ABSTRACT

ROGERS, ANDREW GLENN. Appalachian Trail Long-Distance Hikers' Use of Information, Views on Technology, and Spatial Decisions. (Under the direction of Dr. Yu-Fai Leung).

Smartphones are becoming increasingly ubiquitous, which creates new challenges and opportunities for recreationists and protected area managers. Many long-distance hikers now bring smartphones on the trail, but colleagues have questioned whether these tools may detract from the hiking experience or have other social or biophysical implications. This research used semi-structured in-depth interviews conducted in situ with 20 Appalachian Trail long-distance hikers to explore their use of information sources, views of technology, and spatial decisions. Results help to explain avenues of communication facilitated by smartphones and describe participants' views on technology, which ranged from welcoming to resistant. While most hikers were satisfied with the information available to them, some described instances of information overload or even a preference for uncertainty. While GPS appeared to be an important resource for some participants, user-generated content in smartphone applications may be the most salient feature associated with smartphones. These findings aid trail and protected area managers in understanding long-distance hikers' preferences and potential issues as smartphones become increasingly common. In addition to the long-distance hiking context, these results may also contribute to a larger conversation about technology's role in outdoor recreation.

Appalachian Trail Long-Distance Hikers' Use of Information, Views on Technology, and Spatial Decisions

by
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DEDICATION

To my family, friends, trail lovers (a term I hope soon encompasses all people), and all the special places.

BIOGRAPHY

Andrew Rogers was born and raised in Rome, Georgia where he graduated from high school in 2011. He graduated from the University of Georgia in 2015 with a Bachelor's of Science in Forest Resources, majoring in Natural Resources Recreation and Tourism. A few extracurricular experiences have contributed significantly to his education and worldviews: five seasons introducing people to the Wild and Scenic Chattooga River, a year and a half in the role of naturalist at a state park facility accessed only by footpath, and a couple of long hikes on the national trails system. He hopes to hike another National Scenic Trail in 2021.

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CHAPTER 1: Introduction

It was estimated that 10.9 billion outdoor outings occurred in the United States in 2017, and the number of participants exceeded 146 million (Outdoor Foundation, 2018, p. 1). Overnight backpacking saw a more than 65% increase from approximately 6.6 million participants in 2007 to 11 million participants in 2017 (Outdoor Foundation, 2018, p. 35). Long-distance hiking trails have especially seen surges in use. For example, since the Appalachian Trail's (AT) completion in the 1930s, nearly 20,000 people have reported hiking 2,000 or more miles of it, but nearly 14,000 of these hikes have been reported since the year 2000 (Appalachian Trail Conservancy [ATC], 2019). Similar trends have been documented on the Pacific Crest Trail (PCT). When the Pacific Crest Trail Association (PCTA) standardized long-distance permits in 2013, 1,879 permits were issued, but that number grew to 7,888 in 2019 (PCTA, 2020).

The AT and PCT are the two original routes designated by the National Trails System Act, as amended (2019), which provides "for the ever-increasing outdoor recreation needs of an expanding population and in order to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the Nation" (Sec. 1241.a). Fondren and Brinkman (2019) have suggested that "long-distance hiking has captured the zeitgeist or cultural climate of the time" (p. 1), and a growing number of representations of long-distance hiking in the popular media support this claim.

A growing body of literature has documented that outdoor recreation and hiking provide mental and physical health benefits (e.g., Thomsen et al., 2018; Winter et al., 2020). However, recreational use can also create unacceptable biophysical impacts, and these can have substantial impacts on the visitor experience (Manning et al., 1996, p. 142). To accommodate long-term

resource protection as well as present-day provision of recreation opportunities, recreation and protected area managers must balance social and environmental objectives. This is the case in any protected area that allows recreational use, including National Trails System corridors (Daniels & Marion, 2006; Peterson et al., 2018). As recreation on trails increases, impacts on environmental and social conditions require more attention.

The use of information to address visitation-related impacts has long been recognized as an appropriate management strategy (Roggenbuck & Watson, 1985). This strategy may attempt to increase knowledge, change behavior, or redistribute use (Marion & Reid, 2007). For example, the ATC shows aspiring long-distance hikers how many individuals start the trail each day with the goal of distributing use more evenly across the hiking season (ATC, 2020). Using information in this way is considered an indirect management strategy, as opposed to more direct measures, such as issuing a limited number of daily permits.

The efficacy of information in steering behavior has been observed for a number of informational sources (e.g., brochures or face-to-face communication) (Manning, 2003), but new technologies may introduce new challenges to effectively and appropriately leveraging information as a management tool. This is especially pertinent in light of the increasing ubiquity of smartphones. In the U.S, more than 90% of adults age 23 to 54 own smartphones (Vogels, 2019), and it is estimated that there are 5.2 billion unique mobile subscribers globally (GSMA Intelligence, 2020). The tourism sector has acknowledged and embraced this shift toward mobile apps and user-generated content (e.g., Dickinson et al. 2014; Salem & Twining-Ward, 2018). While the outdoor recreation realm is beginning to accept this change (Valenzuela, in press), strong arguments have been made against the increasing presence of smartphones on trails (Dustin et al., 2019).

Recent work documented that PCT long-distance hikers are carrying mobile phones and using them to navigate (Amerson et al., 2019). Dustin et al. (2017) identified the increasing influence of smartphones on the PCT, describing a transition from "landscape to techscape." Given the two trails' overlapping subculture (Fondrend & Brinkman, 2019), and the general ubiquity of smartphones (Vogels, 2019), it is likely that the AT has also seen similar increases in smartphone use. Research needs to examine how hikers' experiences and decision making processes in protected areas may be influenced by these tools.

The level of connectivity smartphones offer may detract from or contribute to the personal benefits of outdoor recreation, or these new technologies may redistribute use and impacts. Thus, understanding recreationists' smartphone use is critical to meeting recreation provision and resource management goals. Long-distance hikers travel by foot for weeks or months at a time and use various information sources (e.g., mobile apps and printed trail guides) to guide their travels. Spatial decisions, such as selecting a campsite or deciding where to stop for water, have immediate and tangible impacts to the natural resources. A better understanding of how AT long-distance hikers interact with information sources to make spatial decisions could facilitate more effective resource management.

This research seeks to enhance our understanding of AT long-distance hikers' views on and uses of information sources, including emerging technologies such as smartphones. Research questions include: (1) How do long-distance hikers view the use of technology on the trail?, (2) How do long-distance hikers use information sources on the trail?, and (3) How do information sources influence spatial decisions of long-distance hikers? Results of this research provide insights into AT long-distance hikers' relationships with technology, which could aid managers in providing quality recreation experiences. These results may also serve to improve

communication strategies to minimize recreation impacts and maximize the sustainability of protected natural areas through which long trails pass. As long-distance hiking participation increases and new trails (e.g., the Mountains-to-Sea State Trail in North Carolina) become established, the results of this research may help to positively shape growth such that recreational opportunities and resource sustainability are maximized.

Reflexivity Statement

I recognize the value of both quantitative and qualitative data. In an ideal, longer-term research process, I see the two working together, one informing the other in turn. I employed principles of naturalistic inquiry in this project. This approach holds that social phenomena should be studied in their "naturally occurring state, and not through the artificial prisms of postal surveys, formal interviews, or psychological laboratory experiments" (Bloor & Wood, 2006, p. 122).

In this qualitative work, researcher subjectivity should be acknowledged directly in a process known as self-reflexivity (Tracy, 2013, p. 2). The self-reflexive researcher considers their past experiences and points of view in the context of the research and lays them bare. This is critical for qualitative semi-structured interviews, since they are a process of active co-participation between interviewer and interviewee in which research data are socially created (Bloor & Wood, 2006, p. 146).

With that in mind, I am a long-distance hiker. I thru-hiked the PCT in summer of 2017 and the Pinhoti National Recreation Trail in winter of 2017-2018, and I also have done a number of shorter hikes on long-distance trails. Thus, I am familiar with the physical process and social world of long-distance hiking, which allows me to immerse as a participant-researcher. During my time on trail, I have navigated with both traditional tools and with technology such as my

smartphone. I recognized the increasing influence of smartphones in the long-distance hiking world and wondered about their effects on the hiking experience, both for myself and for other hikers. I also wondered about smartphones' effects on the biophysical resources, such as concentrating use at user-determined sites. This thesis represents my exploration of this phenomenon.

Thesis Format

This thesis is written in manuscript format. The second chapter is focused on long-distance hikers' views of technology and their perceptions of their use of information. The third chapter explores more direct management implications by describing long-distance hiker avenues of communication and spatial decision making. The final chapter offers reflections on key findings, lessons learned, and concluding thoughts on the thesis.

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CHAPTER 2: "More helpful than hurtful"? Appalachian Trail Long-Distance Hikers' Views of Technology and Information Use

Abstract: As smartphones become increasingly ubiquitous, their role in outdoor recreation requires further examination. Some researchers and academics push back while others encourage the field to embrace this shift. Long-distance hikers attempt to streamline their information sources and constantly navigate new areas, and GPS-enabled smartphone applications that provide input from other hikers offer an unprecedented ability to plan along the way. This study is based on interviews conducted in situ with 20 Appalachian Trail long-distance hikers. Participants were asked to describe their views on information and communication technologies and use of information sources (paper or electronic) on the trail. Findings indicate that hikers display a wide range of views on technology from unquestioningly pro-technology to technology-resistant. On their use of information sources, some hikers expressed satisfaction while others indicated information overload. In certain instances, hikers viewed uncertainty favorably. These findings have implications for trail and protected area managers, and they contribute to a larger conversation about technology's role in outdoor recreation.

Keywords: hiking; long-distance trail; recreational experience; smartphone; user-generated content

Introduction

As technology becomes increasingly integrated into daily life, protected area managers and researchers must adapt alongside the people they serve. While national outdoor recreation participation has held relatively steady over the last decade (Outdoor Foundation, 2018), use of

smartphones continues to increase. More than nine out of ten Americans age 23-54 own smartphones, and those age 55 to 73 are not far behind them with nearly 70% owning smartphones (Vogels, 2019). Globally, there are an estimated 5.2 billion unique mobile subscribers (GSMA Intelligence, 2020). The pervasiveness of technology and the impressive utility of smartphones represents a cultural shift that protected area managers and recreation researchers cannot ignore. Recreation managers and researchers, recognizing the need to update research agendas and management strategies, have identified keys areas of focus for recreation research, including technology's role in changing patterns of recreational use and visitor experiences (Igniting the Science of Outdoor Recreation, 2020). Valenzuela (in press) encouraged the cooperative investigation of not only the effects but also the utile possibilities of evolving technology in the outdoor recreation realm at "the dawning of the age of constant and instant digital connectivity" (p. 101).

Valenzuela (in press) noted that while "the business community has embraced this change and encouraged it as part of our consumer society, government land managers have yet to fully acknowledge this new environment" (p. 134). Indeed, both profit-driven as well as non-commercial crowd-sourced mobile application (app) creators have brought trail guides and recreation information into the digital age. Some platforms, such as the HikerBot (Google Play, n.d.), rely almost exclusively on user-generated content (UGC), while in fewer instances there has been formal land manager buy-in and more calculated dissemination of information. For example, the OuterSpatial cloud-based recreation information platform allows managers to input and provide feedback on certain data while facilitating a "two way communication stream" between managers and visitors, with dozens of partners from local to national level (OuterSpatial, 2020).

Valenzuela (in press) encouraged managers to leverage new technologies "to research the real activities, recreation use, values, needs and benefits visitors are seeking" and to embrace this shift since it is inevitable (p. 108). However, other colleagues view increasing connectivity as an affront on the wilderness experience that must be resisted. Dustin et al. (2017) made a strong case for the Pacific Crest Trail's (PCT) transformation "from landscape to techscape." They emphasized that smartphones are particularly problematic that should be discouraged on trails through natural areas. They argued that smartphones represent a unique tool that surpasses more typical "technological refinement" (e.g., cook stoves and breathable rain gear) since smartphones, unlike other backpacking equipment, do not bring hikers closer to nature. While Dustin et al.'s (2017) point of view is founded on (and a product of) a strong tradition of wilderness stewardship, insight from current long-distance hikers is needed to understand the situation as it is currently playing out in the National Scenic Trail corridors. As Valenzuela (in press) suggested, research should leave open the option that technology presents an opportunity rather than a threat.

The current research explored this intersection—where traditional conceptions of outdoor recreation experiences meet the emergence and ubiquity of smartphones—by asking long-distance hikers to describe their views on this potential dilemma. Certain characteristics of this group make them an interesting population to examine in this context. Long-distance hikers are especially cognizant of the weight of the items they carry and seek to streamline their materials (Littlefield & Siudzinksi, 2012), which means they may be receptive to the smartphone's status as a multi-tool. They are also somewhat beholden to the information sources they choose to bring, making daily decisions about where to camp or where to stop for water based on the ever-changing situation and the information available to them (Siudzinski, 2007). With these

characteristics in mind, this investigation sought to address the following questions: (1) How do long-distance hikers view the use of technology on the trail?, and (2) How do long-distance hikers use information sources on the trail? Answering these questions will help long-distance trail managers stay abreast of emerging trends and understand hikers' views on technology and use of information sources, enhancing their ability to provide quality recreational experiences while promoting low-impact behaviors and sustaining the natural resources for future generations. Additionally, this study could offer broader insights into recreationists' views on technology and information use.

Literature Review

Information as a Management Tool

There is a long-standing consensus in the recreation literature that the use of information is an appropriate management strategy (Roggenbuck & Watson, 1985; Marion & Reid, 2007). The use of information to influence visitor behavior is a form of indirect management (Echelberger et al., 1978), which differs from direct strategies such as enforcement of rules or limiting access. While some undesirable visitor impacts are unavoidable (e.g., soil compaction on a natural surface trail), many result from careless, unskilled, or uninformed actions, and the potential for communication to reduce these impacts has been identified (Hendee, et al. 1990, as cited in Roggenbuck, 1992). For example, managers may communicate peak visitation times to people inquiring about permits to encourage off-peak visitation, or a brochure may demonstrate appropriate campfire technique to minimize impactful fires. These are opposed to more direct management actions, such as capping the number of permits on a certain day or prohibiting fires altogether. The efficacy of information in steering behavior has been observed for a number of

informational sources from face-to-face communication and brochures (Roggenbuck & Berrier, 1981) to micro-computers (Huffman & Williams, 1985).

More recently, Marion et al. (2018) suggested that maps and GPS files indicating approved camping locations could be posted on websites or via mobile applications to improve the success of connecting visitors with appropriate sites. They pointed out that individuals are "increasingly using smartphones, and their connectivity to accurate GPS satellite networks allows a variety of phone apps to access easily updated digital maps for wildland navigation" (Marion et al., 2018, p. 96). However, research needs to assess the impacts (both ecological and social) of new technologies so that appropriateness and effective management strategies may be identified (Marion et al., 2016).

The introduction of user-generated content (UGC) paired with the expansion of mobile networks and increased battery life compounds the need to re-examine information use and access in natural settings and along hiking routes. UGC has, to some degree, undermined established communication channels and democratized digital media. While the tourism sector is embracing this and leveraging UGC (Salem & Twining-Ward, 2018), research on the role of UGC in the outdoor recreation realm in general and long-distance hiking trails in particular is lacking. Thus, information as a management tool is coming into the digital age, but a critical look at long-distance hiker use of smartphones and other information sources could inform managers and aid them in steering long-distance hikers toward preferred behaviors.

