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Craftsmanship as a Carrier of Indigenous and Local Ecological Knowledge: Photographic Insights from *Sámi Duodji* and Archipelago Fishing

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ABSTRACT

Indigenous and Local Ecological Knowledge (ILEK) has been recognized for its potential and contribution to sustainable use of natural resources. It has proven difficult, however, to investigate and observe its tacit and embodied character. The objective of this article is to explore ways in which we can theoretically and methodologically understand ILEK. It does so by theorizing ILEK as craftsmanship using literature on practice theory, and analyzing the tacit and embodied nature of craftsmanship of a *Sámi* craftswoman and an archipelago fisherman through the use of visual methods. Results of this study are used to analyze and discuss how craftsmanship reproduces ILEK and its potential to contribute to environmental sustainability.

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Introduction

There is increasing recognition and acknowledgement of Indigenous and Local Ecological Knowledge (ILEK) for informing alternative strategies for sustainable management of natural resources (Gadgil, Berkes, and Folke 1993; Berkes 2009; Kimmerer 2011; Gómez-Baggethun, Corbera, and Reyes-García 2013; Tengö et al. 2014; Karki et al. 2017). Repositories of ILEK represent valuable storehouses of memories of past experiences in coping with adversity (Barthel, Folke, and Colding 2010). Traditional, Indigenous and local, natural resource users draw on knowledge about their specific geographical environment that comes from their experiences of living and working in it. ILEK, therefore, cannot be considered apart from the practices that generate it, and through which people and nature are interconnected (Gadgil, Berkes, and Folke 1993; Lauer and Aswani 2009; Brondizio and Tourneau 2016; Mistry and Berardi 2016; Tengö et al. 2017). We argue in this paper that it is important to understand ILEK not only as memories but also as situated practices.

We build this argument by exploring how we can methodologically identify and theoretically articulate the tacit and embodied knowledge of local, natural resource users.

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We do so by theorizing the concept of craftsmanship in relation to practice theory, and applying a visual methodology in two case studies of Swedish craftspeople: a *Sámi duojár*, or crafts artist, and a fisher in the Stockholm Archipelago. We end the article discussing how craftsmanship reproduces ILEK and its potential to contribute to sustainability.

Theorizing Indigenous and Local Ecological Knowledge through a Focus on Craftsmanship

To capture the intimate and tight interconnections between knowledge, people and nature, social science scholars frequently consider ILEK in relation to the practices that (re)produce it. There is a varied scholarship on practice theory; it is applied across a number of academic fields, in particular Science Technology Studies (Gad and Jensen 2014), but also Organization Studies (Feldman and Orlikowski 2011) and Sustainability Science (Shove and Spurling 2013; Spaargaren 2011).

Through a focus on practices scholars aim to overcome dualist explanations for the reproduction of social-ecological interdependencies (Raymond, Giusti, and Barthel 2018). These dynamic interdependencies are thus neither explained with recourse to intra-human attributes, such as social construction or agency, nor with recourse to extra-human phenomena, such as social structures or ecological systems (Spaargaren 2011; Feldman and Orlikowski 2011). Instead, explanations are premised on the ontology that interdependencies become real through a series of concrete, everyday activities. These activities, or practices, are mutually constituted through interaction between humans, non-human others, technical artifacts, as well as living and non-living nature (Spaargaren, Weenink, and Lamers 2016). Knowledge, in practice theory, is considered as “enacted.” It does not exist independently of doing, and scholars highlight the importance of tacit knowledge, or practical consciousness (Giddens 1984), for the (re)production of practices (Ignatow 2007). Tacit knowledge is practical knowledge connected to accomplishing things, which resists articulation unrelated to the persons embodying it and the social and ecological conditions in which it is used (Polanyi 2005[1958]; Gascoigne and Thornton 2013).

A number of publications highlight that local, natural resource users, such as fishers, operate through different styles of work (Boonstra and Hentati-Sundberg 2016) that imply different kinds and qualities of knowledge and skill (Thorlindsson 1994; Lauer and Aswani 2009; King 2011). To distinguish the various degrees in which people mutually constitute practices with living and non-living nature and technical artifacts (Cooke, West, and Boonstra 2016) we theorize the distinctive qualities of ILEK with the concept of craftsmanship (Veblen 1914; Becker 1978; Harper 1987; Mills 1980[1952]; Sennett 2008; Thorlindsson, Halldorsson, and Sigfusdottir 2018).

Our interpretation and usage of the term “craftsmanship” refers to skilled work in the most general sense (see also Sennett 2008). It is thus not reserved exclusively for work associated with crafts and crafting (Pye 1968). The cases discussed in this paper reaffirm this point. We observe skilled work in the making of *Sámi* boots, which associates readily with craftsmanship, but just as well in the catching of fish.

