From Start to Finish: Understanding Group Sharing Behavior in a Backcountry Skiing Community

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Abstract
The availability of contextually relevant information is often safety-critical while practicing extreme outdoor sports. Off-piste skiing is not an exception. This activity requires group communication and information sharing before, during, and after each descent. We are reporting on the results of an exploratory research study that we conducted with an experienced group of seven backcountry skiers. Using grounded theory methods to evaluate data from participants, we discovered that "Sharing" is one of the key pillars contributing to a positive skiing experience. This poster describes current information sharing practices that emerged from the data analysis. We also present several design ideas from our participants for mobile and wearable devices / services to assist backcountry winter activities in the stages of planning, execution and follow-up.

Author Keywords
Information sharing practices; user requirements; skiing; exploratory research; qualitative data analysis; focus group; concept design.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

Skiing can be a highly social activity where participants can enjoy time outdoors, catch up with each other, and at the same time do a fair amount of physical exercise. As a group activity, downhill skiing sees groups typically ranging from 2 to a dozen people or more. Backcountry or "off-piste" skiing is a highly demanding specialization of downhill skiing. It requires experience, good analytical and physical conditions, and special attention to safety during the descent on an unmarked slope. In off-piste skiing, forming a group is crucial for safety.

In our current work, we seek to understand information sharing behavior in outdoor sports, such as running, cycling, or skiing. To this end, we conducted a focus group study with a group of backcountry skiers in a French Alps resort. We wanted to know what information – related to their skiing activities – they would share with each other; how they would share this information; with whom they would share it; and when this sharing would take place. Additionally, we asked participants in a separate ideation exercise to sketch devices, services, and tools that they would like to use in order to help them plan, coordinate, and analyze their group skiing activity.

Related Work

Several studies have looked at the skiing domain, mostly from a technology perspective. Pfleging et al. have outlined an emerging ubiquitous connectivity in the mountains [11], where smartphones are used extensively on the slope and ski lifts support wireless access. Weilenmann and Holmquist prototyped a wearable computer to support communication during skiing, though its most significant benefits turned out to be in facilitating informal social interaction than actual skiing activities [12]. Jambon and Meillon have evaluated a system that supports piste skiing [9]. Dunlop et al. discussed the importance of visualizing ski data using familiar resort maps, rather than generic online maps (e.g. Google Maps) [5]. We have not come across any empirical studies that evaluated group behavior and sharing practices of a backcountry skiing community, where we believe the novelty of our contribution lays in.

The area of technology-mediated physical exercises has been extensively studied. Ahtinen et al. explored tracking aspects of outdoor sports and its motivations for exercising [1]. Curmi et al. provided an athlete's biometric information in real time to external observers and supporters in order to facilitate social interaction during sport events [4]. Ojala has provided fruitful results on understanding social needs and motivations to share data in online sport communities [10]. Consolvo et al. has studied technology-mediated physical activity that supports social sharing among friends [3]. In our work, we are trying to understand the influence of exercise context on information sharing practices in outdoor sports, e.g., to understand differences between running and skiing communities.

Study Design

We recruited seven experienced backcountry skiers and organized a group interview with them to identify their information sharing practices before, during and after the skiing activity. Additionally, following a participatory

design methodology [8], we had them collaboratively sketched a series of interfaces and services that could help a backcountry skiing community to share necessary information during their group rides.

Our participants were 4 males and 3 females, ranging from 25 to 31 years of age. All were working – one participant as an architect, the rest as engineers in industry or in research. Each participant had daily exposure to technology, possessed a personal smartphone and actively used it during the day for both professional and personal purposes. Participants identified their skill level of backcountry skiing from "upper-intermediate" to "advanced". Each group member also had extensive experience in on-piste skiing. Their motivations to change to off-piste skiing varied from simply following friends to exploring new techniques to challenging their own abilities.

We conducted two moderated discussion sessions on two different evenings during a two-week skiing holiday (taking place in early February) where each group member was out skiing every day. The first session was an introductory one and took half an hour. It was aimed to assess participants' attitude toward technology usage during their skiing vacations and present the format, the nature, and the objectives of our study. The second session took 45 minutes and was dedicated to explore group communication, behavioral and contextual aspects of off-piste group skiing, and to learn about personal experiences with technologies while skiing. At the end of the second session, we prepared a creative follow-up activity where we invited participants to sketch ideas for mobile devices and services that would address the challenges they just identified during the moderated discussion session. This additional session took another 45 min and included sketching, the presentation of ideas, and a discussion of their sketches. On several days, we also observed the group while skiing.

