A Survey of Mobile Apps to Support Hiking

Ashley Colley
University of Lapland
Rovaniemi, Finland
Firstname.lastname@ulapland.fi

Emma Napari
University of Lapland
Rovaniemi, Finland
Firstname.lastname@ulapland.fi

Jonna Häkkilä
University of Lapland
Rovaniemi, Finland
Firstname.lastname@ulapland.fi

The 2nd workshop on NatureCHI - Unobtrusive User Experiences with Technology in Nature, at MobileHCI '17, September 04, 2017, Vienna, Austria

Abstract
Hiking is a mainstream pastime delivering both physical and mental wellbeing benefits to participants. However, the use of mobile computing in the hiking domain brings many contradictory requirements e.g. the desire to be disconnected from everyday life, yet still be connected for safety reasons. We review 357 hiking related apps from the Google Play store and identify features aimed to address the specific challenges of the hiking domain.

Author Keywords
Hiking; outdoors; wilderness; mobile apps, wellbeing.

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

Introduction
Hiking is a recreational outdoor activity, which combines exercise and adventure with solitude and nature experiences. Hiking is the 3rd most popular outdoor activity amongst US adults (behind jogging and fishing), and more than 31 million Americans participated in hiking in 2015 [18]. Investigating the use of mobile technology in the context of hiking is of particular interest as it encompasses various technical limitations and several contradictory design requirements.

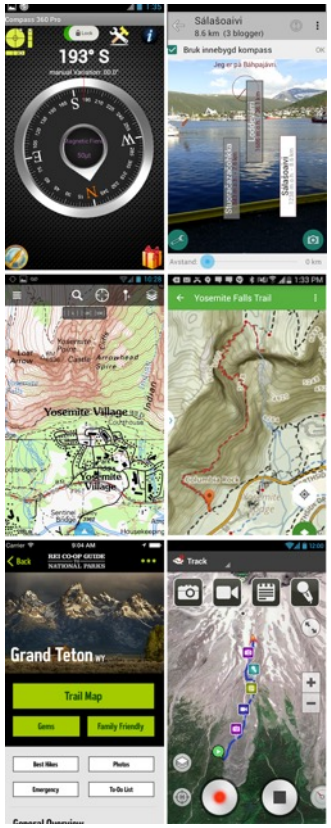

Figure 1: Example hiking related apps included in the dataset. Top-bottom: Compass 360 pro Sami Hiking Compass, BackCountry Navigator, AllTrails, REI app, Ramblr.

Whilst hiking is conducted in environments where the use of mobile technology is challenging e.g. due to limited mobile network connectivity, lack of battery charging possibilities, and harsh physical conditions, it can still play an important role in use cases related to navigation and emergency situations. The potential benefits of technology in emergency situations is highlighted by the death of a hiker who strayed just a few meters from the Appalachian trail, became lost and tried in vain to send SOS messages [20].

Considering technology in general, hiking is nowadays a very technical pastime, with many high-tech elements applied in the area of hiking equipment design, e.g. for clothing, shoes, tents, and cooking. However, the extension of this to encompass the use of mobile technology, such as smartphones, may not be desirable for many hikers [7]. For many the essence of hiking is being alone in the remote wilderness, disconnected from everyday life and not disturbed by emails or social media. Fortunately, this is often enforced by the lack of network connectivity in hiking locations. In contrast, some hikers may desire to post images and details of their experiences via social media [7].

In this paper, we investigate the current use of mobile phone apps for hiking by conducting an analysis of existing apps. The work seeks to provide an overview of the currently adopted practices and highlight directions for future research on the topic, thus contributing to the growing interest of the outdoor context [11] and nature [10] activities in the HCI community.

Related Work

Motivations for Hiking

The benefits of hiking on physical health are well reported, e.g. [17, 22]. Nordbø and Prebensen explore the benefits of hiking on physical and mental states, concluding that the latter is of most importance to many participants [17]. Several studies exist identifying the motivations of hikers [1,4,14,22]. Escape from urban life and contact with nature, being the most common themes identified, e.g. a study of hikers on the Tatra mountains in Poland identified *silence* as a major driver [22]. In particular, the group bonding benefits of hiking together, for example with family or friends are exposed by [1,4]. Muhar et al. report that almost all hikers in their study were in groups, with a median group size of 3 [14]. Hiking seems to be rather gender balanced, with studies reporting only a minor bias towards male hikers [3,14].