According to Sennett (2008, 8–9) craftsmanship is “the skill of making things well, [...], an enduring, basic human impulse, the desire to do a job well for its own sake” (see also Ingold 2000, 413). Thorlindsson, Halldorsson, and Sigfusdottir (2018, 4) find

that underlying craftsmanship is: “intrinsic motivation, engagement in the task at hand, holistic understanding, emphasis on informal learning, and the honing of skills that are needed to accomplish the task at hand.” These scholars recognize the constitutive role skill plays in craftsmanship, which Ingold defines as a “[practical] mastery that we carry in our bodies and that is refractory to formulation in terms of any system of mental rules and representations” (Ingold 2000, 162). It is generated and maintained “not through formal instruction, but by routinely carrying out specific tasks involving characteristic postures and gestures” (Ingold 2000, 162).

Craftsmanship that develops from the work with living objects of nature—land, sea, animals, and plants—has three defining characteristics. First, the central place of living nature in these craft practices, as well as the direct and skilled engagement of craft persons with living objects/specimens of nature, demand continuous attention, evaluation, and adaptation, because of biological and ecological variability and a certain irrevocable degree of unpredictability (van der Ploeg 2013, 92). Second, a *sustainable* relation between local users and the living nature they depend upon is best conceived as “co-production.” Co-production in this interpretation refers to the interactions between people and nature—their mutual involvement and dependency—that result in ecological services and benefits (Fischer and Eastwood 2016). The term is useful because it highlights the agency of both humans and non-humans, as well as their mutual interdependence, and covers a variety of social-ecological interactions and relations, rather than perceiving humans and non-humans as providers, i.e. users of ecological services and benefits only (Flint et al. 2013).¹ Third, the tools used in the work are crucial too because they afford the realization of craftsmanship as well as co-production, and in so doing influence the impact of craft practices on environmental sustainability. To understand the ways in which tools limit and/or facilitate craftsmanship van der Ploeg (1991, 199–201) distinguishes “skill-supposing” from “skill-excluding technologies” (see also Ingold 2000, 368–369 where he makes the same distinction). Skill-supposing technology refers to relatively simple tools that require a large amount of embodied skill for their effective use. In contrast, skill-excluding technologies are often technically sophisticated and complex but require substantially less skill to operate. In what follows we use this distinction to explore how craftsmanship can come to function as a carrier of ILEK and whether it offers potential for achieving environmental sustainability.

Based on the literature cited here we consider craftsmanship of local, natural resource users as a process through which the social and ecological dimensions interconnect (Ingold 2017). This interconnection is grounded in the concrete, everyday practices of local resource use that include: (a) embodied skill (Ingold 2000); (b) working with tools that afford the use of skill (Ingold 2000; Sennett 2008; van der Ploeg 1991); and (c) co-production (van der Ploeg 1997, 2013). Assuming that these three aspects are general enough to accommodate the social and cultural diversity in which craft practices originate and develop, we use them to identify and visualize the tacit aspects of ILEK.

Visual Methodology

Social scientists tend to investigate tacit and embodied aspects of ILEK by situating “the practitioner, right from the start, in the context of an active engagement with

the constituents of his or her surroundings” (Ingold 2000, 20). To capture active engagement between local users and their environment *in situ* we relied on a visual methodology that included participatory observation, interviewing and photographing.

Visual methodologies, such as photo voice and photo elicitation, are often used when speech is not sufficient to communicate and discuss the object of study (Collier 1957, 1967). As described by Wang and Burris, photo voice is a participatory method used to generate knowledge that can be used to enable communities (more commonly than individuals) to identify and discuss changes that they want to bring about (Wang and Burris 1997). We chose not to rely on photo voice because a requirement of that method is that the respondents themselves produce and select photos to discuss (Mannay 2016). The method would not work well for our research because people cannot photograph themselves at the same time when they are fully immersed in their work. We thus opted for photo elicitation, whereby photos are used as a dialogical tool to facilitate rich and detailed interviews (Collier 1957, 1967). They allow the researcher and the respondent to share focus on minutiae of practices that can easily escape attention.

The photographs (a selection is presented in Figures 1–4) helped us to freeze-frame distinct moments of the work process, and to break down craftsmanship in images of composite actions, such as the direction of the gaze and how a tool is held. In this way, they captured actions done automatically and unconsciously, and that are otherwise hard to put into words. A similar research project that employed photo elicitation to understand the skills and tacit knowledge of a car mechanic (Harper 1987), found that the method evoked a different kind of information than interviewing alone. Feelings and memories were conjured up, possibly because the images probed deeply “into a different part of human consciousness than do words-alone interviews” (Harper 2002, 23).

For the first case, the first author followed how a *duojár* fashioned a pair of boots from reindeer skin. The materials used to make the boots come from reindeer skins which are tanned in willow or birch bark gathered locally. Skills and knowledge are required to transform the materials into a pair of boots that are suitable for reindeer herding² or special occasions, such as weddings. For the second case, both authors followed the catching, cooking, and selling of fish. The fisher who participated in this research, runs a restaurant in the Stockholm archipelago together with his family. Using gillnets and traps he fishes what the restaurant needs.

