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Whither wilderness? An investigation of technology use by long-distance backpackers

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Abstract

The popular outdoor pursuit of backpacking is profoundly changing as the community embraces contemporary information technologies. However, there is little empirical evidence on the adoption and use of consumer electronics by backpackers, nor the implications this has for their habits, practices, and interactions. We investigate long-distance backpackers' articulations with mobile information technology during the TGO Challenge, a coast-to-coast crossing of the Scottish Highlands. By employing mixed methods, we explore how and why backpackers use such technology when planning and undertaking their journeys via a survey (n = 116), pre- and post-challenge interviews with selected TGO participants, and daily in-field video-logs. Our results suggest many advantages to using technology in this context, including fluidity of communications and access, while noting that reliance on technology is leading to issues such as increased need for battery power management, and deskilling. The findings highlight implications for the juxtaposition between outdoor recreation, information behavior, and human computer interaction (HCI) and suggest future work in this area.

1 | INTRODUCTION

> "*Well, you know, technology, electronic technology... this has been the huge change in backpacking since I began. Nothing else has come along that didn't exist when I began and has revolutionised everything*" Participant P07

Backpacking involves immersive walking in nature while carrying what is needed for survival (including food, shelter, and cooking systems) for more than one day over tens, hundreds, or thousands of miles (Mueser, 1997). Backpacking and hiking are very popular outdoor pastimes—in 2017 44.9 million Americans (15.1%) said they hiked and 10.98 million (3.7%) said they backpacked (Outdoor Industry Association, 2018). Such pursuits are as old as humanity itself; however, tools for navigating through the wilderness and motivations for doing so have changed considerably over time (Amato, 2004). A relatively recent, and quite dramatic, change to this scene is the deployment of digital information and communication technologies (Borrie, 2000). The introduction and use of Global Positioning System (GPS) units, Internet-connected smartphones, satellite-based personal locators, and smart watches are having a profound effect on how people approach and enjoy such activities (Martin, 2017).

These mobile information technologies allow backpackers to navigate wild and complex terrain without significant recourse to learned outdoor skills, provided they are able to use a smartphone and an app. Such tools facilitate access to and knowledge of wilderness areas in ways that disrupts established patterns of wilderness behavior. Although there are many potential benefits to such technologies, there are concerns that excessive reliance on

them may lead to physiological distancing from the activity itself or even to a potentially dangerous lack of knowledge (Shultis, 2012). There has been interest in this area of research in fields as diverse as environmental medicine (Hung & Townes, 2007), park management (Martin, 2017), information science (Hyatt, 2017), and human computer interaction (HCI; Biedermann, Aleksejeva, Mikkonen, & Wilde, 2018).

This paper considers these increasingly ubiquitous information and communication technologies from the perspectives of Information Science contexts, including information behavior (Chang, 2009; Savolainen, 2007; Tinto & Ruthven, 2016) and human–computer interaction. The work on information behavior and sharing readily complements research into social dynamics (Hall, Widen, & Paterson, 2010) with backpacking being an original context for what Stebbins (2015) and Hartel (2005) frame as *serious leisure*. Extant HCI studies have largely focused on designing and deploying new applications, sometimes generically related to nature travels (Pielot, Kazakova, Hesselmann, Heuten, & Boll, 2012) rather than specific to backpacking (Biedermann et al., 2018; Häkkilä et al., 2017). Systematic empirical research on the use of off-the-shelf technologies is not well represented in the literature. Work to date has been either largely theoretical in nature, based on only surveys or questionnaires, or derived from auto-ethnographic accounts of a single researcher (Dix, 2017, 2018; Mueller & Pell, 2016) and has not investigated community use of such technologies in long-distance backpacking contexts (Shultis, 2012).

Our multi-participant, mixed-method research considers the role of mobile communication, mapping and health tracking technologies in the long-distance 2019 TGO Challenge (The Great Outdoors Challenge[1]), an annual event in which 400 backpackers walk coast-to-coast across the Scottish Highlands. The study investigates how participants use such technologies to plan and support their activities and to interact with others during their journeys. Results are based on a survey ($n = 116$), pre- and post-TGO interviews, and self-reported videologs (short videos in a diary-like format, henceforth "vlogs") from an in-field study of eight backpackers over a period of approximately two weeks. We use a mixture of quantitative analysis of the survey data, and qualitative thematic analysis of the interviews and vlogs to gain in-context understanding of the impact of modern technology on backpacking.

This paper builds upon the work of Harmon (2015) and Dix (2017) by extending the planning phases they discuss into a multiuser study of a specific social group, developing rich insights into individual and group strategies for technological interaction through all parts of the hiking experience. The study examines the dynamics and technological interactions of a singular social community in motion and investigates technology's role in enabling and enhancing the social nature of the TGO Challenge. We show how such technology can act as a gateway into backpacking that might enhance or ameliorate lived experience, creating potential for opportunity, reward, risk, and danger.

2 | BACKGROUND AND RELATED WORK

Work on the adoption and use of information and communication technologies by the backpacking community in recent years has largely considered their impacts in wilderness settings, backcountry management practices, and safety issues. While our study is situated in the UK, it should be noted that much extant literature pertains to the North American experience.

2.1 | Information behavior and serious leisure

A key thread running through the study is the nature of information behavior exhibited by long-distance backpackers. As an intense outdoor activity, backpacking requires specific knowledge and skills, perseverance, and dedication, and necessitates ongoing information seeking, access, and use prior to, during, and after the backpacking experience. Furthermore, backpacking provides a sense of community, identity, and values. In this sense, backpacking can be understood as a *serious leisure* pursuit (Stebbins, 2015).

Hartel (2005) suggests that serious leisure offers a useful interdisciplinary lens for studying information behavior in original contexts; backpacking represents one such uncharted territory. Backpacking is normally a non-competitive activity, occurring outdoors and enjoyed in one's spare time. Exceptionally, it may become a professional paid career (e.g., as a guide, gear tester, or instructor) and include a competitive element, where backpackers may be vying for Fastest Known Times (FKTs; PCTA, 2012). A complementary classification for such pursuits is "nature challenge activity (NCA)," proposed by Stebbins (2005). Such a concept was considered further by Davidson and Stebbins (2011) in an exploratory desk-based study looking at the sustainable consumption of the outdoors. An NCA is defined by the authors as "a leisure pursuit whose core activity or activities center on meeting a natural test posed by one or more of the six elements." From this perspective,

backpacking can be categorized as a land-based activity providing a sense of satisfaction when achieving endurance, self-reliance, and being in flow.

