning to move westwards. She explained that this meant that the reindeer was separated from the rest of the herd on the way up to the summer grazing land. This also happened at a time when the weather was extremely warm, even for the season, and the ice was dangerous to move on. In order to steer the reindeer in the right direction, Ellen and Per drove there to see if they could make her move in the right direction. When they reached the place by the river, they saw through their binoculars that there was not just one reindeer but a small herd walking around on the islet. As Ellen said, ´The whole situation was stressful." From the GPS transmission, it seemed to be an easy job to drive out on a snow mobile and get the reindeer back. In reality, however, there were difficult snow conditions that could not be seen on the GPS map." Nature is a factor that strongly affects the survival of the herd (Johnsen et al. 2017). Per explained that various changes in the weather had made the ice cover on the river unsafe to move on, and places that had previously been stable and good for crossing became unsafe and dangerous. This can be seen as a consequence of changes in the weather and the displacement of the seasons, with spring coming earlier than usual. Per reflected on the incident which was made worse because the river is regulated, i.e. the river flow changes due to a dam upstream:

> This river is difficult because it is regulated. It had been an early spring with poor ice. There was a lot of water on the ice, so it was not possible to drive a snow mobile or ski there. We did not dare go out onto that; it would have been risking our lives. If it had been possible for us to fetch the reindeer, we would have done it. But now it was impossible to get across.

Reindeer herder and author Apmut Ivar Kuoljok (2007) has argued that the construction of hydropower plants throughout the 1900s has also affect-

ed the river. With the river dammed, the water level fluctuates which affects the conditions on the ice and also creates dangerous gaps under the ice. Since the ice becomes dangerous at certain times, it is no longer possible to move the reindeer along the shore.

When the reindeer finally went over to the right side of the river, the next problem arose when the signal from its transmitter remained stationary. This gave rise to more disquiet and speculation. What happened? Where was it now? Was it dead or alive? "There were many questions that came up," said Ellen, "We were lost, just like the reindeer." She continued,

> When there was nothing else to do, I just went in and looked at the map to see if the reindeer had moved and where it was. We became worried when we saw that the reindeer stayed in the same place for several days. It was in an area exposed to predators, especially wolverine. Reindeer disappear all the time, so we assumed that it had been killed by wolverine. That was our conclusion. It was fun to follow the tracker as long as there was movement, but as signals had suddenly stopped it was no fun at all. Then we began to suspect that the reindeer was gone for good.

The insight that the tracker collar gave was connected with how and whether the reindeer was moving. The reindeer's movements allowed for imagination, and the feelings that arose when the animal stopped moving or moved far away from the area can be connected to previous experiences and memories, which made it possible for the owner to visualize several steps ahead and predict what this might mean in the longer term. In this incident, the interpretation could be that the reindeer had stopped because it had been killed by predators, or that it had stopped to calve on one of the bare rock areas nearby. Still, in their minds, Ellen and Per had doubts whether the technology was working properly. Ellen concluded the narrative with an account of how they found the reindeer and its calf at a calf marking in the neighbouring Sámi community in the summer. She was so happy: "We even found her calf and now it is marked; we can just hope that they will find their way back to our grazing grounds." Per got up and went to the hallway and came back with the tracker in his hand, "I have changed the battery, and now it is ready for the next winter season."

Ellen explains how the reindeer's movements changed her way of looking at digital technology. Until then, it had been a positive experience to follow the reindeer movements. Looking at the GPS map, she tried to look at the landscape with the eyes of the reindeer. In the past, when she was young, it was the predators who demanded that they guard the herds. Today there are so many other things you have to be afraid of, bad ice on the rivers, car traf-

fic and snow scooter traffic besides the predators. Ellen says: "despite this, I would not like to return to the old times. It was a heavy time. Today's reindeer husbandry work has changed and technology is making it easier".

Visualisations of the movements

With the story of the reindeer that wandered off, the visibility and the invisibility offered by the GPS collar are shown. Thus, as the reindeers' movements are transformed into map inscriptions, certain references are filtered out, and others are preferred, leading to a map that represents a narrowed down framework (Hind & Lammes 2016, 84). The GPS collar produces a narrow and partial view, and sometimes it is difficult to interpret and fully comprehend the data. It is seeing but still not fully knowing (Hind & Lammes 2016, 84). Perhaps the central capabilities of GPS are to view animals spread over a vast area and to view movements that might otherwise be invisible. With this information, the GPS map represents a constantly updated mediated visualisation, and the information offered by this visualisation influences the herders' practices. However, as shown in the story, the signals to the satellite did not reach further west and had therefore stopped transmitting the reindeer's movements, instead showing a fixed position, which reveals a defect in the technology.