We accompanied the fisher on three fishing trips, observing and photographing every activity between setting the nets, catching and gutting the fish, to cooking and plating it up. Likewise, the first author accompanied, observed, and photographed the *duojár* at the reindeer corral as she skinned legs, and at her home where she tanned the leather, sewed and decorated the boots. We first observed what the craftspersons were doing, making notes of their activities (Emerson, Fretz, and Shaw 1995), before starting to take any photographs. After getting a sense of the whole activity, we began capturing the individual actions by taking photographs.

The first author shot approximately two thousand digital photographs and video clips for both cases. A range of wide shots captured the craftsperson in context—the fisher preparing to set his nets at sea, for example. A large proportion of the images are close-

ups to capture details such as the positioning of fingers, eyes fixed on a point in the distance, or how tools were employed.

The interviews were performed later after the first author had made a selection of photographs to use for the photo elicitation. Photographs used in the interviews were selected based on several criteria: to understand the knowledge and skills involved and how they had been acquired; to know more about social and ecological contexts and history.

The interviews were semi-structured (Weiss 1994) using the photos taken but also the notes we made from participant observation. Participants were also invited to point out photographs (that we brought with us to the interviews) that they liked or wanted to talk about. The interviews were audio recorded and conducted in Swedish (fisher) and English (*duojár*).

The photos together with transcripts from the interviews were coded by the first author using an inductive approach (Strauss 1987) to see if patterns emerged about components of craftsmanship. More refined coding of the images and interview material relating to the image followed in a second cycle where the coded material was related to, and contrasted with, definitions of tacit knowledge and skill from the social science literature (see section “Theorizing Indigenous and Local Ecological Knowledge through a Focus on Craftsmanship”) as well as social-ecological systems thinking (Berkes, Colding, and Folke 2003).

The main respondents in this study were the fisher and the *duojár*, however, we also conducted interviews³ with other people closely connected to or involved in their craft practices. We spoke with the daughter of the fisher. She cooks the fish her father catches and is responsible for running the family restaurant, and is a close and long-time observer of her father’s craftsmanship. The first author also interviewed a reindeer herder and accompanied her on a number of occasions when she was marking new calves and administering antiparasitic treatment to adult reindeer. The first author also interviewed a Professor from the Sámi University of Applied Sciences in *Kautokeino*, who is a specialist on *duodji*. The interviews with these people helped to take account of the broader social and ecological context in which the craft practices were performed.

In the following sections, we demonstrate, through interview excerpts and images, depicting the fisher and the *duojár* at work, how craftsmanship (re)produces ILEK by paying attention to the three interrelated aspects that we conceptualized earlier: interacting with nature through embodied skill; working with tools that afford the use of skill; and co-production.

Embodied Skill

The first step in making boots from reindeer skin is knowing how they feel when you walk around in them. As the *duojár* remarks:

We know the material with the body, even if we haven’t sewn it by ourselves before we entered school. I had worn [the boots] since I was a child, so I knew the feeling and the smell and all that.

Smelling, feeling and seeing the hides and the other material that is used, is crucial throughout the whole process of making the boots. Crawford (2009) posits that



Figure 1. A close up of a pot of boiling willow bark. The bark is boiled to tan the reindeer skins. Photo: Viveca Mellegård.

craftsmanship is premised on “attentiveness” (82). The “handling, using, and taking care of things” (Crawford 2009, 69) together with “direct inspection” (1) gets us mentally and bodily involved. This level of engagement stimulates “intimacy” (Dreyfus and Kelly 2011, 210) with materials, animals, or plants.

In the following conversation about color and tactile qualities we discuss photographs that we took when the *duojár* was tanning the reindeer hide:

I(interviewer): Why is willow used for the tanning process?

D(uójar): I don’t exactly remember why but the Sámi have done it... used it for hundreds of years. And if you take birch... it will get harder and darker – the color. So, people have just found it out that it’s the best bark to get to reindeer skins.

I: So, birch makes the actual leather hard?

D: Yes.

I: Does willow make it softer?

D: Yes. And if you use fir tree, you use it to leather... It’s thicker

I: [referring to [Figure 1](#)] How long does it have to boil to get the color that you like?

D: This kind of bark... one hour... If it is fresh bark you can boil it a little bit longer

I: When do you collect these twigs and bark?

D: In the summer time if you want the color to be brown and the softness. In the winter, it will be light green... not as brown. You know in this area we like the dark brown but in Kautokeino [town in Norwegian Sápmi] they want to have it white... the fur... inside... they don’t like the brown.

I: How long does it take to tan?

D: Five to 15 minutes otherwise they will be too hard. When they go too dark, they go harder also.



Figure 2. The *duojár* uses rules-of-thumb when measuring and checking the size of bits of skin used to make the boots. Photo: Viveca Mellegård.