Data Analysis

We recorded all sessions using both a voice recorder and a separate video camera, and later transcribed the footage verbatim. Two researchers employed an open coding technique from grounded theory to analyze the collected qualitative data [7]. Using a professional analysis software (Atlas.ti [2]) we then constructed logical relationships among sociological constructs, organized codes into categories and, eventually, explored emerging themes.

We were positively surprised by the richness of insights collected from this small-scale study. Seven main themes emerged from the focus group discussion: (1) group communication; (2) group behavior; (3) contextual considerations; (4) technology usage; (5) tracking attitudes; (6) information sharing; and (7) user experience. While all seven themes contributed to a positive skiing experience, we initially decided to focus predominantly on information sharing activities and attitudes. Information sharing is particularly important in backcountry skiing, as it is critical for safety and decision making, supports skill acquisition, and facilitates social bonding and outreach.

Current Information Sharing Practices

As one can imagine, any group skiing activity usually starts with a planning of a trip. Our participants were carrying out a discussion related to the preparation and organization of the trip over E-Mail. This form of group communication was chosen over other options, e.g.,

social networking or IM chat, because of its wide adoption. Every group member had an E-mail account, while membership in social networks and choice of the IM clients varied heterogeneously.

During the actual skiing activity, group members shared a variety of information with each other: location, media (both with co-located and remote participants), and relevant reference information.

Location sharing
Personal location sharing is often a necessity when one is lost on the mountain or finds oneself in any other kind of emergency. It is tightly linked with skier safety and uses any means of technology available at hand, like a mobile phone or a walkie-talkie to communicate orally one's current (suspected) position to the nearest member of a group or to a local rescue service. Several participants had used location sharing via an online map with close group members when they had been lost. Normally, they supplemented this map information with several telephone calls or radio sessions to direct the lost skier to a familiar area to meet the rest of the group. In case of an emergency, location sharing obviously had to happen with a minimum of interaction needed. All of our participants carried both avalanche beacons and beacon detectors with them for short-range localization in such an emergency. Obviously, participants shared their location also in less dramatic situations, e.g., when members of the group needed to schedule a meeting with each other during or after a ski day. However, due to the typically high roaming costs, Internet usage is often very limited on the slope and participants preferred to arrange such meetings in advance using paper maps and meeting times, or to make a few short telephone calls.

Media sharing
Taking photos and videos during the skiing day was prevalent among our participants, who often liked to share these with friends and family right away (i.e., on the slope) to express their excitement and to feel more connected with each other. From the group interviews and our own field observations, we found that participants carried a number of media capturing devices with them during the day, ranging from smartphones and point-and-shoot cameras to high-end DSLR cameras and hi-performance camcorders. Our seven participants had four GoPro extreme sport camcorders among them, which they use extensively. For example, the group reported that they had collected over 100Gb of raw video material during their last two-week ski-trip in the previous year. Collection of these shared media usually happened during an evening reflection session or at the end of the trip when everybody would still be on site. A volunteer usually collects pictures and videos from other members and organizes a file transfer. The shared repository comprises media taken from phones, cameras and camcorders. The repository is eventually uploaded and shared via a cloud service upon arrival at home. Access to the media repository is granted exclusively to the members of the skiing group. Filtering of the media is often a responsibility of each participant before transferring to the common repository. It is quite common to have lots of raw materials sitting for months and years untouched after the end of the trip. The group that we interviewed had a tradition to do a final film of each of their ski trips, featuring memorable, exciting moments during their rides. However, editing of the film always takes a lot of time and dedication and is, usually, the endeavor of a sole enthusiast.

Upon availability of an Internet connection (e.g., free WiFi) during the day, participants usually shared photos with selected friends and family, or sometimes publicly, augmented with a status update on a social network profile. Almost all participants used their smartphones to support such activity. After the trip ends, participants often do their own selection and re-share material to an extended group of friends and family. Sometimes the final film of the ski trip is made available on social networks for public viewing. Group members could opt-in to be tagged in the video clip.