The GPS tracker network is a fragile system; it requires a battery and connectivity, and it must be within a certain range to send information. This range does not span the entire grazing area, so the connection cannot always be reliable. However, by discussing the loss, one must also consider the gain (Latour & Hermant 2006, plan 17). From an ANT perspective, visualisations of movement are effects of the functioning network. Because the herders have this vision, there is a sense of stabilisation and control. Digital technology is changing the way herders monitor their reindeer. *In situ*, in the reindeer forest, herders navigate from below, being attentive to both tangible and intangible factors that influence reindeer movements.

Traditionally, monitoring means that the herders are at place in the reindeer forest where they can see and hear the animals; feel, smell and taste the condition of the snow and the ground; feel the wind and listen for noises to see if there are disturbances. As herders are monitoring the reindeer *ex situ*, through GPS maps, they are navigating from above and must have faith in what the technology shows. When technology fails, the herders use their traditional knowledge to resolve the situation. They simply have to accept this uncertainty in the same way they did before the introduction of GPS technology. This shows that the GPS devices do not improve control because of their limited functionality. The technology can perform specific tasks but will not

be a full alternative. The picture transmitted therefore acts only as a complement to the active participation of the reindeer herder.

Double-sided information

The GPS collar can be characterised, in sociologist Bruno Latour's words (1998), as something that enables action and makes work easier. However, the GPS transmitter is not innocent; when we delegate properties to things, we give them a certain power. The GPS collar becomes a tool for the herder who wishes to monitor the reindeer, but the information from this technology has the power to affect us on a personal level. The collar gives rise to multiple meanings, to feelings of fantastic insight associated with feelings of safety, and control and to feelings of unease and anxiety. The information from the collars has become an important support in the daily reindeer husbandry work, where today´s planning of working days is often based on the web-based overview of the reindeer´s nightly movements shown on the map. Daily connection induces feelings of safety. It adds further information to the traditional knowledge. Monitoring reindeer through the GPS map involves experiences which can quickly change. The herder Per pointed out, as he was reflecting over the uncertainty that the collar contributes to, that there are negative aspects associated with the use of the collar. It is imaginable that having constant access to information about the reindeers movement may cause increased anxiety, instead of decreased.

Per has used GPS transmitters on his reindeer during the last two winters. There are many different models of transmitters on the market, but the one he chose can indicate if a reindeer is still for a certain number of hours. Per says that, in the beginning, he felt scared when he received information that a reindeer was still for a long time, and he often assumed the reindeer had died. Several transmitters often showed the same thing. In the end, he realised that, when a reindeer is digging in the same pit and grazing, the transmitter sends out a warning that it has been still for a long time. "This is something I've learned during these two winters. If it is good pasture and the transmitter shows that the reindeer is not moving, I now know that it can still mean that it is alive." He goes on to say, 'When I first saw it, I could be startled and I drove where the transmitter showed that the reindeer was, only to find reindeer that were grazing.'

In line with the concerns expressed about the missing reindeer, I asked another herder, Johan, whether the technology provides information that you might not want, and he replied, "Yes, you can say so; hope can be lost with the technology. It is the hope that allows us to continue". His response reflects the uncertain conditions for reindeer husbandry, in which herders must al-

ways hope and work for the best of the reindeer. Johan reports that he has programmed his transmitter to display the reindeer's position once per day, in the morning. He looks at the GPS map while drinking his morning coffee. He explains that if he had set up the GPS transmitter so that it shows the positions in the afternoon, he would have had that "night problem", where one wonders and worries about what is happening.

Herders must anticipate the risks and calculate the loss of animals. Although herders have learned to live with uncertainty in reindeer husbandry, they emphasise that knowing can be worse than not knowing. This opens up the question of what defines the GPS collar as a successful tool in reindeer husbandry. One answer could be that the technology can be considered functional when the herders have the possibility to react and act upon the transferred information.

