# Technology as a Bridge for Children to Explore the World Around Them

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Workshop on HCI Outdoors: Understanding Human-Computer Interaction in the Outdoors at CHI 2018, Apri 21, 2018, Montréal, Canada

## Abstract
Children have different needs, motivations, interaction styles, and perspectives than adults as they utilize technology and explore the world around them. We present some of these differences and discuss issues and technologies that are appropriate for children in outdoor spaces.

## Author Keywords
Outdoor technologies, children, design.

## ACM Classification Keywords
**• Human-centered computing~Human computer interaction (HCI)**

## Introduction
*An 11-year old girl goes on a walk in a park with her friend. They see a beautiful waterfall and take a selfie in front of it together and share it with their friends via Facebook's Messenger Kids. Several friends immediately like the picture and dare one of the kids to hike up close to the waterfall and get wet.*

Adults reading this vignette may likely have several questions, including: Why are two "children" hiking by themselves? Should children be using social media? What effect might social media have on dangerous behavior in a natural environment? Many other issues may arise from technology use outdoors. Some of these issues are related to general technology use such as

the currently controversial use of social media by those under age 13 – even when apps like Messenger Kids reportedly were designed with parents, and children in mind. Or perhaps, what about the potential for technology to distract a child (or an adult) and cause them to walk into harm's way.

In addition, technology is sometimes blamed for keeping children inside and isolating children from one another [19]. On the other hand, technology has been utilized as a bridge to engage children with their environment (including augmented reality [2,15]). Platforms and tools have engaged children in collecting information from their environment, sharing it, playing outdoors, and increasing outdoor physical activity [9–11,14]. Research has underscored the importance of outdoor activity for children's physical and mental health [16].

In this position paper we first discuss motivations for using technology outside, a short description of some technologies created by or envisioned by the authors, and conclude with a description of our position on outdoor technologies for children.

## Motivations for Using Technology Outdoors

Basic user-centered design approaches teach us that adults and children will likely have different technology needs and motivations. While children utilize technologies designed for adults all of the time, there is a large body of research that seeks to involve children in the design of technologies intended to be used by them [12]. We start with a description of an initial investigation of adult's motivations for using technology outdoors. We then share some motivations for children and compare and contrast some of these (sometimes competing) motivations.

*Adult Motivations*

Previous work describes adult motivations for bringing cell phones when hiking, using a model of two worlds (the natural world and the civilized world) separated by a gap. This model emerged from a series of surveys of adults including [3]. In the model, the *natural world* is the world in which we visit to find peace, contentment, and recreation. We are visitors in the natural world and it also contains threats, danger and unsafe things like mountain lions. The *civilized world* is the world in which we live. It contains family, friends, co-workers, stress, demands, safety and comfort. Adults' use cell phones to help bridge the gap, maintain the gap, and/or ignore the gap as described below. For example, going hiking moves a person physically from the civilized world to the natural world and bringing a cell phone can help bridge the gap by being a lifeline back to civilization.

Maintaining the gap includes actions and motivations related to maintaining the gap between the natural and civilized world. This includes statements about not bringing a phone in order to avoid the distraction or leaving a phone off except during emergencies. It also includes behavior intended to help the adult remain in the civilized world though they are physically located in the natural world. This includes behaviors like watching movies, playing games to escape the natural world.

Bridging the gap means using the phone to remain connected to people in the civilized world,  It also means bringing something from the civilized world into the natural world (such as a map or music) or taking part of the natural world back to the civilized world (such as taking pictures or posting to social media). Interestingly, tasks associating with transporting data were reported more commonly than tasks associated

with actually using the phone to communicate with a person.

Ignoring the gap means a person doesn't see a gap between the two worlds. This includes statements like "I always carry a phone" or "I feel naked without it."

*Child Motivations*

While the above background information on adult's motivations is elucidating, the average of age of respondents to these surveys was 34 and only people over age 18 were eligible to participate in the study. This means that respondents were, on average, 24 when the first iPhone was released. This differs significantly from children's experiences and perspectives as most children these days do not remember when smartphones were not ubiquitous.

This raises several questions: How does that impact how children mind the gap between these two worlds when hiking or in other forms of outdoor recreation? More fundamentally, do children even perceive a gap between the natural and civilized world when it comes to interactive computing? What can that tell us more generally about the role of interactive computing in other areas of their lives (if anything)? Do children ignore the gap between the worlds? Are they more or less adamant than adults about maintaining the gap between nature and technology?

While we have not yet conducted a survey to elicit information regarding children's motivations, we share some of the motivations we have encountered in our experience interacting with children in developing technologies and conducting collaborative design studies [9–14]. As part of this we consider how children may interact with computing devices as they hike or explore an environment. Of note, from our observations the differentiator is not so much about minding the gap between the natural and civilized worlds, but more about leveraging technology to draw them to the natural world to encourage them to playfully or thoughtfully interact with it and one another in safe and productive ways. We have observed that technology that encourages generative constructive activities not only can encourage informal scientific inquiry of the environment, but are also engaging and fun [9,10,15].