Sharing context-relevant reference information
The availability of contextually relevant information is often crucial for an enjoyable skiing experience during descent and overall during the whole ski trip. Reference information worth sharing for backcountry skiers includes the time left until sunset, the operational hours of a lift service at a particular location, conditions of the slope with detailed information about potential hazards during descent, such as crevices, sudden drop-offs, and cliffs. Sharing such information is typically time-critical. Our participants typically communicated such information orally, using radio transceivers (walkie-talkie), mobile phones, or simply by shouting while on a slope.

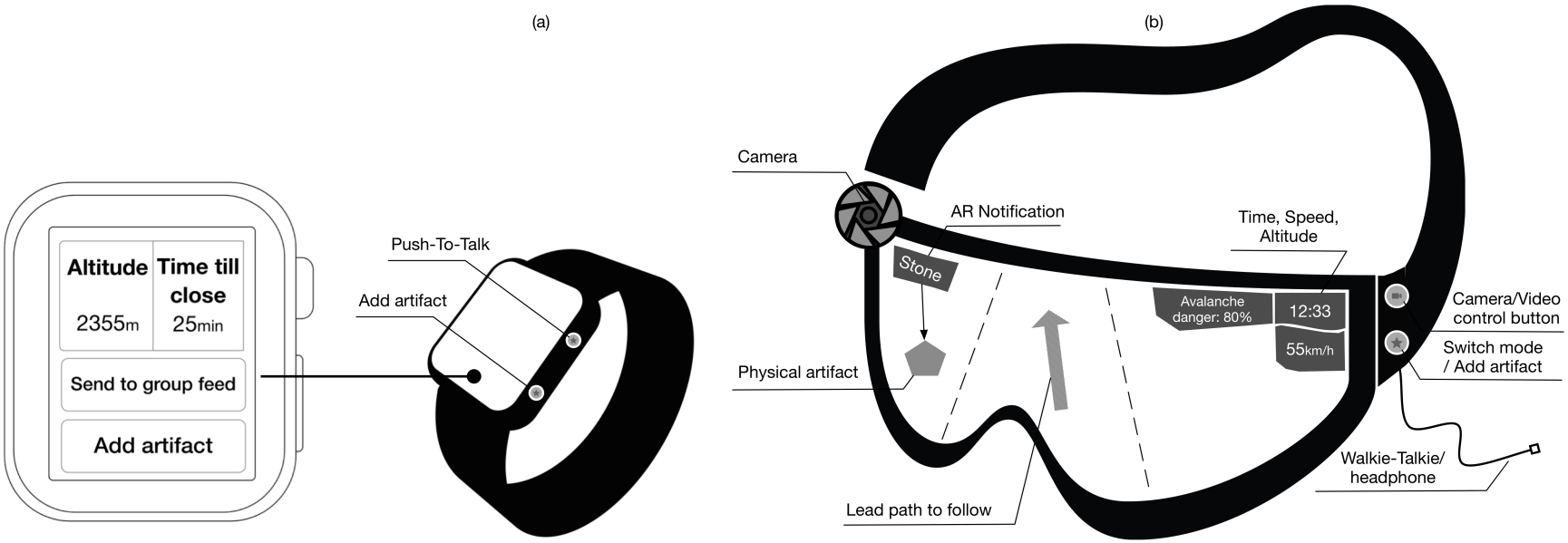
Design Ideas for Content Sharing

During the on-site participatory design session, several ideas emerged that explored alternative methods of communicating information of immediate need, as well as sharing location and captured media. We describe three such ideas below: *Assistive real-time reference feed,* an *Activity Journal* and *Shared Tracks.* Table 1 describes how these design ideas fit the elicited sharing needs and practices of the skiers.

Design Idea	Sharing Practice
Assistive real-time reference feed presented on AR goggles	Reference information, Location
Activity journal	Media, Location
Shared tracks on the map	Location, Reference information

Table 1: Mapping design ideas to information sharing practices

An assistive real-time reference feed
Participants designed a set of Augmented Reality-enabled Ski goggles that would inform members of the ski group about potential hazards during off-piste descents, such as tree wells, uncovered rocks, cliffs, bad weather conditions and, most importantly, avalanches. Group members and other skiers would collect this information in a crowdsourcing manner and provide it directly on a ski goggle display in form of virtual notification for each member of the group. Visual notes carry embedded geolocation information and hence can be linked to a physical environment accordingly (Figure 1b). The presentation of contextual notifications has to be performed in a non-intrusive manner and must insure low cognitive load during a skiing activity. Any group member could register a virtual notification and send it to a "safety feed" using a wrist-worn device or a physical button on the goggle itself (Figure 1). Notifications would be automatically broadcasted to group members and would be promptly available on their goggle displays. A "track" of the group lead would be always visible to the rest of the group members and could be consulted against during their own descent. The trajectory of the lead would be overlaid on the physical environment and virtually represented on the transparent display in form of a continuous line or an arrow to where skier should be heading next to meet a group (Figure 1b).