Mobile Devices and Applications in Hiking

Whilst research on the use of mobile computing devices specifically in hiking is rare, a very large body of work on the use of activity trackers exists. This ranges from applications that measure time spent outdoors [13], their use as an agent for behavior change [8], or to guide correct running technique [6]. As well as smartphone form factors, wearable devices such as smartwatches present the capability for use as trackers or guides. One approach to overcome the limitations of such in hiking type contexts is presented by Wening et al. [23] who demonstrate a strip map located on a rucksack strap. An interesting alternative to map based approaches are the verbal and landmark based hiking route descriptions presented by Sarjakoski et al. [20].

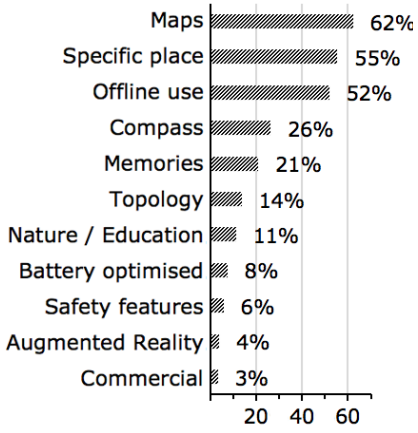

Figure 2: Percentage of the dataset of 357 hiking related apps from Google Play store that include specified features.

Mountains as a research context has been addressed for adventure and extreme situations [14], and for practices and wearables development for climbing [5,12]. In one of the few works addressing hiking from a HCI perspective, Posti et al. developed a mobile application designed for solitude seeking [19]. Cheverst et al. developed a crowd-sourced mobile tool for creating and annotating location sensitive media in rural places, such as on nature tracks [3].

Method

In order to select the apps included in the analysis, a systematic review process was applied to the search, and screening of apps. Similar analysis of mobile application on specific topics in the area of wellness and health have earlier been conducted e.g. for sleeping apps [8], weight management [1], and bi-polar disorder [16]. Search terms to identify apps primarily targeted to support hiking activities were first identified via explorative searches of the Google Play store. It should be noted the search algorithm utilized by the Play store search is not available. The search returns a maximum of 250 results for a single search. Search words that returned applications meeting our inclusion criteria were selected, and thus the following search terms were applied in 3 separate searches: *hike, hiking* and *trekking*, resulting in a raw dataset of 750 apps. The searches were performed using a node.js based scraper application, and imported to Microsoft Excel for further processing. Of the 750 applications, 251 were identified as duplicates and removed, resulting in a set of 499 applications. Following this, to remove applications unrelated to hiking, two researchers independently parsed the list, voting on conflicts, and removed non-relevant applications: general fitness and messenger applications, flashlight applications, games, and other applications out of the scope of this study. Also applications with languages other than English were removed to ease further processing, resulting in a final dataset of 357 applications, see Figure 1 for examples. These applications were then analyzed based on their store descriptions.

Based on the related work and a first pass though the dataset, one researcher defined a codebook, by which the features of the applications could be structured. The codebook included the following attributes: offline usage, battery life, maps, topography, social features, educational content, recording memories, compass, augmented reality, safety features, and commercial content (e.g. equipment and tour advertisements). A second researcher then coded on the dataset based on the full description text (max 4000 characters). Each application could be coded with multiple attributes.

Findings

Two-thirds of the apps (237/357) were free to download. For the paid applications, the minimum cost was 0.99$ and the maximum 19.99$, with the median cost being 1,32$. Half of the applications (180/357) explored had 1000 or less downloads. The four most downloaded applications, with over 10 million downloads, were mostly compass applications (*Smart Compass, Compass, Compass 360 Pro Free*, and *Maps & GPS Navigation — OsmAnd*). Figure 2 presents the results of coding the dataset.

Altogether, 62% of the applications explored had map features or a possibility to download maps, often mentioning that the maps were topographical (14%). Over half of all the applications were related to a specific place – a specific nature area, hiking trail, or a

country. The inclusion of compass functionality was common with 26% of all the application descriptions mentioning compass features.

The lack of coverage in typical hiking locations had been addressed, with over half of the applications mentioning the possibility to use the application offline without Wi-Fi or cellular reception. Many of the apps supporting offline usage were map applications, e.g., the *BackCountry Navigator TOPO GPS* application was described: "*Download topo maps for the US and many other countries in advance so you won't need cell coverage for navigation*". The limited charging possibilities when hiking were acknowledged by 8% of the applications, which mentioned e.g. optimized for low battery usage or had a battery drain warning.