The types and dynamics of information activities in serious leisure have been discussed by Hartel, Cox, and Griffin (2016) in testing Hektor's model of information behavior (Hektor, 2001). While appreciating how such models support comparative and more precise research insights in serious leisure, the authors also noted some shortcomings, including the need to further examine embodied information, and the blurring of boundaries brought by social media in relation to communicating and giving information. The mobile technologies we consider provide increasingly convenient ways to obtain and share information, offering backpackers a range of support tools. People often share information essential to the task at hand while mobile (Sohn, Li, Griswold, & Hollan, 2008) and the increase in everyday information sharing creates a sense of being connected, fostering communities, and improving friendships and relationships (Savolainen, 2007; Tinto & Ruthven, 2016). The behavior of backpackers is often shaped by information technology and these tools can support access to key information sources in situ. The availability of information in-context will significantly affect the way it is used, shared, and communicated. Timely access to information ultimately supports decision making, which can directly impact a backpacker's well-being.

2.2 | Technology in the wilderness

Early work in the field concentrates on land management and wilderness issues, offering largely anecdotal reports of concerns regarding technology. Ewert and Hollenhorst (1997) contends that "less experienced participants who place a greater dependency and reliance on technology" will be more prevalent in adventure recreation over time; a view that perpetuates in the literature. Borrie (2000) note the disruptive nature of technologies, postulating that "Of the many threats to wilderness, the impact of technology is one of the most troublesome" suggesting that technology supplants wilderness experience. Similarly, Dickson (2004) explores the tensions between space, connectivity, risk management, and authentic experience asking "Where is the balance between a connection and experience of the natural world versus a technology-dependent and dominated experience?" Noting an increase in accident reporting by cell phone, Attarian (2002) suggests that technology "may also create a false sense of security, especially if climbers believe that help is just a phone call away."

This trend continues with Van Horn (2007) highlighting potential conflicts between wilderness preservation and use of GPS and Internet technologies to share information about access to fragile areas. Pohl (2006) suggests the adoption of "responsible simplicity" as an ethical mechanism to limit technology in the backcountry to an appropriate extent without diminishing the wilderness experience. Shultis (2012) concludes that studies of technological impacts on wilderness would benefit from an interdisciplinary or mixed methods approach. Dustin, Beck, and Rose (2017) contends in general that "smartphones are antithetical to a wilderness experience," while Martin (2017) summarizes much of the extant literature noting that technology has wrought largely inextricable changes to outdoor recreation.

2.3 | Backpackers' changing experience

The contemporary backpacker can navigate by using a smartphone app and GPS, and while this freedom of opportunity brings reward, it also invites risk. For example, Martin and Blackwell (2016) note a possible rise in solo and off-trail journeys in wilderness areas by those who carry PLBs (Personal Locator Beacons). This 2011 survey of 635 people notes that 29% of respondents carried smartphones, 26% a GPS, and 15% a PLB. A later 2018 survey of 502 hikers (Halfwayanywhere, 2018) states that 98.8% carried a smartphone, while 95.4% used smartphone-based mapping and navigational applications. Detailed studies on the extent and usage of technology in the backpacking sector are scarce: our questionnaire, while largely location and event specific, sheds further light on backpacker technology use.

Harmon (2015) investigated different forms of disconnection from digital technologies from the lens of computing as context, and also considered the connecting and disconnecting behaviors of hikers met during a 5-month backpacking trip along the 2,600-mile Pacific Crest Trail (PCT) in the United States. Mueller and Pell (2016) provide an auto-ethnographic account of a single researcher during an expedition via Nepal to Mt. Everest, disrupted by two earthquakes. Part of this work identified key occasions where technology supported as well as hindered the adventure and calls for designers of future hiking technologies to support rather than lessen and sanitize adventure. This was echoed by an ACM 2017 Technology on the Trail workshop, which considered "developing ways for technology to support positive and mutually beneficial connections among people" (McCrickard et al, 2018).

Within technology-related studies on hiking and backpacking, the most pertinent to our research is Dix's

2013 long-distance walk in Wales (Dix, 2017, 2018). During three and half months on foot, Dix embarked upon a formidable auto-ethnographic study employing multiple data collection instruments while adopting walking as a method to explore the sociability of such embodied activity. The wealth of data from this study led to a grounded theory framework primarily focused on the social engagement and experience of walking (Asimakopoulos & Dix, 2017). This highlights some of the specific features and challenges to the backpacking community and their real-life use of technology.

2.4 | Power management

The penetration of ubiquitous consumer electronics into backpacking communities highlights the battery life and power issues central to the deployment of such devices, although these have not yet been addressed in backpacking literature. Many backpackers will be without access to power supplies for long time periods, a circumstance that our research suggests brings battery conservation and management to the fore.

A notable concern for many smartphone users is battery life as it is a "limiting factor for mobility in mobile devices" since "managing battery life is a real, everyday concern for the majority of mobile phone users" (Ferreira, Ferreira, Goncalves, Kostakos, & Dey, 2013). Rahmati, Qian, and Zhong (2007) found that 80% of mobile phone users take measures to increase battery lifetime and that a perception of the need to maximize battery life is a source of anxiety. Dhir, Kaur, Jere, and Albidewi (2012) investigated perceptions towards battery life via a series of focus groups and found evidence of similar battery life anxiety, with several participants experiencing significant frustration at running out of battery.

Ferreira et al. (2013) identified a number of potentially worrying outcomes of running out of battery life due to our reliance on mobile devices for communication, timekeeping, and navigation. The threat of power loss in the backcountry has been addressed by manufacturer developments such as the Biolite stove as noted by Bødker (2017), who, while characterizing himself as a "romantic luddite," notes that a commercially available combined backpacking wood-burning stove and thermoelectric 5 W smartphone charger combination might transcend the divide between technology and the wilderness, creating an affinity between them.

We have discussed existing interdisciplinary literature on the adoption and deployment of mobile and electronic technologies by the backpacking community. Such works are essentially theoretical in nature, and largely focused on a North American context. The TGO Challenge situates participants in wild country for an extended time period: the study of a distinct backpacking community of independent individuals with the same goal is unique in the literature. The data gathered from our research subjects records a physical, mental, and emotional journey in which information technologies support planning and activity organization which are often mediated through technological interactions. This work shows and evaluates how information technologies support backpackers endeavors while walking.

3 | METHODOLOGY AND DATA COLLECTION

We investigated backpacking and technology use on a long-distance hiking trail, collecting data both off-site (online survey $n = 116$), and on-site (pre- and post-TGO interviews, and vlogs, with eight selected participants). Our participants were walking independently from each other and included a backpacking member of the research team (P08). This mixed-methods approach allowed us to collect separate, distinct, and rich accounts of their journeys, and to triangulate our findings.

The survey data provides an overview of the demographics of the backpacking community and some understanding of their technology use in this context. The interview and vlog data (Table 1) provide extensive in-depth insights around how the introduction of modern information technology into the backpacking scene has changed habits, practices, and mores. The vlogs also give contextual evidence of in-field technology use in backpacking, together with how these systems and application become part of the hikers' routines and thought processes.