Information and Communication Technologies (ICT)

Shifting away from managers' use of information, ICT present new questions related to the user experience. These technologies, which allow for the storage of increasingly large amounts of information and are connected to unified communications systems, are more and more a part of

daily life for most people. More than a decade ago, Haid et al. (2008) asserted that "GPS outdoor navigation systems in particular are playing a more and more important role in tourism and leisure and provide new possibilities to people undertaking outdoor activities" (p. 313), and the outdoor recreation literature has begun to reflect the increasing ubiquity of these technologies. Spyker's (2004) examination of spirituality and technology on the AT includes an assessment of early ICT:

> Emerging electronic technologies are working their way into the backpacking world as well, though their role is hardly secure. Cell phones, global positioning system (GPS) receivers, and other electronic devices such as personal digital assistants (PDAs) may soon become standard equipment (p. 23)

> Researchers have explored the implications of cellular and satellite phones (Holden, 2004) and personal locator beacons (PLB) (Martin & Blackwell, 2016) on wilderness experience and behavior. However, the smartphone represents a departure from these communication tools through its unprecedented utility (such as internet access and user-to-user communication) and its sheer ubiquity and deep integration into the daily life of most Americans (Salem & Twining-Ward, 2018; Turner, 2020). Whereas recreationists had to actively decide to bring a satellite phone or PLB, hikers today must proactively leave their smartphones at home if they are to have an "unplugged" or traditional wilderness experience. For most people in the United States, having a smartphone at hand at all times is simply the default option.

It has been argued that smartphone use detracts from connecting to place, especially in natural settings (Dustin et al., 2017). Amerson et al. (2019) explored the connection between smartphones and place attachment among PCT hikers. Although 97% of respondents used their smartphones for an average of more than 3 hours each day on their hikes, this research found no

relationship between place attachment and smartphone use on the trail. This leaves open the possibility that smartphones do not inherently detract from hikers' ability to connect with the land. Harmon's (2015) work on the PCT indicated that a shift toward smartphone reliance was in motion in 2013, but Amerson et al.'s (2019) documentation of the breadth and intensity of smartphone use underscores the need for academicians and recreation managers to explore the implications of ICT in the context of long-distance hiking.

Uncertainty and Outdoor Recreation Values

The volume of information contained in smartphone-based hiking guides, paired with photos and reviews submitted by other hikers, can diminish much of the uncertainty about what lies ahead on a long-distance trail. Early work on uncertainty focused on interpersonal communication and relied on the assumption that reducing uncertainty is always beneficial (Berger & Calabrese, 1975). Brashers (2001) introduced an alternative view of uncertainty—that the assumption that uncertainty will produce anxiety should be abandoned. Coming from a health and medical decision making context, Brashers (2001) argued that a range of emotional responses (positive, negative, neutral, combined) is possible, and individuals may intentionally manipulate uncertainty in a desired direction (increasing, decreasing, or maintaining) to meet their needs. To summarize, "'uncertainty' and 'anxiety' are not synonyms" (Brashers, 2001, p. 489).

Turning back to the context of outdoor recreation and long hikes through protected areas, navigating uncertainty may be a prerequisite to some of the motivations that researchers believe drive outdoor recreation. For long hikes through protected areas, navigating uncertainty may be a desirable component of the experience for some recreationists. A review of early works on motivations, preferences, and benefits in outdoor recreation identified dozens of items to describe the range of recreation experience preferences and personal benefits of outdoor

recreation (Driver & Brown, 1986). Although not explicitly mentioned, navigating uncertainty is arguably a component of some of these items such as competence testing, exploration, and risk taking. Kaplan and Kaplan's (1989) description of the restorative environment as a space to address mental fatigue gave another layer of depth to the notion that time in nature yields benefits to recreationists. They note a number of contributing and essential factors for restoration, but the key piece that separated their concept of the "restorative environment" from similar, more developed leisure settings was "experiencing nature" or "enjoying the natural surroundings" (Kaplan & Kaplan, 1989, p. 187). Based on a review of literature, they identified four informational factors of environmental preference with the most preferred scenes reflecting "mystery"—where uncertainty (and inference) about what lies ahead is paired with a sense of exploration (Kaplan & Kaplan, 1989, p. 55).

More recently, in an intensive review of literature, Thomsen et al. (2018) identified several physical and mental health outcomes associated with various wildland recreation activities, with hiking prominently represented. Several setting attributes, including natural environment and wilderness, perception of escape and solitude, and a stress-free environment, were identified as key influencing factors for the positive health outcomes (Thomsen et al., 2018). Whether smartphones detract from these attributes or may in some way contribute to accessing them is unclear.

Methods

Given the relative dearth of research on long-distance hiker views of technology and information use, methods that could uncover richness or complexities were deemed most appropriate. On-site semi-structured interviews were employed to generate data related to the use of information and technology by long-distance hikers. A semi-structured interview protocol (Appendix D) was

developed to capture hiker characteristics and demographics, avenues of communication and information sources, and perceptions of the role of mobile electronic devices for long-distance hikers. The first author, who identifies as a long-distance hiker, acted as a participant-researcher to facilitate interviews in a "natural" setting (Lincoln & Guba, 1985). The participant-researcher carried a smartphone (which also served as the recording device) as well as paper guides and compass. The interviews were conducted with hikers encountered on the AT in New Hampshire, USA in the last week of July and the first week of August, which allowed for in situ interaction with different types of long-distance hiker: northbound, southbound, and flip-flop thru-hikers (those attempting the entire trail in a single year but in non-consecutive segments), as well as with section hikers (those doing multi-day hikes but not attempting the entire trail). Participation was limited to hikers who had been on the trail for at least three consecutive weeks and were 18 years or older, and participants were encountered at random.

Once conversations with fellow hikers moved beyond cursory greetings, the researcher informed them of the project and its goals (Appendix F). Out of the twenty-three hikers contacted and informed of the project, one individual rejected citing a lack of desire to participate, and two individuals rejected due to time constraints. In total, seventeen interviews were conducted with twenty long-distance hikers consenting to participate (Appendix B). Two were group interviews: one with a couple, and one with a couple plus a third hiker. Group interview participants were encouraged to indicate and clarify any departures from their partner's statements, and the researcher proactively checked the level of agreement during these interviews. All participants were informed that there were no right or wrong answers; the goal of the interview was to understand their point of view and experiences. Informed consent guide, interview protocol and a data management plan were approved by the researcher's university's

institutional review board (IRB) These and other IRB-approved documents are included as Appendices A through F.

While the trail itself primarily traverses protected natural areas, hikers visit nearby towns to re-supply expendable materials (food, cooking fuel, battery) and to access laundry, showers, and other services. Generally, participants in this research distinguished between being in town and being on-trail. Since both realms are part of the long-distance hiking experience, interviews were deemed appropriate in either. Specific interview locations included campsites, trail shelters, developed areas, and rest spots or viewpoints along the trail, and two were "go-along" or walking interviews. Interviews ranged from 26 to 121 minutes, averaging 57 minutes. The conversations were digitally recorded and transcribed verbatim. Transcripts were analyzed and coded following Tracy's (2013) guidance on iterative analysis while keeping in mind the goal of understanding long-distance hiker communications, use of information sources, and perceptions of technology. Primary- and second-cycle coding led to the identification and description of salient themes. Debriefing sessions between the authors and peer scrutiny (from both researchers and long-distance hikers) helped to sharpen the focus of the project (Shenton, 2004). Themes are summarized and represented through exemplar invivo quotes.

Trustworthiness of themes was verified through a member-checking process (Lincoln & Guba, 1985). Similar to the Synthesized Member Checking described by Birt et al. (2016), thirteen participants who provided email addresses were sent request to participate in the member-check (Appendix E) and given access to a list of synthesized analyzed data from the whole sample and instructed to edit, alter, remove, or otherwise comment on the content provided in a personally addressed and private Google Document (Appendix G). Nine participants responded to the request, and themes were refined according to their input.

Reflexivity increases the credibility of qualitative work. The semi-structured interview is a form of data co-creation between the research and the participants. With that in mind, the first author is a long-distance hiker who has used various information sources, including smartphones, on trails. This project stemmed from a curiosity about smartphones increasing influence in the long-distance hiking realm. While smartphones have been criticized in the outdoor recreation context, the participant-researcher attempted to approach the research and the interviews with neutral language and mindset.

Results

Situating the Sample

Participants ranged in age from 22 to 56. While not explicitly asked, racial/ethnic background of participants appeared overwhelmingly white, while gender expression appeared more evenly split. Participants had been on-trail between 28 and 150 days and had hiked between 295 and 1,880 miles at the time of the interview. Hikers traveling northbound (n=14) and southbound (n=6) were interviewed. While most were attempting thru-hikes (n=17), three participants were undertaking section hikes. Four of the thru-hikers were flip-flopping the trail.

In terms of hiking experience, one participant was on the final leg of a three-year section hike of the AT, one participant had never backpacked overnight before this journey, and the rest had completed at least one backpacking trip from one night up to several days. Two participants had formal experience leading backpacking trips but considered themselves inexperienced as long-distance hikers before this trip. As one explained, "I knew like, textbook, the way you're supposed to do things. But that's a lot different when you're on a thru-hike." When asked to describe their level of experience at the time of the interview, participants offered a range of responses from expert to novice. However, the majority indicated they were experienced but still

learning. Nonetheless, all of them were at least four weeks and hundreds of miles into their respective hikes.

All participants used at least one of three AT-specific guides: The A.T. Guide (better known as "AWOL's guide," theatguide.com), Guthook's Guide to the A.T. (an offline smartphone application known as "Guthook," https://atlasguides.com/appalachian-trail/), and the Appalachian Trail Thru-Hikers Companion (the "official guide" according to the ATC, https://aldha.org/companion). A PDF version of AWOL's guide was used by six participants. While PDFs facilitate smartphone use, they are similar to paper sources in that they are not GPS-enabled and they do not facilitate user-generated content. That is, they are static sources of information, unlike Guthook or other mobile applications which are GPS-enabled and facilitate user-generated content via commenting feature.

Whether it housed their primary information source or not, all participants in this research carried a smartphone with them. While thirteen participants used Guthook at the time of the interview, twelve of them also had a supplementary static source of information. Only one participant used Guthook alone.

For the rest of this section, quotes will be followed by parentheses containing the relevant participant's pseudonym (self-selected, not their trail name or real name), miles hiked so far on this trip, and information sources. Miles hiked is included since the longer participants have been immersed in the trail, the more time they have had to adjust their information sources or form opinions. Information sources are included to contextualize participants' statements with the materials they actually carried.

Views on Technology

Questions about the appropriateness of ICT on the trail were clearly not unheard of in this sample of hikers, and most seemed eager to share their point of view on this potential dilemma. Participants' views represent a spectrum from pro-technology to technology-resistant, with many expressing a more ambivalent view. In this sample, views on technology did not seem to align with age, previous experience, or amount of time or distance covered by the time of the interview.

Pro-Technology View

Hikers with a pro-technology pushed back against the idea that there is a dilemma at all and embraced technology fully. They described technological change as a simple inevitability where smartphones and hiking apps are just current iterations in a long line of innovations. For these hikers, smartphones are the tools available at this point in time, and it would be almost artificial not to use them. Hikers underscored that technology could make hiking easier, safer, or more comfortable.

> "There's no dilemma at all because, as years go, things are going to change. 30 years ago, of course there's no cell phone, GPS. People gotta use whatever you got to use. But now, technology makes things a little bit easier. Plus, it's a safety thing for me." *(Ben, 1894, app & book)*

> "It enhances the experience I'm already having. It makes it more comfortable, really. Like a backup, why not? If you have the technology to let you know where you are, how far it is to the water, why not? I'd like to know it if it's out there." *(Henry, 1894, app & PDF)*

"Change is always good. We have technology and we're using it in many different ways… The technology out here, it's so much easier to do the AT now than it was in 1986, than it was in the 1940s. This is a breeze, it's a vacation." *(Wanderer, 295, book)*

Out of the participants who displayed a pro-technology point of view, Wanderer is the only one who did not use an app-based trail guide. However, this was because all of his "juice" (i.e., battery power) was dedicated to a smartphone-based photography project.

Technology-Resistant View

The views of other participants represented the other end of the spectrum. These hikers carried smartphones but conveyed that they minimized technology use and relied exclusively on paper trail guides. They explained that knowing precise locations (GPS) and details of what was ahead (UGC) could diminish the "sense of discovery." They described a desire for some amount of mystery or uncertainty. They desired the trail to be a space where they could experience "wildness" and "get back to [their] roots"—and smartphones inhibited that.

"I would like to not have to deal with [smartphones] just 'cause for me, it's like trying to get away from all that kind of stuff." *(JK, 915, book)*

"Sometimes it's better for you to not know where you are and just enjoy." *(Flower, 1777, book)*

"[Technology] does change the dynamic of the trail in a distinct way. I don't know. It takes that element of wildness out of it when you can call an Uber or you could see other people doing it. Even though we don't have these things, like we don't have Uber, we don't have Guthook… there's always that choice. You see people lugging heavy batteries. I don't know. It just makes me feel like, "Okay. If this isn't the place you can detach, where is it?" *(Sally, 440, book)*

For hikers with this view, smartphones are not part of the most authentic or legitimate hiking experience. However, this mindset did not fully extend to town settings, where these hikers used social media, Google maps, or other otherwise accessed the internet.

Technology Ambivalence

Other participants' views fell closer to the middle. As James summarized after sharing mixed feelings, "[technology]'s more than helpful than hurtful." Whereas the technology-resistant view sought to minimize technology use, the ambivalent views support balanced technology use. The participants who expressed these views relied on their phones but also expressed some concerns about ICT on the trail. These hikers were not strongly oriented toward either end of the spectrum, noting both benefits and issues associated with technology use on the trail. Despite some concerns, the benefits slightly outweighed the costs for these participants.

> "It's really handy to have for me. And also like an emergency situation it'd be really nice to know where I am. But it kind of ruins a little bit of the surprise when I know how close I am to the next water source, automatically… Or like a shelter, I don't really want—I want to see what it looks like 'cause I want to know if it's a good one, but I also want to be surprised when I get there." *(Charlie, 1868, app & book)*

> "There's definitely benefits to technology on-trail. Being able to pinpoint myself, know exactly where I am, is huge. Not having to carry paper maps and switch them out the whole time—that's huge. It's less weight I have to carry on my back. The disadvantages are sometimes we get a little too caught up, you know, on our phones in our daily lives, and now you're doing it on the trail." *(Dan, 1858, app & book)*

> "Finding the happy-medium is important." *(GG, 495, app & book)*

"As a tool, using Guthook is pretty awesome. It's sort of like a technology compass in my head, you know what I mean? I do see a lot of people still plugged in and listening to podcasts and stuff like that. I was thinking about it the other day, I was just kind of thinking, 'I wonder what it would be like if they all were just unplugged?'" *(Stacy, 1879, app & book)*

Information Relations

Participants were asked about their use of information sources and how they plan ahead. All participants in this research carried at least one AT-specific guide. They typically planned on a re-supply to re-supply basis and often left room for flexibility in the daily details, such as where they would camp each night between towns. Hikers relied on their information to understand the distance (and days of hiking) between re-supplies, and their information sources also helped them to plan daily activities (where to stop for water, viewpoints to visit) to the extent they desired.