Journaling was a relatively common feature, with 21% of applications including the possibility to create a timeline, add photos or otherwise record memories along the journey, e.g. the *Trip Journal* application: *"Track, record, document and share your travels with friends and family"*. Educational features were rather limited, only 11% of the applications had educational features about nature, hiking in general or a specific place. In this respect *The Big Hike* is an example of an educational application for children: *"Come join the Mountain Rangers as they learn to safely enjoy the outdoors!"*

Safety features were mentioned in 6% of the application descriptions, typically being the possibility to send exact GPS location information via a message, e.g. the *REI National Park Guide & Maps* application features a possibility to "*record a GPS track or send your exact location to help in case of emergency*". Only 4% of the applications included Augmented Reality features. Many of these applications featured the possibility to get information about your surroundings by pointing the phone camera to a mountain top, e.g. *Sami Hiking Compass: "It will show you the Sami name, direction and distance… …to many hill- and mountain tops in the terrain around you."*

Discussion & Conclusions

We discovered a large number of apps that aim to enhance the hiking experience in a variety of ways. The volume of apps is driven by the general approach that each hiking area develop their own custom application. The largest number of apps are those presenting maps, many including features to overcome the lack of network availability common in wilderness locations. Whilst the reviewed mobile apps provide clear benefits e.g. for navigation, information and safety, the general use of smartphones whilst hiking threatens the core values of hiking. Here, echoing the findings of Dickson et al. [7]. As network coverage continues to expand, the current 'enabler' for being disconnected, lack of coverage, cannot be taken for granted. This issue cannot be addressed by individual applications, but requires changes at the operating system level of smartphones or by network operators themselves. This is a major challenge to address to ensure the important mental benefits of hiking are not lost. As future work we plan to examine approaches to address this issue.

We acknowledge that our work is limited by the contextuality present in the Play store search algorithm and conducting the analysis based on app descriptions rather than actual usage. However, we consider our sample size of 357 hiking related apps is sufficiently large to get an overview of the space.

References

1. Børge Baklien, Borgunn Ytterhus, and Rob Bongaardt. 2016. When everyday life becomes a storm on the horizon: Families' experiences of good mental health while hiking in nature. *Anthropology & medicine 23*, no. 1 (2016): 42-53.
2. Marco Bardus, Samantha B. van Beurden, Jane R. Smith, Charles Abraham. 2016. A review and content analysis of engagement, functionality, aesthetics, information quality, and change techniques in the most popular commercial apps for weight management. *International Journal of Behavioral Nutrition and Physical Activity*, 13(1), 35.
3. Keith Cheverst, Trien V. Do, Dan Fitton. 2016. Supporting the Mobile In-situ Authoring of Locative Media in Rural Places: Design and Expert Evaluation of the SMAT app. *IJHCR* 6(1): 1-19 (2015)
4. Noga Collins-Kreiner and Nurit Kliot. 2017. Why Do People Hike? Hiking the Israel National Trail. *Tijdschrift voor economische en sociale geografie* (2017).
5. Florian Daiber, Felix Kosmalla, Frederik Wiehr and Antonio Krüger. 2016. Outdoor Nature Lovers vs. Indoor Training Enthusiasts: A Survey of Technology Acceptance of Climbers. In *Proc. NatureCHI 2016 workshop at CHI*.
6. Florian Daiber et al. 2017. Towards Amplified Motor Learning in Sports using EMS. In *Amplify workshop at CHI 2017*.
7. Janet Dickinson, Julia F. Hibbert, and Viachaslau Filimonau. 2016. Mobile technology and the tourist experience:(Dis) connection at the campsite." *Tourism Management 57* (2016): 193-201.
8. Rúben Gouveia, Evangelos Karapanos, and Marc Hassenzahl. 2015. How do we engage with activity trackers?: a longitudinal study of Habito. In *Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing* (UbiComp '15). ACM, New York, NY, USA, 1305-1316. DOI: http://dx.doi.org/10.1145/2750858.2804290
9. Diana S. Grigsby-Toussainta, Jong Cheol Shinb, Dayanna M. Reevesb, Ariana Beattieb, Evan Augustec, Girardin Jean-Louisc. 2017. Sleep apps and behavioral constructs: A content analysis. *Preventive Medicine Reports, 6,* 126-129. Elsevier.
10. Jonna Häkkilä, Keith Cheverst, Johannes Schöning, Nicola J. Bidwell, Simon Robinson, and Ashley Colley. 2016. NatureCHI: Unobtrusive User Experiences with Technology in Nature. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (CHI EA '16). ACM, New York, NY, USA, 3574-3580. DOI: https://doi.org/10.1145/2851581.2856495
11. Michael Jones, Florian Daiber, Zann Anderson, and Kevin Seppi. 2017. SIG on Interactive Computing in Outdoor Recreation. In *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (CHI EA '17). ACM, New York, NY, USA, 1326-1329. DOI: https://doi.org/10.1145/3027063.3049289
12. Felix Kosmalla, Frederik Wiehr, Florian Daiber, Antonio Krüger, and Markus Löchtefeld. 2016. ClimbAware: Investigating Perception and Acceptance of Wearables in Rock Climbing. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (CHI '16). ACM, New York, NY, USA, 1097-1108. DOI: https://doi.org/10.1145/2858036.2858562
13. Michael S. Lam, Suneeta Godbole, Jacqueline Chen, Melody Oliver, Hannah Badland, Simon J. Marshall, Paul Kelly, Charlie Foster, Aiden Doherty, and Jacqueline Kerr. 2013. Measuring time spent outdoors using a wearable camera and GPS. In *Proceedings of the 4th International SenseCam &*