3.1 | The TGO study

The TGO is a self-supported backpacking challenge of between 180–300 miles through some of the most remote parts of the Scottish Highlands, UK. Each "Challenger" designs their own route and submits it for approval to the TGO organizers. Backpackers can hike individually or as team with no more than four members, completing the TGO within two weeks while checking in with the Challenge Control team at planned intervals. During the event backpackers must refrain from motor vehicle assistance, and the entire journey is on foot. Challengers can wild camp, or sleep in accommodation. Figure 1 shows the GPS tracks of the five participants whose GPS logs were complete and reliable, illustrating the varying routes participants chose.

TABLE 1 Demographics of participants selected for the TGO field study

ID	Sex	Age	Nationality	First TGO	Solo TGO
P01	M	35–44	British	Y	N
P02	M	55–64	British	N	N
P03	F	45–54	British	N	Y
P04	M	45–54	British	N	Y
P05	M	65–74	British	N	N
P06	M	45–54	British	N	N
P07	M	65–74	British	N	Y
P08[a]	M	55–64	British	Y	Y

[a]One of the authors.

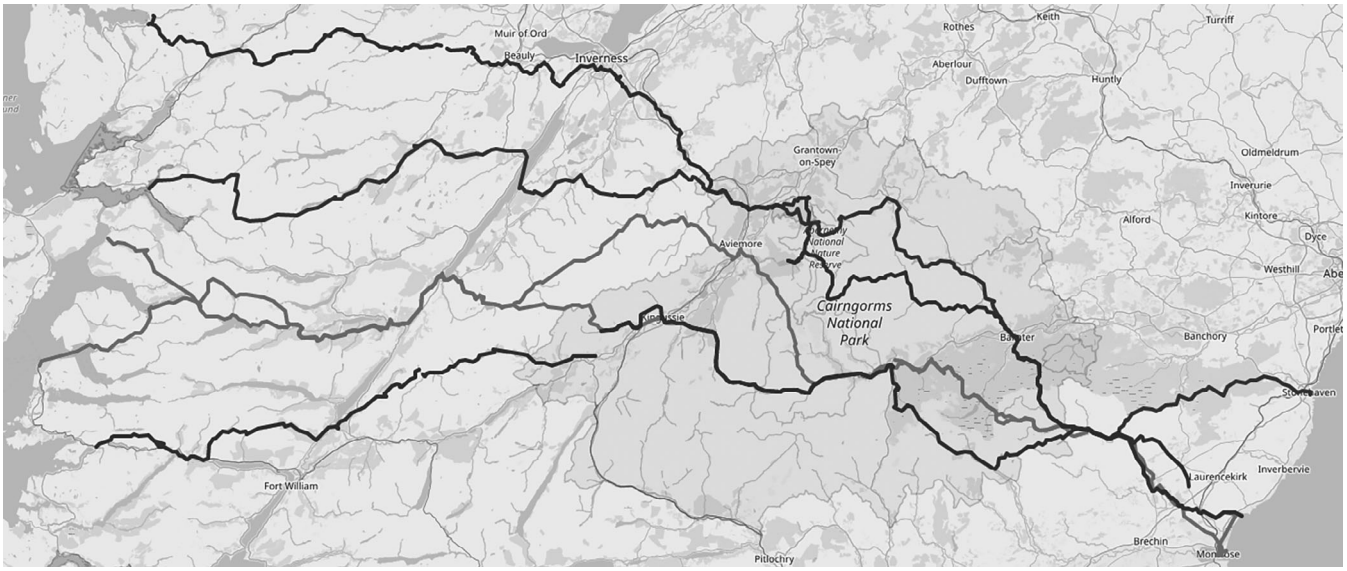

FIGURE 1 Map of Northern section of Scotland with GPS tracks of the five participants whose GPS logs were complete and reliable

3.2 | Online survey

Our online survey used Google Forms and was developed over a number of iterations following an internal pilot. The survey consisted of 16 questions, took approximately five minutes and was completed by 116 people between March 18, 2019 and May 5, 2019. Designed to minimize completion time, the survey questions included: demographic information; participation in the 2019 TGO; and questions regarding the participant's use of technology when backpacking. We asked how they planned routes (on paper, digitally or a mixture of both), which types of software they use for planning, whether or not they use electronic mapping apps, social media-based communication apps, satellite trackers, personal fitness trackers, and portable power-banks when backpacking.

Participants were recruited by posting threads on popular backpacking forums, social media and on the official TGO Challenge forum. These posts explained the context of the research and invited survey participation.

3.3 | Main study

Survey participation was conditional on granting us permission to contact individuals regarding their further engagement in the research. We selected a subset of those intending to participate in the TGO Challenge who also indicated that they use information technology when backpacking. These were contacted to enquire if they would like to take part in a study over the course of the TGO. We recruited a total of seven who, in addition to a

research team member, comprised the eight participants of our TGO Study. Each participant was sent an overview of the study and asked to sign a consent form. We note that, although having an author as a participant might introduce some biases, key extant literature (e.g. Dix, 2017; Harmon, 2015; Stelter & McCrickard, 2017) is auto-ethnographic in nature and that these methods are a means to give the researcher a more empathetic perspective on the topic, while still allowing attention to be paid to issues other participants might miss.

3.3.1 | Pre- and post-challenge interviews

We developed pre- and post-interview questions covering the areas of discussion detailed below. The semi-structured interviews took on average twenty minutes each and were recorded and transcribed.

Points for discussion in the pre-challenge interview included: perception of the participant's own fitness, level of technological awareness; planning for the TGO Challenge, the use of technology in this process and perceptions of difficulty including any issues encountered, together with the use of pre-prepared information, and obtaining new information during a backpack.

Areas for discussion in the post-challenge interview included: whether the participant adhered to their planned routes and if the plans were helpful; what information was used during the Challenge and why; how much participants used technology during the Challenge, how they feel about the use of such devices for backpacking and how (un)supportive the technologies were and why.

3.3.2 | Data collection during the challenge

In-context data about the participants' experiences and use of technology during the Challenge itself were obtained by asking participants to collect data in a number of different forms. These included: GPS tracking, satellite messaging, wearing a fitness watch, logging mobile phone browsing and search history, and recording short screen vlogs with a voice-over each morning and evening. The vlogs added an "in-context" dimension to the data collection process, providing vivid insights into technology use, communication, and planning on the TGO. The vlogs also have the potential to reduce biases in and triangulate the findings of the interviews and survey data.

Prior to the Challenge, participants were sent equipment packages and instruction guides. Our goal was for all participants to have and use a Garmin inReach satellite communicator, an Android phone, and a Xiaomi Mi Fit Band. Of the rich data collected on the Challenge we analyze only the vlogs in this paper. These devices were chosen as they represent three commonly used examples of information/communication technology employed by backpackers. We do not claim that they encompass all of the technologies used by backpackers, and therefore will not provide us with examples of all possible information behaviors in this context. However, they do permit us to investigate use and behaviors of information technologies available to and used by many backpackers.