The *duojár* explained that her grandmother was the first to teach her *duodji*. She was a skilled craftsperson and passed on rules-of-thumb—techniques that were developed by *duojárs* who came before her, through processes of trial and error across generations (see Figure 2). As the *duojár* explained:

They haven't known by their own why it [rules-of-thumb] is so necessary but they knew if you don't do it like that it would not go, [not get] a good result...

At first, the *duojár* learned by imitation, carefully observing her grandmother at work and copying movements until they became second nature, embodied, and effortless. The *duojár* is only consciously aware of the ease and familiarity of knowledge and skills that she embodied when she occasionally learns new techniques. She reflected that:

It's so many years [ago] that I start to learn the new technique. So, I have forgotten how tough it could be if you are a student. How tired you could be.

We accompanied the fisher on several trips to take pictures of his working routines. From these observations, it becomes clear that both the fisher's physical condition as well as his senses, sight especially, are crucial to perform the practices that make up his fishing style. Working alone he performs several activities concurrently. Hand-eye coordination enables him to steer the boat whilst looking at the sea and horizon (see Figure 3). Setting and pulling the net, likewise, requires him to both steer to hold course as well as working with his free hand(s) to pull or release, and to free bycatch from the net. Looking at some of these pictures together with him triggered discussion about how he managed to not pay attention to what his hands were doing, which exemplifies how craftsmanship consists of embodied skill:



Figure 3. The fisher’s embodied knowledge enable him to scan the horizon and adjust the steering, at the same time as pulling in the fishing nets. Photos: Viveca Mellegård.

I: In this picture [Figure 3], you can see how you look at the horizon the whole time, at the same time as you work with your hands.

F: Yeah, I’m often on markets demonstrating how to filet fish. People then tell me “you are standing there, talking and looking folks in the eye, while you are cutting away”. People have a hard time understanding [how one can do handiwork with a knife without looking at what one is doing].

I: Can you explain how that is possible?

F: Eh, it’s just routine. I’ve fileted a couple of fish, so I can do it more or less without thinking⁴.

I: And how important is your sight for you?

F: Very important [that it remains good] so that you don’t have to wear glasses. Because it’s always splashy and misty and so on. I’ve never needed glasses.

These conversations make clear that the intimacy or familiarity with materials and nature is foremost to accomplish something—boots for walking and fish on the table. Knowledge is “working knowledge”; directed toward the goal and task at hand (Harper 1987). The level of intimacy helps, for example, the fisher to know where and when he can catch which type of fish, as the following dialogue exemplifies:

F(isher): I always listen to the weather reports between 4 and 5 PM. Where I will fish depends on what they [his daughter and wife] want me to come home with. When they want whitefish (*Coregonus lavaretus*), I will come home with whitefish; if it’s

perch (*Perca fluviatilis*), I'll come home with that; cod (*Gadus morhua*), I'll come home with that. So, I choose the places with that in mind, using different gear and nets.

I(interviewer): So, how do places differ when you want a perch or a herring?

F: Yes, the places where you can catch these fish are different. It's a big difference. And normally I know where the fish is staying, at which places and at which depth.

I: And you know this because you have fished them before?

F: Yes, I've been fishing in this area since I was a kid, and my dad did this before me, and so on. So, I don't need to think so much to know where to go. Just look at the weather and then I pretty well know where I will be going.

The above dialogue also indicates how tacit craftsmanship is. According to the fisher's daughter—who was listening to our conversation—we would have to spend a lot of time with her father at sea (“years”) before we can acquire the knowledge he has, and to also be able to understand how he makes his decisions on where and when to fish. In her own words:

[My dad] has so much information in his head that he won't be able to get all that out to another person because it's too much information that's embedded in his skull somewhere. Very deep down. So, I think you need to be really small [i.e. young of age] and just be with him always and let it come naturally, [...].

She later remarked that her father knows what to do because he feels it in his “*bone marrow*” as if craftsmanship is something that one is born with: a natural gift. The fisher himself offered a similar explanation:

I: You also mentioned that you fished together with a friend when you were young.

F: Yes, you can learn a lot on your own. It's [know-how] just something that sits in your genes. How everything works. But this kind of fishing, that's just science. And that's why there are so few people who are able to become fisher at an older age. There is so much to learn about winds and currents and water levels, and all of that, and how it all works together. Especially knowing the currents takes time, and the herring is directed through the currents.

Metaphors of bones, genes or blood (Gustavsson and Riley 2018) appeal because they emphasize how knowledge and skill is an irrevocable part of a person's biological make-up. It is embodied. The metaphors create the impression that people are born with it. Although this is not completely true, it makes a lot of sense from a sociological standpoint. Acquiring craftsmanship requires a long gestation period during which people need to practice, imitate and experiment preferably from a very young age (see previous quote and the first quote of this section), and a social context that offers opportunities to practice and perform craftsmanship.

