Research Article

Updating in the mountains: A sensemaking perspective on ski guiding

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ABSTRACT

For a ski guide, updating on the ever-changing natural conditions and group dynamics is essential to stay safe and provide a good experience for clients. In this paper, we explore how guides update their understanding in the mountains. Our data arise out of a one-season participant ethnography of ski guiding in Norway. The research team had two authors collecting data, one as an "outsider" and another as an "insider". We find that the work of a ski guide involves a process of monitoring, testing, and projecting. Complementing and challenging the avalanche literature, we find that ski guide decision-making is an embodied updating process rather than a cognitive one that happens at "decision points". We highlight the implications of these findings both for guides and researchers.

Management implications:

- Continuous updating is critical for adapting to changing conditions and for breaking with set frames of understanding. Therefore, guides should not overly rely on decision aids or fixed decisions.
- Guides should listen to their intuition when something "feels off" and be in doubt when something "feels right".
- Clients should acknowledge that they are an active part of the setting and, therefore, influence the outcome with both direct and indirect actions.
- Updating relies on the continuous monitoring, testing, and projecting of ecological and social cues. Neither type should be viewed in isolation.

1. Introduction

A ski guide's job is to take paying clients into the mountains. However, the best skiing experiences are often found on avalanche-prone slopes (see Stewart-Patterson, 2014). Avalanche terrain is a complex, ever-changing, and hazardous environment (Landrø, 2021), and ski guides must have a continuously updated understanding of nature's changing conditions and the dynamics of group processes. Consequently, updating – "the process of revising provisional sensemaking to incorporate new cues" (Christianson, 2019, p. 45) – is of critical importance to remaining safe (Sutcliffe et al., 2016), as a failure to update easily becomes disastrous (Whiteman & Cooper, 2011). But we know little about how updating is done in practice. Our research

question is, therefore, how do ski guides update their past sensemaking?

Research into human behaviors in avalanche terrain has mainly focused on the ecological conditions or social biases of single isolated decisions (e.g., Landrø et al., 2020; Mannberg, Hendrikx, & Johnson, 2021). This provides little insight into how continuous updating is achieved. Updating is difficult (Berthod & Müller-Seitz, 2018; Christianson, 2019; Weick, 1993). For example, Kayes (2004) suggests that the infamous 1996 Everest disaster arose from expedition teams failing to update and sense ill-defined and unexpected problems, such as changing weather, as well as topographical features creating bottlenecks, in addition to team dynamics. In combination with the narrowly defined goal (the summit), directive and strong leadership from the guides and limited adaptability caused the deaths of eight guides and

clients. To shed further light on the updating process, we apply a sensemaking lens to the work of ski guides.

Sensemaking is "a process prompted by violated expectations, that involves attending to and bracketing cues in the environment, creating intersubjective meaning through cycles of interpretation and action, and thereby enacting a more ordered environment from which further cues can be drawn" (Maitlis & Christianson, 2014, p. 67). Traditionally, sensemaking has privileged cognitive, narrative, emotional, and physical cues (Sandberg & Tsoukas, 2015, 2020) that are external and directly observable to a researcher. Recently, research has focused on the role of the sensemaker's experiences in addition to the sensory cues (Allen-Collinson et al., 2018; de Rond et al., 2019; Meziani & Cabantous, 2020; Wacquant, 2004) to explore sensemaking more holistically, including "emotional, physical, relational and moral aspects" (de Rond et al., 2019, p. 64). Only recently has a sensemaking lens been used to explore ski guiding, in the context of how planning is achieved, but this has yet to focus on how planning is updated (Løland & Hällgren, 2022). Therefore, this article aims to build on the nascent holistic "from the body" lens (de Rond et al., 2019) to explore how continuous embodied updating revises sense previously made in the mountains.

Our ethnographic fieldwork allows us to make three contributions. First, we outline some of the theoretical differences and similarities between the decision-making-oriented avalanche literature and a sensemaking lens. This has implications for how behaviors in avalanche terrain are studied and theorized. Second, we show how guides update themselves to deliver a safe and memorable trip. We find that ski guiding is best conceived as a perpetual, co-constructed process between the guide, nature, and clients. This allows us to offer an understanding of ski guiding as a *process* rather than decision-making *events*. Third, we show how lived embodied experiences help us to understand how continuous updating is achieved.

2. Theoretical background

2.1. Making decisions in avalanche terrain

Broadly, the avalanche literature follows two streams: an "ecological assessment" stream, and a "social impact" one. The first stream on how skiers assess the risk of ecological conditions, primarily avalanches, including, for instance, snow stability, weather, and slope angle (e.g., Landrø et al., 2020; Thumlert & Haegeli, 2018). The social impact stream shows that social relations impact risk assessment, such as, for example, group pressure, leadership, organizational culture, and skill (e. g., Hallandvik et al., 2017; Johnson et al., 2016; Mannberg, Hendrikx, & Johnson, 2021; Zweifel & Haegeli, 2014). There is a growing interest in social aspects (Ivaldi & Whitehead, 2021), but it is restricted to discursive and cognitive biases that predominantly focus on single decision points despite the dynamic and complex environment. Equipped with primarily quantitative measures, the decision-making process has been divided up into phases (Landrø, 2021, p. 18), the stepwise expansion of decision points (Haegeli & Strong-Cvetich, 2020), or levels of emotional categories under different conditions (Mannberg, Hendrikx, Johnson, et al., 2021). This has led Mannberg et al. (2018) to note that, ideally, human behavior in avalanche terrain should be studied in a real-life setting.