Information Satisfaction

Whether they chose a book, PDF, mobile applications, or a combination of sources, all of the various tailor-made guides that AT long-distance hikers rely on contain very similar baseline information such as shelters and campsites, significant road crossings, water sources, prominent points of interest, and other major landmarks on the trail. Generally, hikers indicated they were very pleased with the information available to them, regardless of which type of information source they relied on.

"I'm pretty happy with how I get and use information. I like that all the information that I feel like I need or would want, I'm able to get to. Then, when I don't want it or need it and

I just want to enjoy the hike, I put it away in my pack and it's there when I need it. I'm not

sure if there is anything that I'd want to improve." *(John, 470, app & PDF)*

"If you have that book, AWOL's book [or the PDF version], then you can hike the AT

and be confident about where you're going. Everything is very accurate in there." *(James,*

340, PDF)

"Aside from some roughly blazed areas, I feel like I've all but had my hand held out here,

like the ways I can go, the ways I can navigate myself. It's like, it's all very clear. It's all

very accessible." *(Sweet, 495, app & book)*

Information Overload

Participants indicated that there could be an excess of information in some cases. Hikers who

used two sources in tandem could spend too much time cross-referencing and comparing.

Multiple participants brought up the issue of checking their location too frequently with the GPS-

enabled apps, and those without GPS speculated that they would do this if they had the

technology. Some hikers with static sources contended that the rich information provided by

apps was actually inhibitive in some ways, desensitizing app users to trail blazes and seasonal

water patterns.

"Guthooks kinda makes it too easy. It kinda makes you feel like you're cheating" *(Nut,*

860, app & PDF)

"I find myself checking my phone much more often. You know, I'll be like, 'Okay, I

know it's a mile and a quarter to get to the top of this mountain,' and I'll check it every

three tenths of a mile because I'm just so fucking tired of walking up this mountain that I

want to know exactly where I am, how much more misery I'm going to be in before I get

to the top." *(Rhino, 299, app)*

"I think people come to rely on the comments a little bit too much, and they'll be like 'Wow, there hasn't been a comment in six months, I don't know if there's water here.' It's like, well yeah but like it's a full water droplet, it's supposed to be a reliable source, it's April, it's still early in the season... So I think it can desensitize people to having more like environmental awareness of what's been going on around them. Um yeah, in that way I think that it can hurt you in the long run because you're not paying attention. You're used to relying on it." *(Sarah, 1810, PDF)*

Positive Evaluation of Uncertainty

While some participants questioned whether more information was always beneficial, others went a step further and suggested that a lack of information could be positive. It was suggested that individuals "should not know" or that it was simply "nice not to know" some information, especially precise location through GPS. Expectations of the trail ahead could be problematically influenced by UGC provided in apps, or photos could ruin the surprise of a special vista or unique trail shelter.

"There is something taken away from the experience a bit by knowing how far you are from a location. I mean there's definitely a safety feature with [GPS]… But you know, sometimes when you're climbing a mountain like you shouldn't know how far you are because it's, it's changing your experience of climbing that mountain or descending" *(BS, 495, app & book)*

"I see the value in [Guthooks], but I also could see the value in not having it... just getting to experience what's in front of you without anyone else tainting that reality and without having any expectations or preconceived notions. You would just get to be exploring like an old school adventurer, and it would be very different than knowing everything you're

going to see and how far away it is, and what it's going to be like, and all the details about the terrain." *(Cinderella, 480, app & book)*

"Sometimes like at the end of the day, I'd like to know how far I am from camp. Like yesterday, I felt that way. Like, 'Am I going to be there soon? How far am I?' But sometimes it's nice not to know… instead of focusing on where exactly I am." *(Jane, 830, app without GPS, book, & PDF)*

Discussion

This study intended to demonstrate how long-distance hikers view the use of technology and how they use information sources on the trail. It is our contention that managers who are aware of emerging trends will be better equipped to provide quality recreational experiences while promoting low-impact behaviors and sustaining the natural resources for future generations. These results may also contribute to broader conversations about technology and information use in recreational contexts.

The range of views expressed by the participants in this research seems to reinforce the classic dilemma on the appropriateness of technology in wild or natural places. Those participants with pro-technology views would mostly agree with Valenzuela's (in press) argument that we need to embrace technology and use it to our advantage. Those who displayed technology-resistant points of view would find favor with the arguments of Dustin and colleagues (2017)—namely, that technology detracts from our ability to connect with the land, the trail, or some deeper part of ourselves. Those participants who expressed ambivalent views would find common ground with both camps. While only a few participants mentioned it by name during an interview, the ambivalent view meshes well with the "hike your own hike" mantra that dominates the long-distance hiking social world (Littlefield & Siudzinski, 2012).

This ethos holds that hikers should interpret and recreate the hiking experience to fit their own preferences and values (Littlefield & Siudzinski, 2012). While it seems that the pro-technology view can accommodate ambivalent views, the technology-resistant view necessarily draws a hard line. Dustin et al. (2017) make exceptions for some gear, but they resist smartphones. In this research, even those participants with views labeled as technology-resistant carried smartphones and used them under varying degrees of self-regulation.

Views on ICT seemed to be entrenched for the two groups on either end of the spectrum, and especially those with technology-resistant views. Their eschewing of technology seems almost a part of their identity. This aligns with Lum et al.'s (2020) identification of distinct subgroups in the PCT hiking social world. Aversion to technology was a characteristic of a group they termed "romantic purists" (Lum et al., 2020). By not connecting to the trail app and UGC from other hikers, the participants with technology-resistant views reduced the extent to which they could take part in the commonly shared experiences mentioned in the app's comments (e.g., a popular swimming hole just out of sight of the trail), which could contribute to the development and maintenance of distinct sub-groups.

It appears that the two sides of the dilemma are represented in the decisions and experiences of long-distance hikers, and interactions between the groups and those in the middle are overwhelmingly positive. The one exception is the portion of technology-resistant hikers who acknowledged that other hikers' use of smartphones was enough to detract from their experience on the trail (some technology-resistant hikers were clear to communicate that this was not a problem for them). This presents a challenge for the trail community and outdoor ethics organizations to tackle. How might we preserve the experience for these few purist hikers without alienating the majority of other hikers who appear content with smartphone use on the

trail? Lum et al. (2020) indicated that "romantic purists" tended to hike with others of the same typology. This may be a strategy that technology-resistant hikers employ (whether knowingly or unknowingly) to minimize the detraction of others' technology use.

As for information use, participants—even those hikers who avoid UGC, GPS, or PDFs in favor of guidebooks—had sufficient information to meet their needs. Paper guides have been in production for years, and some for decades, like the Appalachian Long Distance Hikers Association's (ALDHA) Thru-hikers' Companion (ALDHA, 2020). Surely information management technology, publishing software, and the ability (whether they choose to exercise it or not) for members of the trail community to send an email or a photo whenever a re-route opens up or a hostel has closed down have increased the richness and reliability of paper guidebooks over the years. The "game of telephone," whether a hiker has a mobile app or not, spreads information up and down the trail. Thus, even those hikers who choose paper books are still exposed to information through the power of high-tech. Future research on technology and its effects on recreationists should consider that even those recreationists who do not use apps or other ICT may still glean information hosted on mobile devices through other communication channels. In a similar vein, multiple participants in this research indicated that they do not rely on their smartphones for navigation. Yet, as revealed through responses to probing questions, it turned out that some of them did use their smartphones for navigation and decision making but in less common ways, such as through fitness tracking applications. Future research on technology use must be cognizant of "alternative" uses that participants may not consider, such as taking photos of a paper guidebook to reference while hiking or using a health monitoring application to estimate distance traveled.

Some participants who used hiking apps and paired them with another source reported information overload. While this may seem unsurprising considering the real-time location information, plus the user-generated content, plus the secondary source, other hikers with the same amount of information available to them indicated information satisfaction. This underscores the role of personal preferences in determining how hikers perceive information use, which may be tied to views on technology. Research on use of information and decision making should explore perceptions of information (inadequate, sufficient, excessive) and examine the relationship with recreational motivations, preferences, and experiences.

Of particular interest is the finding that some hikers acknowledge the value of not having some bits of information. This sentiment was communicated primarily around UGC and GPS. By avoiding "looking ahead," hikers believed they were more likely to experience a sense of discovery as the trail was allowed to unravel before them. This may be a more feasible mindset on the AT, where planning and logistics are considered relatively easy, than on more remote long-distance routes (Fondren & Brinkman, 2019). Kaplan and Kaplan (1989) identified mystery as a preferred component of the environment, and traditional wilderness values such as escape, risk taking, and exploration arguably contain elements of mystery or uncertainty. Future research related to wilderness recreation or technology's role in outdoor recreation should continue to explore the importance of mystery or uncertainty alongside the collective knowledge and information resources associated with a given place or activity. This understanding may enable better recreation provision as the population grows, recreational use increases, and information and communication technologies become more integrated in daily life.

Study Limitations

This work is based on discussions with a small sample of Appalachian Trail long-distance hikers and was conducted in a natural setting by a participant-researcher with a smartphone as a recording device. Although the participant-researcher also carried paper information sources, the use of the smartphone must have indicated some degree of technology acceptance to the participants, which could have impacted their choice of words and our discussions. Additionally, while member-checking and peer debriefing (with both researchers and long-distance hikers outside of this project) helped to improve the trustworthiness of this work, the coding and synthesizing of data were interpretive processes performed solely by the first author, and peer debriefing was facilitated through personal relations.

The views on technology and information relations reported above were all shared by multiple participants, but more intensive sampling will be needed to generalize beyond this group. This work only generated data with participants who were currently hiking, and this was done on a section known for its incredible scenery and difficult terrain. Generating data on other sections or before or after a long-distance hike would likely yield new findings. While the AT fits into a larger hiking subculture, the AT has unique characteristics of its own (Fondren & Brinkman, 2019). Thus, these findings may be transferable but not generalizable to other long-distance trails or other similar activities, like long-distance bicycle touring.

Conclusion

Wilderness travelers have always taken on large amounts of uncertainty by leaving the comfort of homes, road networks, and other societal trappings. Appalachian Trail guidebooks have, for decades, removed enough of the uncertainty to make the journey relatively safe and attainable by providing critical water, shelter, and resupply information. Smartphone-based information

sources have condensed a nearly unimaginable amount of information into one little, accessible package, removing more of the uncertainty associated with long-distance hiking than has yet to be the case. This does not mesh with some hikers' expectations, so they intentionally break from the natural progression and forego the use of apps. Others concede to the power of the smartphones and apps, but limit their use in some way. These hikers may intentionally introduce uncertainty to facilitate the experience they want to have. Uncertainty has been such a basic part of wilderness recreation and time in nature that it seems uncertainty may have been unrecognized or taken for granted up to this point.

Of course, some hikers want as much information as possible, and that is a valid way to enjoy the Appalachian Trail, too. Fortunately for them, the momentum of our society propels us toward greater connectivity and more seamless information exchange. Whether managers should provide spaces and experiences where ICT are absent is unclear, although a cadre of individuals would certainly appreciate those areas. Whether it is within managers' ability to actually offer those spaces is another question. However, it is possible for wilderness and protected area stewards to encourage recreationists to turn their devices off or leave them at home. Managers and other leaders in the hiking community should empower all recreationists to create the experiences they desire while being mindful of others' preferences and values.

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CHAPTER 3: Smarter Long-Distance Hike: How Emerging Technologies Shape Information Use and Spatial Decisions on the Appalachian Trail

Abstract: Emerging technologies create opportunities and challenges for managers and recreationists by facilitating novel communications. Through semi-structured, in-depth interviews with 20 Appalachian Trail (AT) long-distance hikers, we explored hikers' use of information sources to describe avenues of communication and information's role in spatial decisions. While GPS seemed to be a reassurance tool, user-generated content appeared to play a greater role in decisions related to camping, points of interest, and water sources. Results can aid managers in understanding AT long-distance hikers' experiences and perceptions with regard to smartphones. Findings add to ongoing discourse on the appropriateness of emerging technologies in protected areas.

Introduction

Participation in overnight backpacking has been steadily growing in the United States (Outdoor Foundation, 2018), and national scenic trails in particular have seen recent surges in popularity. Since the Appalachian Trail's (AT) completion in the 1930s, nearly 20,000 people have reported hiking at least 2,000 miles (or 3,160 km) of it, but nearly 14,000 of these hikes have been reported since the year 2000 (Appalachian Trail Conservancy [ATC], 2019a). This growth prompted Fondren and Brinkman's (2019) suggestion that "long-distance hiking has captured the zeitgeist or cultural climate of the time" (Figure 1).

Figure 1: Long-distance and day hikers overlooking the Blood Mountain Wilderness, Appalachian Trail, Georgia, USA.

Recreational use causes biophysical impacts, which can have substantial consequences on ecological integrity and the visitor experience (Manning, et al., 1996). Long-distance hiking is no exception, especially when one considers the amount of time spent in wilderness and protected areas over the course of a long hike. Managing the areas through which these trails pass involves balancing social and environmental objectives (Daniels & Marion, 2006). This is often complicated on long-distance trails, which typically traverse multiple protected areas, connecting towns, open spaces, and everything between. In the case of the AT, two federal agencies, more than 20 regional clubs, and the non-profit ATC all share the responsibility of managing the trail. On one hand, managers must provide recreational opportunities for today's visitors; on the other, they must protect the natural resources for generations to come. As recreation on national scenic trails increases, impacts on environmental and social conditions require more attention.

Emerging technologies create new challenges to managing wilderness and protected areas. More than two decades ago our colleagues wondered, "Will we be able to feel assured that the next person coming down the trail won't have a cell phone stashed away in their pack and be able to contact the outside world if an emergency arises? Will people still elect not to bring their cell phones along?" (Freimund & Borrie, 1997). The reality is that handheld information and communication technologies are almost ubiquitous now, including in national scenic trail corridors. Recent work on the Pacific Crest Trail showed that 97% of long-distance hikers carried smartphones and used them daily (Amerson, et al., 2019), and this work has fueled important discourse surrounding the "cognitive costs" of smartphones in wild places (Dustin, et al., 2019).

This study explored long-distance hikers' use of information sources. One focus was on avenues of communication: how do hikers receive information and from who? The other focus was on spatial decisions, such as selecting a campsite or deciding where to stop for water, as they have immediate and tangible ramifications for the natural resources. Long-distance trail managers who stay abreast of emerging trends and understand hikers' use of information sources are better able to promote low-impact behaviors and sustain the natural resources for future generations.