Participants used screen recording software and their chosen mapping software to detail each day's plans, and to reflect on how their day went every evening. These vlogs—in the form of individual movie files—were transcribed to facilitate analysis. We did not otherwise prescribe to participants how they should use the devices we provided for them. After completing the study, participants were sent a USB pen to upload their collected data to for analysis, which they were asked to send back, together with the devices they had borrowed for the study. All associated costs were covered by the research team.

3.4 | Limitations and notes

The chosen research methodology and study design is, of course, not without its limitations, which we discuss below.

We note that the very different types of data collected and scales of the two main studies (i.e., a large-scale survey as opposed to a much smaller-scale in-field study with interviews) do mean that results from both are not directly comparable. However, they can provide data that is complementary and permits a more generalizable—albeit somewhat superficial—overview of use to be obtained, as well as a more detailed account of the experiences with and use of technology on the trail by a smaller group of participants. Equipping participants with new technology for them to use and then analyzing their employment of same is potentially problematic for a number of reasons (Crooks, 2019). This may be particularly so in this context, given the very personal and individual nature of the TGO challenge for participants and the potential for this technology to detract from their experience.

Our study adopted an "in-the-wild" research approach to investigate "user experience phenomena that differ from those derived from other lab-based methods" (Rogers and Marshall, 2017): we carried out *in situ* research with multiple subjects in real-world settings,

deploying potentially disruptive technologies new to some participants. Although it may have been more "naturalistic" to observe the use of the equipment each participant already had to hand, as in ethnographic studies, our approach reduced the number of different variables at play and ensured that we had the opportunity to study communications, navigational, and health tracking technologies by each participant. This approach also permitted more "standardized" data collection and ensured that all players could record daily vlogs.

An "in-the-wild" study afforded us rich insights to technology use, allowing better understandings of real-life, dynamic "contextual factors and situated conditions arising from their deployment" (Luger & Rodden, 2020). We were aware that the technology and its use could not be fully anticipated prior to the field research; indeed, as Rogers and Marshall (2017) noted, this is also "one of the main reasons for conducting in the wild studies in the first place!" We also considered the agency of the research team to address emergent issues and provided consistent online and phone support to our participants before, during, and after the TGO. As noted by (Probst, 2016), employing a "researcher as participant" design can improve the research team's understanding of the participants' experience of the study, although one must be very careful to separate the two roles as appropriate, which may not always been entirely achievable. We have aimed to be transparent where we have used data from the author–participant and have, where possible, provided the same study experience for all participants. We also note the potential ethical issues raised by adding new technologies and daily data collection procedures into what is already a challenging and tiring situation. We discuss this aspect in more detail in our conclusions.

4 | DATA ANALYSIS

4.1 | Online survey

The survey data was downloaded in CSV format and imported into the statistical programming software environment R^2 for analysis.

4.2 | Pre- and post-TGO interviews

The interview transcripts and in-field recordings were thematically analyzed using six stages (Braun & Clarke, 2006) to develop higher-level concepts out of lower-level codes. Transcribed interviews recordings were open coded using on online tool.[3] Researchers first familiarized themselves with the data, noting initial ideas. Interview data were systematically organized into meaningful clusters and extracts relevant to each code were collated. These were then combined and contrasted into a potential initial set of themes, gathering all data extracts relevant to each potential theme. Each theme was then described by considering the data extracts, defining the theme, and creating a brief narrative around the theme's story.

The pre-TGO interviews generated 31,120 words, resulting in 199 coded excerpts. The post-TGO interview transcripts comprised 29,669 words, yielding 284 coded sections. Over the interview transcripts, we identified 25 different codes, 20 of which were subordinate to a super-code of "technology."

4.3 | Data collected during the TGO

Phone vlog data were uploaded to a secure Video Manager and transcribed using its automated subtitling facility. Each recording was then manually checked, and any necessary corrections made. Once all transcriptions were complete, they were exported using the *.srt format in preparation for open coding. We coded each recorded transcript collaboratively using the same method as the interview data. Validity was built-into the coding and revisions processes by using multiple researchers to reach a consensus on the coding structure.

Although all eight participants made daily recordings, technical reasons and unexpected data loss meant that two were unable to provide us with their data, *ergo* analysis was based on recordings from the remaining six participants. This was in one instance due to the participant struggling to reliably use the screen recording software, a theme which appears in the vlog data from the other participants. In the other instance, the participant did not correctly copy the video files onto the memory card we provided and subsequently deleted the original files from their mobile phone. A total of 132 separate recordings—an average of 22 by each participant—yielded 44,832 transcribed words. From this raw data, we coded 1,183 individual sections and generated 24 different codes.

5 | FINDINGS AND DISCUSSION

5.1 | Survey

Findings from the survey reveal means of using analogue and digital technologies by backpackers, together with their perceived benefits and shortcomings.

Of 116 participants, 18 (15.5%) identify as female and two (1.7%) did not wish to state their gender. Most participants (66 or 56.5%) were aged 45–65 with 22 (19%) younger and 28 (24.2%) older. More than half (59 or 50.9%) indicated that they would be taking part in the TGO Challenge this year and rated the perceived difficulty of their route to be 3.16 on a scale of 1–5 (*straightforward to challenging*). The majority (91 or 78.5%) rated their backpacking experience to be 4 or 5, indicating that most felt they were experienced. The average reported experience of those taking part in the Challenge was higher than those who were not (4.39 against 4.11). This difference might suggest that TGO Challengers can be considered as serious leisure hobbyists characterized by noncompetitive, rule-based activity participation (Hartel, 2013). There was a significant linear relationship between backpacking experience and expected route difficulty ($R^2 = .047$, $F = 4.03$, $p = .048$). TGO Challengers planned an average of 8.16 wild-camps over their routes and this was also a significant predictor of route difficulty ($R^2 = .218$, $F = 21.96$, $p \ll .01$).

Only four (3.4%) said they exclusively use physical maps when devising routes, while 44 (37.9%) use exclusively digital maps; the remaining 68 (58.9%) use a mixture of the two. Unsurprisingly, younger respondents were more likely to plan digitally than older participants and all four who said they exclusively use paper maps were 55 or older, although the differences were not significant ($X^2 = 21.637$, $df = 14$, $p = .086$). This evidence of reliance on digital mapping and planning tools by many backpackers suggests that fears of a decrease in understanding of traditional, nondigital techniques may be well founded (Pohl, 2006; Shultis, 2012).