Both the "ecological assessment" and the "social impact" streams rely on decision theory which is a cognitive exercise of choosing among externally existing alternatives. A sensemaking perspective is ontologically different (see Boland, 2008; Løland & Hällgren, 2022; Winch & Maytorena, 2009). First, the assumption in the avalanche literature is that there is a correct answer for the decision-maker to identify, and biases negatively affect the outcome. The result of the cognitive process is a final choice, which ends in (no) action (cf. e.g., Furman et al., 2010; Marengo et al., 2017). Second, there is a focus on a few isolated decisions that are cognitively negotiated. When using these theoretical perspectives, the focus becomes solely on the guide (or skier) and the

guide's decisions during the ski-guiding activity. According to this view, the unit of analysis is the decision to ski or not, and studies try to identify biases and develop techniques (like rules and tools) for effectively avoiding adverse events (see e.g., Landrø, 2021; Mannberg, Hendrikx, Johnson, et al., 2021). This risk simplifying the understanding of the avalanche terrain, which is a dynamic environment where conditions quickly change over space and time, and where obtaining a "right" answer is a mere theoretical exercise. Third, viewing decision-making as a cognitive process positions the environment and the social context ontologically outside of the individual making the decision. From this perspective, the decision-maker is passively trying to determine the best alternative in any given situation.

2.2. Making sense of sensemaking

Sensemaking is new to the outdoor recreation and avalanche literature. A sensemaking lens assumes that "reality is an ongoing accomplishment that emerges from efforts to create order and make retrospective sense of what occurs" (Weick, 1993, p. 635). This contrasts with the essentialism of a decision-making lens where a thing has qualities and attributes that cannot be separated from it. Ontologically, sensemaking is a process in which individuals and groups subjectively create meaning. From a sensemaking perspective, problems and alternatives are not static, nor is there one correct interpretation (Weick, 1995). By reciprocally and continuously referring to the past, present, and future, sensemaking identifies a plausible narrative that helps the agent(s) live in the present (Boland, 2008). Essentially, sensemaking is a process of progressively developed approximations of "what is going on here?" (Weick, 1995; Weick et al., 2005) (see Maitlis & Christianson, 2014; Sandberg & Tsoukas, 2020, for reviews).

A sensemaking lens suggests the importance of emotional, sensorial, and material cues for understanding (Maitlis & Christianson, 2014; Sandberg & Tsoukas, 2020). For example, Whiteman and Cooper (2011) suggest that ecological conditions and processes impact sensemaking as people make intuitive sense of their environments, which unfold irrespective of their presence. Similarly, Good (2020) explores how fishermen make sense of the sea to find their catch. Løland and Hällgren (2022) find that while planning, ski guides work in a socio-ecological embedding process by making sense of who the clients are, and what the mountain conditions are, in their determinations of where to ski. From a social perspective, it is suggested that emotions fuel and conclude sensemaking processes within and between people (Maitlis & Sonenshein, 2010), as individuals become sensitive to others by the way we move and the emotions that we show (Cunliffe & Coupland, 2012). In addition, Maitlis et al. (2013) argue that people are more likely to engage in sensemaking if the trigger leads to moderately intense negative emotions. Updating is integral to all these sensemaking processes.

2.3. Updating past sensemaking

Even with obvious cues, updating is difficult because it requires breaking with a plausible frame of understanding. For instance, Weick (1993) suggests that the firemen in Mann Gulch failed to update their belief that a small fire would build up. When it did, those who held on to previous understandings and tried to outrun the fire died, whereas the surviving leader counter-intuitively made a fire and laid down in the ashes. Berthod and Müller-Seitz (2018) have explored the crash of flight AF 447. They posit that the unfortunate combination of material and human agencies in highly automated systems led to "mindful indifference" that hid small problems from the operators, which accumulated and caused the crash. Similarly, Cornelissen et al. (2014) show how a series of minor misunderstandings influenced by materiality, communication, and emotional framing created a contraction of meaning, ending with police officers shooting an innocent person.

Others succeed in their updating through mindful organizing (see, e. g., Sutcliffe et al., 2016) that emphasizes the "rich awareness of

discriminatory detail" coupled with a "capacity for action" (Weick et al., 1999, p. 88). This perspective privileges the importance of "sweating the small stuff" and making minor adjustments (Vogus & Rerup, 2018). Oftentimes, this implies trusting intuition (Meziani & Cabantous, 2020) and cues that are impossible to discern (de Rond et al., 2019). For instance, aircraft carrier staff may notice a small sign of nervousness in the voice of a pilot who is landing and adapting their activities (Weick & Roberts, 1993). US Navy SEALs may normalize a dynamic environment and train their mental and physical capabilities to embrace uncertainty (Fraher et al., 2017). Finally, in a controlled medical simulation, Christianson (2019) finds that teams that balance ongoing work with updating are the most effective and updating is most effective when the team members doubt and rapidly interpret cues from unexpected events, which they confirm with others, in addition to assessing changes for feedback. Understood in this way, a near-error-free performance is a "dynamic non-event" that is "continuously re-accomplished" (Weick, 2011, p. 21–22). The implication is two-fold. First, there is always the potential of something going wrong. There is no way of knowing about close calls that did not materialize. Second, control is a matter of small, insignificant actions that adjust to changing conditions one minuscule step at a time, rather than setting the direction once and for all.

To understand how people make sense of events, Wacquant's (2004) "carnal sociology" emphasizes the lived experience of a setting. In Wacquant's case, it was boxing. By becoming an apprentice of the pugilistic science and turning the gaze inwards, he began to explore the small intuitive adjustments and rationales in the fighting technique, and how the activity is embedded within society. Utilizing this lens, Mark de Rond describes the lived experience of updating during a close call. While rowing down the Amazon in pitch darkness, de Rond noted the sound of a diesel engine. Suddenly he realized that another boat was almost upon them, threatening to capsize them.

> The guilt of Anton [his rowing partner] drowning on my watch would have likely dispatched me, even if nothing else had. And so, my body did the only thing it knew now to do: it roared. It needed to rouse Anton. It also began to backpaddle mightily, unthinkingly, pushing the stern backward to get the boat out of harm's way while Anton, delirious with sleep, hand-pumped a plastic horn to awaken the jungle … What we did and did not do can only ever be understood (if not excused) when appreciating "how things felt" at the time (de Rond et al., 2019, p. 1974, p. 1974)

One way to study updating is, therefore, to draw upon lived embodied experiences, with the sensemakers being physically and emotionally exposed to the real world. This helps us understand how "sensemaking *felt* to those involved […] and how sensemaking is mediated by embodied experience" (de Rond et al., 2019, p. 1979, original italics). From this perspective, updating is as much about the observable, cognitive, and knowledge-based cues, such as seeing the gradient of a mountain changing to above 30° and thus becoming avalanche-prone, as it is about felt experiences, such as a "bad feeling" when moving onto such a slope. In dangerous settings, it is very much a theory of flesh and, possibly, blood.