Methods

On-site semi-structured interviews were employed to generate data related to decision making and the use of information by long-distance hikers. The semi-structured interview protocol was developed to capture hiker characteristics and demographics, avenues of communication (including use of GPS, crowd-sourced information, and communication from managers), and spatial decisions while on trail (with a particular focus on spatial decisions). The first author

acted as a participant-researcher to facilitate interviews in a "natural" setting (Lincoln & Guba, 1985). The interviews were conducted with hikers encountered on the AT in New Hampshire, USA in the last week of July and the first week of August, which allowed for interaction with northbound and southbound thru-hikers (those attempting the entire trail in a single journey) as well as with section hikers. Interview protocol, informed consent form, and other documents approved by the institutional review board are included (Appendices A-D).

Out of the twenty-three hikers contacted and informed of the project, one individual rejected the offer to participate citing a lack of desire to participate, and two individuals rejected due to time constraints. In total, seventeen interviews were conducted with twenty long-distance hikers participating. Interviews ranged from 26 to 121 minutes, averaging 57 minutes. Interviews were digitally recorded and transcribed verbatim. Transcripts were analyzed and coded following Tracy's (2013) guidance on iterative analysis while keeping in mind the goal of understanding long-distance hiker avenues of communication and spatial decision making on long-distance trails. Primary- and second-cycle coding led to the identification and description of salient themes, which are summarized and represented through key invivo quotes. Trustworthiness of themes was checked by nine participants through a member-checking process (Appendices E & F).

Results

First, an overview of the participants contextualizes the results. Communication, with a focus on smartphones and with managers, is described next. Then, the role of information sources for decisions related to camping, points of interest, and water are described.

Description of the Participants

Participants ranged in age from 22 to 56. Participants had been on-trail between 28 and 150 days and had hiked between 475 and 3,025 kilometers (295 to 1,880 miles) at the time of the interview. Hikers traveling northbound (n=14) and southbound (n=6) were interviewed. While most were attempting thru-hikes (n=17), three participants were undertaking section hikes. Four of the thru-hikers were flip-flopping the trail, a practice where the entire trail is hiked in non-consecutive segments within one year.

One participant was on the final leg of a three-year section hike of the AT, one participant had never backpacked overnight before this journey, and the rest had backpacked between two and ten days. Two participants had formal experience leading backpacking trips but considered themselves inexperienced before this trip. As one explained, "I knew like textbook the way you're supposed to do things. But that's a lot different when you're on a thru-hike." When asked to describe their level of experience at the time of the interview, participants offered a range of responses from expert to novice. However, the majority indicated they were experienced but still learning.

Avenues of Communication

All participants carried a smartphone with them, and all used at least one of three AT-specific guides: *The A.T. Guide* (better known as "AWOL's guide," theatguide.com), Guthook's Guide to the A.T. (an offline smartphone application known as "Guthook," https://atlasguides.com/appalachian-trail/), and the *Appalachian Trail Thru-Hikers Companion* (the "official guide" according to the ATC, https://aldha.org/companion). A PDF version of AWOL's guide was used by six participants. While PDFs facilitate smartphone use, they are similar to paper sources in that they are not GPS-enabled and they do not facilitate user-

generated content. That is, they are static sources of information, unlike Guthook or other mobile

applications which are GPS-enabled and facilitate user-generated content via commenting

feature. While thirteen participants used Guthook, twelve of them also had a supplementary

static source of information. Only one participant used Guthook alone. All participants used their

phones for taking photos (Figure 2).

Figure 2: Thru-hiker taking photo with smartphone from Zeacliff Overlook, Pemigewasset

Wilderness, Appalachian Trail, New Hampshire, USA.

GPS

Many participants valued their smartphones' ability to verify their location and help them stay on trail. The majority of GPS use was through the Guthook application, but hikers also used Google maps and other apps to check their location.

> "Guthooks is also, like kind of gratifying. Like you can… hit your location and see how close you are like exactly on-trail." *(7)*

But many hikers also mentioned reservations about GPS effect on the experience.

> "Sometimes it makes it just seem like you're trying to get something over with." *(6)*

Of the seven hikers who carried only static sources, four reported accessing GPS through other means.

> "There is an application called iHealth, and you can see how many miles you hike during the day." *(8)*

> "I use Google quite a bit, Google Maps all the time, to try and-- sometimes I'm like, 'am I on the trail?' Haven't seen any blazes in a while. Sometimes I'll be able to pull it up, and like it has little green dashes" *(12)*

Only three participants, each of whom carried paper guides, did not use GPS for navigating on the trail, although one of them did carry a personal locator beacon.

User-Generated Content

Mobile application users had overwhelmingly positive statements regarding the user-generated content, which they referred to as "comments."

> "Guthooks is nice. You can find like little secret gems along the trail… because of a random Guthook comment that somebody finds" *(2)*

"Seeing some people's comments lets you know that you should really make the trip off-trail to go see this vista or campsite or whatever it is. I think that the comments enhance my experience by sharing other people's experiences and letting me know if it's something worthwhile or something that I want to skip." *(3)*

Although participants pointed out that the comments were not entirely reliable, the solution seemed to be more comments.

"You can't take just one comment, because those are just people like you or I just commenting, sometimes in a bad mood. I try to read a few of the comments and get the gist." *(9)*

"The more they're completely crowdsourcing everything, and the more people that use it, eventually, you get a critical mass and the cream would rise to the top." *(13)*

Hikers who didn't even use Guthook still reported benefitting from the comments.

"Although we don't have Guthook, we definitely have the advantage of information from Guthook through other hikers. That's been nice on occasion." *(17)*

Communication with Managers

The ATC encourages thru-hikers to register their hikes "so they can plan their itinerary in order to avoid the social and ecological impacts of overcrowding" (ATC, 2019b). Fifteen participants (all but two of the thru-hikers) registered, citing desires to help the ATC, to be recognized and documented, or to receive a hang tag (a commemorative tag with Leave No Trace information designed to hang on a pack).

"I thought it was the proper thing to do. And also it could help keep track of people coming in and out. And also I would like to have my name on the database so that you know that I hiked the AT!" *(1)*

"I just thought it'd be fun to register. Get a tag. That was maybe the main thing. I wanted

a tag." *(19)*

However, these motivations did not resonate to the same extent with section hikers or the thru-

hikers who did not start at one of the ATC's Visitor Centers.

"Since I'm only out here for like a month, just doing two states, pretty much, I was like,

'Ah, it's not a big deal. They don't need to know I'm out here.' And it'd be weird having

the badge and people would ask me about it, and I'd be like, 'Oh well I'm just section

hiking.'" *(10)*

Many of those who registered were set on a particular date, but some thru-hikers decided to shift

their start date after visiting the ATC website. They also benefitted from the education provided

at the visitor center at the southern terminus.

"I did look on the site... I was going to start on [a particular day but] it was super full. I

backed it up a day and went [the day before]." *(19)*

"They give you some tips, and they show you how to hang your bear bag as well, and

they ask you to be really careful with your trash and with your food." *(8)*

Spatial Decisions

Acknowledging that trails intend to concentrate recreation impacts to a narrow linear corridor,

the semi-structured interview protocol sought to elucidate participants' decisions to step off the

tread and the role that their information sources play in those decisions. Camping, visiting points

of interest, and stopping for water appeared to be strongly influenced by information sources

while the other spatial decisions examined (where to break and where to dispose of human

waste) were less clearly linked to trail guide information, user-generated or otherwise.

Camping

Camping is a major source of concern given the potential for impacts, even when practicing low-impact techniques (Cole & Monz, 2004). Researchers have classified and described various camping management strategies (Marion, et al., 2018), but participants tended to simply view campsites as either "official" or "stealth." Official sites are those published in guidebooks. Stealth sites are not formally mentioned in guidebooks, although they may be noted by other hikers via mobile app comment feature (Figure 3). Guthook comments were valuable for some hikers to locate "stealth" sites that aligned with their preferred distance for the day. However, participants who used only static sources still knew where to look for existing stealth sites.

Figure 3: Heavily trampled unofficial camping area where the AT crosses Mink Brook, White Mountain National Forest, New Hampshire, USA. A mobile app had an entry for the stream, and many user-generated comments mentioned camping (e.g., "Great place for lunch or camping" and "Tent island, fit 7 tents on the island by the fire ring. Great spot.").

"A lot of the Guthook-- it's mostly official campsites. But with comments, a lot of hikers can tell you where to go, how far, and then give you more information about it." *(1)*

"I'll only look for a stealth site if there isn't a campsite or a shelter within the miles, plus or minus a couple of miles of what I plan on doing. Then I'll start clicking on other icons in the Guthook's app where I do want to stay and see if anyone is mentioning a stealth site." *(13)*

"It's a good guess, when there's a stream or whatever, there's usually a stealth site somewhere close by within 0.2." *(20)*

Only one participant reported true dispersed campsite selection.

> "When… it's really late, and I haven't found a spot, sometimes I just start wandering in the woods to find a spot. Cause you're like, 'Something's gonna be flat somewhere around here.'… I don't think anyone will ever find some of those spots that I do." *(12)*

Points of Interest

Participants wanted to enrich their hikes by exploring points of interest, but they were also conscientious of doing "sideways miles." Word of mouth, Guthook comments, and distance often determined if a hiker chose to go to a point of interest or not (Figure 4).
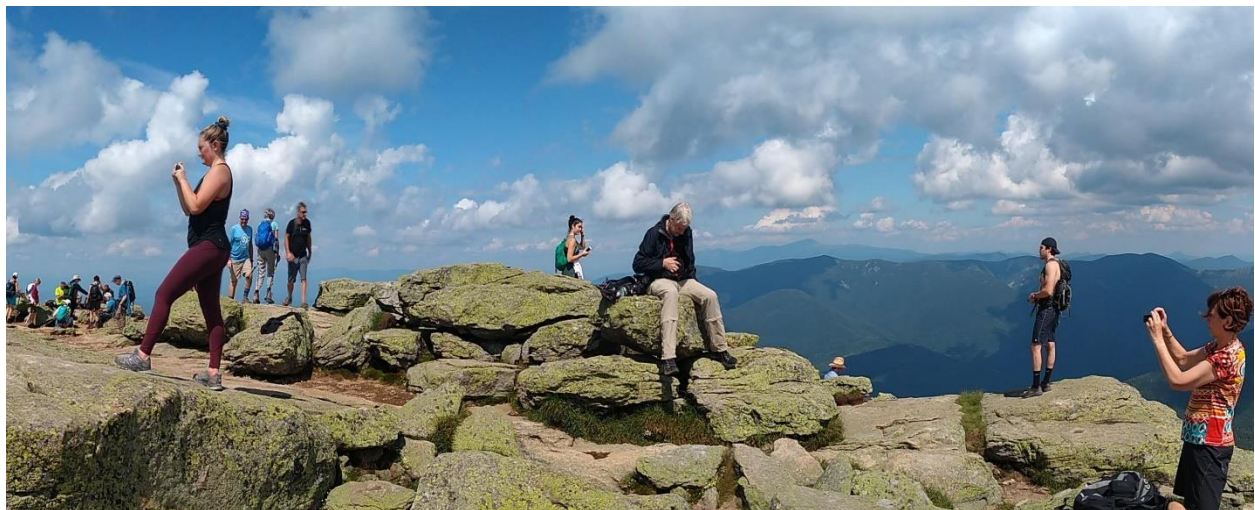
Figure 4: Some points of interest, like the summit of Mount Lafayette in White Mountain National Forest and adjacent to the Pemigewasset Wilderness, New Hampshire, USA, are more popular than others.

> "It's usually about word of mouth that I'm like 'I'm going to go through a blue blaze.' Not much else takes me off." *(2)*

> "Is it worth going up there? Well, the last comment was that the trees have grown up. 'You can't see anything.' Well, I'm not going there. Thanks to Guthooks, I was able to learn not to waste an hour going half a mile out of the way." *(9)*

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"Something that's not too far off the path-- a lake or a pond that I might go swimming in or an exceptional view that everyone is raving about… Unless it's one of those two things, I'm not really getting off the trail. I try not to do too many sideways miles." *(13)*

Water

Some participants closely managed water stops based on the quality and reliability of sources, while others simply tried to carry as little as possible. Comments provided enough information that Guthook users could be very selective except in the driest times. Hikers who carried only static information sources used word of mouth to learn about unreliable sources, but sometimes they ended up with less than ideal water.

"There was a really bad water source that we had a couple days ago, and we were just like 'Nah, like let's push on to get a little bit better water,'… I don't really prefer to dig it out of a bog." *(5)*

"I try to stop where there is a good spring, but sometimes, yeah you don't really have the choice, so yeah. Many times I had to stop and like use some frog water." *(8)*

"We'll try and look for something three to five miles from where we're at… And then using Guthook's too just to figure out what are good water sources. If it's like three miles out and it says 'This water's shitty,' and there's another one five miles out, we'll go to the five mile one." *(15)*

"I ask other hikers a lot. Like now especially with water sources, especially as it gets later into the season, like the sources AWOL is listing as unreliable, asking other hikers 'Hey, did you see water here?" *(18)*

Discussion and Implications

This inquiry further substantiates a phenomenon already documented by Amerson et al. (2019)—smartphones are part of the long-distance hiking world. In this small sample, all hikers carried smartphones, but they engaged with them to different degrees. The mobile app essentially adds GPS and user-generated content to the same base information as the static guides. For hikers with access to GPS, the primary use was simply to confirm one's location. While increasing use of GPS in backcountry and wilderness areas certainly warrants investigation into potential experiential and biophysical impacts (Martin & Blackwell, 2016), it appears that GPS did not guide spatial decision making for the participants in this research.

On the other hand, user-generated content does appear to influence spatial decision making, at least for some decisions. Even those hikers who made a point to "disconnect" reported that they received crowd-sourced information via word of mouth. User-generated content allowed hikers to plan around stealth sites with certainty and told hikers which points of interest and springs to visit and which to hike past. While water sources are critical to survival on the trail, the motivations that underpin visiting points of interest are less clear. While these stops could be entirely hedonistic, a better understanding of what motivates hikers to stop or venture off-trail could be valuable information for managers seeking to steer use,

Given that resource impacts are inextricably linked to recreationists' physical presence, an information source that determines the spatial distribution of hikers must, to some extent, determine the spatial distribution of impacts (Cole, 2009). This is true for any trail guide, but the user-generated content of mobile apps sets them apart from more traditional guides. Managers should be aware of the influence of user-generated content on protected area visitors and respond where necessary. For example, managers should check "stealth" sites indicated by user-

generated content for proximity to sensitive resources and potential for expansion. When better sites exist nearby, managers could close the site and request that the comments be removed and the appropriate site indicated in the app. In longer stretches of trail without sustainable campsite options, user-generated content could aid managers in identifying where new campsites should be located to minimize unconfined camping and concentrate resource impacts (Marion et al. 2018).

If managers intend to guide long-distance hikers toward preferred behaviors, they must work proactively with app developers and users. Participants in this research appeared sensitive to social and biophysical impacts when they were aware of them, and they were willing to follow the guidance of trail managers. The ATC's web-based registration system paired with education sessions at the southern terminus helped many hikers make "good" decisions. More interventions, guided by theory and past successes and acknowledging the prevalence of user-generated content, should be developed as the scene continues to unfold. Leave No Trace-style recommendations have begun to reflect the prevalence of mobile devices (e.g., wear headphones to listen to music (Leave No Trace Center for Outdoor Ethics, 2020)). Similar guidelines could be developed to guide long-distance hikers' use of information in the digital age. A "no spoilers in comments" recommendation could be encouraged to maximize "sense of discovery," which participants indicated was threatened by comments and photos of what's ahead. Photos are already an optional download for offline use of Guthhok's Guide to the AT. App users could be reminded that they can control their access to photos, and they can choose not to view comments while still having access to the critical content included in standard information sources.

