Technology and the Outdoors: An Analysis of Technology to Improve Outdoor Recreation

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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INTRODUCTION

As society's reliance on digital connectivity increases, the controversy surrounding the presence of technology in the outdoors continues to grow. Traditionalist views highlight wilderness philosophical concerns that conflict with new generational ideas for technologically enhanced outdoor experiences (Selin et al., 2020). Issues related to environmental ethics and resource management have also risen from the increased use of smartphones in remote outdoor spaces (Kahn et al., 2009). Despite the controversy surrounding technology and digital connectivity, potential benefits persist related to safety, availability of information, resource management, and sustainability.

On February 19th, 2021, I began a long-distance hike (thru-hike) of the 2,193-mile Appalachian Trail, which stretches from Georgia to Maine. Throughout this journey, I relied heavily on my smartphone for GPS and digitalized maps. In addition, while preparing and planning for the hike, I spent countless hours researching the trail and searching online for advice. My experience was not unique, as most hikers depend on the abundance of information related to the trail and safety provided by popular hiking apps such as Guthook's Guide (Rogers & Leung, 2021). Despite the abundance of information, resources and how-to guides surrounding the Appalachian Trail lack diverse perspectives and inclusive guidance. This trend is not specific to the Appalachian Trail, rather it follows a national pattern of minority underrepresentation in outdoor recreation, specifically in national park visits (Winter et al., 2019). Therefore, my technical project is to design a web application for the Appalachian Trail that promotes diversity, education, and inclusion within the hiker community.

An additional dimension to the relationship between outdoor recreation and technology is the influence of digital connectivity. The nearly instant availability of vast amounts of

information provided by technologies such as computers and smartphones has modernized the way people interact with the environment. Therefore, this STS research investigates how technology is changing outdoor recreation through both environmental and human factors perspectives. Through interdisciplinary secondary research analysis, I argue that technology has a net positive impact on outdoor recreation and spaces given its benefits to safety, wellness, diversity, and land management. This tightly coupled sociotechnical project addresses the complicated relationship between technology and the outdoors. Whereas my technical work utilizes technology as a tool in these spaces, my STS research will analyze the effects technology has on outdoor recreation and how it is experienced.

LITERATURE REVIEW

My research began with the report "Igniting research for outdoor recreation: Linking science, policy, and action" by Selin, et al (2020) - written by members of the U.S. Department of Agriculture, Forest Service, out of the Pacific Northwest Research Station. This report provided general background knowledge of the effect of technology on outdoor recreation. Specifically, "Chapter 7: Technology and Outdoor Recreation in the Dawning of the Age of Constant and Instant Digital Connectivity" informed my work by providing key discussions and background into the cultural evolution of technology in the outdoors. Although the report lacked primary research, the presented discussion was crucial to identifying topics for investigation such as safety, participation, and land management. The report conceptualizes technology as a tool that is changing outdoor experiences and highlights potential areas of conflict with existing wilderness paradigms. Although the report briefly explores technology as a threat to the "true wilderness" experience, the authors mainly focus on the potential benefits of technology.

Another influential article from my research was “The Impact of Technology on the Wilderness Experience: A Review of Common Themes and Approaches in Three Bodies of Literature” by Shultis (2012). The published analysis includes an investigation into the topic from the perspective of wilderness researchers, leisure studies researchers, and science and technology studies researchers. In the conclusion of the article, Shultis highlights the lack of empirical evidence available on the topic, especially from work by wilderness researchers. However, Shultis notes that a key finding across all perspectives is “the common concern with the link between technology, consumption, and self-identity.” The article also brings into question what is and what is not considered technology in outdoor settings. Additionally, Shultis (2012) notes the lack of interdisciplinary research on the impact of technology on the wilderness experience and calls for more research to be conducted in the area to better analyze the relationship.