During our conversations, it became apparent how the fisher's social context has changed over the years, and consequently the opportunities for acquiring and performing craftsmanship. First, when we were discussing who would take over the fishing business after him, both daughter and fisher commented that there might be no-one.⁵ Although the daughter's son likes fishing, they both said that there is simply not enough time (due to schooling obligations) for him to accompany his grandfather on fishing trips. The time fisher and grandson spend together at sea was seen as a most important requirement for acquiring the skills to continue this specific style of fishing. Second, in a discussion about

the demographic changes on the island where the fisher lives, he remarked that he found it harder nowadays to locate fish, simply because he is currently the only remaining professional fisher. Earlier there always used to be neighbors, friends or relatives fishing in the archipelago who would inform each other about the whereabouts of the fish.

We tend to think of knowledge as something mental, functioning independent of vision, hearing, smell, taste, touch, emotions, and context. But as Ignatow (2007) points out, ignoring the situatedness and embodied aspects of knowledge is no longer defensible in the light of new insights from neuroscience about how our brain works (Damasio 2006). Contrary to received wisdom, cognitive scientists now assume that sensory experiences are not transduced to representations (what we would readily associate as knowledge). Rather, perceptual and bodily experiences are captured together to represent situations (Ignatow 2007). This embodied and habitual knowledge becomes available as soon as the same or similar situations are experienced again (Dewey 1922). In the next section, we analyze how situations are not only experienced through the body but also through tools that crucially limit and enable this bodily experience.

Tools and Skill

In a study of how people experience countrysides, Carolan presents the example of how a farmer “feels” the contours and soil of his land from riding on a tractor. When Carolan (2008, 413) asks how he knows this from sitting in his tractor, the farmer replies: “*When you’ve been doing this as long as I have you can tell a lot about the ground by how the tractor handles. It’s almost like the tractor is part of me.*” Carolan explains how through repeated and habitual use technology can become an extension of our bodily experience. The crucial insight is that different technology “affords” (Gibson 1979) different ways of experiencing and using nature.

As we have seen previously, van der Ploeg and Ingold distinguish between tools in terms of the skill that they can afford (Ingold 2000; van der Ploeg 1991). Relatively simple design and purpose are typical features of tools that presuppose a lot of skill. To illustrate how different tools afford craftsmanship in our cases, we first focus on a quintessential tool that both the fisher and the *duojár* use—the knife (see Figure 4)—and then discuss a more complex tool the *duojár* uses to remove skin from bones.

The *duojár* was given several pairs of reindeer legs during slaughter season (September) by the herders belonging to the *Sirges sameby*, or herding community, that gathers at *Gúorpak* just outside *Sarak* National Park. She used a small, sharp knife with a reindeer horn handle molded to her palm from years of use to cut off the skins, in one piece, from the bones. As she deftly nicked and sliced one leg after another, friends and family greeted her and exchanged a few words. The *duojár* looked up but her hands continued their work, precise and without a wrong slip of the blade.

The fisher spends considerable time aboard and at the shore gutting and filleting his catch. Some of the catch he immediately releases from the net and guts aboard; the rest he processes in the harbor, or at home. When we discussed the pictures, his daughter, who was also viewing them with us, commented on the uniqueness of this skill. She



Figure 4. Both craftspeople are highly skilled in using a knife. On the left, the *Sámi duojár* skins reindeer legs. On the right the fisher fillets aboard at the same time as looking at the horizon. Photos: Viveca Mellegård.

also explained why it was important to process the fish themselves immediately after it is caught, and what difference it makes for the quality of the fish if one uses hands or a machine to do the work. She said:

Nobody else filets herring with a knife. [...]. And, if you do that the herring needs to be at least two days old [...] needs to be really loose in the flesh because the bone comes out easily that way. [...]. The ones [trawler boats] who fish herring, they usually do it big scale [...] like two or three tons [...] 50 tons of herring. Of course, they can't use a knife. They have a machine to do that. And the herrings pass through a lot of water. Hundreds of liters of water that rinse over it all the time and they get a bit washed out. So, our fish is much harder in the flesh and if we sell it we could take a lot of money because it's really a handicraft. It takes a lot of time to just clean out one herring [...]. And, they're really small fishes and there's a lot of them, and it's the cheapest fish we have, and that's really ridiculous because we don't work with any other fish the way we do with herring because it takes at least three or four minutes per fish.

Although handwork in combination with the use of basic tools can add quality to the final product, it is important to also recognize the downside of tools that afford skill. When, for example, the *duojár* has removed the hides from the bone, she must remove connective tissue before the tanning process can begin. For this task, she uses a machine that shoots out streams of water at very high pressure that detach the tissue from the skins. In the time it would take the *duojár* to use a hand tool to scrape clean one skin, the machine finishes several. She told us that she not only saves time using the

machine, but gets to handle more skins and becomes more familiar with the different qualities of fur, the patterns of markings and so on—knowledge that contributes to refining her skills:

D(uójar): If I hadn't learned to use this machine I would never have worked a lot with skin. I am working with it for 20 years [...] because if I would do it like this [using the hand tool to scrape] I would never have the time to go with some skin, so I [...] have learned a lot when I had the chance to do this process easier [with the machine] [...].