To understand the updating process, we must, for the reasons provided above, comprehend the lived experience of people engaged in these settings and grasp the action in the making. Consequently, we head for the mountains.

3. Methodology

3.1. Selecting the research setting

Ski guiding involves providing a high-quality experience to paying clients in an uncontrolled and risky mountainous environment (Stewart-Patterson, 2014). In Norway, ski guides often work alone, or in pairs, with groups typically consisting of four to six clients per guide. The ski-touring trips are based out of lodges and small hotels close to the

mountains, and groups typically ski 1000–1500 vertical meters per day. Rescue services are distant, and the weather is often harsh, calling for self-sufficient groups. This means that guides are uniquely responsible for updating their understanding on behalf of the group, as failing to attend to subtle changes can have significant outcomes.

3.2. Data collection

Sweating the small, often insignificant, stuff as well as activities related to updating call for careful methodological considerations. Instead of using questionnaires or conducting formal interviews, we needed to go "where the action is" (Goffman, 1969) and explore what guides actually do (Geertz, 1973). Others have suggested that ethnographic fieldwork is useful to understand processes and the lived experiences of participants as they interact with nature, and each other (de Rond et al., 2019; Whiteman & Cooper, 2011). By participating in the action, we explored updating as it happened with access to the experiences (de Rond et al., 2019) in line with a social constructionist ontology (Boland, 2008; Hammersley & Atkinson, 2019; Weick, 1995). To access experiences, researchers must become immersed. Immersion is achieved by involvement (the researcher having a role in the organization), engagement (the researcher embracing the participants' way of thinking), constructing the space for the social action (where the action is performed), and duration (spending enough time to go beyond single episodes) (Dumont, 2022). To achieve *involvement* and *engagement*, the primary data for our analysis have been gathered by Stig and Maria, two of the authors, who followed 10 ski guides before, during, and after ski trips. To observe where the *social action was constructed* and identify broader patterns of the work, Stig and Maria did not follow the same guides. Moreover, they immersed themselves in the capacity of a guide and a client, respectively. Stig is an International Federation of Mountain Guides Associations guide with 20 years of guiding experience, and he had the position of co-guide and with it, direct access to his colleague's reasoning, the group climate, and his own experiences. Maria, on the other hand, took the role of a client. Maria is an avid but novice skier without guiding experience. By providing an "outsider" view, she could reflect upon her experiences as a client, and ask guides about perspectives that an insider would take for granted (Hammersley & Atkinson, 2019). To achieve *duration*, they observed 35 days of skiing from January until June 2021.

The fieldwork took place in seven mountain areas with challenging and complex terrain. The avalanche danger levels ranged from moderate to high, and the weather varied from sunshine to zero visibility and strong winds. The ethnographers observed one female and nine male guides. All guides have been given fictitious names and informed consent was obtained before the fieldwork took place. A total of 77 clients participated in the trips, creating, together with the natural conditions, an important context for studying how guides work. In this article, we focus on observations made while in the mountains. In line with an ethnographic approach and processes ensuring validity, initial observations were collected with a broad interest in what ski guides do (Hammersley & Atkinson, 2019). As we gained further insight, our research question became narrower and more specific. To collect the data, both Stig and Maria utilized their phones to make short written notes and voice memos, as well as capture photos and videos (Hammersley & Atkinson, 2019). These data entries were created whenever there was a suitable, non-intrusive moment. Employing a phone for data collection helped to decrease the intrusiveness as everyone, including guides and clients, frequently used their phone to read digital maps, or record the experience by taking pictures.

Data collection focused on the actions and sayings of the guides, and the lived experiences of being exposed to the conditions through an ontology of 'flesh and blood' (de Rond et al., 2019; Wacquant, 2004). This involved, for instance, making notes about the mood in the group, the shifting granularity of the snow, and the feelings of the observers (de Rond et al., 2019; Emerson et al., 2011). For instance, a brief note could

say: "On ridge [where], wind starts picking up [sensory information]. Don't like it [lived experience]. Thinking about options [making sense]". The notes were subsequently expanded into full narratives within 24 h (Hammersley & Atkinson, 2019). Photos, videos, and GPS tracks complemented the insights from the day as they helped to "re-play" the experiences in the researchers' heads. Extensive memoing was conducted during the data expansion phase to identify early themes in the research (Emerson et al., 2011), such as, for example, how changes in snow conditions were assessed by the guide when testing snow stability.

3.3. Analysis

Inspired by grounded theory, we used NVivo to code the empirical material with an inductive analysis strategy (Langley, 1999). Grounded theory is a research method that aims at generating theory which is 'grounded' in raw data that has been systematically collected and analyzed (see e.g., Hammersley & Atkinson, 2019). As noted by Langley (1999, p. 700), grounded theorizing is relevant when studying processes. We found this approach appropriate since during early stages of the analysis, we quickly noted that the sense ski guides make on a ski trip is more ongoing than one-off decisions described in the avalanche literature (see e.g., Furman et al., 2010; Marengo et al., 2017). We therefore started to look for instances of updating. Christianson (2019, p. 55) describes updating as following a sequence of "noticing cues, searching for explanations, and testing those explanations".

To identify cues, we were particularly sensitized to the ecological materiality, social processes, and lived experiences. Examples include what is said and done (or not), gestures and expressions, as well as equipment and how it is used. In addition, cues such as wind, snow surface, slope angle, and visibility were coded. In relation to all of these, we coded personal thoughts, reflections, and feelings. This allowed us to identify how cues would build up to updating as part of the operations.