While not reported here, each participant in this research discussed the appropriateness of technology on the trail in depth. Some embraced technology fully while others tried to minimize

its intrusion into their hikes, but most fell in the middle. They relied on their phones, but they also had concerns about how smartphone use might affect their experience of nature and the trail, echoing the sentiments articulated by Dustin et al. (2019). Despite these concerns, they found smartphones too convenient and too practical to leave at home.

Focusing on the two ends of the spectrum, neither group appears likely to be swayed, but both respect the other group's point of view. These two groups share many key characteristics. They chose to take long walks in nature. They respect other hikers' autonomy. They want the freedom to choose their own style of adventure. Mirroring Dustin et al.'s (2018) charge, managers and planners must find the underlying wilderness values of both groups and develop palatable policies on the common ground. The shift that is occurring boils down to this: Previously, people had to actively choose to bring information and communication technologies on the trail. They were clunky, unreliable, and often inconvenient. Now, paper guidebooks are beginning to be considered clunky, unreliable, and often inconvenient. People now must be proactive to avoid information and communication technologies on the trail. Given the momentum carrying the situation toward full connectivity, managers and interested members of the trail community should encourage hikers to consider "unplugging." Wilderness managers must make a case against convenience and practicality and for more meaningful experiences if they are to be successful in providing "outstanding opportunities for solitude or a primitive and unconfined type of recreation."

Acknowledgements

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CHAPTER 4: General Conclusions

Reflections and Implications

This research began with my curiosity about the relationship between smartphones and biophysical impacts to natural resources on long-distance trails. Discussion following my thesis proposal presentation emphasized that technology's influence on the experiential aspect of long-distance hiking may be more significant than the impact to resources, and that is ultimately where the primary focus of this thesis landed. I recently realized, I think, why my interest was trained on the resource impacts more than the experiential impacts: because people can advocate for themselves and shift their actions to meet their needs and desires, but the biological and physical resources need people to speak for them when impacts are occurring.

Nonetheless, I do firmly believe that natural resource protection and the provision of recreation opportunities are of equal worth and importance. With that said, any information that steers the distribution of recreational use must, to some extent, determine the distribution of impacts to resources. These interviews revealed that UGC provided through smartphone apps does steer hikers to certain features, primarily "stealth" sites, preferred water sources, and the most interesting points of interest. Future research that measures impacts to resources and integrates hiker information sources will be needed to determine the nature of the effects of those information sources on the resources.

It seems that UGC is concentrating use in certain areas. In the recreation ecology and visitor use management realms, distributing use and impacts over space and time tends to be the preferred strategy until levels of use exceed some threshold; then, concentrating use and impacts to previously impacted areas becomes the strategy to minimize the areal extent of impacts (Marion et al., 2016). Smartphones should be employed (as other information sources have been

used) by managers to meet their objectives. As long as smartphones are concentrating use in areas that can handle those levels of use, then smartphones can positively contribute to management strategies. Where concentrated use is problematic, managers must either harden the resource or take action to re-distribute use.

Shifting back to the experiential implications, recent research indicated that long-distance hikers increasingly rely on smartphones (Amerson et al., 2019), and all 20 of the participants in this research carried one with them. However, they used them to different extents and in different ways based on their values, preferences, and needs. A major issue, especially for wilderness managers, is that some technology-resistant hikers reported that their experience was diminished simply by knowing that others were using technology in certain ways around them. If simply being aware of technology's presence in a recreational setting can detract from the experience, what does that mean in light of an increasingly robust global satellite network? Even if you choose not to use it, does knowing that you or others could pinpoint your location through GPS detract from the experience for these recreationists?

Also pertinent to this discussion is the increased accessibility, perceptions of safety, and comfort facilitated by smartphones, GPS, and UGC—things that many of the participants in this research mentioned. While it has been argued that smartphones detract from hikers' ability to connect with the land, the primary challenge to this is that they allow people who might not typically venture past a certain point to push their boundaries and connect with land they otherwise would not visit. Some take issue with this as increased use tends to beget increased impact. However, in a world where overt and covert oppression must be actively battled, traditional conceptions of how outdoor spaces should be enjoyed require scrutiny and open

mindedness. Accessibility and exposure to public lands expands and builds new generations of advocates for these special places

Whether managers can actually facilitate or enforce a space without "technology" is questionable, and whether they should is a matter of opinion. Personally, I can relate to the technology-resistant point of view, but I also agree with those thinkers who view continued connectedness as an inevitability. The onus, then, seems to be on those who want to enjoy technology-free spaces to create them for themselves. If enough people want to create areas that prohibit smartphones or PLBs, I believe it could happen. But I think it's more likely that technology-resistant recreationists will have to turn a blind eye and adapt intentional mindsets to minimize the role of technology in their recreational endeavors. Indeed, it is likely that smartphones will remain on the recreation landscape and will soon be embraced by managers and integrated into visitor use management and protected area research strategies (Munoz, 2018; Valenzuela, in press). Leave-No-Trace-style ethics could be developed to minimize the social impacts associated with smartphone use, but they should be co-created by managers, academicians, and a variety of recreationists to maximize their efficacy and palatability.

All of the participants in this research indicated that they had enough information, and some even had too much. As information sources become richer and more powerful, it is likely that some outdoor recreationists will continue to intentionally introduce uncertainty or curate their level of connectedness to create their desired recreational experience. Maybe more advanced measures to shield others from one's technology use will be developed—current recommendations advise recreationists to "be discreet" with their use of technology. Introducing or embracing uncertainty by avoiding smartphone use may represent a new approach to accessing wilderness. It has been argued that wilderness is a state of mind. Limiting one's

smartphone use may not change what others are doing, but it could help to facilitate e a positive state of mind for those hikers looking to unplug. Future research should explore the role of uncertainty in outdoor recreation and the wilderness experience.

Methods Lessons

Interviewing on the AT presented some interesting learning opportunities related to hiker mindsets, rugged terrain, and temperature and weather. First, even though they are engaged in leisure, hikers do not feel like they have a lot of downtime, which makes me all the more appreciative of the time they volunteered for this project. It was a lot to ask anyone to set aside time aside for an interview. This made it even more encouraging to hear participants say they actually enjoyed thinking about these things after wrapping up an interview.

Conducting interviews in the White Mountains presented a couple unique challenges. The rugged terrain meant that nearly everyone was doing less miles than they were accustomed to, which made hikers feel even more constrained in terms of time. The Whites demanded long days for few miles, which made time in camp or town extra precious, too. The terrain also made walking interviews, which I had hoped to do, unfeasible in many cases. Climbs were steep enough that heavy breathing yielded low quality audio, and some sections required scrambling instead of walking.

Temperature and weather also presented some challenges. An interview in a shady campsite one cool morning meant sharing my jacket, in another instance we were able to move to a sunnier spot, and a storm with lightning and blowing rain forced us to call one interview off and retreat to our shelters one evening. Fortunately, we reconnected and finished the conversation the next day, but all of that is to say that environmental awareness, two-way

communication with participants, and flexibility were important to accomplishing this field work safely.

The fact that I was also a self-sufficient hiker presented some challenge as well, but the value of immersed research and the enjoyment of hiking through such a beautiful area with interesting people far outweighed any difficulties. In fact, my love of backpacking was one of the primary motivators of this research. I want to aid in our collective understanding of this activity, and I want to help protect the places through which long trails pass. My status as a long-distance hiker gave me the ability to seamlessly enter into the AT social world and conduct naturalistic research with less need for immersion before data generation began, and it allowed me to apply my familiarity with that context as I interpreted the data.

Final Thoughts

It would be wrong to end this thesis without acknowledging the great irony: that I relied on a smartphone to conduct this research; also that I used relatively advanced software to transcribe the data; that I relied on ICT and stared at computer screens for many months before and after the data generation period; that the loudest critics of technology in wild places also rely on high-tech gadgetry to hone and share their ideas. Like some of the participants in this research, the worldview I adopt is one where I am personally skeptical of technology, but I justify its use where I see fit, and I apply a "hike your own hike" mentality to others' technology use. With that said, I recognize value in both of the ends of the spectrum arguing in favor of their views. When we listen to both sides of a dilemma and the various rationales that support either end, we come away with a better understanding of the whole situation and the people who we seem to disagree with. In a similar vein, researchers, thinkers, and managers have dedicated their work to facilitating recreation in wild or protected areas, maximizing the benefits people receive

from those experiences, or preserving those resources for future generations, and we should heed their warnings and advice. Nonetheless, we must also be mindful of the needs and desires of the actual visitors. Like many other things, the most accurate summary would be that it's just a big balancing act with no right answers. Ultimately, hikers, recreation researchers, and land managers work toward the same end goal, whether they advocate for protection of resources or promotion of technology: positive experiences for people facilitated by healthy and sustainable natural resources. Interaction and understanding between the various parties is key to achieving this shared vision.

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APPENDICES

Appendix A: Data Management Plan

After meeting with Yael Allen (IRB Coordinator for Outreach and Education) and consulting with David Goodwin (Technology Support Specialist, College of Natural Resources), the following Data Management Plan was developed:

In the field, I will use my personal mobile phone for data collection. After consenting to participate (which entails audio recording), I will ask if the participant is willing to engage in member-checking, which requires me to record their email address.

Audio will be recorded and stored on my mobile phone using the Recorder Pro application. This has no sharing permissions. The audio is protected by three digital locks. First, my phone must be unlocked with either a PIN or fingerprint. Then, the Recorder Pro app must be unlocked through the Super AppLock application with a pattern lock. Then, the Recorder Pro application has its own PIN-protected lock. All audio recordings will be stored in this way until I get back to NC State. Then, I can upload them to my password and 2FA-protected NCSU Google Drive over the securely encrypted EduRoam network. After uploading, they will be deleted from my phone.

If a participant agrees to member-checking, then I will create a file in the Safe Notes app on my phone. This app has no sharing permissions. Each file will contain only the participant's pseudonym and their email address. Each note is protected by three digital locks. First, my phone must be unlocked with either a PIN or fingerprint. Then, the Safe Notes app must be unlocked through the Super AppLock application with a pattern lock. Finally, the note itself must be unlocked with a manually entered password. Email addresses will be stored in this way until I get back to NC State. Then, the information will be manually entered into a spreadsheet in the same Google Drive mentioned above. This sheet is marked as private (that is, only my email

address can access it), and the options to download, print or copy the file have been disabled. After entering the data on this sheet, the records on my phone will be permanently deleted.

For the participants that agreed to member-checking, I will contact them via the email they provided after I have transcribed and de-identified the interview. This contact will be in a generic email, and it will contain a link to a google drive folder that only that participant's email has been granted access to and that only contains that participants de-identified transcript and my comments on it. After the participant has responded in the member-checking process, then I will remove their access to that folder. If a participant does not respond by the end of the reporting period, then I remove their access to that folder. After the member-checking process is complete, I will delete the file with participant pseudonyms and email addresses.

Appendix B: Informed Consent Form

North Carolina State University
INFORMED CONSENT FORM for RESEARCH

Title of Study: An Examination of Mobile Technologies and Spatial Decision-Making by Long-Distance Hikers, eIRB 18006
Principal Investigator: Andrew G. Rogers, agrogers@ncsu.edu, 919.515.7118
Faculty Point-of-Contact: Yu-Fai Leung, leung@ncsu.edu, 919.513.3489

<u>What are some general things you should know about research studies?</u>
You are being asked to take part in a research study. Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate and to stop participating at any time without penalty. The purpose of this research study is to gain a better understanding of AT long-distance hiker decision making. We will do this through semi-structured interviews with long-distance hikers.

You are not guaranteed any personal benefits from being in this study. Research studies also may pose risks to those who participate. You may want to participate in this research because it can aid in protecting hiking trails. You may not want to participate in this research because it may detract from your expected trail experience.

In this consent form you will find specific details about the research in which you are being asked to participate. If you do not understand something in this form it is your right to ask the researcher for clarification or more information. A copy of this consent form will be provided to you in paper form or through email, or both. If at any time you have questions about your participation, do not hesitate to contact the researcher(s) named above or the NC State IRB office (contact information is noted below).

<u>What is the purpose of this study?</u>
The purpose of the study is to understand how long-distance hikers use mobile technologies to help them make decisions related to navigating along the trail.

<u>Am I eligible to be a participant in this study?</u>
There will be approximately 10-30 participants in this study.

In order to be a participant in this study you must be 18 years or older, identify as a long-distance hiker, and consent to be audio recorded. Many people define this differently, but three weeks or more on the trail is the criteria for this study.

You cannot participate in this study if you are under 18 years old.

<u>What will happen if you take part in the study?</u>
If you agree to participate in this study, you will be asked to participate in a semi-structured interview. This means that there is a set of open-ended questions, and clarifying questions will be asked based on your responses. This type of interview is conversational in nature.

The total amount of time that you will be participating in this study is between 20 and 60 minutes

Audio recording

Interviews will be audio recorded to assist with the accuracy of your responses. Audio recordings will be stored in a secure device until they are transcribed in de-identified form. After transcription, audio recordings will be destroyed. Only those who consent to be audio recorded may participate in this research

<u>Member-Checking</u>

In a process called member-checking, the researcher may share a participant's interview transcript or a summary of findings with that participant so that they can verify the accuracy of the information. This information would have any identifiers removed and would be sent to you in an email. We would like your consent to email you as part of the member-checking process. This procedure is typical in our field and in this type of research. The purpose of member-checking is to ensure that your thoughts and ideas are being accurately represented. It also gives you an opportunity to clarify if the researchers have misunderstood something.
____ I consent to be emailed
____ I do not consent to be emailed

Risks and benefits

There are minimal risks associated with participation in this research, such as detracting from your expected trail experience. In order to minimize this risk or any discomfort, you can simply end the interview at any time. There are no direct benefits to your participation in the research. The indirect benefits are: trail and land managers will better understand how hikers make decisions on the trail; better management can protect the trail corridor and sustain the benefits it provides.

Right to withdraw your participation

You can stop participating in this study at any time for any reason. In order to stop your participation, please state that you wish to end the interview. There are no penalties of any kind if you choose to withdraw your consent and stop participating.

Confidentiality

The information in the study records will be kept confidential to the full extent allowed by law. Data will be stored securely on a password protected device until uploaded to an NC State-managed, 2-factor authenticated Google Drive. Unless you give explicit permission to the contrary, no reference will be made in oral or written reports which could link you to the study. Any identifiable information collected as part of this research will not be used or distributed for future research purposes. De-identified data may be used or shared for the purposes of presentation, publication, or future research. De-identified data includes words or phrases that have had any sort of identifying information removed to prevent a person's identity from being connected with that data.

Compensation
You will not receive anything for participating.

What if you have questions about this study?

If you have questions at any time about the study itself or the procedures implemented in this study, you may contact the researcher: Andrew G. Rogers, Campus Box 8004, 4008 Biltmore Hall, Raleigh, NC 27695, agrogers@ncsu.edu, 919.515.7118

What if you have questions about your rights as a research participant?
If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact the NC State IRB (institutional Review Board) Office via email at irb-director@ncsu.edu or via phone at 1.919.515.8754. An IRB office helps participants if they have any issues regarding research activities.