I: That's really interesting so the time that this machine gives you ...

D: I work more hours with the leg skin.

We have seen how craftsmanship is costly because it demands many hours of experience to know *how* a tool is to be used to get the desired end result (van der Ploeg 1991). The interview excerpt also makes clear that simple tools can wear a body out (Veblen 1914), and that the introduction of mechanized or motorized tools is not only a great physical relief, but also frees up time and energy to allow craftsmanship to flourish in other aspects of the work.⁶

Essential to technology's affordances is the extent to which the user of a tool can tweak and repair it so that it not only does the job as required, but can also be adapted to changing circumstances and kept in operation, even if it wears down. Reduction of this leeway, as with highly complex tools, or planned obsolescence (Gultinan 2009), limits the affordance of craftsmanship. In the case of complex tools, embodied knowledge and skills are simply no longer required to operate them. Reconfiguring or repairing a tool is often also impossible due to its specific design (e.g. it cannot be dismantled), or because it requires specialized knowledge, or special repair equipment. Van der Ploeg (1991, 202–206) remarks in this respect that complex technology tends to separate mental and physical labor and, in doing so, reverses the relation between worker and tool. When the tool becomes more complex it starts to dictate and regulate the work. According to Berry (1981, 174–175) skill-imposing technology, on the other hand, has built-in restraints because there is a human-physical limit to what craftsmanship can do in terms of speed, endurance and attention. Skill-imposed technology is, in other words, designed to a human scale. In the next section, we will discuss to what extent craftsmanship can induce people to self-restrain and canalize their use of and dependence on natural environments.

Co-Production

The so-called nature-deficit disorder (Louv 2005) is the received wisdom that in modern or industrial societies people lack a connection with nature. The lack of this connection is considered problematic, because it impedes “*ecological conscience that motivates care and action*” (Zylstra et al. 2014, 123). The discussion that this claim evokes highlights that we are all existentially related to nature (Dickinson 2013; Fletcher 2017). A human being can indeed only exist as a being-in-the-world (Elias 2012 [1970]), but some ways of relating to nature can be *experienced* as more engaging and less alienating (paraphrasing Coeckelbergh 2012, 214). In what follows we explore how craftsmanship represents a type of practice that can counter experiences of disconnection or alienation through co-production.

As we pointed out, co-production refers to the wide variety of interactions between people and nature—their mutual involvement and dependency—that result in a wide variety of land- and seascapes (Fischer and Eastwood 2016). Next, we highlight how craftsmanship establishes a specific type of co-production and society-nature interconnection, and use literature from rural sociology (van der Ploeg 1997), environmental anthropology (Ingold 2000) and philosophy of technology (Crawford 2009; Larrère and Larrère 2018) to interpret these examples.

The skin from reindeer legs is used to make boots. It gives an intriguing parallel because the materials for the boot serve the same function for animals as well as humans. There are good reasons for doing so. The fur is toughest above the reindeer's hooves, which is why it is used for the sole; the part of the boot that takes the most wear and tear. Moreover, the design and functionality of the boot harnesses the properties of the reindeer fur. The sole, for example, becomes non-slip by placing bits of reindeer skin with the hair going in opposite directions to add grip. As much as possible, the form of the material is preserved and used for its specific qualities to serve a new purpose.

To utilize the qualities of the skin, the *duojár* relies on intimate knowledge of the animal in its environment. She selects the materials using her knowledge of the seasonal changes in the Arctic habitat of the reindeer and how temperature and availability of grazing pastures affect the quality of the skin and fur. She chooses the best techniques according to the function of the boots—work boots need to be hardwearing and warm so thicker, longer fur from a reindeer's winter coat is suitable.

I(interviewer): What are the qualities of the reindeer skin that you look for?

D(uójar): If you are going to use [...] sew shoes for when you are at the finest celebration in church, for instance weddings. So [then] you will get the finest, the shortest hair and that reindeer which is slaughtered earliest in the Autumn because it has shortest and thinnest hair.... the skin of the shoe will not be so warm as if you would take the skin in October, November, December but if you take them then it's not beautiful then. They are really hairy, like a dog.

Through these craft practices, agency is less exclusively a human property. Of course, the *duojár* made the boots, but the details of her work are determined by the specific qualities of the Arctic climate, landscape, plants, and animals. Nature, in these examples, influences both the labor process as well as the final labor products to a very large extent. Nature sets terms and conditions for use that local users can and will agree to through their craftsmanship. The fisher formulated this insight as follows:

One has to adapt to nature's quirks. The whole time I need to keep account of nature's conditions, so to speak.