We made our analysis from the 'bottom up', starting with empirical details and through emerging concepts into a resulting grounded theory (Langley, 1999, p. 700). To do so, inductively, and separately, Maria and Stig coded the transcripts line by line into emergent first-order concepts. The concepts included practices associated with updating, e.g., any first mention of a cue, such as an emotion or ecological condition, and the enactment thereof. Interested in how ski guides operate, we did not conduct a cross-case analysis but used the two datasets to identify differences and similarities in coding the guides' experiences. This was particularly useful as the insider, the outsider, and the non-participant researchers could act as devil's advocates and triangulate the findings (Rerup & Feldman, 2011). After reaching an agreement on the initial codes, the team organized the themes into theoretical dimensions (Gioia et al., 2012). For example, "digging snow pits" and "testing the clients" became "working hands-on". Finally, we developed these second-order findings into three aggregate dimensions (monitoring, testing, and projecting) that describe ski guide updating. This process of going from raw data gradually toward abstract conceptualizations is shown in Fig. 1, the data structure (Gioia et al., 2012). To account for the dynamic interrelationships between concepts, themes, and dimensions, we built Fig. 2 as a grounded theory model showing how the dynamic process of updating happens (Gioia et al., 2012).

4. Guide work as practice

Ski guides work in settings where they must make sense of ecological and social contexts, which are both difficult to assess and continuously evolve. In their professional roles, guides are accountable to the clients and must balance risks with clients' expectations and experiences. Clients' expectations can be in form of direct wishes, such as to visit specific summits or experience steep skiing. Other times the pressure to perform is more subtle, like overhearing clients talk about a "really good guide in Austria" (Stig's fieldnotes). It can also be self-induced pressure, such as

"my own feeling of doing a good or bad job is important […]. Because I know how good a job I can do" (Terje, guide). Altogether, guides' professional role influences their behaviors. Since the best experiences, for many clients, are found in the avalanche-prone slopes, guides must participate in updating practices. We find that guides engage in monitoring, testing, and projecting to continuously re-make sense.

4.1. Monitoring

Monitoring refers to noticing the continuous flow of "small stuff" associated with clients and ecological conditions. As guides monitor what is going on, they pay attention to details that may help in advancing the understanding of the situation to provide a safe and memorable event. For example, one early morning Stig noted that "the air feels warmer than expected [influencing the avalanche conditions]" (fieldnotes). Monitoring does not make sense in isolation, but only when combined with the broader setting in which it unfolds. For example, avalanche conditions have different meanings depending on who is skiing. Maria's guide says that "I was here last weekend with my [expert] friend. The avalanche conditions were bad, I would never have done that [exposed trip] with these [clients]". Monitoring is accomplished in two ways: by perceiving ecological conditions and sensing clients' states. For analytical clarity, we present the practices separately and demonstrate their interdependence at the end.

4.1.1. Perceiving ecological conditions
Perceiving refers to using the senses (eyesight, hearing, taste, touch, and smell) to make sense of the mountain conditions, and the risk of, for example, avalanches. When skiing, guides are constantly mindful of the texture of the snow. They pay attention to differences in the sound of the snow when walking on it, and what the temperature and wind feel like to the touch of the skin. Guides also search for terrain features, like terrain traps. By combining the impressions, guides develop an inner image, beyond the sensory experience, of what the conditions feel like. As Stig reflected in his fieldnotes,

> The peaks are in the clouds, and it snows lightly. It feels like a few degrees below zero. There is 20 cm of fresh snow. When I break trail, the snow does not feel loose, and it does not glide back into the ski tracks. There is no wind here, but there are movements in the clouds higher up. That means that there is snow transportation up there. I get a slight sense of uneasiness. It was not supposed to be that windy. How avalanche-prone is it going to be higher up where it is steeper?

The quality and amount of snow, combined with the signs of wind higher up, suggest an increasing danger of an avalanche. When updating by perceiving, the guide makes connections between the impressions and what they mean and can anticipate the future. The question that arises is whether to stay on the current trajectory or adjust it.

4.1.2. Sensing clients' states
Sensing the clients refers to cues other than spoken ones: "you look at how the clients talk and behave. How they move" (Maria's guide). For example, a guide might notice that a client is lifting the skis higher than necessary when walking and therefore spending more energy. This might have future consequences, like affecting the duration of the trip. Noticing a client who is falling while skiing easy terrain means that exposed steep terrain is not an option, and clients that are laughing and looking around in wonder are most likely enjoying themselves. Generally, this sensing of the clients involves a set of continuously changing cues. There are also situations where guides fail to update or update too late. As captured in Stig's notes:

> Bjørn [client] turns to me, he looks exhausted, with his heavy equipment. Beads of sweat run down his red face. His voice is strained: "Are we really [with emphasis] going into that valley where it is steep on all sides?"
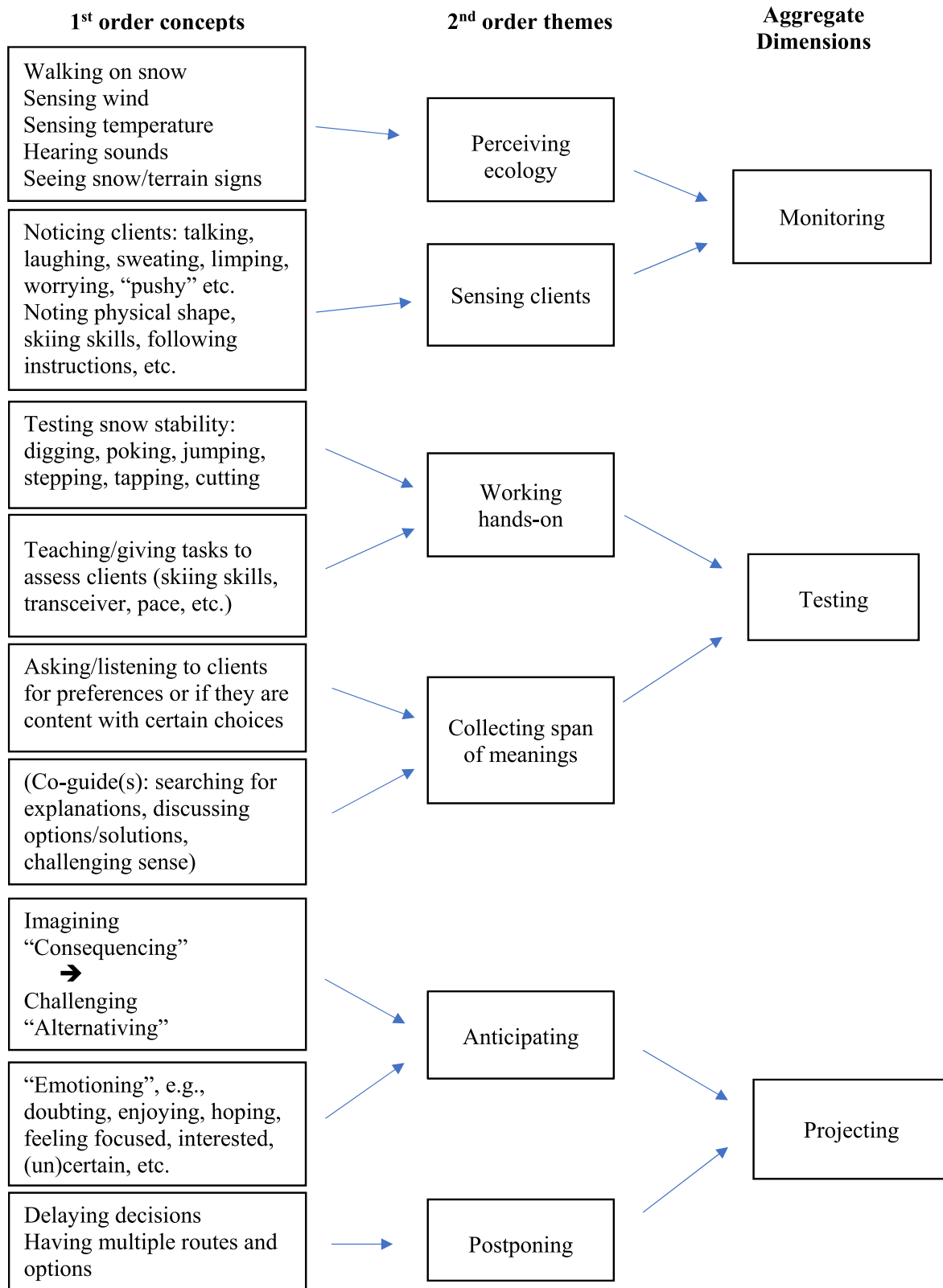
1ˢᵗ order concepts

2ⁿᵈ order themes

Aggregate Dimensions

Walking on snow
Sensing wind
Sensing temperature
Hearing sounds
Seeing snow/terrain signs

Noticing clients: talking, laughing, sweating, limping, worrying, "pushy" etc.
Noting physical shape, skiing skills, following instructions, etc.

Perceiving ecology

Sensing clients

Monitoring

Testing snow stability: digging, poking, jumping, stepping, tapping, cutting

Teaching/giving tasks to assess clients (skiing skills, transceiver, pace, etc.)

Asking/listening to clients for preferences or if they are content with certain choices

(Co-guide(s): searching for explanations, discussing options/solutions, challenging sense)

Working hands-on

Collecting span of meanings

Testing

Imagining
"Consequencing"
➜
Challenging
"Alternativing"

"Emotioning", e.g., doubting, enjoying, hoping, feeling focused, interested, (un)certain, etc.

Delaying decisions
Having multiple routes and options

Anticipating

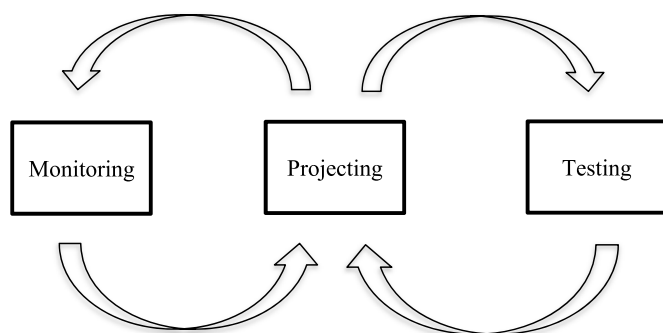Postponing

Projecting

Fig. 1. Data structure.

Fig. 2. The updating processes.

In this case, the guides did not understand how tired one of the clients was before he was almost exhausted, and the client was also worried about the avalanche conditions. Both aspects created a suboptimal experience for the client. We observe that if clients look happy and seem to be managing the environment, guides rarely adjust. But if the collected cues indicate that something is "off", guides consider adjusting. Depending on the context, this could mean walking more slowly, changing the route, and/or explaining, for example, the avalanche conditions.

By both sensing the clients' state and perceiving the conditions, the guides obtain an idea of the future. For example, noticing that "the clients' ski boots look heavy" (Stig's fieldnotes), indicates that the clients will probably walk slowly, but ski fast. When this sense is combined with "bad avalanche conditions" it means that descents that can combine high speed and safe terrain should be considered. Although the guides' continuous monitoring of these cues is relevant, we find that guides utilize other practices to dig deeper.

4.2. Testing

Testing explanations aim at developing a plausible understanding from the cues collected while monitoring. Sometimes these are so subtle that they are but an uneasy feeling, "I have never descended from here before, but my gut feeling says we should not continue" (Maria's guide), and at other times they are clear, like a "whomp" sound from the snowpack, indicating avalanche danger. By testing cues, guides obtain more information and can make a better decision regarding whether they will need to adapt or not. Guides test in two ways: working hands-on and collecting a span of meanings.

4.2.1. Working hands-on

Working hands-on involves physically testing the ecological conditions. The need for testing can be the result of, for example, the angle of a slope, or other cues that have been collected while monitoring. As described the following fieldnotes, Stig decided to work hands-on with the snow because of a lack of information – and because he and the group were entering avalanche terrain:

> I take off my backpack and find the shovel. I dig a snow profile through the snowpack. 30–40 cm with dry snow, loose at the top (F) and gradually firmer (1F) down towards the old snow. The old snow is a melt-freeze layer from previous mild weather. This is a favorable snowpack. I saw out a block in the snow and tap with my hand. ECTN12 in transition to the old snow. Hmm, I become cautious. Are there facets over the crust? I lift the block and look underneath. Is it faceted snow? It does not look like it, but why did it collapse? [I think of] the avalanche forecast stating that there can be remains of old facets on the highest summits. This might be bad.

