Mobile Computing and Well-Being in the Outdoors

Zann Anderson
zann.anderson@uvu.edu
Utah Valley University
Orem, Utah

Michael D. Jones
Brigham Young University
Provo, Utah
m@byu.edu

ABSTRACT

The inclusion of mobile computing in outdoor recreation raises important questions about its ability to contribute meaningfully to activities without detracting from their benefits to well-being. In this paper, we present results from our research, which seeks to explore and set directions for computing's place in outdoor recreation. Our work addresses smartphone use while hiking. Our position is that computing already has a place in outdoor recreation and can contribute meaningfully to well-being in the outdoors now and in the future.

KEYWORDS

mobile computing, smartphones, hci outdoors, hiking, outdoors

ACM Reference Format:
Zann Anderson and Michael D. Jones. 2019. Mobile Computing and Well-Being in the Outdoors. In *Adjunct Proceedings of the 2019 ACM International Joint Conference on Pervasive and Ubiquitous Computing and the 2019 International Symposium on Wearable Computers (UbiComp/ISWC '19 Adjunct), September 9–13, 2019, London, United Kingdom.* ACM, New York, NY, USA, 4 pages. https://doi.org/10.1145/3341162.3344832

1 INTRODUCTION

Many individuals participate in outdoor activities as a means of recreation, exercise, relaxation, or rejuvenation. The Outdoor Foundation reports that 44.9 million Americans participated in at least one hiking trip in 2017 [14]–more than the 38.9 million people who attended both Disneyland and Disney's Magic Kingdom in the same year [1].

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.
UbiComp/ISWC '19 Adjunct, September 9–13, 2019, London, United Kingdom
© 2019 Association for Computing Machinery.
ACM ISBN 978-1-4503-6869-8/19/09…$15.00
https://doi.org/10.1145/3341162.3344832

Spending time outdoors can positively impact mental and emotional wellbeing. John Muir, a Scottish-American naturalist and author wrote in 1901:

> Climb the mountains and get their good tidings. Nature's peace will flow into you as sunshine flows into trees. The winds will blow their own freshness into you, and the storms their energy, while cares will drop off like autumn leaves. – Muir, *Our National Parks* [12]

Research in psychology and sociology has supported this idea as well. Ulrich et al. found viewing of nature scenes to be effective in stress recovery [16]. Kaplan and Kaplan found that natural environments provided restorative benefits [6]. Being outdoors is widely seen as a benefit to individuals and society.

Technology has long been used to support outdoor well-being by increasing safety, comfort, and ability. Shoes and boots protect feet from rocks, roots, and dirt. Hats and sunscreen provide shade and protect from sunburn. Backpacks allow individuals to carry more than they could otherwise.

In recent years mobile computing has led to the inclusion of a new technology—namely, interactive computing—in outdoor activities. A recent survey reported that 95% of individuals prefer to carry a cell phone or smartphone when hiking [2]. Apps exist for hiking[1], tracking one's path and sharing it with others[2], finding mountain biking trails[3], birdwatching[4], fishing[5], and engaging in countless outdoor pursuits.

It remains to be seen, however, just what effect computing will have on outdoor recreation activities. Specialized apps and other computing technologies seem to contribute positively to the outdoor experience. There is risk, however, that notifications and countless other distractions may cause individuals to miss out on the benefits of being outdoors.

The photograph in Figure 1 illustrates the potential for computing to impact the well-being benefits of hiking. The photograph shows a woman taking and sharing a selfie while on a hike in the desert. Her use of a smartphone can either improve the well-being benefits of hiking by helping her share her experience with friends or can reduce the well-being

[1] https://www.alltrails.com/mobile
[2] https://www.strava.com/mobile
[3] https://www.trailforks.com/apps/map/
[4] https://www.sibleyguides.com/about/the-sibley-eguide-to-birds-app/
[5] https://www.cabelas.com/category/Top-Fishing-Apps/1980688680.uts