We asked respondents which software tools, if any, they used for their route planning and then analyzed the aggregated text at the entity level. Table 2 shows the most frequently used tools, indicating that mobile applications are in common use, as are online mapping tools. The majority said that they either always (46 or 39.7%) or sometimes (27 or 23.3%) use mobile navigation software while walking with only 21 (18.1%) never using such software. Interestingly, those who stated they were doing the TGO Challenge were significantly less likely to say they used mapping software than others surveyed ($X^2 = 8.04$, $df = 3$, $p = .045$). Despite the general ubiquity of social media, its reported use to communicate and diary experiences during backpacking was quite low: 48 (41.4%) said they never use social media to communicate on the trail and 60 (51.7%) said they never use it to diary or document their hikes. Only seven (6%) always use social media to communicate, with the majority (52.6%) using it sometimes or rarely. Results were similar for use as a diary tool; only eight use it always or often and 48 (41.4%) use it rarely or sometimes.

TABLE 2 Most frequently used applications and web sites for planning

Software	Count	Software	Count
ViewRanger	45	Anquet Maps	13
Ordnance Survey site	35	Geograph	12
Memory Map	19	Where's The Path	11
WalkHighlands	17	RouteBuddy	8
Google Earth/Maps	15	Caltopo	7

We asked how often respondents personally use common technologies that could be of benefit to backpackers. Fifty-six percent of respondents use an Android device, fewer (31%) use an Apple iPhone and only a small number (15 or 13%) use another type of phone. Very few (14 or 12.1%) use a satellite communication device, considerably more wear a fitness tracker (42 or 36.2%), and many take a rechargeable power-bank with them (91 or 78.4%). Of our respondents 12% use a dedicated GPS device, in contrast to the 2011 survey from Martin and Blackwell (2016) with 26%.

Mobile phone use was almost 100% in our survey, mirroring the results from Halfwayanywhere (2018), yet contrasting with Martin and Blackwell's (2016) 29%, which dates from 2011 when mobile phone use was beginning to grow. Although the uptake of mobile technology by backpackers is high, we cannot in certainty suggest that those backpackers use the technology for navigation; only 23.3% of our sample used mobile navigation software, although 95.4% of the Halfwayanywhere (2018) sample did. Comparisons here are difficult, as our survey was in Scotland with a more elderly sample, whereas the Halfwayanywhere (2018) survey looks at a younger demographic on the very different PCT (Pacific Crest Trail). However, the demographic in our study was a more representative sample of participants within this context, supporting the real-world interactions with technology on the TGO.

The number who bring a power-bank with them is interesting as it suggests concern about various electrical devices having sufficient battery life and/or an awareness that access to power sockets to recharge may be sporadic or non-existent. There was a significant difference in the use of power-banks between younger and older respondents ($X^2 = 30.34$, $df = 7$, $p \ll .001$); all below the age of 45 said they carry a power-bank with them, while more than half older than 65 said they did not. We did not observe a similar significant demographic split for any of the other devices we asked about. These results echo the concerns of participants in a number of previous studies (e.g., Ferreira et al., 2013; Rahmati et al., 2007), although the discrepancy between age groups is a novel finding.

5.2 | Pre- and post-TGO interviews and vlog data

Findings from the interviews and vlog recordings emphasize the complex relationships between backpackers, their motivations, different types of embodied activities and spaces, interactions with people, and technologies. The findings also highlight the sheer breadth of different uses, and therefore information behaviors, associated with the information technologies used by the participants in the study. Participants discussed using modern information technology in ways that directly replace existing physical technologies—for example, viewing a digital map on a smart phone—but also in ways that go beyond what was possible before such technology existed, such as being able to ascertain one's position on the map automatically and with high levels of precision and certainty via GPS. Participants used devices to obtain information about their routes and amenities or features thereof, in some cases replacing physical guidebooks, but in others providing up-to-the-minute updates on, for example, weather conditions or the availability of bridges.

We report specific examples that highlight both the complexities of these relationships and suggest opportunities for contributing to existing studies and theories. Findings are clustered into three main themes (see Figure 2) as well as a separate section on *power management*, which is a subtheme of *planning and organizing*:

1. Planning and organizing: habitual software, hardware, platforms and information sources used to plan and organize backpacking; lessons learned from previous backpacking experiences; activities prior to, during, and after the 2019 TGO; battery management and power planning; and planning for next backpacking routes after the 2019 TGO.
2. Communicating: communication actions prior to, during, and after the 2019 TGO; communication receivers; content and media shared with others; keeping in touch with family and friends back home.
3. Navigating: discussion on navigating and tracking activities during the 2019 TGO, including changes of plan, tracking one's own performance and the (un) reliability of physical and digital maps.

Challengers' motivations and emotions prior to, during, and after the 2019 TGO were present in all three themes and have been weaved into the analysis. They include a sense of community, drivers for participants' decisions, and how they felt about a variety of technologies.

5.2.1 | Planning and organizing

The TGO Challenge is an intense and often taxing endeavor in which planning and organizing activities require a granular level of detail using multiple information technologies, behaviors, and information seeking. The TGO does not have a competitive element—its challenge lies in planning and navigating one's unassisted journey across the Scottish Highlands. Thus, within the serious leisure perspective (Hartel, 2013) the event may be regarded as a serious leisure hobby characterized by non-competitive, rule-based activity participation. Participants shared lessons learned in planning and organizing

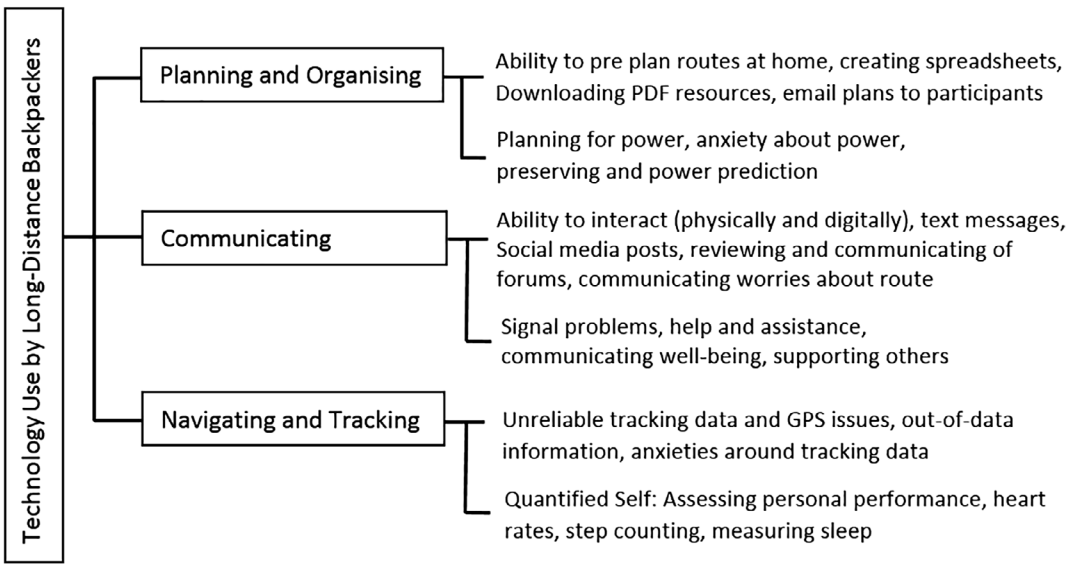

FIGURE 2 Diagram of themes and codes identified

their journeys, together with their battery management practices. Identified applications, devices, and analogue media, together with printed paper maps, blogs, forums, emails, social media, wearables, and satellite devices reveal a rich palette of information technologies and approaches used on the TGO.