You can also find out more information about research, why you would or would not want to be a research participant, questions to ask as a research participant, and more information about your rights by going to this website: http://go.ncsu.edu/research-participant

Consent to Participate

I have read and understand the above information. I have received a copy of this form. I agree to participate in this study with the understanding that I may choose not to participate or to stop participating at any time without penalty or loss of benefits to which I am otherwise entitled.

Appendix C: Institutional Review Board Approval Document

NORTH CAROLINA STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD FOR THE USE OF HUMAN SUBJECTS IN RESEARCH

SUBMISSION FOR NEW STUDIES

Protocol Number 18006

Project Title

An Examination of Mobile Technologies and Spatial Decision-Making by Long-Distance Hikers

IRB File Number:

Original Approval Date:

06/12/2019

Approval Period

06/12/2019 -

Source of funding (provide name of funder not account number): none

NCSU Faculty point of contact for this protocol:NB: only this person has authority to submit the protocol

Leung, Yu-Fai: Parks, Recreation & Tourism Management

Does any investigator associated with this project have a significant financial interest in, or other conflict of interest involving, the sponsor of this project? (Answer No if this project is not sponsored)

No

Is this conflict managed with a written management plan, and is the management plan being properly followed?

No

Preliminary Review Determination

Category:

Exempt d.2

In lay language, briefly describe the purpose of the proposed research and why it is important. Provide a brief synopsis of the study including who is targeted to participate and the data collection methods employed (limit text to 1500 characters)

Appalachian Trail hikers who are 18 or older and have been on the trail for three or more weeks will be encountered on the trail and interviewed regarding their experiences and behaviors related to their use of information sources (especially mobile technologies) and their spatial decision-making processes. Given the contextual and nuanced nature of decision-making, on-site, semi-structured interviews are an ideal method to better understand this phenomenon.

If any investigator on the project (or the spouse, domestic partner or any members of the investigator's immediate family who reside in the same household) has a financial or other type of conflict of interest that could potentially affect the design, conduct, or reporting of this research project, please describe the conflict of interest here or indicate that it has been fully disclosed in the investigator's most recent COI disclosure filed with NC State. If your team does not have any

conflicts of interest,

please respond with N/A. If you are uncertain how to respond or have questions, please contact coi-noi-compliance@ncsu.edu.";

The purpose of this research is to better understand long-distance hiker decision-making in the context of new and emerging technologies. Spatial decisions (such as deciding where to camp or which spring to visit) are a focus of this research, because spatial decisions have the most direct connection to the biological and physical resources. The areas through which long-distance trails pass are intended to protect these resources while also facilitating recreation. However, recreation always results in some amount of impact to the biological and physical resources. Understanding hiker decision-making can aid managers in meeting both of these objectives more effectively. Ultimately, improved management can help to sustain the flow of benefits (both ecological and social) that long-distance trails provide, such as physical and mental wellbeing or ecosystem services.

My research qualifies for Exemption. Exempt research is minimal risk and must fit into the categories d.1 - d.8 found here:

http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.html

1

Is this research being conducted by a student?

Yes

Is this research for a thesis/disseration/capstone?

Yes

Is this research for a dissertatiion?

No

Is this independent research?

No

Is this research for a course?

No

Do you currently intend to use the data for any purpose beyond the fulfillment of the class assignment?

No

Please explain

If so, please explain

If you anticipate additional NCSU-affiliated investigators (other than those listed on the Title tab) may be involved in this research, list them here indicating their name and department.

None

Will the investigators be collaborating with researchers at any institutions or organizations outside of NC State?

No

List collaborating institutions and describe the nature of the collaboration. If researchers from both institutions are doing any of the following activities: recruitment, consent process, data collection or handling of identifiable information/specimens a reliance agreement may be appropriate. For more information, please contact irb-coordinator-admin@ncsu.edu

What is NCSU's role in this research?

Describe funding flow, if any (e.g. subcontractors)

Is this international research?

No

Identify the countries involved in this research

An IRB equivalent review for local and cultural context may be necessary for this study. Can you recommend consultants with cultural expertise who may be willing to provide this review? Consultants may not be a part of the research team or have a stake in the research project. Provide email contact information for consultant(s). A local context review may lengthen the time it takes for your approval.

Adults 18 - 64 in the general population?

Yes

NCSU students, faculty or staff?

No

Adults age 65 and older?

No

Minors (under age 18--be sure to include provision for parental consent and/or child assent)?

No

List ages or age range:

Could any of the children be "Wards of the State" (a child whose welfare is the responsibility of the state or other agency, institution, or entity)?

No

Please explain:

Prisoners (any individual involuntarily confined or detained in a penal institution -- can be detained pending arraignment, trial or sentencing)?

No

Pregnant women?

No

Are pregnant women the primary population or focus for this research?

No

Provide rationale for why they are the focus population and describe the risks associated with their involvment as participants

---

Fetuses?

No

Students?

No

Does the research involve normal educational practices?

No

Is the research being conducted in an accepted educational setting?

No

Are participants in a class taught by the principal investigator?

No

Are the research activities part of the required course requirements?

No

Will course credit be offered to participants?

No

Amount of credit?

No

If class credit will be given, list the amount and alternative ways to earn the same amount of credit.Note: the time it takes to gain the same amount of credit by the alternate means should be commensurate with the study task(s)

How will permission to conduct research be obtained from the school or district? IRB approval is not permission to conduct the research. You need to access a gatekeeper. If you are implementing a survey with NC State populations, please make sure you follow the NC State survey regulation.

Will you utilize private academic records?

No

Explain the procedures and document permission for accessing these records.

Employees?

No

Describe where (in the workplace, out of the workplace) activities will be conducted.

From whom and how will permission to conduct research on the employees be obtained?

How will potential participants be approached and informed about the research so as to reduce any perceived coercion to participate?

Is the employer involved in the research activities in any way?

No

Please explain:

Will the employer receive any results from the research activities (i.e. reports, recommendations, etc.)?

No

Please explain. How will employee identities be protected in reports provided to employers?

Impaired decision making capacity/Legally incompetent?

No

How will competency be assessed and from whom will you obtain consent?

Mental/emotional/developmental/psychiatric challenges?

No

Identify the challenge and explain the unique risks for this population.

Describe any special provisions necessary for consent and other study activities (e.g., legal guardian for those unable to consent).

People with physical challenges?

No

Identify the challenge and explain the unique risks for this population.

Describe any special provisions necessary for working with this population (e.g., witnesses for the visually impaired).

Economically or educationally disadvantaged?

No

Racial, ethnic, religious and/or other minorities?

No

Non-English speakers?

No

Describe the procedures used to overcome any language barrier.

Will a translator be used?

No

Provide information about the translator (who they are, relation to the community, why you have selected them for use, confidentiality measures being utilized).

Explain the necessity for the use of the vulnerable populations listed.

No vulnerable populations are targeted groups for this study.

State how, where, when, and by whom consent will be obtained from each participant group. Identify the type of consent (e.g., written, verbal, electronic, etc.). Label and submit all consent forms. Consent Form Template for NC State Research

There is only one participant group: Appalachian Trail hikers who are 18 or older and have been hiking for three or more weeks. The consent process and subsequent interview can occur at any public point along the Appalachian Trail and any time a conversation occurs between the researcher and a hiker.

After initial contact with hikers, the researcher will identify himself as a North Carolina State University master's student and researcher, and he will explain the research project. If the hiker is interested, the researcher will then share the consent form (or information form if signed consent is waived) with the hiker, give the hiker time to read it, offer to talk through it together, and offer to clarify any questions the hiker may have. If the hiker is over 18 and has been hiking for three or more weeks, if the hiker consents to be interviewed, and if the hiker consents to be audio recorded, then they will be considered a participant in the research.

If they are willing, participants will consent to provide their email address so that they may be contacted later as part of a member-checking process, but this is not a requirement for participation. Ideally, requirement for signed consent will be waived. Since there is minimal risk associated with this research, and in order to minimize the chance of participant identification, verbal consent is an appropriate option. If only verbal consent is required, then neither the researcher nor the participants will have consent forms that link the participants' identities to the research. The only direct identifiers will be securely stored behind three digital locks.

If any participants are minors, describe the process for obtaining parental consent and minor's assent (minor's agreement to participate). No minors will participate in this research.

Are you applying for a waiver of the requirement for consent (no consent information of any kind provided to participants) for any participant group(s) in your study?

No

For each participant group that you are requesting a waiver of consent for, please state what method this waiver is needed for, why it is needed and address each of the above 5 criteria to justify why your study qualifies for a waiver of consent.

Are you applying for an alteration (exclusion of one or more of the specific required elements) of consent for any participant group(s) in your study?

No

Identify which required elements of consent you are altering, describe the participant group(s) for which this waiver will apply, and justify why this waiver is needed.

Are you applying for a waiver of signed consent (consent information is provided, but participant signatures are not collected)? A waiver of signed consent may be granted only if: The research involves no more than minimal riskThe research involves no procedures for which consent is normally required outside of the research context.

Yes

Would a signed consent document be the only document or record linking the participant to the research?

No

Is there any deception of the human subjects involved in this study?

No

Describe why deception is necessary and describe the debriefing procedures.Does the deception require a waiver or alteration of informed consent information? Describe debriefing and/or disclosure procedures and submit materials for review.Are participants given the option to destroy their data if they do not want to be a part the study after disclosure?

For each participant group please indicate how many individuals from that group will be involved in the research. Estimates or ranges of the numbers of participants are acceptable. Please be aware that participant numbers may affect study risk. If your participation totals differ by 10% from what was originally approved, notify the IRB.

The range of the number of participants in this research is between 10 and 30.

How will potential participants be be found and selected for inclusion in the study?

Potential participants will be encountered at random on the trail. The researcher will also be backpacking during the study period. Hikers who are interested in participating, are eligible to participate, and consent to participate will be selected for inclusion in this study.

For each participant group, how will potential participants be approached about the research and invited to participate? Please upload necessary scripts, templates, talking points, flyers, blurbs, and announcements.

Potential participants will be encountered at random on the trail. When hikers are encountered on the trail, the researcher will identify himself as an NC State master's student and researcher if the conversation moves past basic small talk or pleasantries. For example, I may exchange a passing "Hello" with a hiker, but if we start to talk about where we started, when we got on trail, what we do when we're not hiking, or anything outside of brief small talk, I will identify myself and my researcher status and, if they're interested, explain the research project. If they are still interested after a brief explanation, I will ask if they might be interested in participating, if they are, then I will offer them an information form and begin the consent process.

Inclusion criteria: Participants must be 18 years or older and must have been hiking for at least three weeks prior to the interview. Participants must be 18 years old because I want to study adult hikers' decision-making. Hikers must have been hiking for at least three weeks because I expect that decision-making processes will be somewhat crystallized by this point. On the other hand, hikers who have been backpacking less thank three weeks may still be in a transitional phase where they are figuring out which information sources they prefer or are still developing decision-making strategies.

Is there any relationship between researcher and participants - such as teacher/student; employer/employee?

No

What is the justification for using this participant group instead of an unrelated participant group? Please outline the steps taken to migitate risks to participants from the pre-existing relationship, including power dynamics of this relationship and/or perceived coercion.

Describe any risks associated with conducting your research with a related participant group.

Describe how this relationship will be managed to reduce risk during the research.

How will risks to confidentiality be managed?

Address any concerns regarding data quality (e.g. non-candid responses) that could result from this relationship.

In the following questions describe in lay terms all study procedures that will be experienced by each group of participants in this study.For each group of participants in your study, provide a step-by-step description of what they will experience from beginning to end of the study activities.

Participants will be randomly encountered on the Appalachian Trail. If we have a conversation that moves past simple "hello"s and the most basic small talk, then I will identify myself and my researcher status, and explain the project to them. If they are interested, we will go through the consent process. They will have the option during this process to agree to participate in the member-checking process. Once the consenting process is complete, the interview can begin. The interview will be audio recorded and will be of a semi-structured nature. That is, I will have an interview guide with mostly open-ended questions, and I will ask probing and clarifying questions based on the participant's responses and statements. If the participant agreed to participate in member-checking, then I will contact them via the email they provided after I have transcribed and de-identified the interview. This contact will be in a generic email, and it will contain a link to a google drive folder that only that participant has been granted access to and that only contains that participants de-identified transcript and my comments on it. After the participant has responded in the member-checking process, then I will remove their access to that folder. If a participant did not agree to member-checking, then their participation with the study activities will end at the close of the interview.

Are you requesting the use of existing information to be used as data for this research project or are you requesting secondary data to be used as data for this research project? (Discuss the following: access, transfer, storage, destruction, (re)identifiable nature of the data and if data is subject to

FERPA or HIPAA)

No, no existing information or secondary data will be used as data for this research project.

Social/Reputational?

No
___

Psychological/Emotional?

No
___

Financial/Employability?

No
___

Legal?

No
___

Physical?

No
___

Academic (affect grades, graduation)?

No
___

Employment (affect job)?

No
___

Financial (affect financial welfare)?

No
___

Medical (harm to treatment)?

No
___

Insurability (harm to eligibility)?

No
___

Legal (reveals unlawful behavior)?

No
___

Private behavior (harm to relationships/reputation)?

No
___

Religious Issues/Beliefs?

No
___

Describe the nature and degree of risk that this study poses. Describe the steps taken to minimize these risks. You CANNOT leave this blank, say 'N/A', none' or 'no risks'. You can say "There is minimal risk associated with this research." For each 'Yes' selected above, describe the probability of the risk occuring and the magnitude of harm should the risk occur. Discuss how you are mitigating those risks through participant selection, study design, and data security.

There is minimal risk associated with this research.
___

If you are accessing private records, describe how you are gaining access to these records, what information you need from the records, and how you will receive/record data. Private records may include: educational, medical, financial, employment. Some of these private records may be subject to laws such as FERPA and HIPAA. Your content here should match what you've discussed on the procedures tab.

I will not access private records.

Are you asking participants to disclose information about other individuals (e.g., friends, family, co-workers, etc.)?

No

You have indicated that you will ask participants to disclose information about other individuals (see Populations tab). Describe the data you will collect and discuss how you will protect confidentiality and the privacy of these third-party individuals.

If you are collecting information that participants might consider personal or sensitive or that if revealed might cause embarrassment, harm to reputation or could reasonably place the subjects at risk of criminal or civil liability, what measures will you take to protect participants from those risks?

I am not collecting information that entails these sorts of risks. If a participants happen to disclose to me illegal activity or sensitive information, it will be transcribed in such a way as to protect their identity. Audio files will be destroyed after transcription. Privacy and confidentiality of the participants will be maintained throughout the project and to the full extent of the law. If a participant was to interpret a certain topic as sensitive or risky, they will be fully encouraged and aware through the consent process and information form that they can skip any question or end the interview at any time without any sort of penalty.

If any of the study procedures could be considered risky in and of themselves (e.g. study procedures involving upsetting questions, stressful situations, physical risks, etc.) what measures will you take to protect participants from those risks?