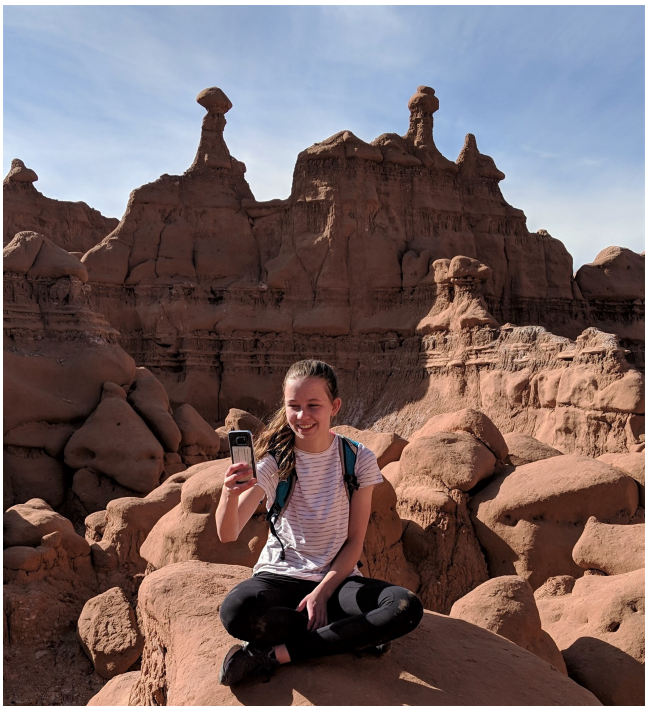

Figure 1: A woman using a smartphone to take a selfie on a hike and then share it with friends. Does this improve well-being by allowing her to share her experience with friends or does this reduce well-being by distracting her from her surroundings?

benefits by distracting her from the environment around her. Such considerations lead to questions such as *What is computing's place in outdoor recreation?* and *Is it an enabler or a distraction?*

Our research explores these and similar questions, focusing on the activity of hiking. Through empirical, theory-building, envisionment, and systems-building work, we have come to the conclusion that computing already plays a valuable and meaningful role in hiking, and that there are many ways that computing might improve well-being while hiking.

In this paper we present, briefly, results drawn from our work. Our hope is that our work will lead to better outdoor experiences supported by computing and, in turn, greater well-being for individuals and society at large.

2 RELATED WORK

Others have investigated the impact of technology in active outdoor settings. Tholander et al. explored the experience of professional and amateur athletes [15]. Knaving et al. explored designing for "Advanced Amateur" runners—those who are not professionals or sponsored athletes but nonetheless actively participate in races [8]. Bi et al. studied the shared experiences of ameteur runners and their spectators in long distance running events [3].

Others explore computing's ability to act in various support roles in the outdoors. Within the realm of cycling, Dancu et al. explore signaling and navigation with *GestureBike* [5]. Kosmalla et al. explore notification channels and their suitability to climbing [9].

Researchers also explore social engagement in exertion and recreation activities. Various research explores running together with a distant friend via video chat [11], sharing athletes' heart rates over social networks and allowing friends and family to provide feedback during races [4], and sharing heart rates on the back of cyclists' helmets [17].

Posti et al. created the *HOBBIT*, an asocial hiking app [13]. The *HOBBIT* uses WiFi signals from the phones of other hikers together with a pre-loaded map of a given hiking area in order to help hikers avoid others while on the trail. This is an example of supporting individuals' emotional wellbeing by allowing them to maintain desired solitude while on the trail.

3 PRESENT USES OF COMPUTING TO SUPPORT OUTDOOR WELL-BEING

Our initial work in this area was mixed-methods, including online surveys, interviews, and on-trail observations. Among important results of this work was the finding that rather than computing becoming a distraction on the trail, individuals carefully adopt and adapt technology to meet their needs when hiking. One interviewee, who uses a smartphone for several uses including tracking hikes and trail runs, taking pictures, and keeping his children on-track with how far they are hiking as a family, stated that phone use takes up roughly five minutes per hour of hiking (participants anonymized as per study parameters):

> I'd say for an hour maybe five to ten minutes. Ten minutes may be pushing it. Yeah. But maybe five minutes per hour of hiking. –IP11

Besides mobile phones, headphones and earbuds are the most common device carried by individuals. In response to open-ended questions, participants indicated several ways in which they use headphones in support of their well-being when hiking. The most common of these was using music to support the emotive aspects of the hiking experience. This is reflected in the following quote from a survey participant:

> So I can listen to music and escape in my own world of sound. There's nothing like listening to your favorite playlist of great positive songs while you're hiking in the woods or mountains. –P10

This individual finds listening to music an enhancement to the restorative experience of being in nature. Another participant uses headphones for a slightly different purpose:

> It has music on it. I like to listen to my music when I am hiking, because it calms me down. Sometimes I get afraid of mountain lions. –P193

While others often find the sounds of nature relaxing, this participant feels uneasy at times but is able to support their emotional well-being, calming their nerves with music.