An example of smartwatch-like user interface for skiers

Figure 1: (a) A wrist-worn device to assist skiers. Generic watch image CC BY 3.0 Sherrinford on the Noun Project. (b) An Augmented Reality ski goggles provides contextual notifications from group's "safety feed", includes "track" of the lead to follow and custom reference information. Original goggles image CC0 1.0 Icons8 on the Noun Project.

Continuously populated activity journal

A shared feed is another idea that arose from the participatory design session. Participants were enthusiastic to have a "group feed" in form of a daily journal (Figure 2) that could be automatically populated with media, POIs, and contextual and statistical details of the skiing activity, and which would be accessible online through a mobile phone or a personal computer. The feed would show user-captured events that present these on a timeline. Events could be added via a simple tap on a smartwatch-like device (Figure 1a callout) or through physical controls on the ski goggles (Figure 1b) or one's helmet. This "group feed" populated by custom events and memories of participants could be used as a trip report or a blog to create a narrative about ski vacations for the group members. The feed would be automatically shared among participants with an option to grant access to external observers who want to follow a particular participant or the entire group in near real time. Apart from pictures, videos, paths traversed, and maps the feed could feature some relevant tracking and reference information about a location and activity (e.g. an après-ski party). The shared content of the feed could be a good conversation starter during evening reflection sessions, e.g. when some participants decided to split from the group and ski in another resort. The automatic creation of a film from various media captured by participants

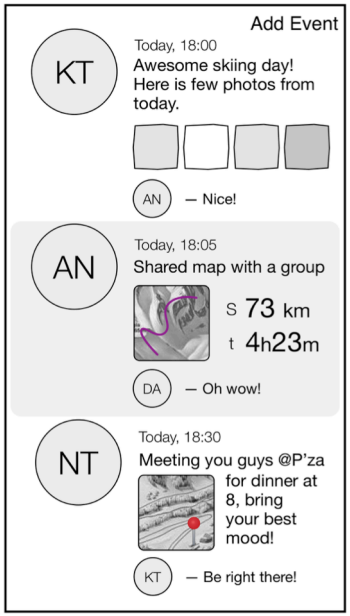


Figure 2: A shared group feed is populated in semi-automatic fashion with user-captured events. Group members can grant access to extended circles

would solve the problem of gigabytes of raw media sitting untouched on participant's hard drives.

This shared group feed could be an interesting opportunity for group members and external observers to feel more connected, facilitate face-to-face and remote conversations, and strengthen social ties.

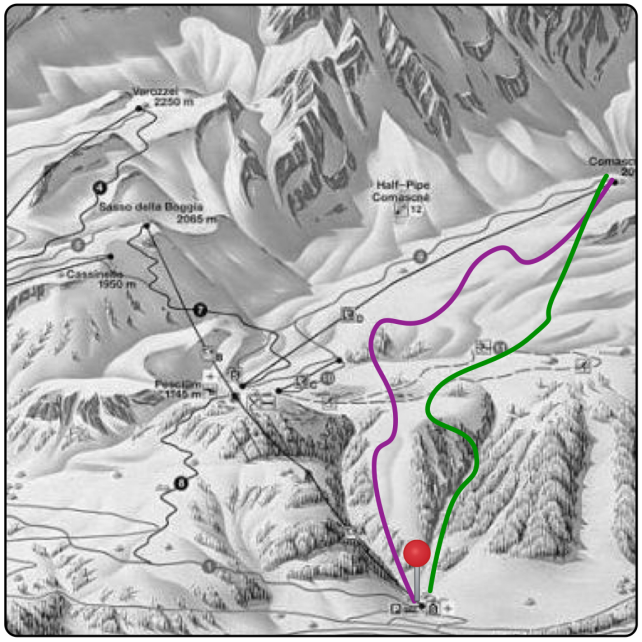


Figure 3: Ski "tracks" shared between two group members on the familiar ski map of the resort. Background image source: authors' personal photo of resort map.