To gain an interdisciplinary perspective during my early research, “The Human Relation with Nature and Technological Nature” by Kahn et al. (2009) was used. The article was published in the Journal of the Association for Psychological Science and focuses on the impact of technology on the psychological and physical well-being of humankind. The article introduces the idea of environmental generational amnesia and its relation to biophilia – a term coined by E.O. Wilison that refers to the fundamental human need to affiliate with nature. Kahn et al. uses the term environmental generational amnesia to refer to the idea that each generation bases their idea of environmental normalcy on what they experienced as children, thus increasing the threshold for environmental degradation over time. In the article, Kahn et al. acknowledges the benefits of technological nature but primarily focuses on the dangers of replacing actual nature interaction with technological nature. Kahn et al. warns that relying on technology for interacting

with the outdoors could accelerate environmental generational amnesia and make combatting issues related to climate change more difficult. The psychology background of Kahn's work influenced my research by providing a unique dimension to the issue of technology and human wellness long term.

Due to the controversy and evolving nature of technologies, current research lacks sufficient discussion of the intersectionality surrounding the role of technology in outdoor recreation. Researching how technology affects outdoor recreation and the ways people experience these spaces can benefit outdoor visitors, land use managers, and conservationists. Specifically, investigating this topic can inspire innovative programs to improve outdoor interactions for diverse groups of people, while managing the environmental impact. In addition, this area of research has important policy implications, including public land protection, clean air, and clean water legislation.

METHODOLOGY

My STS research analyzes the impact of technology on the ways people experience the outdoors and proposes how these technologies can be utilized to improve such experiences and outdoor spaces. My research included an investigation of the impact of technology on areas related to safety, wellness, diversity, and sustainable land management. In addition, given the intersectionality of the topic, the investigation touched upon studies relating to sustainability, public policy, and health. These interdisciplinary resources provided insight into the larger picture surrounding what society needs from the outdoors and how to provide those experiences feasibly. Due to the controversy of this topic, conflicting statements, and points of view on the

impacts of technology were explored to provide a complete picture of the role of technology in outdoor recreation.

Results from my research included both qualitative and quantitative secondary data with most data being qualitative. Qualitative data was vital given the importance of human experience on the topic.

The investigation began with a literature review of technological innovations and their impact on the outdoors. This search helped narrow down the field of study to include the focus areas listed above (safety, wellness, diversity, and sustainable land management) and a concentration on the effect of smartphones and social media. These topics were chosen based on their relevance and the number of published works available. In addition, these topics presented arguments from multiple points of view which were essential to the validity of the project. Secondary case studies were also used to gather data and analyze measurable impacts, including data from national parks, public lands, and outdoor recreation groups. A thematic analysis was conducted to interpret the qualitative data and identify patterns of pro-technology and anti-technology arguments.

FINDINGS

Technology has modernized the outdoors and altered people's expectations and approaches to outdoor recreation. Smartphones have eliminated much of the uncertainty associated with outdoor activities by providing "seemingly boundless amounts of information into one little, accessible package" (Rogers & Leung, 2021). Therefore, this project will focus primarily on the impact of smartphones and social media on outdoor recreation, due to their relevance and popularity.

SAFETY

A study of national park visitors across the country found that the availability of information improves feelings of safety and security, enabling visitors to explore new challenges and go outside their comfort zone (Shultis, 2012). Similar findings were collected from a study by Martin and Blackwell (2016) on the effect of Personal Locator Beacons (PLB) on wilderness visitor behavior. The study collected survey data from Sequoia-Kings Canyon National Parks and concluded that PLB devices were the most useful for peace-of-mind benefits, with the goal being never to use them. Another notable finding from the study was the trend between increased solo travel, remote area access, and PLB devices. Researchers Martin and Blackwell (2016) also highlight the potential increase in search and rescue (SAR) operations due to PLB devices and suggest that education is key to preventing unjustified SAR requests.

Another school of thought argues that excessive digital connectivity has led to a false sense of security and a lack of preparedness in wilderness areas. Frequent GPS use physically changes the way the brain creates internal maps, which can create dependency issues and resultant anxiety (Selin et al., 2020). These troubling dependencies have led users to blindly follow GPSs into dangerous situations rather than trusting their abilities and instincts. GPS reliance issues are an example of how a perceived increase in safety can lead recreationalists down a risky path that could have been avoided by wilderness skills.