Loyalty to and appreciation of specific applications media or information sources was noted during the interviews. For example P02 mentioned having had ViewRanger on his phone "as an add-on on my screen for, goodness me, 10 years, maybe more" and P03 was enthusiastic about Geograph, a collection of photographs and information for the UK and Ireland: "I love Geograph, it's fantastic." For P08 route planning revolved around distance and ascent and Caltopo was the application of choice, however, he noted that "CalTopo can be a bit quirky in terms of the server uptime [...] It runs on North American time, so it can be a bit pissy when you're trying to get into it in UK times on occasion."

Attitudes to technology over time and familiarity with it, and its role in backpacking were expressed by participants. P03, when going solo for the first time mentions that "I then said to my partner, 'Do you think I could do this on my own?' Because my partner normally is the map person and looks at all the technical stuff and the map." Some participants actively manipulated downloaded maps and other information for their own backpacking needs. P08 mentioned cutting and pasting his maps from online systems:

"Memory Map mainly because it uses OS maps [... .] I also dump my data into PDFs and drop it into my phone in a working walking file, which gives me bus timetables and stuff like that."

Four participants (P01, P02, P04, P07) use printed, normally waterproof, maps in addition to the digital maps downloaded on their phones. P07 said he mostly used "the paper maps when the weather is reasonably good [...] because they're easy to carry in a pocket and it saves battery on the phone" but that he "used the phone ... when the weather was bad and I was in the mist because then, you know, I could pinpoint exactly where I was."

Participation in backpacking as a serious leisure hobby and nature challenge activity (Davidson & Stebbins, 2011) encourages acquiring and employing substantial skills and knowledge in multiple areas. Over-reliance on technology and related deskilling may be at times an issue in backpacking, as noted by Heggie and Heggie (2009) and expressed by P08: "You can't rationalise these routes based on an electronic line on a map, but I think you do tend to, because it's there and the maps said that it's possible." P07, further expanded on deskilling related to over-reliance not only on technology, but also on printed materials instead of robust applied knowledge: "It's not actually the technologies that's the problem. Sometimes it's the knowledge of how to use it and what you need to have." This sentiment was bluntly echoed by P08: "you don't deliver autonomy [...] not knowing how to navigate: you're a fucking idiot if you go in the hills and don't have the skills, quite frankly."

Prior to the TGO, participants signaled concerns about power access during the event: "in terms of its (Garmin inReach) battery, because that obviously will be something I need to consider. Because I am taking... I took a three-panel solar charger last year [P02]." P02 moves on to highlight an instance of power loss when one of his team "went two days without power at all. Mainly because he thought he'd switched his, one of his devices off, and he hadn't." Our survey reveals that 78.4% of 2019 TGO participants carried a power bank, reflecting the power management concerns highlighted by Dhir et al. (2012) and Rahmati et al. (2007).

5.2.2 | Communication

Findings from interviews are aligned with Harmon's (2015) suggestion to rethink "computing technologies as context" for thru-hiking, "sites where life happens," shaping lived experiences and human interactions. Regarding the study remit P06 commented that "you're asking people to potentially compromise the purity of their ... it's a challenge. You're potentially going to intrude into their experience," thus voicing a perceived tension between technology and experience of the authentic natural world (Borrie, 2000; Dickson, 2004). However, in practice all participants actively used a rich variety of information technologies and media to connect with others prior to, during, and after the 2019 TGO.

To keep in contact with fellow challengers, most of our participants used devices and smartphone applications specific to hiking and backpacking. These and other apps were often used *en route* as a means to eventually physically meet other challengers—a confirmation of the sociability of walking (Asimakopoulos & Dix, 2017; Dix, 2018). Our study further contributes to understanding contemporary aspects of highly physical serious leisure activities, as noted by (Hartel et al., 2016): information abundance and blurring of boundaries of information activities brought by social media. We noticed that our participants counteracted information abundance before, during, and after the TGO by carefully selecting sources for information such as blogs, forums, and electronically mediated word-of-mouth within the TGO community. This blurring of information actions connected to social

media was particularly evident through the use of smartphones, which allowed our participants to seek, gather, communicate, exchange, and publish information for multiple publics. Reflecting on the TGO, P04 expressed the desire to "talk to other people on the Challenge, that I might want to walk with. You know, 'What are you doing next year?' [...] just finding out where other people are going so I can meet up more and walk with." Getting in touch with and receiving news from other challengers was a common theme across the interviews. By backpacking the TGO, participants found a new itinerant "family": "we've all got this immediate family, almost. You all care about each other and you all look out for each other. You still go off and do your own thing but when you meet up, you know each other. It's weird, it's the weirdest thing" [P03].

In the field, communication with the outside world, with loved ones and other Challengers was important and the signals and modes of communication affected plans and behavior. P08 collaborated with another TGOer "about software use and I'm gonna show him the messages," which supported the participant in route planning. P08 and P02 also experienced signal issues and P02 even altered his plans to go make "a phone call from the bridge because we have been out of communication for a couple of days," highlighting concerns around the false sense of security created by modern communications devices, which may not always have a signal (Attarian, 2002). This is not surprising given the routes taken by participants (Figure 1) across the remote and rugged Scottish Highlands, where mobile phone signals can be patchy at best. Even when a signal is present, it may not be of sufficient strength to support a usable data connection.

The satellite communicator used in this research, Garmin inReach, can send and receive real-time texts and emails, rescue alerts, and share location information and is not dependent on a terrestrial network signal, so was always available. P04 was so enthusiastic about the communication afforded by this that he wanted the TGO organizers to "get everybody that's got an inReach to get their inReach details," because "that's the whole part with the Challenge as well." P06 enjoyed having had "a lot of chats!" using his inReach. In terms of hiking-specific apps, during the 2018 TGO, P02 had installed BeaconBuddy for Viewranger, a feature facilitating the sharing of one's real-time location. P04 used the Social Hiking app, which shares live progress on a map, with embedded tweets, photos, and blog posts. P08 habitually used a wide palette of devices and media while backpacking, and continued to do so also during the 2019 TGO using the "whole gamut" of communication devices, including using his smartphone for tracking:

"I will go out of my way to talk to people [...]. I will try and send messages with an inReach, a satellite communicator. That makes life easy. So, you can tell people you're fine, which I think is also quite nice—it's one of the reasons I carry one."