Pervasive Imaging Conference (SenseCam '13). ACM, New York, NY, USA, 1-7. DOI=http://dx.doi.org/10.1145/2526667.2526668

14. Andreas Muhar, Thomas Schauppenlehner, Christiane Brandenburg, and Arne Arnberger. 2007. Alpine summer tourism: the mountaineers' perspective and consequences for tourism strategies in Austria. *Forest Snow and Landscape Research* 81, no. 7 (2007).
15. Florian 'Floyd' Mueller and Sarah Jane Pell. 2016. Technology meets adventure: learnings from an earthquake-interrupted Mt. everest expedition. In *Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing* (UbiComp '16). ACM, New York, NY, USA, 817-828. DOI: http://dx.doi.org/10.1145/2971648.2971683
16. Jennifer Nicholas, Mark Erik Larsen, Judith Proudfoot, Helen Christensen. 2015. Mobile apps for bipolar disorder: a systematic review of features and content quality. *Journal of medical Internet research, 17*(8), e198. JMIR Publications.
17. Ingeborg Nordbø and Nina K. Prebensen. 2015. Hiking as Mental and Physical Experience. In *Advances in Hospitality and Leisure*, pp. 169-186. Emerald Group Publishing Limited, 2015.
18. Outdoor Industry Association participation report http://www.outdoorfoundation.org/research.participation.2016.topline.html Accessed 19 May 2017
19. Maaret Posti, Johannes Schöning, and Jonna Häkkilä. 2014. Unexpected journeys with the HOBBIT: the design and evaluation of an asocial hiking app. In *Proceedings of the 2014 conference on Designing interactive systems* (DIS '14). ACM, New York, NY, USA, 637-646. DOI: http://dx.doi.org/10.1145/2598510.2598592
20. L. Tiina Sarjakoski, Pyry Kettunen, Hanna-Marika Flink, Mari Laakso, Mikko Rönneberg, and Tapani Sarjakoski. 2012. Analysis of verbal route descriptions and landmarks for hiking. *Personal Ubiquitous Computing*, 16, 8 (Dec. 2012), 1001-1011. DOI=http://dx.doi.org/10.1007/s00779-011-0460-7
21. The Guardian: https://www.theguardian.com/us-news/2016/may/26/hiker-who-went-missing-on-appalachian-trail-survived-26-days-before-dying Accessed 19th May 2017
22. Karolina Taczanowska, Christiane Brandenburg, Andreas Muhar, Kinga Hat-Pawlikowska, Szymon Ziobrowski, Bogusława Chlipała, Szymon Grocholski et al. "Who is hiking in the Tatra National Park, Poland? A socio-demographic portrait of visitors." In *The 7th International Conference on Monitoring and Management of Visitors in Recreational and Protected Areas* (MMV). Tallinn, Estonia, pp. 27-29. 2014.
23. Dirk Wenig, Florian Heller, and Johannes Schöning. 2016. StrapMaps: bringing map-based navigation to the straps of bags. In *Adjunct Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing* (UbiComp '16). ACM, New York, NY, USA, 225-228. DOI: https://doi.org/10.1145/2968219.2993411
24. Isabelle Wolf and Teresa Wohlfart. 2014. Walking, hiking and running in parks: A multidisciplinary assessment of health and well-being benefits. *Landscape and Urban Planning* 130 (2014): 89-103