The experience that the snow is "dry", "loose" or "faceted" is a combination of color, form, and texture that can be seen, heard, and felt by touch. The terminology of (F) and (1F) relates to snow hardness, and

the extended column test (ECT) is a stability test. The initial sense formed into a violated expectation as the test showed more instability than the preliminary understanding. When the testing was combined with knowledge from the avalanche forecast, Stig started doubting whether the slope was safe to ski or not.

Sometimes guides also test their clients. In the following example, the guide intentionally sought steeper sections down in the safer forest to see whether the clients had the skills to go to a specific steep summit. Maria's guide suggested to the group, "'Let's try out the kick turns for a bit'. He positions himself a few meters further up the slope and follows with his gaze" (Maria's fieldnotes). Later, he explained to Maria that the reason that they did not continue towards the summit was that the clients did not have the technical skills, as "they have to be in control or else they will fall off the cliff to certain death". A potentially difficult situation was identified, tested, and developed into plausible future scenarios, and allowed the guide to select more suitable goals for the group.

4.2.2. Collecting a span of meanings

Guides frequently ask for opinions from the members of the group. If there is a co-guide, the guide has the benefit of discussing observations and understandings as they go along. In this example, the guides were on their way up, but discussing where to ski down:

> Simon: Where do you think it is best to ski?
>
> Stig: As close to that cornice as possible, where the snow is untouched and in the shade. The snow is probably best there.
>
> Simon: Agreed. I was wondering if we should go even further to the left [pointing]. But it's too steep and I do not quite like those formations. They can be sideloaded [and form an avalanche].

On the mountain, these discussions are kept brief with the purpose of checking if the other guide is making the same sense. This is a social way of updating and challenging the sense made. This quote also serves as an illustration of how the guides do not only try to avoid accidents but are continuously searching for optimal (skiing) experiences.

As part of achieving good and safe experiences for the clients, guides also ask for clients' opinions and encourage them to speak up if something feels wrong. Guides do not transfer risk assessments to clients, but we frequently observed guides asking clients if they are satisfied with the pace, when to have breaks, and similar inquiries. Sometimes clients can help choose where to ski if the guide has suitable options. For instance, Maria's guide asked the clients: "We could ski down the slope here, then we get some steeper sections, or we could ski back down where we came from. What do you prefer?"

By working hands-on and collecting meanings, the guides uncover possibly hidden cues. By continuously monitoring the context and combining hunches with testing, guides check if the previous sense remains plausible. We also find a third way by which guides update themselves: projecting.

4.3. Projecting

Monitoring and testing help guides update themselves on the current conditions and develop a plausible explanation. However, some situations do not allow themselves to be translated into a compelling explanation, but need to be fitted into a narrative. To accomplish this, guides make inferences about the future, based on existing, plausible understandings. We identify two types of projecting: anticipating and postponing.

4.3.1. Anticipating

Guides anticipate "now what?" in two ways. First, guides consider plausible future scenarios by imagining the consequences of their current actions. Second, anticipation also consists of challenging or doubting current frames of understanding. This, in turn, ends in a search

for different alternative solutions. If there is a co-guide on-site, challenging can be a social activity (as mentioned under collecting span of meanings), but when there is not, it is an individual task. In the following excerpt, where a client had voiced a suggestion for a specific slope, Stig is trying to envision both the consequences of the social and ecological context and challenge his understanding:

> I must go further down. I do not quite like it. As I am about to go forward on the edge where it rolls over, a typical place where avalanches start, I feel the pressure in my neck hairs … If [the avalanche] slides, we will be beaten to death against the rocks on the way down. We will be dead before the avalanche stops. It is 400 m, at least. I do not know the client. I pause to make sense of the bad gut feeling. Is he at all capable of skiing this steep? I do not like it.

The quote also shows that emotions are involved when anticipating the future. In between describing what is said and done, there are personal notes, and quotes from guides, on how the situation feels. This includes "doubt", "relief", "confidence", "hope", "fun", "uncertainty", "enjoying", "feeling thrilled", "feeling safe", "worry", "excited", "flow" and so on. It is consistent across the observations that the more dangerous the conditions were perceived to be, the more prevalent the negative emotional cues were. "Doubting" and a "bad gut feeling" were particularly common when the conditions were challenging. One guide describes these emotions as "when in doubt, you *are* in doubt. Period. It's a horrible work situation. Walking around with gnawing doubts and bad gut feelings all day. In the past, I did it a lot. Now I try to avoid it". Similarly, Maria's guide reflects on the day's events: "Today I felt like the trip was kind of iffy […] That weather. We have wind sacks and all that … but if something were to happen it would not be good. I don't like bringing guests into that stuff". Guides also actively doubt their understanding, as exemplified by Stian (guide) who says, "I wonder if this trip fits these guests, the trip might be a bit too challenging". The emotions do not emerge because the group *is* in a crisis, but because the guides are trying to anticipate the consequences of their actions.

Guides work hard to remove the bad gut feeling by reducing the ambiguity of the situation. For instance, after a few hours of doubting if the avalanche conditions were manageable, when the guides were finally at a high enough point to do a relevant test of the snowpack, Stig was able to

> stick the ski pole in the snow and dig with my hand. There is loose snow on the top, and very hard below. Affected by mild weather. Simon [co-guide] does the same. We exchange glances, and he says, "it must have rained at this altitude too, three days ago, so there are no weak layers left down there." I feel relieved. This means it's safe.

