

Reflections on the NatureCHI Workshop

Series: Unobtrusive User Experiences with Technology in Nature

Jonna Häkkinen, University of Lapland, Rovaniemi, Finland

Nicola J. Bidwell, University of Namibia, Windhoek, Namibia & University of Pretoria, Pretoria, South Africa

Keith Cheverst, Infolab21, Lancaster University, Lancaster, UK

Ashley Colley, University of Lapland, Rovaniemi, Finland

Felix Kosmalla, German Research Center for Artificial Intelligence (DFKI), Saarbrücken, Germany

Simon Robinson, Future Interaction Technology Lab, Swansea University, Swansea, UK

Johannes Schöning, University of Bremen, Bremen, Germany

ABSTRACT

Being in nature is often regarded to be calming, relaxing and purifying. While technology has the potential to support engagement with nature, developing systems that provide support in an unobtrusive manner holds many challenges for interaction design. In this article, the articles describe their reflections around the NatureCHI workshop series. The aim with the workshops has been to help foster a research community interested in the design of Unobtrusive User Experiences with Technology in Nature. The first of two workshops ran as part of CHI 2016 in San Jose, California, while the second workshop took place alongside MobileHCI 2017 in Vienna, Austria. With 25 papers presented in total, the workshops demonstrate a rising interest in the areas where nature and interactive technologies meet.

Keywords

Interaction Design, Nature, NatureCHI, Technology

INTRODUCTION AND MOTIVATION

The benefits of nature to the public are widely recognised. For example, a recent EU report (Brink et al., 2016) concludes that:

There is robust scientific and practice-based evidence that nature can contribute to addressing health and social challenges that EU citizens are facing.

Mobile technologies (such as sports trackers, electronic tourist guides, mobile phone integrated cameras and omnipresent social media access) have the potential to both enhance and disrupt a user's interaction with, and experience of nature. Our review of the HCI/Design literature reveals surprisingly few examples of research that have studied the role of digital technology in nature since Bidwell and Browning's review in 2010. Furthermore, the research papers that do report on technology interaction 'outdoors' typically focus on the learning domain, e.g., the Ambient wood project (Rogers et al. 2004), the GreenHat Mobile Augmented Reality system (supporting students in learning about biodiversity) (Kimiko and Agogino, 2013), the MobileGIS system (which forms one of the case studies described by Adams et al. (2013)) or a large-scale study on the geography of Pokémon Go (Colley et al. 2017).

In their research on so-called nature-technology hybrids, Edwards et al. (2015) deliberately resisted the use of smartphone technologies because of the potential "captivating hold of the screen" (Edwards et al., 2015). The issue of disruption is further considered by Coyne (2014), who argues "the proliferation of mobile apps brings into sharp relief the power of digital technologies to disrupt, and therefore reveal, aspects of our experience of the natural world" (Coyne, 2014). Technology can be used to bring people to defined rural places to share and enjoy the same experiences (Cheverst, Turner, Do & Fitton, 2016) or to facilitate solitude by providing guidance on how to avoid other people (Posti et al., 2014). It can offer a way to bridge different ways of knowing, such as those of indigenous or rural inhabitants (Turner et al., 2007, Bidwell et al., 2010).

Perhaps the most common examples of smartphone apps that aim to support 'interaction in nature' are those that relate to hiking. Indeed, according to the study by Colley et al. (2017), there are over 350 smartphone apps related to hiking. A somewhat different approach to hiking support is presented by Posti et al. (2014), where the authors describe their Hobbit 'asocial hiking app' which was designed to provide navigation support that "enables solitary hiking by informing the user of approaching people" (Posti et al., 2014). An example of non-screen navigation support through an augmented hiking stick is presented in (Johnson et al., 2016).

Thus, the combination of technology and nature presents a multitude of interesting aspects and challenges, with a wide range of impacts ranging through, for example, individual wellbeing, sustainability and social issues. As time progresses, one will no doubt see increased levels of urbanization and penetration of technology and design at the intersection of nature and technology will continue to grow in importance.

NATURECHI WORKSHOP SERIES: EMERGING THEMES AND TOPICS

In order to help foster a research community with a shared interest in the design of mobile technologies that support unobtrusive interaction in nature, the authors have organised and run two NatureCHI workshops. The first workshop (Häkkinen et al., 2016) ran as part of CHI 2016 in San Jose, California and included 11 position papers. The second workshop (Häkkinen et al., 2017) took place alongside MobileHCI 2017 in Vienna, Austria, and included 14 position papers. The workshops comprised of both paper presentations (with follow-on discussions) and group activities (see Figure 1). From the collection of research papers presented across the workshops, a wide range of themes and topics emerged. The following subsections present these themes and topics, and associated research papers. To conclude, we reflect on the NatureCHI series of workshops, and potential future directions.