Conclusion

In this article, I have described how use of digital technology into reindeer husbandry can be emotionally experienced. According to Bruno Latour, ANT is an approach that allows for more careful study of relationships and discovering more revealing action patterns where different actors are linked to a network of relationships (Latour, 2005).The use of the GPS collar shows that knowledge is produced as an effect of a heterogeneous network. An important view within ANT is that actors can include humans and non-humans, and that humans are not central in this context. Sámi scholar Elina Helander-Renvall states that both human and non-human actors are treated as partners in the network within Sámi culture as Sámi do not stand apart from nature; instead, they regard themselves as an integral part of it (2016, 71). Reindeer herders have close relationships with animals and the land, and both of these relationships are equally important components.

The visualisation of the movement in the GPS map acts as a powerful aid to the herders. The view offered by the GPS map is partial and limited (Hind & Lammes 2016, 84). When it comes to "reading"the GPS map, the movement on the GPS map is not just one experience; instead there are manifold ways of experience the reindeer movements. The interpretations are subjective and also experienced in different ways depending on the circumstances. With their embodied skill, their traditional knowledge the herders evaluate the information from the GPS map. The herders review the GPS data knowing that reindeer's movements are effected by different actors. Everything has an effect, the wind, the weather and the difference in pasture steer the movement of the animal and demonstrate the agency of the land. Even if the reindeer are free roaming animals, the herders manage them from time to time and determine

their movements. Also predators, insect harassment, disturbance from hunters, tourists, motor vehicles and so on affect the movement of the reindeer (Kitti et al. 2006, 148-149). Other non-human agents such as tracking devices, the collar's battery and network signal coverage have effects on the network. In reindeer husbandry, GPS tracking devices shapes the relationship between the herder and the reindeer. As the GPS collar transports information, there are multiple ways to act based on the information and the technique changes both daily practices and the relationship between the human and the animal.

My aim has been to show another side of the mediated knowledge offered by GPS visualisations, namely the effects these visualisations can have on the herders. The reindeer that wandered off served as an eye opener, which helped to raise new questions about the use of GPS collars on reindeer. An analysis of the GPS map visualisations led to a multi-layered view of how reindeer movements and herding lands interact and how these interactions can raise conflicting emotions. On the one hand, the data helps to bridge distances and reveals movements that otherwise could have gone unnoticed. On the other hand, because the GPS collar makes movements visible, the herders become exposed to an increased amount of information. Knowledge of the reindeers' movements in itself is not new to the herders; however, specific knowledge about individual reindeer movements over vast spatial areas can be new information. The amount and the level of detail of the information provided about the movements made a difference. The herders' experiences of the GPS collars and the movements they track emerge from a relational experience where there is a close bond between herder and reindeer. Even though herders have been experiencing elements of ambiguity and anxiety connected to reindeer movements before, the instant flow of detailed information adds another dimension to the anxiety. As shown in this article, the reasons behind incorporation of digital technology could be seen in the light of feelings of insecurity which has increased due to changes in the surrounding environment. GPS collars become part of a herder's tool box aimed at managing reindeer movement. However, once it has become a natural part of everyday herding practice, having constant access to information about one's reindeer's whereabouts may cause increased, as opposed to decreased, anxiety. Drawing from the experiences of the interviewed herders, one conclusion is that herding reindeer *ex situ* instead of *in situ* is a practice that shifts the herders experience from an actual state of security and control over the herd towards a state of perceived security.

The emotions connected to the movements of the reindeer helps to understand the influence the technology has on the herders, which are both positive and negative. The reindeer herders' stories reflect a technology-positive atti-

tude where people largely trust the technology and think that the technology solves a number of problems. The history of the reindeer with GPS necklace that left the herd made Ellen, the reindeer owner, change her way of looking at digital technology. Before that, she had only positive experiences following the reindeer movements through the GPS map.

The empirical findings demonstrate how technology works in unpredictable ways and opens up the possibility for different experiences and valuations. The way people experience the GPS devices enriches an understanding of the modern reindeer-herding community where digital technology increasingly has become common as one of many new tools that are intertwined with daily herding practices.

AUTHOR

Kajsa Kuoljok, PhD, is an ethnologist at Ájtte Swedish mountain and Sámi museum. Previously she has worked on various projects about árbbediehto, traditional Sámi knowledge, and about the Sámi language and its significance for individual Sámi and the Sámi society.

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Johan, male 2, reindeer herder, 50-60 years. Interviewed at his home, June 2016.
Susanna, female 2, reindeer herder, 50-60 years. Interviewed at her home, June 2016.
Erik, male 3, reindeer herder, 40-50 years. Interviewed at Ájtte museum, September 2016, October 2018 and August 2020.

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