Mobile computing also proved to be an enabling technology for some. For instance, one interview participant found the ability to use her smartphone for navigation and to keep her husband aware of her location to be enabling:

> I use my phone to, I have an app called AllTrails, and I pull up that AllTrails app, right? And I use that on my phone to track. Um, also my husband can track my phone. Since I hike by myself all the time. –IP3

> I mean, I you know, I think back before technology and cell phones, and had I been hiking, I'm not sure ... I might not have been as brave to hike by myself and go as far as I go, and do some of the things I do...I never feel like I'm lost. –IP3

Others found that having a mobile phone enabled them to share the wellness benefits of their outdoor experience with others or use it to enhance their relationships with loved ones:

> I like being able to contact friends. Being in a different space can make the interaction different too. –P84

> I also use it to stream music if I stop to sit and write for a while, or sometimes to communicate with someone close to me if I've gone to clear my head. –P54

While some indicated they bring a mobile device with them when hiking out of habit, others carefully selected whether or not to bring it. Some individuals felt that the inclusion of technology might prove detrimental to social or familial well-being when hiking. This survey participant prefers to leave headphones home because:

> Usually I'm hiking with friends, my partner, or my family, and I like to talk to them. –P211

Individuals carefully tread the territory that lies between technology contributing to and detracting from hiking. Some individuals found creative ways to support their goals. This interviewee mentioned a creative use for a digital camera:

> I guess sometimes I will take the old digital camera that's like five years old that just takes pictures and that's all it does. And we'll pawn that off on the kids so that they can be distracted, kind of keep plugging along without realizing they are hiking and take pictures, you know. – IP7

Rather than becoming a detriment to the family's enjoyment of their hike, the camera in this case supports their goal by helping their children to avoid becoming bored or easily tired when hiking.

4 THE FUTURE OF COMPUTING SUPPORTING WELL-BEING IN THE OUTDOORS

By combining ideas from HCI, attention restoration theory [7] and results from our own research, we have developed a vision for the future place of computing in outdoor recreation. This vision balances the connected and attention-intensive aspects [10] of mobile computing with the desire to disconnect from daily life and recuperate that often motivates outdoor recreation activities.

We envision a world in which computing discretely exists around us when we are outdoors. In this world, compute-enabled outdoor gear observes us and the world around us and responds in meaningful and useful ways, all while remaining largely at the periphery of our experience. It will not demand attention but will be available when needed. It will cater to individuals' human-computer interaction preferences while encouraging deeper human-nature interaction. This vision is based on three core principles:

- Time spent outdoors is good for individuals and society
- Computing can play a valuable role in enhancing, encouraging, and enabling time spent outdoors
- In outdoor activities, human-nature interaction holds priority over human-computer interaction

One important area in which computing could contribute now and in the future is to allow individuals with physical disabilities the opportunity of participating in outdoor activities on some level. Action cameras have allowed individuals to get a first-hand view of activities which may be too difficult, dangerous, or even physically impossible for some.

We imagine a system in which a hiker wears a helmet with a top-mounted camera on a remote-control gimbal. An individual back home who is unable to hike for physical reasons could use this camera as a means of enjoying the scenery and being included in the hiking experience from afar. This system would allow individuals who could not otherwise go hiking to enjoy some of the benefits of communing with nature in this way.

5 CONCLUSION

Outdoor recreation and time in nature play an important role in supporting wellness for individuals and society. In this position paper, we have presented some results and

conclusions from our research. Through understanding computing's present use in the outdoors, carefully charting a course for its future, and building systems which explore this course, we hope to ensure that computing contributes to meaningful and restorative outdoor experiences.

REFERENCES

[1] AECOM. 2018. https://www.aecom.com/content/wp-content/uploads/2018/05/2017-Theme-Museum-Index.pdf. Online, accessed 26 October 2018.

[2] Zann Anderson, Candice Lusk, and Michael D. Jones. 2017. Towards Understanding Hikers' Technology Preferences. In *Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2017 ACM International Symposium on Wearable Computers (UbiComp '17)*. ACM, New York, NY, USA, 1–4. https://doi.org/10.1145/3123024.3123089

[3] Tao Bi, Nadia Bianchi-Berthouze, Aneesha Singh, and Enrico Costanza. 2019. Understanding the Shared Experiences of Runners and Spectators in Long-Distance Running Events *(CHI '19)*. ACM, New York, NY, USA, 1-13.