Figure 1. Group exercise (mapping out presented systems) carried out during the 2nd NatureCHI workshop held at MobileHCI 2017



Designing for Revitalizing and Meditative Experiences in Nature

Five papers in the series have described interaction designs aiming to entice, persuade or compel. Ahtinen and Väänänen (2017) discuss how technology could support the mindsets of Liberty and Recovery in the context of outdoor walking meeting experiences, achieving this through discreet and direct persuasion, respectively. The potential positive impacts of a simple walk in the outdoors are further investigated by Dingler and Machula (2017), who explore cognition-aware systems capable of detecting circadian rhythms. Their system seeks

to trigger interventions to align cognitive states with the requirements of current tasks, where such interventions can include taking an outdoor walk.

To encourage feelings of empathy with nature, Brereton et al. (2017) present the design and deployment of the Ambient Birdhouse prototype. Here, indoor experiences aim to foster appreciation of nature, and entice people to step outdoors. Another education-focused paper, Fenicio et al. (2017) considers the different roles of creating and consuming digital content that support nature exploration, and how consumers may be persuaded to become content creators or leaders.

The feelings evoked in some natural settings are overlaid and influenced by cultural contexts. For example, Häkkinen and Colley (2016) considered graveyards as a design context for unobtrusive digital interaction, noting “graveyards are places of natural beauty and peace, which are often described as having a special atmosphere and tranquility”. Considering modalities beyond the visual in sensitive natural settings, the suitability of auditory notifications has been explored by Kerber and Krüger (2017) (see Figure 2).

Figure 2. Example images from workshop submissions which seek to design for revitalizing or meditative experiences with nature. Left to right: Häkkinen & Colley, 2016; Brereton et al. 2017; Ahtinen & Väänänen, 2017



Technology to Support Physical Activities in Nature

The potential of technology to support rambling or hiking in nature has attracted much interest in the series. An analysis of the large number of smartphone apps available to support this activity was presented by Colley et al. (2017). Focusing on a particular context, Cheverst, Bracken, Fleming & Porter (2017) describe the design of a smartphone app that supports navigation and learning via Locative Media for ramblers on a short trail in the English Lake District. In a similar vein, a personal account describing the impact of technology on the Appalachian Trail (an extended multi-day hike) was presented by Stelter and McCrickard (2017). Here, a range of recommendations for selecting, connecting, designing for, and using technology on the trail is provided. Navigation guidance is a central issue when hiking, and in this respect Mayer et al. (2017) described the potential of flying drones to act as a “personal outdoor assistant” and “provide navigation by hovering in the right direction, not far from the users”.

Two papers focused on the potential role of digital technology in supporting so-called “nature sports” (Krein, 2014). Daiber et al. (2016) describe the findings of a survey designed to provide understandings on the extent to which climbers are prepared to accept the use of

digital technologies in their sport. Similarly, the nature sport of cross-country skiing is the subject of the study presented by Häkkinä and Colley (2016), who present a concept design for a ski-attached information display.

In a more philosophical exploration, Bødker (2017) discusses the appropriate vocabulary for considering and describing interaction with technologies in nature (Bødker, 2017), and explores how the notion of “focal things and practices”, as proposed by Borgmann (2017), is a useful framework to describe experiences with technology in the wilderness (see Figure 3).

Figure 3. Example images from workshop submissions in category Technology to Support Physical Activities in Nature. Top row: Mayer et al. 2017, Häkkinä et al. 2016. Bottom row: Cheverst et al., 2017