To drive home the point, in many modernized practices of primary resource production the agency of nature is reduced as much as possible, which in turn sidesteps terms or conditions to be respected on account of the animal, plant, or landscape.

One of those terms that the fisher and *duojár* adhered to is the idea of a reciprocal relation between themselves and the natural environment: the conviction that if you take something from nature, you need to give something back. There are numerous examples of this mechanism reported in the anthropological literature (Komter 2005).

To avoid the impression that reciprocity between humans and non-humans is only relevant for practices from long ago and far away, we can return to our own cases. The *duojár* pointed out on several occasions how important it is to use the whole animal. To illustrate the point, she remarked that her grandmother even used offcuts of fur to stuff pillows. A practice that she maintains:

You will use all the material. You can't just take the finest part of it and throw it away [the rest] because it's a lot of work, and it's hard work, and it's also not an honor for the animal. [...] all this work is an honor to the reindeer.

Not wasting the animals was something we also came across in the fisher's case. When we asked the fisher's daughter how they treated the waste of the restaurant, she replied:

All [...] that he [the fisher] cleans out from the fish goes back out to sea to feed the seagulls, [...]. His birdies. And I use a lot of the fish to make the soups and sauces and everything like that. And whatever comes in from the plates goes to the chickens. We also have compost of course for the peels. The lemon rind is the only thing we throw away.

Returning to nature can be grounded in different motivations. It can be rooted in a concern for sustainability (as in the previous quote) but also in the pleasure of seeing non-human animals enjoy and establishing relations with them. We noticed this when the fisher remarked that he takes special care to not leave the spines in when fileting the fish, otherwise the gulls cannot eat the leftovers.

I(interviewer): So you take the leftovers with you back to sea?

F: I will take it with me this afternoon. The gulls can eat it. They have become totally tame when they're around me, you know. But today, when you were with me, they did not dare to come aboard. When I am alone I have dozens of gulls on my ship. They sometimes even sit on me [...]. They eat from my hands. [...].

The idea of reciprocity points to the fundamental insight that both people and natural environments can be mutually supportive and enriching. Together they can comprise a “*reciprocally integrated ecosystem*” (Lombardo 2017, 3).

We argue that craftsmanship is an essential practice that can accomplish and sustain this type of reciprocity, attributing “*identity, specificity and significance to both the human and the non-human*” (van der Ploeg 1997, 50).

What makes the mode of co-production that craftsmanship enables and represents different from other modes of co-production? The difference lies not in the level of artificiality (i.e. absence of living nature) because all modes of human production involve the use of ecological and biological processes and entities (living and non-living) as well as technical artifacts (Crawford 2009). Rather, modes differ to the extent that they leave room for the autonomy and influence of context, including variability, on the item that is to be produced.

Unpacking this difference helps to outline the distinct features of the type of co-production that craft practices entail. Larrère and Larrère (2018) make in this respect an important distinction between two modes of production: “*fabrication*” and “*piloting*” (Ingold 2000, 175 makes the same distinction with “*construction*” and “*co-option*”, respectively). Fabrication refers to a process of making where people produce items from scratch, while with piloting people produce things through harnessing, i.e. “make-

do with”, nature or living beings to obtain benefits (Larrère and Larrère 2018, 192). With fabrication, the room or autonomy of nature is minimized; with piloting it is maximized (Larrère and Larrère 2018, 198–199). A good example of piloting that we came across in our fieldwork are birch burls, which by their round shape suggest to the *Sámi duojár* a functional item like a cup, which is called *gukse*. These burls are not remodeled, but keep their form and qualities and are used in that form to accomplish the task at hand. The mode of co-production that craftsmanship enables can, with this distinction in mind, be understood as an amalgam of thick piloting and thin fabrication.

Craftsmanship for Sustainable Resource Use

The survival of diverse repositories of ILEK is seen by some as equally vital as the conservation of biological diversity for long-term sustainability of global human society (Berkes and Folke 1992; Barthel, Crumley, and Svedin 2013; Mistry and Berardi 2016; Tengö et al. 2017). Yet, some of this literature is based on a narrow conceptualization that humans connect to nature through knowledge only (see e.g. Berkes, Colding, and Folke 2003, especially the diagram of their conceptual framework on page 22; but also Hill, Wilson, and Watson 2004; Zylstra et al. 2014, 123). Considering craftsmanship as a carrier of ILEK broadens this interpretation.

First of all, based on our engagement with social science literature, and the study of craftsmanship, we argue that the knowledge and practices of local natural resource users are so tightly interconnected that it is misguided to analytically separate them. Knowledge and practices dialectically presuppose one another. With the concept of craftsmanship, we present an alternative relational and non-dualist (mind-body) understanding that leaves intact the intimate relations between knowledge and practice, and the distinct social-ecological connection that it reproduces. Second, by introducing craftsmanship we also create an opportunity to differentiate between various degrees and kinds of social-ecological connection instead of assuming that people are either disconnected or connected to nature. Craftsmanship is a particular type of connection, a skilled engagement that grows from direct interaction with natural environments through embodied skill, skill-oriented tools, and co-production. While Russell et al. (2013) provide an extensive review of how different ways of interacting with nature contributes to well-being, craft as a way to interact with nature is not included.