[4] Franco Curmi, Maria Angela Ferrario, Jen Southern, and Jon Whittle. 2013. HeartLink: Open Broadcast of Live Biometric Data to Social Networks. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '13)*. ACM, New York, NY, USA, 1749–1758. https://doi.org/10.1145/2470654.2466231

[5] Alexandru Dancu, Velko Vechev, Adviye Ayça Ünlüer, Simon Nilson, Oscar Nygren, Simon Eliasson, Jean-Elie Barjonet, Joe Marshall, and Morten Fjeld. 2015. Gesture Bike: Examining Projection Surfaces and Turn Signal Systems for Urban Cycling. In *Proceedings of the 2015 International Conference on Interactive Tabletops & Surfaces (ITS '15)*. ACM, New York, NY, USA, 151–159. https://doi.org/10.1145/2817721.2817748

[6] Rachel Kaplan and Stephen Kaplan. 1989. *The experience of nature: A psychological perspective*. CUP Archive.

[7] Stephen Kaplan. 1995. The restorative benefits of nature: Toward an integrative framework. *Journal of environmental psychology* 15, 3 (1995), 169–182.

[8] Kristina Knaving, PawełWoźniak, Morten Fjeld, and Staffan Björk. 2015. Flow is Not Enough: Understanding the Needs of Advanced Amateur Runners to Design Motivation Technology *(CHI '15)*. ACM, New York, NY, USA, 2013–2022.

[9] Felix Kosmalla, Frederik Wiehr, Florian Daiber, Antonio Krüger, and Markus Löchtefeld. 2016. ClimbAware: Investigating Perception and Acceptance of Wearables in Rock Climbing *(CHI '16)*. ACM, New York, NY, USA, 1097–1108.

[10] Golden Krishna. 2015. *The Best Interface Is No Interface: The simple path to brilliant technology (Voices That Matter)*. New Riders. https://www.amazon.com/Best-Interface-No-brilliant-technology-ebook/dp/B00T0ER57I?SubscriptionId=0JYN1NVW651KCA56C102&tag=techkie-20&linkCode=xm2&camp=2025&creative=165953&creativeASIN=B00T0ER57I

[11] Florian 'Floyd' Mueller, Shannon O'Brien, and Alex Thorogood. 2007. Jogging over a Distance: Supporting a "Jogging Together" Experience Although Being Apart. In *CHI '07 Extended Abstracts on Human Factors in Computing Systems (CHI EA '07)*. ACM, New York, NY, USA, 1989–1994. https://doi.org/10.1145/1240866.1240937

[12] John Muir. 2018. *Our National Parks*. Gibbs Smith. https://www.amazon.com/Our-National-Parks-John-Muir/dp/1423650395?SubscriptionId=AKIAIOBINVZYXZQZ2U3A&tag=chimbori05-20&linkCode=xm2&camp=2025&creative=165953&creativeASIN=1423650395

[13] Maaret Posti, Johannes Schöning, and Jonna Häkkilä. 2014. Unexpected Journeys with the HOBBIT: The Design and Evaluation of an Asocial Hiking App *(DIS '14)*. ACM, New York, NY, USA, 637–646.

[14] The Outdoor Foundation. 2018. Outdoor Participation Report. https://outdoorindustry.org/resource/2018-outdoor-participation-report/. Online, accessed 26 October 2018.

[15] Jakob Tholander and Stina Nylander. 2015. Snot, Sweat, Pain, Mud, and Snow: Performance and Experience in the Use of Sports Watches. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15)*. ACM, New York, NY, USA, 2913–2922. https://doi.org/10.1145/2702123.2702482

[16] Roger S Ulrich, Robert F Simons, Barbara D Losito, Evelyn Fiorito, Mark A Miles, and Michael Zelson. 1991. Stress recovery during exposure to natural and urban environments. *Journal of environmental psychology* 11, 3 (1991), 201–230.

[17] Wouter Walmink, Danielle Wilde, and Florian 'Floyd' Mueller. 2013. Displaying Heart Rate Data on a Bicycle Helmet to Support Social Exertion Experiences. In *Proceedings of the 8th International Conference on Tangible, Embedded and Embodied Interaction (TEI '14)*. ACM, New York, NY, USA, 97–104. https://doi.org/10.1145/2540930.2540970