Clear tradeoffs exist between the benefits of the resources provided and the false securities created by such technologies, thus land management personnel must seek a balance between providing resources and assuring people use them properly. Education is crucial to assuring technology, such as PLB devices, are used as tools rather than as justification for partaking in dangerous activities and wilderness unpreparedness. Similar to principles for

"Leave-No-Trace" that exist to encourage nature preservation, principles regarding the use of technology should be discussed.

WELLNESS

In addition to physical technological innovation effects, the influence of technology on human well-being and the health of outdoor spaces must be considered. According to a study by Martin et al. (2020), of adults in England, virtual interactions with the outdoors, including watching nature documentaries, produced similar benefits and feelings of connectedness compared to physical interactions. The study by Martin et al. also found that nature connectedness was positively correlated to "eudaimonic wellbeing and pro-environmental behaviour." Given the socially constructed and contested meanings and values of land and the outdoors, an affinity for the natural world encourages conservation and sustainability efforts, thus benefiting outdoor spaces (Meyfroidt et al., 2022). However, a study by Arendt and Matthes (2014) investigating the effect of nature documentaries on pro-environmental behavior found that nature documentaries only increased pro-environmental behavior in participants that already expressed a strong connectedness. Therefore, the results of Arendt and Matthes's study suggest that although nature documentaries produce benefits for both the viewers and outdoor spaces through pro-conservation behavior, benefits are limited by existing beliefs and creatively constructed films.

Another promising technology promoting personal wellness through nature exposure is virtual reality (VR). A study completed by Browning et al. (2020) supported this conclusion by stating that wilderness interaction through virtual reality (VR) can be used to improve mental health and promote environmentalism. However, the work by Browning et al. fails to address the comparison between the benefits of VR interactions and physical interactions. Although outdoor

recreation replicated in VR has shown increases in psychological well-being, including relaxation and reflection, these reported benefits are less than those reported by physical nature interactions (Frost et al., 2022). Thus, VR nature should be considered supplemental to physical outdoor recreation with the understanding that VR cannot replace the need for outdoor experiences. With that being said, VR can aid those physically unable to participate in outdoor recreation by providing some wellness value.

An alternative school of thought presented in a case study by Rogers and Leung (2021) addresses technology as dangerous for wellness, citing technology as threatening uncertainty in outdoor recreation. The study, on Appalachian Trail thru-hiker technology use, found that although every hiker in the study carried a cell phone, some hikers craved the uncertainty of the trail without technology. Study participants mentioned feelings of information overload that took away from the outdoor experience and "better not to know" instances. Although the study presents an interesting argument for the avoidance of technology, it is worth noting the study participants were avid backpackers with extensive experience. Therefore, despite contrasting opinions from a small group of advanced wilderness recreationalists, the positive impacts of outdoor recreation technology on wellness cannot be ignored.

DIVERSITY

An additional area for possible technological improvement in outdoor recreation is diversity and inclusion. Research by Ho and Chang (2021) suggests that many idealized images and promotions of the natural world fail to connect with the wider populace and instead exclude vast diverse segments of the public. These findings align with results from a study of equity in the outdoors by Winter et al. (2019) stating that lack of interest and lack of information are two of the leading constraints on ethoracial national forest participation. Winter et al. suggest the lack

of interest by ethoracial groups is reflective of generations of discrimination in outdoor spaces, leading to feelings of unwelcomeness. To combat these issues, Winter et al. found evidence that technology, specifically social media, can help affirm a sense of belongingness among ethnoracial minority cultures in outdoor recreation and spread information across social networks. The importance of word-of-mouth information sharing in minority groups was emphasized in a study by Chavez et al. (2008). The study concluded that tailoring the information outlet for outdoor recreation to meet the identities of ethnic/racial minorities was necessary, given the difference in media consumption.