None of the study procedures are risky in and of themselves. If a participant was to interpret a certain topic as sensitive or risky, they will be fully encouraged and aware through the consent process and information form that they can skip any question or end the interview at any time without any sort of penalty.

Describe the anticipated direct benefits to be gained by each group of participants in this study (compensation is not a direct benefit).
There are no direct benefits to be gained by the participants in this study.

If no direct benefit is expected for participants describe any indirect benefits that may be expected, such as to the scientific community or to society.

The indirect benefits are that trail and land managers will better understand how hikers make decisions on the trail, and better management can protect the trail corridor and sustain the benefits it provides.

Will you be receiving already existing data without identifiers for this study?

No

Will you be receiving already existing data which includes identifiers for this study?

No

Describe how the benefits balance out the risks of this study.

Will data be collected in a way that would not allow you to link any identifying information to a participant?

No

Will any identifying information be recorded with the data (ex: name, phone number, IDs, e-mails, etc.)?

No

Will you use a master list, crosswalk, or other means of linking a participant's identity to the data?

Yes

Will it be possible to identify a participant indirectly from the data collected (i.e. indirect identification from demographic information)?

Yes

Audio recordings?

Yes

Video recordings?

No

Images?

No

Digital/electronic files?

Yes

Paper documents (including notes and journals)?

Yes

Physiological Responses?

No

Online survey?

No

Restricted Access (who, what, when, where)?

Yes

Password Protection (files, folders, drives, workstations)?

Yes

Suggestion of anonymous browsing?

No

Locks (office, desks, cabinets, briefcases)?

No

VPN (transfer, upload, download, access)?

No

Yes

Describe all participant identifiers that will be collected from each data collection method (surveys, interviews, focus groups, existing data, background data collected via host site or software). Discuss why it is necessary to record identifiers at all and describe the deidentifying process

Through the information form, the participant will understand confidentiality. Before I begin audio recording the interview, I will reiterate my commitment to their confidentiality. We will select a pseudonym (as an extra layer of confidentiality, I will request that participants select a pseudonym other than their trail name), and I will instruct them to avoid the use of other individuals' names or other information that could be used to identify them, such as the name of their hometown or where they went to school, during the interview. I will explain that identifiers will be transcribed out if they come up, but it's best to avoid them altogether. Audio will be recorded and stored on my mobile phone using the Recorder Pro application. This has no sharing permissions. The audio is protected by three digital locks. First, my phone must be unlocked with either a PIN or fingerprint. Then, the Recorder Pro app must be unlocked through the Super AppLock application with a pattern lock. Then, the Recorder Pro application has its own PIN-protected lock. All audio recordings will be stored in this way until I get back to NC State. Then, I can upload them to my password and 2FA-protected NCSU Google Drive over the securely encrypted EduRoam network. After uploading, they will be deleted from my phone. During the transcription process, any potential identifiers will be transcribed out or, where appropriate, replaced with generic terms.

If a participant agrees to member-checking, then I will create a file in the Safe Notes app on my phone. This app has no sharing permissions. Each file will contain only the participant's pseudonym and their email address. Each note is protected by three digital locks. First, my phone must be unlocked with either a PIN or fingerprint. Then, the Safe Notes app must be unlocked through the Super AppLock application with a pattern lock. Finally, the note itself must be unlocked with a manually entered password. Email addresses will be stored in this way until I get back to NC State. Then, the information will be manually entered into a spreadsheet in the same Google Drive mentioned above. This sheet is marked as private (that is, only my email address can access it), and the options to download, print or copy the file have been disabled. After entering the data on this sheet, the records on my phone will be permanently deleted. The member-checking process (and thus, the recording of identifiers) is necessary to ensure the accuracy and trustworthiness of the data and my interpretations. It is also expected within my field of study.

If recording identifiable information about participants, discuss any links between the data and the participants and why you need to retain them.

Discuss destruction of links or removal of identifers.

The only direct link between the data and the participants will occur as part of the member-checking process. Member-checking is necessary to ensure the accuracy and trustworthiness of the data and my interpretations. It is also expected within my field of study. These email addresses paired with pseudonyms will be stored behind three digital locks. Once transcription is complete, the transcripts will be uploaded to my password and 2FA-protected NCSU Google Drive. I will create a main folder titled "Member-checking" and within that folder I will create a folder for each participant who agreed to member-check. Each folder will be titled with the relevant participant's pseudonym. Within each of those folders, I will upload a google document text file of that participant's de-identified transcript with my interpretations. I will grant their email address permission to view and comment on only that file. Then, I will send them an email with a generic body and instructions to respond to the transcript and my interpretations within the google document using comments. The email will contain a link to their file. After they respond (or at the end of this project if they never respond), I will remove their access to that file, which effectively destroys the link.

Discuss if you'll be working with your departmental IT to create a data management plan and if you're using NC State managed devices, NC State Google Drive or other NC State non-networked device. If using a personal device, discuss data protection.

I did work with my departmental IT to create a data management plan. In the field, I will only use a personal device. Audio will be recorded and stored on my mobile phone using the Recorder Pro application. This has no sharing permissions. The audio is protected by three digital locks. First, my phone must be unlocked with either a PIN or fingerprint. Then, the Recorder Pro app must be unlocked through the Super AppLock application with a pattern lock. Then, the Recorder Pro application has its own PIN-protected lock. All audio recordings will be stored in this way

until I get back to NC State. Then, I can upload them to my password and 2FA-protected NCSU Google Drive over the securely encrypted EduRoam network. After uploading, they will be deleted from my phone.

If a participant agrees to member-checking, then I will create a file in the Safe Notes app on my phone. This app has no sharing permissions. Each file will contain only the participant's pseudonym and their email address. Each note is protected by three digital locks. First, my phone must be unlocked with either a PIN or fingerprint. Then, the Safe Notes app must be unlocked through the Super AppLock application with a pattern lock. Finally, the note itself must be unlocked with a manually entered password. Email addresses will be stored in this way until I get back to NC State. Then, the information will be manually entered into a spreadsheet in the same Google Drive mentioned above. This sheet is marked as private (that is, only my email address can access it), and the options to download, print or copy the file have been disabled. After entering the data on this sheet, the records on my phone will be permanently deleted.

Describe any ways that participants themselves or third parties discussed by participants could be identified indirectly from the data collected, and describe measures taken to protect identities. (Data can be reidentified by researcher access, technology employed, researcher expertise, and triangulation of data or other information. Discuss the probability of reidentification and the magnitude of harm to participants should the data be reidentified. Discuss the probability of reidentification occuring and the magnitude of harm should it occur).

Indirect identification could occur if someone gained access to the audio files or possibly through the de-identified transcripts. De-identification will be as stringent as possible to protect participants. For example, using pseudonyms instead of trail names is an extra precaution. Not transcribing the date hikers started or where they are from can also minimize the chances of re-identification. With these protections in place, the probability of re-identification is small. Should re-identification occur, the magnitude of harm to participants would be minimal since this research does not cover sensitive or private content.

For all recordings of any type:Describe the type of recording(s) to be made Describe the safe storage of recordings Who will have access to the recordings? Will recordings be used in publications or data reporting? Will images be altered to de-identify?Will recordings be transcribed and by

whom?

Audio will be recorded for all interviews. Audio will be recorded and stored on my mobile phone using the Recorder Pro application. This has no sharing permissions. The audio is protected by three digital locks. First, my phone must be unlocked with either a PIN or fingerprint. Then, the Recorder Pro app must be unlocked through the Super AppLock application with a pattern lock. Then, the Recorder Pro application has its own PIN-protected lock. All audio recordings will be stored in this way until I get back to NC State. Then, I can upload them to my password and 2FA-protected NCSU Google Drive over the securely encrypted EduRoam network. After uploading, they will be deleted from my phone. Only the researchers will have access to these files. The raw recordings will not be used in publications or data reporting, although de-identified data within them may be, as indicated in the consent form. The recordings will be transcribed by the researcher or a transcription service. If a transcription service is used, they will be required to sign a confidentiality agreement and they must agree to send and receive the files via secure, encrypted means. If a transcription service is used, identifiers will be removed promptly after receiving the transcripts. If transcribed by the researcher, identifiers will be removed during the transcription process.

If a participant agrees to member-checking, then I will create a file in the Safe Notes app on my phone. This app has no sharing permissions. Each file will contain only the participant's pseudonym and their email address. Each note is protected by three digital locks. First, my phone must be unlocked with either a PIN or fingerprint. Then, the Safe Notes app must be unlocked through the Super AppLock application with a pattern lock. Finally, the note itself must be unlocked with a manually entered password. Email addresses will be stored in this way until I get back to NC State. Then, the information will be manually entered into a spreadsheet in the same Google Drive mentioned above. This sheet is marked as private (that is, only my email address can access it), and the options to download, print or copy the file have been disabled. After entering the data on this sheet, the records on my phone will be permanently deleted. Only the researchers will have access to these files. These files will never be used in publications or data reporting.

Describe how data will be reported (aggregate, individual responses, use of direct quotes) and describe how identities will be protected in study reports. Reporting data may sometimes reidentify your participants. If needed, you can adjust how you report your data to protect the identities of your participants. Discuss.

Data will be reported with some aggregate or summary statements, plus some individual responses and direct quotes. When individual responses and direct quotes are used, only short snippets with identifying information removed will be used. Long, conversational soliloquies or quotes with any specific identifiers will not be reported to minimize the chance of re-identification.

Will anyone besides the PI or the research team have access to the data (including completed surveys) from the moment they are collected until they are destroyed? This includes sharing data with sponsors, journals, or using the data for future research endeavors. If you are sharing the data, this should be in your consent form.

Only the PI and myself will have access to the raw data from the time they are collected until they are destroyed. There is one potential exception: if a transcription service is used, then the transcribers will have access to the audio files. If a transcription service is used, they will be required to sign a confidentiality agreement and they must send and receive the files via secure, encrypted means.

De-identified data can be used or shared for the purposes of presentation, publication, or future research. This is communicated in the consent form.

Describe any compensation that participants will be eligible to receive, including what the compensation is, any eligibility requirements for that compensation, and how that compensation will be delivered. Examples of compensation include: monetary compensation, research credits, raffle/drawing, novel items. Make sure to check with your department regarding issues of tracking payments as your department accounting office may have requirements that affect your human subjects privacy (such as the mandatory tracking of anyone who receives compensation). This tracking may influence the confidentiality/anonymity of your research and must be addressed in this application. Participants will not receive anything for participating.

Explain compensation provisions if the participant withdraws prior to completion of the study.

Participants will not receive anything for participating regardless of whether the participant withdraws prior to completion of the study or completes the whole process.

Interview Protocol

Brief Introduction (this is after we have reviewed the information sheet and gone through the consent process)	Thanks for agreeing to do share your thoughts with me. I will now begin the audio recording. The purpose of this research study is to understand how long-distance hikers use mobile technologies to help them make decisions related to navigating along the trail. Feel free to skip any questions or stop the interview at any time. Remember that only your pseudonym will be connected to this, so let's try to avoid any other specifics like hometown or your friends' names, too. To get started we'll begin with some more general questions about you and this hike you're on.
Demographics and opening up	- What is your age? - Are you thru-hiking or section-hiking? - If section hiking, what other sections have you completed and over how much time? - When did you start this hike? - What motivated you to do this hike? - How many miles have you come so far on this trip? - How experienced would you describe yourself as a backpacker before this hike? For example, novice, beginner, intermediate, expert, professional? How would you describe yourself now? - Have you done any other long-distance hikes? How many? Which one did you last hike, and when? Have you hiked the AT before? - What's your highest level of education? - What do you do for work or when you're not hiking?
Uncertainty	- How much of your hike would you say you have planned ahead? Or, to what extent are you figuring it out on the fly? - What sorts of things have you specifically planned for? - What sorts of things are harder to plan for? - How do you cope when something planned doesn't work out? - What do you do when you encounter an unplanned situation? - Where do you seek information if your sources aren't enough?

Information sources	- What kind of information sources are you currently using on trail? For example, databooks, mobile apps, rely on hiking partners, trail signage, etc. For each source used:
	    - How long have you been using that?
	    - How did you hear about it?
	    - How do you use it? How does it work?
	    - What kind of decisions do you typically make with that?
	    - What is a more obscure decision you've made with that?
	    - What is its greatest strength compared to other information sources?

	- What is its greatest weakness compared to other information sources? - Are there other sources you used during other hikes or earlier in this one? - Are there other sources you expected to use on trail but aren't? - Why aren't you using it? Or why are you using it less than you expected?
Decision-making	- When do you decide exactly where you'll camp on a given night? - Can you explain to me exactly how you decide where you'll camp? - What criteria are important in determining where you'll camp? - How do you decide where you will urinate? - How do you decide where you will defecate? - How do you decide where you will stop for water? - How do you decide where to take a break? - Are there any other reasons you step off the tread? Please elaborate.
ICT (general)	- People have been critical of mobile phones and GPS devices in wilderness places and even on the trail, but other folks have also identified a number of benefits associated with their use. What are your thoughts on the role of these technologies in long-distance hiking? - Have you used these devices on trail?
For participants that do use ICT	- How does GPS impact your hiking experience? - Some of these technologies (especially trail apps) allow for hikers to leave comments on various waypoints. Do you use any of these? If so, how do these comments impact your hiking experience? - How else would your hike be different without mobile technologies?
For participants that do NOT use ICT	- Why don't you use these technologies? - How do you think GPS might impact your hiking experience? - Some of these technologies (especially trail apps) allow for hikers to leave comments on various waypoints. How do you think comments from other hikers might impact your hiking experience?
Planning ahead with ICTs facilitated by ATC	- Did you register this hike with the ATC (either as a thru-hiker or section-hiker)? Why or why not? - If so, was registering helpful? Did it influence your plans? - Have you ever registered a site on Atcamp.org? Why or why not? - If so, what were the pros and cons? - Why did you discontinue?
Closing	- What would you like to improve about how you get/use information on trail? - How would you advise new hikers to access/carry information on trail? - Do you have any other comments you'd like to make about information sources and on-trail decision-making for AT long-distance hikers? - Thanks so much for your time.

Appendix E: Script for Interactions with Potential Participants

This is a rough script for interacting with potential participants that I might encounter while on the Appalachian Trail. I will also be backpacking and fully outfitted accordingly. I will encounter hikers at random along the trail.

I encounter another hiker and we exchange hellos. The hiker asks me any of the following questions:

- How long are you out for?

- Where did you start?

- When did you start?

- Where are you going?

- Or any other questions of a similar nature; basically anything outside of very general small talk, like questions about the weather or "how are you doing?"

- Or I ask the hiker any of these questions and they engage with me

As part of a response to these or similar questions, I'll respond truthfully about my hike, my research, and my purposes. It would be conversational and informal in nature, but would go something like this: "I started at <location to be determined> and am heading to <location to be determine> over the next <number of days or weeks to be determined>. I'm actually working on my master's thesis research project right now. I'm getting a master's in Parks, Recreation, and Tourism Management at NC State, and my research is about mobile technologies and decision-making by long-distance hikers. I want to interview hikers to better understand this situation."