Why are there reasons to assume that craftsmanship can reconnect people with nature and, in so doing, facilitate sustainable development? First, the direct sensory experience and bodily involvement that craftsmanship allows can shape social relations and engagement (Borgmann 1987). The idea here is that through skilled practices people give meaning to their world (Coeckelbergh 2012). Through craftsmanship people can come to appreciate the meaning and function that natural environments and processes have for their wellbeing and life. The direct dependency on and involvement in nature incites attentiveness, which can cultivate self-restraint and responsibility, because people can become positioned to experience and monitor the effect of their actions (Elias 2012[1939]; Jonas 1984; Kallis 2019). Second, social and human geographers argue that craftsmanship offers better possibilities for sustainable consumption and less-

intensive resource use, because through skill, knowledge, and experience people are able to re-use, repair, repurpose and reconfigure materials and products (Miller 2017).

It is important to acknowledge the provisional character of these arguments. Just as people are not essentially self-interested or altruistic, skilled practices *can* induce people to engage with nature more intimately, leading to more care and responsibility. To be sure, this is sometimes-true theory; craftsmanship can do all these things under certain circumstances. More knowledge is required to understand how social and environmental conditions influence the development of craftsmanship in relation to environmental sustainability.

Conclusion

Sustaining the craftsmanship that is (re)produced in local natural resource users' practices is not a plea for a return to a time past, or to reject technological progress. It is an argument for critical consideration of the impact of modern technology on our opportunities for skilled engagement with others and nature. Currently we lack such critical consideration. Evaluation of technology is reduced to a test of functional-rationality: does the tool make the work more effective and efficient? To reiterate, this is not to say that all technology is bad, but rather to rehearse that technologies differ in what uses they afford and how they connect us to each other and nature.

It is important to emphasize this point because commentators frequently believe that conservation of ILEK and the practices that it generates impedes innovation. According to this view, development, and progress requires external input because craft practices have reached the limits of what can be achieved. Craft practices have, in other words, fully utilized any room for endogenous-driven development and therefore keep local resource users "trapped" (Cumming et al. 2014); local resource users relying on ILEK or craftsmanship are in this view optimally adapted but unable to develop. Advocates of this view therefore suggest destabilizing habits to allow alternative, novel ideas and practices to surface (Frichot and Metzger 2016). We find that such interpretations underplay the 'plasticity' of craftsmanship that allows local natural resource users to adapt to social and environmental changes, and also the role of holistic and embedded social-ecological knowledge as a source of innovation for sustainable practices (Barthel, Crumley, and Svedin 2013).

What we have presented, based on two case studies of local resource users, is a reflexive and critical attitude with regard to new practices and technologies of natural resource use. We end here to ask what skilled engagement new practices allow and what engagement is lost with nature, with others, and with ourselves when we abandon older, craft practices in an era where climate change and the reality of environmental degradation force us to reexamination our relation with our natural habitat?

Notes

1. Please note how this definition of co-production (see also Alkon 2013; Comberti et al. 2015; Fischer and Eastwood 2016; Outeiro et al. 2017; Raymond, Giusti, and Barthel 2018) diverges from approaches that define co-production as the co-creation of knowledge by people that are not from the same organisation or social domain (e.g., Tengö et al. 2014).

2. Some reindeer herders still wear boots made from reindeer skin when they are working with their herds. However, the herders in the herding community we visited mostly wear shop-bought boots for work and reindeer skin boots for special occasions such as weddings. Some herders wear reindeer skin boots when it's very cold because they are warmer and more comfortable than boots with hard soles. A compromise for some herders is to buy hard soled covers to slip on over their reindeer skin boots to protect the softer soles from sharp or rough terrain, or when they travel long distances by snowmobile.
3. The online [supplementary material](#) details the ethical protocol we used, including the consent agreements between authors and respondents.
4. The *duojár* described a similar experience. She sews while watching television. She calls sewing her “resting work” and considers it automatic and easy work.
5. By contrast, extinction of the *duojár*'s craftsmanship is recognised as a threat due to its link to reindeer herding which is inextricably linked to *Sámi* culture (Rønning 2007). The crafts school in Jokkmokk, *Samernas Utbildingscentrum* (the *Sámi* Schooling Centre), teaches young *Sámi* men and women, principally from Norwegian and Swedish parts of *Sápmi*, the skills and knowledge to become *duojárs*. By institutionalising craftsmanship and recruiting craftspeople-in-the-making, the skill and knowledge embedded in *Sámi duodji* is passed on.
6. In a similar way, a gillnet roller and sonar device enable the work of the fisher. These aspects were also discussed during the photo elicitation, but left out here for matters of space constraints.

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