Enhancing Tourists’ Nature Experiences

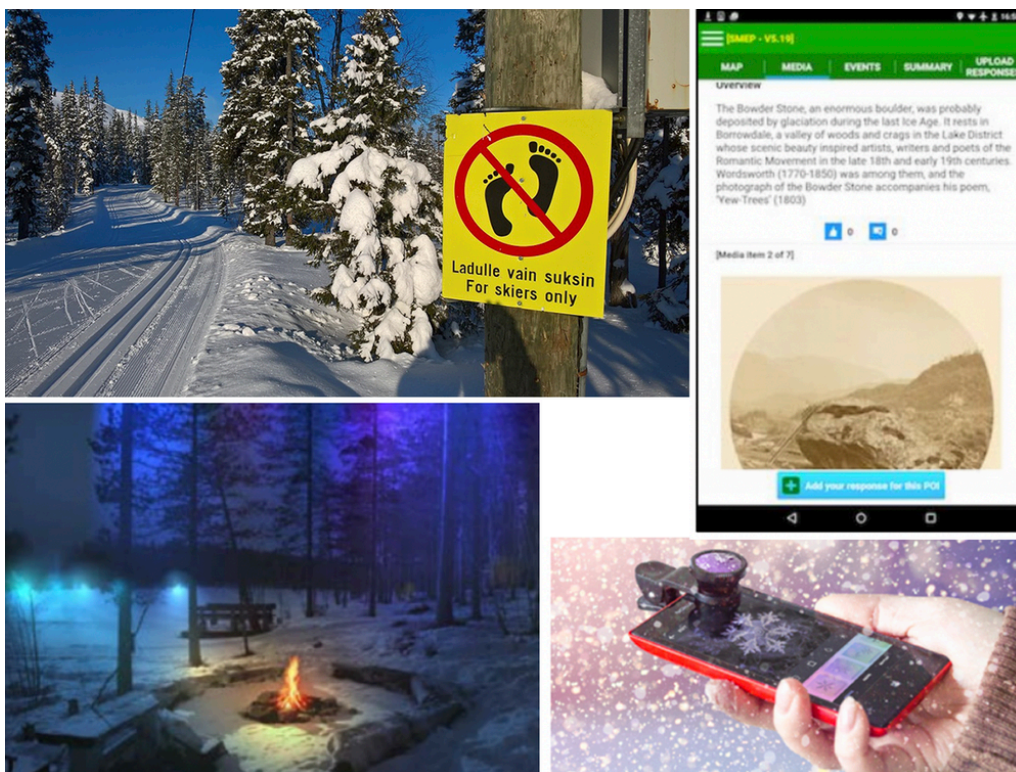
The design of systems to support tourist experiences in nature has also been considered in the series. Dionisio (2017) describes the design of a prototype recommender system for tourists to the island of Madeira that suggests the closest points of interest (POIs) with the “best sunlight”. Another mobile app solution that was presented in the series focused on enhancing tourists’ experiences of cultural heritage within an area of natural beauty (Cheverst, Gregory & Turner, 2016). The system explores the English Lake District’s cultural heritage, including the poetry that the landscape has inspired. The authors describe the design of “Locative Media Experiences (LMEs) that may facilitate visitors engaging both with the landscape and with the poetry itself” (Cheverst et al., 2016).

Tensions between humans and nature are explored in papers by Rantala et al. (2017), Ho et al. (2017) and Webber et al. (2016). A design goal discussed by Rantala et al. (2017) involves sensitivity towards supporting interaction with non-human objects. The authors describe that such sensitivity “...refers also to sensitiveness towards non-human objects and how we enact non-human objects in touristic encounters...” In the context of zoos, Ho et al. (2017) describe their use of augmented reality at San Diego Zoo in order “...to focus visitors’ attention towards survival threats to endangered species...” The authors argue “that civic action (sharing AR content regarding threats to endangered species) can begin from compelling in-person digital experiences”. In the same context, Webber et al. (2016) describe their case study involving Melbourne Zoo aiming to “... explore the nature of the tensions around technology use at the zoo, and some of the challenges involved in designing and deploying technology in this space...”

Cold climes are the location for two papers in the series (Yliharju & Bastadjian, 2016; Rautianen et al., 2016). In the former, the authors describe a playful design concept enabling

tourists to “record their experiences of interacting with snow [...] by capturing snowflakes as they fall from the sky” (Yliharju & Bastadjian, 2016). Service design for a wilderness experience restaurant in Lapland is the subject of Rautianen et al.’s work (2016), aiming to cater for visitors from around the globe. Their design method, Arctic Design, is framed as “a multi-disciplinary approach that connects areas of interaction design, industrial design, service design and social design to increase wellbeing of the periphery and the marginal” (Rautianen et al., 2016) (see Figure 4).