It is of note that children generally do not go to the natural world without parental permission or encouragement. Adults make an active decision to engage with the outdoor environment, whereas children sometimes are passive, in that the decision is made for them. As such, a bridge or enticement can encourage more engagement with the environment. Contrary to adults who often explore the nature in search of enjoyment and relaxation [17], children are fascinated by the various forms of life and colors nature offers. Be it in a zoo or a jungle safari, kids are excited to see things that differ from the civilized world and enjoy capturing that information with technology to review or share it with others. Technology here bridges the gap by letting children save their experiences in the form of photos/videos which can be used later to paste in their science scrapbooks or share with family and friends.

Two additional considerations are the safety and social implications relative to children engaging with the natural world. Children may visit the outdoors with their family, an outdoor club (e.g. boy/girl scouts), to play outdoor games, or perhaps a field trip associated with school. Often this social aspect is partially due to logistics (to minimize the oversight needed) or safety concerns (an important aspect even to adults [3]). Beyond safety, children can also socialize with one of

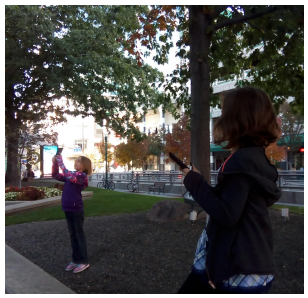

**Figure 1.** Children making observations in the world around them, using Geotagger.


**Figure 2.** Active story where children are participants in a story in the natural world.

their peers. With regards to these issues, some groups ask children to not use or bring technology as it will be a distraction. On the other hand, some parents use technology to track or monitor the locations of their children. Technology can also be used to enhance social activity which could be beneficial.

Technologies like fitness trackers for children, allow children and parents to track their physical activity and stay safe. The intent is to motivate children to be more active and healthy. These trackers come with a variety of features including contacting family in case of emergency, GPS tracking where parents can track the location of their children and draw a virtual fence, which if the child exits the parent gets an alert.

## Outdoor Technologies for Children

There are many technologies that have been developed for children. Here we briefly present some that were developed or envisioned by the authors.

*Tangible Flags & Geotagger*

Tangible Flags allowed children to use a physical flag (equipped with an RFID tag) to place a marker in the environment [9,10]. They could then make a digital annotation which could be a comment or a question. Other visitors in the space could see the flag and scan it to see the digital annotations upon which they could further comment. The flag acted as a bridge from the physical to digital world and allowed them to contextualize the annotations within the natural world.

Geotagger is a collaborative environmental inquiry platform designed initially for children to enable them to observe the world around them, document that observation, share it, and engage in informal discussions about their observations [13,14] (see Figure 1). Geotagger leverages the rampant use of, and affinity for, technology to encourage people to observe the natural world around them and to share and discuss that information with others.

*Active Stories*

This proposed mobile app would allow children to create and share interactive stories tied to physical outdoor locations. To experience a story, children could add text, sound, video, and images, which are unlocked as players visit specific locations (GPS) or complete physical activity challenges (using step counters). For example, a story may unfold as a group of friends and a parent hike up Rock Canyon (in Provo, UT), following a fictional trail of bones across landmarks where they unlock new content, eventually arriving at the Lion's Lair (a small kid-friendly cave) (see Figure 2).

## Position on HCI in the Outdoors

Perceptions and motivations for being outdoors are different for adults and children. Whereas adults may look at being in nature as a reprieve or for health, children may perceive it as an opportunity to explore, be curious, or perhaps even a place their parents are "dragging" them to. In all of these situations technology can be a facilitator or activator to engage with the environment. Engaging with the environment with technology, provides opportunities for children to be curious, active, and social, and to learn. As with adults, technology could be used to block or distract from the environment, but care can be taken through proper facilitation and appropriate apps to promote engagement with the environment. While some of the motivations are similar, the challenge remaining for designers of technology for children in the outdoors is to enable and encourage exploration via technology while not distracting users from the great outdoors.

## Author Biographies

Ankita Samariya (ankitasamariya@u.boisestate.edu) is a Graduate Assistant in the Computer Science Department at Boise State University. Her area of research is the design and development of fitness technologies for children. Ankita researches solutions that motivate children towards a healthier lifestyle by combining technology with social interaction and play. Ankita is on a design team where children and adults partner to design and develop new technologies.

Jerry Alan Fails (jerryfails@boisestate.edu) is an Associate Professor in the Computer Science Department at Boise State University. For the last 14 years, Jerry has participated on and led participatory design groups where children and adults work as design partners. He has developed and evaluated several technologies for children, most of which are for informal educational purposes and leverage technology to bring children together and encourage them to explore their environment [9–11,14].

Mike Jones (jones@cs.byu.edu) is an Associate Professor in the Computer Science Department at Brigham Young University. He researches computer graphics and interactive techniques and is exploring interactive computing in outdoor recreation [3].

Derek Hansen (dlhansen@byu.edu) is an Associate Professor of Information Technology at Brigham Young University. His recent research and teaching explores pervasive play [1,7] that promotes citizen science (e.g., the outdoor Floracaching game [8]), children's learning (e.g., educational alternate reality games [4–6]), and fitness (e.g., his student team's Fitplay Games app [18]). He is also a Scoutmaster, hiker, caver, skier, and outdoor enthusiast.

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