Communication with family, friends, and colleagues was mediated by the inReach and smartphones, which were also used to post on social media platforms, blogs, and forums. Most participants sent text messages to their dear ones and called when possible. There was a notable tendency to reassure and contact others, as P01 reflects "Yeah both my parents are Old Age Pensioners... . I drop them a text or if there is a signal give them a call to say everything is alright." Yet pitfalls exist with such technologies; in using a satellite beacon tracker on mapping software, P02 noted that "I switched it off, which caused a bit of panic, because I wasn't in position to tell anyone that I'd switched it off... which was made the situation even worse, because my partner thought I was dead." P07 states that historically "it's gone from you know sending postcards home so people would know where I was a week earlier. But the last few long walks I've got a SPOT device [a satellite tracker brand]."

5.2.3 | Navigating and tracking

Our participants' navigational choices appear to be related to their status (as solo or team members), degree of technological awareness, and experience. Participants' perspectives on accuracy of devices, applications, and the precision of the systems they employ varied. Interpreting the extracts from the vlogs provided additional in-the-field insights into participants' experiences, thoughts, and interactions with technology while on the TGO. Many of the comments made during the TGO served to triangulate findings from the interviews.

Usability and device choice was considered by P02 as "get[ting] the best possible mapping from the inReach that's on my pack, and that's going to give me the best recording of the route that I've taken... which will be better than my Suunto watch, which should be better than my phone" indeed, the decision as to the appropriate technology is somewhat transient with P04 stating "I might have left my Geko [handheld GPS] at home this time, because I've got my phone... I always carry paper maps anyways. If I'm going to change in the future, I probably am going to start carrying just the phone. But I might change it for a GPS watch."

Navigation software and the mapping it utilizes is regarded as both reliable, and quite unreliable, depending on context—as P02 (regarding the inReach) notes: "it's a good way of checking altitude...of checking that you're in

the right place on the map." The perception is that there is a need to have some redundancy and a backup to the principal navigational tool: "I'll always use the mapping in conjunction with proper paper maps [P02]." Although confidence in electronic mapping is also expressed: "I didn't have to worry about not having necessarily the right paper map because I had ViewRanger [P07]." These are of note as many contemporary electronic mapping products have identical detail to paper maps, *ergo* one might expect similar degrees of confidence. Questions also arose regarding accuracy of satellite system performance as P01 reveals that "the positioning on the map thing, especially when you are tracking, was awful." This is echoed by P02: "the route that was plotted on the inReach...that I was wearing, you'll see that it goes straight through the loch. It's quite strange. But of course, the loch wasn't there."

Tracking and navigation technologies, a core factor in TGO completion, supported decision making with varying levels of success. The majority of participants used technologies (i.e., Garmin InReach) to plan and check routes. ViewRanger, a key planning and tracking tool, did have intermittent connectivity and tracking issues with a number of participants getting frustrated. P04 noted "the roads now seem to be missing from the map" and P08 bemoaned the lack of accuracy when reviewing his GPS trace: "from the look of this it looks like I walked into the middle of the sea but actually I didn't." P08 also experienced tracking problems where "my InReach seems to stop tracking" as they were reflecting upon the day and P05 experienced similar issues "as per earlier there was missing track information left of either side of the map." P03 mentioned using tracking frequently, yet highlighted the need to be aware of battery life: "I like to track myself with ViewRanger, but I do have it on flight mode and then I'll switch it off every night."

Participants reflected on the use of "backup" software/devices: "I prefer a (paper) map. But, I do carry a little Garmin GPS as a back-up...I've only ever used it once [P04]"; "I have two apps on the phone...I use Locus Maps and ViewRanger... . I've had technology fail on me before. I actually take two phones and both phones have two mapping things on [P05]"; "I carry mapping applications on my phone, and I have two as a backup with very detailed maps on them. If I have a signal, I can actually route live on those [P08]."

The use of downloaded maps to aid the participants in the field did cause some confusion; in a number of cases maps were out-of-date. P02, P05 and P06 all expressed problems using maps downloaded to their phones, as they compared actual locations via other tracking technologies. P02 for example, noted that "looking at the OS maps on ViewRanger it generally gave me slightly higher elevation than the GPS said and when I checked it on the summit of Gulvain [a mountain] GPS was giving a reading 50 meters lower than the figure on the OS map. I wouldn't like to say which is right probably the OS." P08 "found out that the OS maps weren't exactly as accurate as they might because they show foot bridges there, there aren't any so I waded across the North Esk and got very cold" and P05 found that a route "doesn't exist, I have no idea where OS managed to get that path from it isn't here." We note that technology failure is a concern, but that different mapping apps afford varying levels of functionality and this too might account for the installation of multiple applications on devices. Some of these issues have resonance with early work questioning the role of technology in the wilderness, and whether the technology supplants learned experiences like navigation (Borrie, 2000; Ewert & Hollenhorst, 1997).

A number of design issues were highlighted by participants, reflecting the actual use of the tools while in wilderness settings. P07 noted "I mostly use the paper maps when the weather is reasonably good simply to have a look at what was coming up and so on because they're easy to carry...Where I used the phone most was when the weather was bad." Further situational observations include backpackers' reflection on the utility of wearables: "I never get my compass out, the last time I used it on a Challenge was 2016. That's the only time I've used one, actually [P04]"; "I like to look at my wrist [consulting a GPS watch] and see where I am. I glance because otherwise I have to bring it up on my phone or my inReach [P08]."

Participants have varying relationships with the navigational technologies they use. Many comments were positive: "ViewRanger will tell me; it will bleep in my pocket [P02]" and "If I have a signal I can actually route live on those, using auto routing if I have a mobile signal, so I can change on the fly [P08]." These views however are counterpointed with some frustrations: "I'd definitely change to ViewRanger [P01]," "I just wish they would get it [inReach] sorted out, so it had OS [Ordnance Survey, UK] coordinates on it [P04]," and "i[the mapping software] is not up to scale and you have to zoom right into that scale and then try to zoom out and then get back and forth to the map [P01]." There were pointed reflections on the role of apps in navigation, such as "they suck life out of hiking to my mind [P08]," a view that reflects those expressed in the literature (Dickson, 2004; Dustin et al., 2017; Pohl, 2006). Levels of personal experience allied with the constant feedback from one's senses when backpacking illustrate the use of embodied information (Hockey & Collinson, 2007). This is key in many forms of highly physical serious leisure activities, including backpacking, which largely depends on the interpretation

and application of information collected directly from multisensory encounters with nature and people. This appears to be similar to what runners do (Gorichanaz, 2015); when walking our participant backpackers sensed and evaluated a route with its hurdles and risks (Davidson & Stebbins, 2011). Additionally, backpackers kept sensing their surroundings when stopping to camp for the night, echoing findings by Asimakopoulos and Dix (2017). Key backpacking information is acquired by actively performing this hobby, adding to a body of knowledge and skills that allow backpackers to take decisions, support their backpacking experience, and communicate with others.