Figure 4. Example images from workshop submissions in category Enhancing Tourists Nature Experiences; Top row: Rantala et al., 2017; Cheverst et al., 2017; Bottom row: Rautianen et al., 2016; Yliharju & Bastadjian 2016



Working with Materials from Nature

The potential of working with materials from (or that represent) nature to build interactive systems has been subject of several papers in NatureCHI. Alakärppä & Jaakkola (2016) describe the design of the ‘BreathScreen’, which utilises “an ephemeral surface for projections enabled by breath clouds produced by human beings in arctic weather conditions”. Lappalainen et al. (2017) used liquid as a material for the design of the ‘Water Table’ installation, where the user places their hand in flowing streams of coloured water to adjust the hue of a merged stream.

Enhancing interaction with plants has also been a focus within the series. Steer et al. (2016) raised “...early questions, abstract ideas and the possible challenges researchers and designers will encounter working with human-plant interaction...” In a similar area, working with the gardening community is the focus of the research presented by Jones et al. (2016). Here, the authors describe their use of environmental sensors deployed in the garden, and their current plans to “introduce a series of prototypes for community members to use to

reveal and interrogate the data within the garden”. Finally, the emotional relationship between humans and plants was studied by Döring (2016). The author explores the potential of “[...] amplified sensory experience of plants, especially by giving the plants a voice and creating sound” (Döring, 2016).

CONCLUSION

We have presented our reflections on two NatureCHI workshops that sought to foster a research community that is interested in investigating the potential ways that digital technology and interaction design can support users’ engagement with nature, and the tensions and challenges that arise. A key, emergent challenge for interaction design is to explore and uncover technology designs that are both playful and unobtrusive for nature experiences. Considering the future directions of NatureCHI, we have identified four topic areas that we believe can make valuable research contributions.

Firstly, a core direction for NatureCHI work is towards enabling the unobtrusive integration and use of technology in nature contexts. The design of such interactive and services should be respectful both of the natural environment and cultural aspects encompassing it. Here, the addition of technology should not disrupt or harm any element of the environmental flora and fauna. All modalities should be considered (visual, audible, tangible, olfactory and gustatory), and a long-term view to the sustainability of the impacted environment should be taken. One potentially useful approach here is the application of value-based design methodologies.

The second direction of the work is the continued exploration of novel UI mechanisms and metaphors for interacting with nature. Whilst new approaches are typically born and applied in urban contexts, their application to the natural environment may present new opportunities and unexpected challenges. As a specific direction, applications of temporal design thinking and ephemeral user interfaces are expected to be fruitful.

As technology becomes increasingly ubiquitous in our daily lives, the maintenance of natural experiences as a respite from technology forms the third branch for the continuation of NatureCHI. Here, work should explore the balance between supporting (or mandating) non-use of technology with the potential benefits of technology use in nature. For example, for many people, technology acts as an enabler to stimulate the process of actually venturing into natural environments; yet, this is counterproductive if it compromises the experience or causes damage. Where environments present potential safety risks, for example due to their remoteness or weather conditions, the role of technology is clear. However, care should be taken when presenting solutions that create a reliance on technology.

A final direction for future work is towards social issues of technology use in nature. Here, technology can both enhance and create friction in relationships. For instance, experiencing nature together is often a core bonding experience amongst families and small groups of friends, and remote connectivity, such as through social media, can enable involvement by physically diverse groups of people.