If they remain engaged, then I will ask if they might be interested in participating. If they indicate that they are interested, then I will offer them an information sheet (assuming

requirement for signed consent is waived; if not, then I will offer them a consent form) and verbally go through the information contained therein. That will look similar to this:

"You are being asked to take part in a research study. Your participation is totally voluntary, and you can choose to stop participating at any time. The goal of this research is to gain a better understanding of long-distance hiker decision-making in the context of emerging technologies through interviews with hikers. Your participation does not guarantee any personal benefits, although it could aid in protecting hiking trails. On the other hand, your participation in this interview could detract from your expected trail experience. To be eligible to participate, you must be 18 years or older, you must have been hiking for at least three weeks, and you must consent to have the interview audio recorded. The interview entails of a set of open-ended questions plus probing and clarifying questions, and it should last no more than an hour. The information you provide will be kept confidential, and any identifiable information will not be used or distributed for future research purposes. If you are willing, I would appreciate your participation in a process known as member-checking. Here's how it works. After I get back to Raleigh and transcribe our conversation, I will add my summary and comments about our discussion. Then, I'll send an email to the email address that you provide me. That email will have a generic body with a link to the document, and only your email address will have access to that link. You are under no obligation to take part in member-checking. If you do want to take part in member-checking, you will need to provide me with an email address, and I will store that in a document behind three digital locks. The audio file of our conversation will also be stored behind three digital locks. If you are eligible and consent to participate, I want to reiterate a couple things. Please review the information sheet carefully, and don't hesitate with any questions you may have. Remember that you can stop participating at any time and for any

reason with absolutely no penalty. Also, in order to ensure confidentiality, I want you to choose a pseudonym other than your trail name that I will use to label this audio file and to address you. Throughout the interview, please avoid sharing information that could be used to identify you either directly or indirectly, like your hiking partner's name or trail name, the name of your hometown, the year you graduated high school, your precise start date for this hike, or any highly visible characteristics about yourself. If you're unsure about any of this, please don't hesitate to ask for clarification."

If the potential participant consents to participate and be audio recorded, then the interview will begin. If the participant agrees to member-checking, then the participants email address will recorded according to the data management plan before the audio recording begins. The interview will follow the interview guide, and probing and clarifying questions will be asked based on the participant's responses. At the close of the interview, I will remind the participant that the information form contains contact information for the researchers and NC State's Internal Review Board, and they are welcome to contact any of us with questions or concerns. If they agreed to member-checking, I will thank them for their participation and indicate that they will hear from me with that email in the coming months, and then we will part ways. If they did not agree to member-checking, I will thank them for their participation, and then we will part ways.

Appendix F: Request to Participate in Member-Check

Dear "Pseudonym",

Thanks so much for interviewing with me on the trail last summer! I hope the rest of your hike was rewarding and fun!

You expressed interest in a follow-up, and I have finally made it to that point! I have summarized key ideas from all the interviews (20 hikers in total!), and now I'm sharing them with you to check my work.

The information is in a Google Document, link at the bottom of this email. Your email address and mine are the only ones that have access to it. I would appreciate you letting me know if I'm on the right track. Just like in our interview, there are no right or wrong answers. I just want to be sure that the picture I paint of your and other hikers' experiences on the Appalachian Trail is as clear and accurate as possible.

Please share your thoughts directly on the Google Document. Feel free to type directly in there. Edit, alter, or remove as you see fit. You can highlight your words or use a different color or font, but you don't have to. You can also comment using Google's comment feature. If this format doesn't work for you, let me know and we can discuss other options.

Feel free to save a copy for yourself if you'd like, but I will remove your access to the Google Doc in 2 weeks (January 29). If you need more time, just let me know. And don't hesitate to reach out with any questions.

I completely understand if you don't want to participate in this step, but would appreciate you letting me know so that I know that you did receive this email - no explanation needed.

Link to document:

Thanks again,

Pano

Andrew Rogers
agrogers@ncsu.edu
MS Student | PRTM
Graduate Assistant | RRS
College of Natural Resources
NC State University

Hey Pseudonym,

Based on my conversations with you and all the other long-distance hikers, I have developed a set of themes related to planning, decision-making, and information sources on the Appalachian Trail. Keep in mind that the focus is on AT long-distance hikers-- a lot of these ideas may not apply to people on shorter trips or different trails.

Let me know what you think about these statements, if something really resonates with you, or if it doesn't sound quite right, please let me know. Some questions you might consider as you read through the themes:
- Does this match your experience?
- Do you want to change anything?
- Is something missing?

Please share your thoughts directly on this document. Edit, alter, or remove as you see fit. You can highlight your words or use a different color or font, but you don't have to. You can also comment using Google's comment feature (highlight the words you want to comment on, then click the "Insert" menu, then click "Comment"). It would be great to hear your reasons behind any adjustments. And don't worry about saving or sending or anything - it's all done automatically. If you have any issues at all, please let me know.

Thanks again for helping me with this project!

Pano

REGISTERING YOUR HIKE

Many hikers register their hikes with the ATC. For many, registering just seems like the right thing to do. It could help the ATC in planning and maybe help them protect the trail. Some hikers register because they want to be documented for the sake of personal achievement or for safety reasons. Some hikers who register really just want a hang tag and a number. Registering isn't as important for some section hikers. To them, registering (and especially a hang tag) is more for thru-hiking. And for those hikers who don't start at one of the three main locations (Amicalola, Harper's Ferry, Katahdin), registering online may not be as practical.

For those who do register, it helps set their expectations for their start day. Some hikers want to start when it's not busy while others want to make sure that there will be other people around when they start. Many northbounders shift their start day after visiting the ATC website and seeing how many people have registered. For those northbounders who start at Amicalola, the information provided there is generally considered helpful. The PCT method of hanging a bear bag is particularly noteworthy.

Although many hikers register their hike, few of them register campsites through ATcamp.org. In fact, most hikers are completely unfamiliar with the site. A small portion of hikers do register sites before they start, but they find that they can't keep it up (at least not accurately) for long.

PLANNING

Hikers use the internet to get an idea of what they're getting into and how they should go about tackling the trail. Some people consider blogs and firsthand accounts really valuable, while others want a more generalized and less personal description of what to expect.

It seems that hikers think about planning on three or four different scales:
(1) Hikers plan ahead at home-- more like preparation. What will be my strategy for getting food on the trail? What gear will I bring? Where will I start and when? Will I need to change gear along the way, and how will I do that?
(2) Hikers plan resupply to resupply. How far is it to the next town? How much food am I willing to carry to make it to Town B instead of stopping at Town A? A small potion of hikers plan the re-supplies for their whole hike, but only a few of them end up sticking to that schedule. (two and three blend together)
(3) Hikers plan how far to go each day. This hopefully aligns with the resupply options and the amount of food they have. Instead of planning a specific spot to stay, some hikers set a minimum goal. "I'll at least make it to this water source or campsite, and then I'll see how I feel when I get there."
(three and four blend together)
(4) Hikers do daily planning. Some hikers do this the night before, some do it the morning of, and some are doing it completely on the fly. The primary question is probably do I need to worry about planning water today? After that, are there cool places (like viewpoints or waterfalls) where I want to spend some time? Is there difficult terrain I need to factor into my day? Too much is up in the air on the day-to-day to plan more than a few days ahead.

Two strategies seem to drive planning. One is to minimize the amount of planning you do in order to maximize flexibility, so that you can decide last minute whether to stop at a swimming hole or go into a town. The other is to get enough of the important stuff planned (like re-supply and food) so that you can fully enjoy everything in between. Some hikers clearly lean toward one or the other, but most probably fall somewhere in between.

Regardless of those strategies, hikers seem to always have a plan in mind, but then something comes up and those plans get thrown out the window. Everyone seems fine with it-- just adjust the plan and keep moving. An exception is for planned meet-ups with family and friends. It's difficult and even stressful to set a specific time and place to meet up more than a few days in advance.

Planning is complicated by a number of things.
- Weather. Even if you know the forecast, days of rain can throw off your schedule
- Terrain and trail condition. Elevation profile helps a little, but you can't predict what you'll encounter on the ground. Muddy, rocky trail or smooth, fast trail.

- Town. Sometimes it takes a while to get a ride, sometimes it's immediate. And then getting around a town made for cars can be very difficult
- Injury is unpredictable
- Water can be tough to plan around, especially late in the season
- Hiking partners. More people usually makes things a little more complicated

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DECISION-MAKING

Groupthink
Most hikers don't make decisions like where to camp or where to resupply on their own but instead as a group. They bounce ideas off friends, hiking partners, people at shelters. They may ask hikers going the opposite direction. They will check Guthook comments. If they don't have Guthook, they might ask someone who does. It tends to just happen naturally for hikers in groups, but solo hikers have to be more intentional. It's often as simple as, "Where are you going tonight?"

Camping
Generally, hikers prefer to camp at water, shelters (especially when weather is a concern), or vistas that are convenient in terms of proximity to the trail and daily mileage. Water is critical for most hikers, but not all. Some hikers are willing to forego water at a site in exchange for good views or for a site that fits their daily mileage goal better. Guthook comments are valuable for many hikers to locate stealth sites. Hikers who don't use Guthook make educated guesses about where they are likely to encounter stealth sites. Most hikers camp at visibly established sites, whether they are "official" or "stealth" sites. Very few hikers stay at true dispersed sites-- places where it looks like no one has stayed before and where people are unlikely to stay again.

Breaks and Lunch
Few hikers actively plan their breaks, although they prefer to take them at vistas, water sources, and convenient rocks along the way. Lunch is often planned in advance with friends and partners to break up the day's mileage. Water sources, vistas, and shelters (especially with picnic tables) are preferred locations.

Points of Interest
Hikers want to enrich their hikes by exploring points of interest, but they also don't want to do too many "sideways miles." Word of mouth, Guthook comments, and distance from the trail typically determine if a hiker chooses to go to a point of interest or not.

Human waste
Although some hikers try to avoid water sources and areas frequented by people, most give little forethought to peeing. Some hikers think it's important to get away from the trail before peeing, but others stay near the trail out of to minimize vegetation trampling or simply out of convenience. For solid waste, many hikers go to great lengths to use privies or frontcountry facilities, while others don't mind or even prefer digging catholes. Some hikers actively avoid privies, especially with norovirus in mind. When hikers do have to dig catholes, poor timing and rocky terrain can make it difficult to get far enough away or dig a cathole deep enough.

Water stops
Some participants closely manage water stops based on the quality and reliability of sources, while others just try to carry as little as possible. Comments provide enough information that Guthook users can be very selective. Hikers without Guthook use word of mouth to learn about unreliable sources, but sometimes they end up with less than ideal water sources.

INFORMATION SOURCES

Long-distance hikers are generally satisfied with the information sources available to them. It's at least at enough to get you by, and sometimes much more than you need. Many hikers (especially those without Guthook) would like more accurate and more consistent signage and blazes. While most of the trail is in good shape, only one poorly marked intersection can make for a bad experience.

Almost everyone hears about AWOL when they're researching before the trip, but many people don't hear about Guthook until they get on the trail. Some of them decide to get it along the way, while others decide to make do with what they've already purchased. Some hikers get Guthook as a direct result of getting lost. Hikers who don't have Guthook sometimes ask hikers who do have it when they have a particular question that their source doesn't answer.

Many hikers have Guthook as well as one of the other guides. Many of these folks prefer to use Guthook for more immediate or day-to-day and they use the other guide for longer-term planning, like resupply to resupply.

Pros and Cons of Common Information Sources

Guthook's Guide to the A.T.
Guthook's Pros
- Provides crowd-sourced information through comments   - Very valuable for water source quality and reliability   - Find random delis or town amenities   - Find stealth sites   - Communicate with other hikers, expands word of mouth   - Ability to pinpoint location immediately   - Gives sense of security   - Removes uncertainty at confusing places   - Immediately and accurately calculate distance to other waypoints   - Updated frequently   - Has more campsites (not including those mentioned in comments)   - Phone is easier to get out than a book-- fits in a pocket or hip belt   - Less weight than paper sources (if you carry a smartphone anyway)
Guthooks Cons

• Can be hard to interpret elevation, seems skewed • Harder to look ahead than paper or line-by-line sources • Keeps you on your phone, which may detract from the trail experience • Consumes battery • No guide if your phone breaks • Keeping your phone charged and accessible can be difficult

Books (AWOL's book and Thru-Hikers Companion)
Book Pros
• Easier to flip back and forth • Doesn't break if you drop it • Doesn't use battery • You can write notes on the paper • Less likely to get sucked into your phone • It gets lighter as you go (if you tear out pages) • Doesn't use battery so you need to recharge less, can save your battery for other uses • Better town info than Guthook • Uses more "objective" measures, information is more standardized
Book Cons
• It's heavy • Hard to access while hiking compared to phone • For the companion: distance and elevation are on different pages • It's not updated as frequently as Guthook • No feedback from other hikers • Lack of information on stealth sites

AWOL's PDF: Pros and Cons (There is also a PDF of the Thru-Hikers Companion, but I didn't talk to anyone who used it)
PDF Pros
• Real hyperlinks make calling service providers or visiting websites easy • Can share the PDF with your family so they can follow along, know where you are, and mail stuff more easily • Uses more "objective" measures, information is more standardized • Better town info than Guthook • Less weight than paper sources (if you carry a smartphone anyway) • Phone is easier to get out than a book-- fits in a pocket or hip belt
PDF Cons

- It's not updated as frequently as Guthook
- No feedback from other hikers
- Lack of information on stealth sites
- Consumes battery
- No guide if your phone breaks

GPS

Hikers value their smartphones' ability to verify their location and stay on trail. Obviously Guthook is good for this, but even hikers who don't have Guthook will sometimes use other applications to verify their location. However, there is a small portion of hikers who never GPS in any fashion on the trail. For some Guthook users, the GPS is the most valuable feature.

COMMENTS

Guthook users had overwhelmingly positive statements regarding the crowd-source feature of the app. Comments help hikers find the "hidden gems" that can enrich the whole experience. Although hikers did point out that comments weren't always useful or accurate, they are able to see past those. Many hikers want more up to date comments. And more comments overall would help to overcome and outweigh the comments that aren't useful or accurate.

Hikers without Guthook sometimes ask Guthook users for more info. Shelters facilitate interacting and communicating, especially around picnic tables. Some hikers point out that the logbooks are the original "comment section" and they still use them. And if anything is really important (dangerous person on trail, bear issue at a shelter) you will hear it through the grapevine whether you have Guthook or not.

VIEWS ON TECHNOLOGY

A small portion of hikers embrace technology fully. They rely on their smartphones, and they are completely satisfied with that. From a practical point of view, it just makes sense to use them. These are the tools we have available now, and it would be weird or artificial to not use them. They can enhance our experience and keep us safer.

A small portion of hikers choose to not rely on their smartphones. They still carry them, but they try not to use them. On trail, they might be used as cameras. In town, they are planning tools and phones for calling home. These hikers want to "unplug" and have a more traditional hiking experience that unfolds before them-- maybe leave a little more to chance. Knowing too much about what's ahead can taint the experience and diminish your sense of discovery.

However, the majority of hikers overlap with both of these viewpoints. They rely on their phones, but they also have concerns about how using a smartphone might affect their experience of nature and the trail. Despite their concerns, it's just too easy and it makes too much sense from a practical standpoint to not use the smartphone.