Given the numerous mental and physical health benefits of interacting with outdoor spaces, social media work to improve information sourcing and feelings of belongingness appears beneficial to outdoor recreation.

SUSTAINABLE LAND MANAGEMENT

A highlighted area of technological potential for advancing outdoor spaces is recreational land management. Social media has been proven to be a promising source of data for gathering information on recreational land use. Public land managers can use a positive correlation between location-based social media activity and recreational use to fill information gaps and monitor protected areas (Wood et al., 2020). One example of this application is the creation of visitation models to estimate public land usage. A study by Wood et al. (2020) of visitation models found that social media data substantially improves visitor estimates at unmonitored sites, even when the model was parameterized with data from another site. These visitation models also have the potential to replace onsite data collection in areas where monitoring is too difficult or costly. Additionally, a study by Ghermandi and Sinclair (2019) found that data from social media can be utilized in environmental research to explore human-environment

interactions, future conservation efforts, and management techniques. These findings point to social media as a tool to better understand the human experience in outdoor spaces.

However, despite the promising potential, limitations such as age bias, park popularity, and platform pattern use exist. “Social media users in national parks tend to be younger than average visitors and that usage decreases significantly with age” (Tenkanen et al., 2017). Therefore, data collected from social media could fail to accurately capture the demographic and volume of visitors. Additionally, Tenkanen et al. (2017) found an inconsistent correlation between park popularity and social media data, meaning high park popularity did not always lead to high social media posting. This finding suggests a gap between what users present on social media and their day-to-day activities. Additionally, using data from social media to monitor public land use relies on scientists staying up to date on not just the most used social media, but the most relevant. For example, data from Instagram proved to be more accurate than data from Twitter in predicting visitation patterns (Tenkanen et al., 2017). A possible explanation for this trend is how users interact with each platform. For instance, Instagram tends to be used for sharing photos and capturing life events, whereas Twitter tends to be used more for sharing brief thoughts.

Another area of concern for the effect of social media on land management is search and rescue (SAR) operations. A study by Lu et al. (2021) on the relationship between SAR incidents in the US National Parks and Twitter tweets discovered a moderate association between tweets and SAR calls. Although this data can be used as a predictor for SAR incident volume and response needs, researchers are concerned that associations are a result of dangerous activities trending on social media (Lu et al., 2021).

Given the complicated nature of social media and its inconsistencies, researchers must continue to monitor the trustworthiness of the data. Social media can be a powerful tool for recognizing trends in land management but cannot replace traditional methods. Due to the lack of a promising solution, the dangers of social media on public lands, including overcrowding and increasing SAR incidents, must continue to be tracked.

CONCLUSION

Technology is constantly changing the way we experience and interact with nature. Although developed as a tool to enhance outdoor spaces and experiences, these technologies challenge existing ideas of "true" wilderness interactions. Despite conflicting opinions on the role of technology in outdoor spaces, the benefits to safety, wellness, diversity, and land management cannot be ignored.

Through proper education, GPS use and cellphone technology have the potential to enhance wilderness experiences by elevating safety and expanding recreation opportunities. Technology, including VR and nature documentaries, can also promote wellness benefits, such as stress and anxiety relief, to the public by making outdoor experiences more approachable and readily available. Given the many physical and mental benefits of outdoor recreation, public land management should utilize ethoracial social media targeting to expand resources to underrepresented groups. In addition, when paired with traditional observation efforts, social media data has been shown to make estimating visitation patterns and monitoring protected areas easier and more affordable for land managers. Therefore, despite traditionalist wilderness concerns, the net effects of technology on outdoor spaces and experiences are beneficial.

FUTURE WORK

Given the constantly evolving relationship, more research is needed to analyze larger trends in the effect of technology on outdoor recreation. Additionally, greater research into how social media is changing public land visitation and contributing to overcrowding is needed. This research would provide a better understanding of changing societal values and the effect of such values on global sustainability efforts.

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