5.2.4 | Power management

Planning was not confined to in situ use of technology to map, track, and orientate participants but also encompassed the planning around and prioritizing of battery life. The latter influenced behavior as power is often at the forefront in planning. P04 commented on the need to "check the battery" and the need to do this "pretty soon [as] it will probably need charging up," P02 explained that his "battery packs are very low, and in fact my secondary battery pack actually failed me so I'm relying on mains charging wherever we can get that." Frustration at power running out due to participants not managing resources well was mentioned, for example: P05 "forgot to turn poxy inReach off and it is as dead as a bloody dodo." P05 was also reliant on mains power to "get it charged up for a bit ... fingers crossed it will last all day because [...] there's no electricity where we are heading." Power failure also affected P02 to the extent where he "returned from the TGO because my battery pack and solar panel system failed," a very unfortunate outcome due to reliance on battery-dependent modern technology.

When reflecting on the 2019 TGO, the issues of power management and the choices it engenders were notable. "I took a small power pack, and I'll take a bigger one next time [P02]." P08 and P04 ape this, respectively noting a "big power pack to power all this, that would be nice if it could disappear, but it won't" and "I carry a heavy power pack with me, which I found, I haven't used that as much as I thought I would.... I could find places to charge things up." P02 had "one time where I got very close to running out of power, with all the various devices that I had," leading to choices being made; P02 states "so I had to prioritise. So, I prioritised the inReach, then the MyFit, then my watch, then my phone." Choices, if not causes, are different, P05 mirrors such experience—"if push had come to shove [...] I'd have charged the phone rather than the inReach." This reliance on power as evinced by Ferreira et al. (2013) and its significance in planning in other contexts (Rahmati et al., 2007) have led to design solutions for backpacking such as that noted by Bødker (2017), yet remain an issue. Finally, P05 summarizes the situation: "The downside of all technology is that you've got to bloody charge it up."

6 | CONCLUSIONS

Our research considered the role of modern information and communications technologies in the context of long-distance backpacking and investigated how backpackers use such technology to support their activities. The results of a survey ($n = 116$), transcripts of pre- and post-event interviews, and data recorded during the event were used to gain an in-depth understanding of technology use on the trail. A thematic analysis identified three main themes of planning and organization, communicating and navigation and tracking. Our study contributes to a relatively small but growing body of literature on the use and impact of modern technologies on backpacking and the wilderness experience.

The design of the study itself contributes to existing literature on field-based approaches to studying information behavior in which participants are exposed to new technologies. Although providing participants with technology and then studying their use of and experiences with the same is potentially fraught with ethical challenges and introduces potential biases, we argue from a pragmatic perspective that it permits data to be collected that would otherwise be difficult to obtain (Rogers and Marshall, 2017). By adding new technologies into our participants' already complex device ecosystem, we are undoubtedly increasing their mental load, battery anxiety and possibly detracting from their own wilderness experiences—issues we argued at the outset are potential detractors of information technology in this context. That said, our participants were already experienced backpackers with well-practiced routines and existing knowledge of analogue mapping and pathfinding techniques and so were not particularly vulnerable in this sense. Participants mentioned integrating these technologies into their existing routines and several expressed positive sentiments towards the devices. This highlights the importance of designing data collection and recording procedures such that they minimize the amount of extra workload imposed on participants, especially under mentally and physically taxing conditions.

We also note that including an author as one of the study participants does have the potential to introduce some limitations, but also some benefits to the study, as noted by Probst (2016).

Our results demonstrate that technology permits communication, not just with loved ones back at home but also with fellow backpackers, enhancing on-the-go planning, assistance, and the development of transient communities. This communication and community building was often achieved using apps and services not explicitly designed for such a purpose, suggesting an opportunity to develop more sophisticated activity-specific software to help backpackers find each other; to swap useful information about weather, obstacles, hazards or good food and water sources; and to meet up on the trail (Dix, 2017, 2018; Harmon, 2015).

Survey results suggest that backpacker behavior is influenced by experience, attitudes, desires, and the need to make decisions. Technology offers a means of mediating many of these things, and as in many other social spheres its use can detract from and/or enhance lived experience. The survey unsurprisingly confirms that younger people tend to use technology in their pre-trip planning to a greater extent, yet for this sample technology-mediated social interactions are relatively modest. The experience of those intending to do the TGO was reflected by their propensity to choose harder routes and wild-camp more, suggesting an intrinsic confidence. The need to ensure a ready power supply in remote conditions was significant, with choices being dictated by age; everyone under 45 years of age carried a power-supply, yet more than 50% of those over 65 did not.

Our field study took place over a sustained two-week period in remote areas, under often taxing conditions. We do not dwell on the evident psychological interplays this engenders but reflect on how the activities are influenced by the use of technology. As evidenced by our pre- and post-TGO interviews, and by data collected during the Challenge, our participants make much of the role of technology in communicating, which is very important to them. There were also reflections on the deskilling caused by an over-reliance on technology, resulting in a reduction in the "wilderness experience" and even the possibility of backpackers getting themselves into dangerous or otherwise worrying situations due to a lack of knowledge of how to navigate and communicate without the assistance of information technologies (Attarian, 2002; Dustin et al., 2017; Martin, 2017). There is potential here for backpacking apps to be designed in such a way that they encourage users to learn and maintain these important skills, and to focus more on the experience of being in a wilderness area (Häkkilä et al., 2017). One recurring subtheme centered around anxieties resulting from the lack of availability of reliable power sources when on the trail, and revealed that the issue in backpacking is compounded by the need to use and maintain a number of quite different devices, each with their own battery lives and energy requirements.

As participant P07 noted:

"*Well, you know, technology, electronic technology... this has been the huge change in backpacking since I began. Nothing else has come along that didn't exist when I began and has revolutionised everything.*"

Similarly to many aspects of society, backpacking is touched by the convergence of consumer electronics and their ability to offer mobile functionalities in affordable and portable form. For the backpacker this moves beyond being able to do the same things with different tools and can fundamentally change the experience. The devices and apps available to long-distance backpackers can replace learned experience, can make life easier, and can affect risk perception. Our initial analysis of some of the study data had produced some interesting insights; we anticipate developing these and others with continuing work on the data set.

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ENDNOTES

[1] https://www.tgochallenge.co.uk/

[2] The R Project for Statistical Computing, https://www.r-project.org/

[3] Saturate, http://www.saturateapp.com/

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