In this excerpt, the combination of Stig's testing of the snowpack and the other guide's comment produced an emotional reaction, a sudden relief after hours of doubt. Similarly, Maria's guide stated that "it feels good to reduce risk when working". In these examples, the emotions are connected to what the cues mean and are both a driving force behind the updating and a result of it. But of course, risky contexts do not always end in bad emotions or turning back. In the next excerpt, by monitoring, testing, and projecting, Stig made sense of the clients' capabilities in relation to the natural context and the potential future consequences:

> A few hundred meters from the summit the ridge is not more than 2–3 m wide. I walk in the rear with the two slowest clients. Falling here is not going to end well. There are hundreds of meters into the abyss. Instead of walking in front of the clients [as I normally do], I walk behind them. Being behind them I can see how they are doing, help them, and catch them before they fall. […]. They don't seem particularly nervous; they are just tired. I ask them if they are ok, and they say yes. Ok, we will continue. The surface is icy and hard, they slip a little but no problem. They are slow but they'll get there. We are in control.

In addition to anticipating, the guides have a second way to project

the future: postponing.

4.3.2. Postponing

Throughout the fieldwork, we observed guides trying to avoid jumping to conclusions. In an environment where the snow conditions, weather, and the capabilities and wishes of the clients can change in time and space, the typical phrase is "we'll just have to see how it looks when we get there" (Maria's guide). The guides also postpone decisions related to their clients, and "base the trip on how [the clients] are doing" (Maria's guide). By avoiding early decisions, guides buy themselves time to collect (monitor, test, and project) more cues to allow themselves to keep updating to a point when, and where, they feel they have a plausible explanation to rely on. When the guides have set up the trip so that there are multiple possible solutions, they can use the different opportunities, and "descend wherever the snow looks good" (Maria's guide). But while Stig was skiing a slope, he noticed that "the snow does not feel soft anymore. There has been more wind than we thought [indicating avalanche danger]. I ski out of the slope and onto a ridge. We need to rethink this" (fieldnotes). Updating never stops.

5. Updating past understanding

Guiding in environments where people may get hurt or killed is a great responsibility. Throughout our fieldwork, we never identified isolated single decision points, nor a situation where there was only one "right" answer. Instead, guide work meant continuously looking for direct or indirect cues which created a temporary, plausible narrative. This observation is consistent with our constructionist ontological perspective where "correctness" and "objectivity" are matters of subjective viewpoints shaped by practices. Finally, this implies that updating is less about noticing objective cues (e.g., about the snowpack), and more about the guide's *feeling* of order (see Weick, 1995, p. 29), and a matter of the "lived experience" (de Rond et al., 2019). This leads us to theorize that guiding is less about cognitive decision-making than continuous embodied updating.

In a setting where accuracy is nothing but a chimera and avoiding an accident can be attributed to sheer luck, guides update and create plausible accounts by reciprocally iterating between monitoring and testing practices of social and ecological conditions. Any set of cues that are identified changes the balance in the sensemaking process. For example, a cue may enforce the plausibility of existing understanding, or it may cause doubt. Furthermore, identified cues alter the meaning of the context (which is a combined result of social and ecological conditions).

Finally, we find that the understanding of the cues impacts how the guide projects the future, and subsequently confirms or disconfirms the sense previously made. The confirmation process, in turn, calls for continuous monitoring and testing to remain in control of the situation. When a guide fails to update, the risk of accidents or an unpleasant experience increases. The updating process is therefore messy, as some cues are obscure. From this perspective, updating is a continuous struggle for control. We illustrate the overall process in Fig. 2.

6. Discussion

In this paper, we explore how previously made sense is revised while ski guiding. To this end, two researchers conducted a season-long ethnography of Norwegian ski guides. Our analysis highlights that ski guiding is embedded within the broader socio-ecological context of which it is a part. We show that ski guiding is not a matter of one-off decisions that keep the group safe, but a constant search for cues and plausible explanations that are used for projecting the future. In the best of situations, this allows ski guides to provide a safe and memorable experience for their clients. More broadly, our findings suggest that ski guiding, as an activity, could be understood as a perpetual process that is co-constructed with clients and nature.

6.1. A socially constructed understanding

Research on decision-making in avalanche terrain has focused on the assessment of social and ecological aspects of decision-making (e.g., Landrø et al., 2021; Mannberg, Hendrikx, Johnson, et al., 2021). Recognizing these aspects has revealed important insights into where things may go wrong. While there are similarities between the literature and a sensemaking lens, such as a concern for how social conditions create pressures to perform, how risk is assessed, and leadership, there are also differences. These include a focus on discursive and cognitive biases associated with single, isolated decisions vis-à-vis a socially constructed understanding of an ongoing process (cf. Winch & Maytorena, 2009).

Ontologically, a socially constructed understanding implies that meaning is attributed to things and situations (Weick, 1995). For example, the snow takes on a different meaning depending on who the others on the trip are. This view also suggests that decisions are the symbolic outcome of a complex process experienced by the sensemaker, rather than externally perceived and cognitively processed by the decision-maker. It also implies that there is no objective truth to be identified, but a (n)ever-ending set of interpretations that may be equally valid at any given point in time. From this perspective, there are no biases, as there is no baseline to be biased from.

Epistemologically, to understand the lived experience of ski guides, we need to understand their daily practice as it unfolds (de Rond et al., 2019; Wacquant, 2004). Without direct experience, we would be less likely to see how the interpretation is constructed. We would tend to focus on the externally available cues rather than the "lived experience" that is challenging to convey in words. Following the suggestion of Goffman (1969) and Mannberg et al. (2018), we need to go where the action is and study ski guiding as it happens. To do this we made used of rather traditional ethnographic fieldwork methods. One could see how other, even more immersed methods could be useful for understanding the process of updating.

6.2. Ski guiding as a process

Our process-centric rather than event-centric take on the work of guiding complements current theorizing on ski guiding in several ways. By promoting an understanding of ski guiding as a process, we emphasize how the activity develops over time, and how cues are reciprocally and continuously co-constructed and compounded (Løland & Hällgren, 2022; Weick, 1995). From this perspective, avoiding failure is not a matter of making the correct assessment, but a dynamic non-event that is continuously re-accomplished by making small adjustments to the understanding of ecological processes and clients' experiences and capabilities (Weick, 2011). When guides engage in updating, they participate in the process of re-accomplishing control. Instead of isolated event-centric assessments, guides make small adjustments to their understanding to avoid the build-up of unnecessarily dangerous situations.