REFERENCES

- Adams, A., Fitzgerald, E., & Priestnall, P. (2013). Of Catwalk Technologies and Boundary Creatures. *ACM Trans. Comput.-Hum. Interact.*, 20(3).
- Ahtinen, A., & Väänänen, K. (2017). Persuasive Design of Outdoors Walking Meetings: Supporting Different Mindsets. In *NatureCHI 2017 workshop*. Retrieved from <http://www.naturechi.net/papers/NatureHCI2017-Ahtinen.pdf>
- Alakärppä, I., & Jaakkola, E. (2016). Ephemerality as a Design Driver: Evanescent Screen Enabled by the Arctic Weather Conditions. *NatureCHI 2016 workshop*. Retrieved from <http://www.naturechi.net/2016/p1-Alakarppa.pdf>
- Bidwell, N. J., & Browning, D. (2010). Pursuing Genius Loci: Interaction Design And Natural Places. *Personal and Ubiquitous Computing*, 14(1), 15–30. doi:[10.1007/s00779-009-0217-8](https://doi.org/10.1007/s00779-009-0217-8)
- Bidwell, N. J., Siya, M., Marsden, G., Tucker, W. D., Tshemese, M., Gaven, N., ... & Eglinton, K. A. (2008). Walking and the social life of solar charging in rural Africa. *ACM Trans. Comput.-Hum. Interact.*, 20(4). Retrieved from <http://doi.acm.org/10.1145/2493524>
- Bodker, M. (2017). Charging as a Focal Practice: Reflections on Digital ‘Focal Things and Practices’ in the Wilderness. In *NatureCHI 2017 workshop*. Retrieved from <http://www.naturechi.net/papers/NatureHCI2017-Bodker.pdf>
- Borgmann, A. (1984). *Technology and the Character of Contemporary Life: A philosophical inquiry*. University of Chicago Press.
- Brereton, M., Dema, T., Vasudevan, M., Soro, A., Cappadonna, J., Chai, M., . . . Paul, R. (2017). Reconnecting with nature by design to bring the outdoors indoors. In *NatureCHI 2017 workshop*. Retrieved from <http://www.naturechi.net/papers/NatureHCI2017-Brereton.pdf>
- Brink, P., Mutafoglu, K., Schweitzer, J.-P., Kettunen, M., Twigger-Ross, C., Baker, J., & Ojala, A. et al. (2016). *The Health and Social Benefits of Nature and Biodiversity Protection. A report for the European Commission (ENV.B.3/ETU/2014/0039)*. London, Brussels: Institute for European Environmental Policy.
- Cheverst, K. W. J., Bracken, J., Fleming, A., & Porter, C. (2017) Experiences with the Co-Design and Evaluation of Locative Media Experiences with the National Trust. In *NatureCHI 2017 workshop*. Retrieved from <http://www.naturechi.net/papers/NatureHCI2017-Cheverst.pdf>
- Cheverst, K. W. J., Gregory, I., & Turner, H. (2016) Encouraging Visitor Engagement and Reflection with the Landscape of the English Lake District: Exploring the potential of Locative Media. In *NatureCHI 2016 workshop*. Retrieved from <http://www.naturechi.net/2016/p11-Cheverst.pdf>

Cheverst, K. W. J., Turner, H., Do, T. V., & Fitton, D. (2016). Supporting the Consumption and Co-Authoring of Locative Media Experiences for a Rural Village Community: Design and Field Trial Evaluation of the SHARC2.0 Framework. 2016. *Multimedia Tools and Applications*. doi: [doi:10.1007/s11042-016-3515-y](https://doi.org/10.1007/s11042-016-3515-y)

Colley, A., Napari, E., & Häkkinen, J. (2017). A Survey of Mobile Apps to Support Hiking. In *NatureCHI 2017 workshop*. Retrieved from <http://www.naturechi.net/papers/NatureHCI2017-Colley.pdf>

Colley, A., Thebault-Spieker, J., Lin, A. Y., Degraen, D., Fischman, B., Häkkinen, J., ... & Wenig, D. (2017). The geography of Pokémon GO: beneficial and problematic effects on places and movement. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*. ACM. doi: [10.1145/3025453.3025495](https://doi.org/10.1145/3025453.3025495)

Coyne, R. (2014). Nature vs. smartphones. *Interaction*, 21(5), 24–31. doi: [10.1145/2656933](https://doi.org/10.1145/2656933)

Daiber, F., Kosmalla, F., Wiehr, F., & Krüger, A. (2016). Outdoor Nature Lovers vs. Indoor Training Enthusiasts: A Survey of Technology Acceptance of Climbers. In *NatureCHI 2016*. Retrieved from workshop: <http://www.naturechi.net/2016/p21-Daiber.pdf>

Dingler, T., & Machulla, T. (2017). Body Clock Awareness: Circadian Scheduling and Interventions. In *NatureCHI 2017 workshop*. Retrieved from <http://www.naturechi.net/papers/NatureHCI2017-Dingler.pdf>

Dionisio, M., Paulino, T., Suri, T., Autzen, N., & Schöning, J. (2017). “In search of Light”: Enhancing Touristic Recommender Services with Local Weather Data. In *NatureCHI 2017 workshop*. Retrieved from <http://www.naturechi.net/papers/NatureHCI2017-Dionisio.pdf>

Döring, T. (2016) Reflections on Plants as Interaction Material. In *NatureCHI 2016 workshop*. Retrieved from <http://www.naturechi.net/2016/p48-Doring.pdf>

Edwards, L., Coulton, P., & Chiasson, M. (2015). Walking off the garden path: a design journey. In: *Proceedings of the 2nd Biennial Research Through Design Conference*, Cambridge, UK, March 25-27.