Sharing map with another participants

Participants found it interesting to be able to overlay their own traversed path complemented with statistical data (e.g. average speed, elevation drop) during a ski day with that of another participant, both for individual analysis and for collaborative, face-to-face reflections about performance and style. As Dunlop et al. pointed out [5] it would be important to visualize these tracks on a familiar ski map of the resort, not simply a standard online map (Figure 3). In addition to tracks, it would also be useful to display contextually relevant reference information about a ski area in order to plan a descent and receive peers' recommendations.

Future Work

Our exploratory study generated seven preliminary themes from qualitative data analysis: (1) group communication; (2) group behavior; (3) context of activity; (4) technology usage; (5) user experience considerations; (6) sport-related data collection and (7) information sharing. We plan to conduct further focus groups with both skiers and other outdoor sports enthusiasts to develop those themes individually. Ultimately, we would like to convert our findings into a set of design recommendations, eventually leading to the implementation of new sharing interfaces and devices in the context of outdoor sport. A first step towards this may be to validate the three design solutions described above with a different group of skiers in order to see how these meet their sharing needs. We also see value in building an empirical data-sharing model and validating it in the context of other outdoor sports communities, like runners and cyclists. Involving a theoretical framework like communicative ecologies [6] could help to strengthen this research further.

Conclusion

In this work, we discussed group sharing behavior and practices of backcountry skiers. During two focus group studies with seven experienced free-ride skiers, we

discovered that location, media, and reference data are among the most-shared types of information that group members engage with before, during, and after a skiing activity. Additionally, several ideas emerged from a participatory design session that would facilitate the sharing of such data among group members and beyond to families and friends.

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References

1. Aino Ahtinen, Minna Isomursu, Ykä Huhtala, Jussi Kaasinen, Jukka Salminen, Jonna Häkkilä. 2008. Tracking Outdoor Sports – User Experience Perspective. In *Ambient Intelligence, Lecture Notes in Computer Science Vol. 5355*, Emile Aarts, James L. Crowley, et al., (Eds.). Springer Berlin Heidelberg, 192–209.
2. Atlas.ti. 2015. Retrieved May 6, 2015 from http://atlasti.com
3. Sunny Consolvo, Katherine Everitt, Ian Smith, and James A. Landay. 2006. Design requirements for technologies that encourage physical activity. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '06), 457-466. http://doi.acm.org/10.1145/1124772.1124840
4. Franco Curmi, Maria Angela Ferrario, Jen Southern, and Jon Whittle. 2013. HeartLink: open broadcast of live biometric data to social networks. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '13), 1749-1758. http://doi.acm.org/10.1145/2470654.2466231
5. Mark D Dunlop, Brian Elsey, and Michelle Montgomery Masters. 2007. Dynamic visualisation of ski data: a context aware mobile piste map. In *Proceedings of the 9th international conference on Human computer interaction with mobile devices and services* (MobileHCI '07), 375-378. http://doi.acm.org/10.1145/1377999.1378040
6. Marcus Foth and Greg Hearn. 2007. Networked Individualism of Urban Residents: Discovering the communicative ecology in inner-city apartment buildings. *Information, Communication & Society* 10, 5: 749–772.
7. Barney G. Glaser and Anselm L. Strauss. 2009. *The discovery of grounded theory: Strategies for qualitative research.* Transaction Publishers, Piscataway, NJ.
8. Judith Gregory. 2003. Scandinavian approaches to participatory design. *International Journal of Engineering Education* 19, 1: 62–74.
9. Francis Jambon and Brigitte Meillon. 2009. User experience evaluation in the wild. In *CHI '09 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '09), 4069-4074. http://doi.acm.org/10.1145/1520340.1520619
10. Jarno Ojala. 2013. Personal content in online sports communities: motivations to capture and share personal exercise data. *International Journal of Social and Humanistic Computing* 2, 1/2: 68–85.
11. Bastian Pfleging, Albrecht Schmidt and Florian Michahelles. 2013. Ubiquitous Connectivity in the Mountains: Enhancing the Ski Experience. *IEEE Pervasive Computing* 12, 2: 5–9.
12. Alexandra Weilenmann and Lars E. Holmquist. 1999. Hummingbirds go skiing: using wearable computers to support social interaction. In *Digest of Papers of The Third International Symposium on Wearable Computers* (ISWC '99), 191–192. http://dx.doi.org/10.1109/ISWC.1999.806924