Our findings show the importance of seemingly insignificant conditions for choosing where, how, and why to travel in certain terrain. This makes guides almost obsessively concerned about, e.g., the snow and the weather, as well as how this impacts the clients and the team, and vice-versa, in a continuous process. Thus, what we commonly call a "decision" is but the outcome of a far more complex process of creating a plausible understanding of the future based on our lived experiences (de Rond et al., 2019; Winch & Maytorena, 2009). This challenges current theorizing by suggesting that too much focus on single, isolated decisions risks de-sensitizing the guide (or skier) to the dynamics of the setting (cf. Weick, 1995). From this theoretical vantage point, decisions are subtle and shapeless. In the endless stream of possibilities and constraints, distinct decision points appear symbolic rather than reflecting what is really going on (Winch & Maytorena, 2009). Without attempting to diminish existing great efforts, we thus postulate that the avalanche literature would benefit from an increased sensitivity to its ontological, epistemological, and methodological stances.

6.3. Ski guiding as embodied updating

The ski-guiding literature has a strong focus on expertise on snow and avalanches and disregards the role of the clients (e.g., Stewart-Patterson, 2014; Thumlert & Haegeli, 2018). Based on our findings, we suggest that a focus on clients as passive recipients is incomplete. Clients are an important and active part of shaping guides' behaviors (cf. Løland & Hällgren, 2022). We, therefore, posit that the meaning of the ecological and social conditions changes depending on and through the situation. The implication is two-fold. First, a sole focus on either social aspects or nature, as the unit of analysis, may reveal important findings, but it is inherently partial. Second, past research on updating has focused on how frontline (expert) personnel, such as medical doctors (Christianson, 2019), soldiers (Fraher et al., 2017), aircraft carrier staff (Weick & Roberts, 1993), firefighters (Weick, 1993), and pilots (Berthod & Müller-Seitz, 2018), update their understanding by sweating the small stuff (Vogus & Rerup, 2018). The active role of clients suggests that there are benefits to not using expertise as a guiding light. Even in settings where the less experienced (clients) trust the experienced (guide), the collection of individuals is not, necessarily, an expert group. Depending on the interactions of the group, the level of expertise will thus change. Alternatively, "true" expertise is best assessed when accounting for an ability to adapt to those interactions, regardless of whether or not the others are experts.

We also complement the updating and avalanche literature by drawing attention to the embodied nature of sensemaking where guides are constantly sweating the small socio-ecological "stuff" (Vogus & Rerup, 2018). Drawing upon de Rond et al. (2019), we move beyond embodied sensemaking in the form of sensory reactions and emphasize the intangible "lived experience". This emphasizes the influence of the past, present, and future of the socio-ecological setting. For example, seeing struggling clients (cf. Cunliffe & Coupland, 2012), hearing whump noises (cf. Whiteman & Cooper, 2011), having a bad gut feeling about the avalanche conditions (cf. Maitlis et al., 2013), and sharing sense with co-guides (cf. Maitlis & Sonenshein, 2010) are all parts of the updating process. We suggest that practitioners pay attention to gut feeling and intuition in avalanche terrain (see Landrø et al., 2020; Stewart-Patterson, 2014) by listening to a bad gut feeling, and doubting a good one, as both are likely to make us 'err' on the 'safer' side.

Based on our findings, ski guides do not update because of major shifts but due to small or even no changes (cf. Christianson, 2019; Weick, 1993) in an endless, continuous, and reciprocal process. On the frontline of ski guiding, noticing weak cues (Vogus & Rerup, 2018) and acting them into action (Meziani & Cabantous, 2020) become critical. We find that ski guiding can be *felt*, and we show the embodied meanings. Embodied meanings are a result as well as a driving force of the sweating of the small stuff. Doubting if the sense previously made still makes sense is therefore not merely a cognitive exercise. Our argument is thus similar to Meziani and Cabantous' claim that sensemaking requires a relational whole of corporeality, cognition, materiality, and discourse. We have barely begun to understand the role of the body and sensory cues. Rather than refuting the role of intuition in how safe practices are created, our findings would suggest that we need to understand their role in constructing the same. Disregarding any cue is likely problematic as they provide important but partial understandings of the setting, and one may fail to update effectively if relying too much on either. Accordingly, treating avalanche risk as a dynamic non-event means that skiers will be slightly safer.

7. Boundary conditions and future research

As with all research methods, there are limitations to ethnography. The number of cases that can be explored is limited. Still, we have overcome this limitation by spending six months on fieldwork. In

addition, since the findings in this article are based on the embodied experiences of the researchers, it may be argued that the generalizability of the findings is restricted. However, we have triangulated our findings by utilizing an insider, an outsider, and two non-participating researchers. Although not all guides or clients react similarly in similar situations, we still believe the findings to be relevant for describing the overall process. Moreover, we have studied ski guiding in a Norwegian context. Guiding practices here may differ from, for instance, guiding in the Alps or North America. Therefore, future research should explore these possible differences and similarities. Based on our experiences, not reported here and thus not discussed in detail, the general embodied socio-ecological updating process is believed to be similar.

Based on our findings, we postulate that future research should use methods that can capture human behavior in avalanche terrain as an ongoing embodied socio-ecological process. Ethnography is but one such method. However, we do not recommend that researchers embark on ethnographic studies in risky environments without carefully considering ethics and safety. Finally, this article has focused on ski guides. We still know little about the clients' lived experiences, so future research should consider studying them.

8. Conclusions

In this article, we explore how ski guides revise the sense previously made. Based on a season-long enactive ethnography by two researchers, with the two different perspectives of guide and client, we show that guides engage in three primary practices to update themselves on the group and the natural conditions: monitoring, testing, and projecting. By viewing ski guiding as an ongoing sensemaking process consisting of lived embodied experiences, rather than cognitive decision-making events, we show how guides continuously balance clients' expectations and skills on the one hand and nature's possibilities and constraints on the other. This has significant implications for the avalanche literature, as these perspectives provide important nuances which we suggest may be important for the survival of guides and clients, alike.

CRediT authorship contribution statement

Declaration of competing interest

Data availability

Data will be made available on request.

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