Fenicio, A., Calvary, G., & Laurillau, Y. (2017). Characterizing User Roles in HCI Technologies for Nature Exploration. In *NatureCHI 2017 workshop*. Retrieved from <http://www.naturechi.net/papers/NatureHCI2017-Fenicio.pdf>

Häkkinen, J., Cheverst, K., Schöning, J., Bidwell, N., Robinson, S. & 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)* (pp. 3574-3580). New York, NY: ACM.

Häkkinen, J., & Colley, A. (2016). Graveyards as a Design Context for Unobtrusive Interaction. In *NatureCHI 2016 workshop*. Retrieved from <http://www.naturechi.net/2016/p43-Hakkila.pdf>

Häkkinen, J., & Colley, A. (2016). Designing Unobtrusive Display Technology for Cross-Country Skiing. In *NatureCHI 2016 workshop*. Retrieved from <http://www.naturechi.net/2016/p6-Hakkila.pdf>

Häkkinen, J., Colley, A., Cheverst, K., Robinson, S., Schöning, J., Bidwell, N., & Kosmalla, F. (2017). NatureCHI 2017: the 2nd workshop on unobtrusive user experiences with technology in nature. In *Proceedings of the 19th International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI '17)*. New York, NY: ACM. doi: [10.1145/3098279.3119836](https://doi.org/10.1145/3098279.3119836)

Ho, P., Miller, G., Wang, M., Haleftiras, N., & Zuckerman, E. (2017). Mission Wildlife: An Augmented Reality Approach to Engaging People About Threats to Endangered Species at a Zoo. In *NatureCHI 2017 workshop*. Retrieved from <http://www.naturechi.net/papers/NatureHCI2017-Ho.pdf>

Johnson, C. S., Mahajan, S., Ordu, M., Sherugar, S., & Walker, B. N. (2016). Will o'the Wisp: Augmented Reality Navigation for Hikers. In C. Stephanidis (Ed.), *HCI International 2016 – Posters' Extended Abstracts. HCI 2016, CCIS* (Vol. 618). Springer. doi: [10.1007/978-3-319-40542-1_60](https://doi.org/10.1007/978-3-319-40542-1_60)

Jones, G., Rogers, Y., & Marquardt, N. (2016). Presence and Use: Sensors In Community Gardening. In *NatureCHI 2016 workshop*. Retrieved from <http://www.naturechi.net/2016/p29-Jones.pdf>

Jones, G., Rogers Y. & Nicolai Marquardt. (2016) Presence and Use: Sensors In Community Gardening. In *NatureCHI 2016 workshop*. Retrieved from <http://www.naturechi.net/2016/p29-Jones.pdf>

Kerber, F., & Krüger, A. (2017). Investigating User Preference for Mobile Auditory Notifications in Different Contexts. In *NatureCHI 2017 workshop*. Retrieved from <http://www.naturechi.net/papers/NatureHCI2017-Kerber.pdf>

Kimiko, R., & Agogino, A. (2013). Off the Paved Paths: Exploring Nature with a Mobile Augmented Reality Learning Tool. *International Journal of Mobile Human Computer Interaction*, 5, 2.

Krein, K. (2014). Nature Sports. *Journal of the Philosophy of Sport*, 41(2), 193–208. doi: [10.1080/00948705.2013.785417](https://doi.org/10.1080/00948705.2013.785417)

Lappalainen, T., Colley, A., & Häkkinen, J. (2017). Water Table - Utilizing Flowing Water as an Input Mechanism. In *NatureCHI 2016 workshop*. Retrieved from <http://www.naturechi.net/papers/NatureHCI2017-Lappalainen.pdf>

Mayer, S., Knierim, P., Wozniak, P., & Funk, M. (2017). How Drones Can Support Backcountry Activities. In *NatureCHI 2017 workshop*. Retrieved from <http://www.naturechi.net/papers/NatureHCI2017-Mayer.pdf>

Posti, M., Schöning, J., & Häkkinen, J. (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) (pp. 637-646). New York, NY: ACM.
doi:[10.1145/2598510.2598592](https://doi.org/10.1145/2598510.2598592)

Rantala, O., Mäkinen, M., & Häkkinen, J. (2017) Designing for sensitive encounters in nature. In *NatureCHI 2017 workshop*. Retrieved from
<http://www.naturechi.net/papers/NatureHCI2017-Rantala.pdf>

Rautanen, M., Häkkinen, J., & Miettinen, S. (2016) Service Design for a Wilderness Experience Restaurant. In *NatureCHI 2016 workshop*. Retrieved from
<http://www.naturechi.net/2016/p25-Rautanen.pdf>