



AALBORG UNIVERSITY
DENMARK

Aalborg Universitet

Connecting children to nature with technology

Sowing the seeds for pro-environmental behaviour

Cumbo, Bronwyn J.; Paay, Jeni; Kjeldskov, Jesper; Jacobs, Brent C.

Published in:

Proceedings of the 13th International Conference on Interaction Design & Children, IDC'14

DOI (link to publication from Publisher):

[10.1145/2593968.2610449](https://doi.org/10.1145/2593968.2610449)

Publication date:

2014

Document Version

Early version, also known as pre-print

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Cumbo, B. J., Paay, J., Kjeldskov, J., & Jacobs, B. C. (2014). Connecting children to nature with technology: Sowing the seeds for pro-environmental behaviour. In *Proceedings of the 13th International Conference on Interaction Design & Children, IDC'14* (pp. 189-192). Association for Computing Machinery. <https://doi.org/10.1145/2593968.2610449>

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal -

Take down policy

If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.

Connecting Children to Nature with Technology: Sowing the Seeds for Pro-environmental Behaviour

Bronwyn J. Cumbo¹, Jeni Paay², Jesper Kjeldskov², Brent C. Jacobs¹

¹Institute for Sustainable Futures

University of Technology

Level 11, UTS Building 10

235 Jones St

Ultimo, NSW, Australia 2007

{bronwyn.cumbo, brent.jacobs}@uts.edu.au

²Centre for Socio-Interactive Design,

Department of Computer Science

Aalborg University

Selma Lagerlöfs Vej 300

Aalborg East, Denmark, 9220

{jeni, jesper}@cs.aau.dk

ABSTRACT

Regular interactions with nature are vital for the development and well-being of children and also to build attachment and value for natural environments that potentially promote pro-environmental behaviour in later life. In this paper, we report on a study designed to identify opportunities for digital technology to support children's connectedness to the natural environment, thereby encouraging positive environmental attitudes in children, as well as healthy physical play. Through participatory engagement with a group of 15 Danish children (aged 8-12) and their parents, using focus groups and follow up interviews, we explore what motivates children to undertake everyday recreational activities, focusing on activities undertaken in nature, and how these interactions influence meaning associated with their local natural place. The contribution of this paper is a deeper understanding of what motivates children to interact with nature, and a discussion of how technology may enhance this interaction.

Categories and Subject Descriptors

H.5.2 [Information Interfaces And Presentation (e.g., HCI)]:

User Interfaces - *User Centred Design*.

General Terms

Design, Human Factors.

Keywords

Participatory engagement, child-centred design, nature, place attachment, pro-environmental behaviour.

1. INTRODUCTION

Regular, playful interactions in the natural environment have many health and well-being benefits for children [8], and build a place attachment and value for the preservation of natural environments [4]. Rising urbanization, safety concerns of parents, loss of 'free time', and popularity of indoor online recreation have led to a significant reduction in time children spend outdoors in nature over the last 40 years [7]. This shift has been linked to an increase in anxiety and depression amongst children, lowered levels of self-efficacy in nature, and reduced awareness and value for its preservation [7, 8].

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.

IDC'14, June 17–20, 2014, Aarhus, Denmark.

Copyright 2014 ACM 978-1-4503-2272-0/14/06...\$15.00.

<http://dx.doi.org/10.1145/2593968.2610449>

Pervasive and emerging technologies have the potential to motivate children to experience more frequent and meaningful interactions with local natural environments by designing opportunities for interactions between children, parents and technology "in the wild". Many children have regular access to powerful digital devices containing GPS, access to online information and networks and audio-visual recorders that motivate children to interact and share how they relate to the physical environment [10]. Elements of this technology can also be applied to counteract some of the barriers to independent outdoor play in children [14]. This study provides a deeper understanding of how children currently view and interact with nature to propose opportunities where technology can play a role in enhancing this connection.

The majority of examples of mobile and ubiquitous technologies designed for outdoor use with children have been oriented toward formal education [2, 9]. Applying technology to extend the learning space beyond the classroom has been shown to motivate more self-directed learning and improved outcomes for a wider range of students [2]. Additionally, systems are increasingly being designed for leisure contexts to motivate children to connect with people and places in their free time. These have been shown to effectively motivate children in social interactions [13, 14], and encourage creative ownership of outdoor environments [14]. In HCI literature there is a general understanding of how technology can successfully engage and motivate children, however, an understanding of how technology influences a child's meaning and attachment for physical places, specifically local, natural places is, as yet, unknown. This is the gap we address with our current research project.

This paper reports on explorations into understanding children's current connections to their local natural environments. Through this we will identify the potential for technology to facilitate more regular, meaningful interactions between children and local nature, with the intention of building place attachment and value for the preservation of these natural areas. We describe our research investigations, specifically two focus groups and follow up interviews, with a group of 15 Danish children (8-12 years) and their parents, to investigate what motivates children to engage in everyday activities, including interactions with local natural environments, and how these interactions influenced the meaning and attachment they have for nature.

2. WHAT IS NATURE?

Nature is traditionally defined as the living and non-living elements that occur 'naturally' without human influence [12],

however over 95 per cent of the earth's surface is now influenced by human activities [3]. For the purpose of this research, we will adopt a broader definition of nature as "the continuum of human-environment influence, ranging from total human designed space to 'pure' wilderness" [3]

3. PLACE ATTACHMENT

Building place attachments contributes to the establishment of identity, sense of belonging and overall well-being of children [4]. Children develop positive or negative associations with the physical places they interact with from a very young age, favouring places where they undertake repetitive, social, and child-directed activities [7]. Repetitive, social and child-centered interactions in local parks and playgrounds develop a child's capacity for independent thought, movement and social behavior [7]. The role of 'child-directed' experiences in building attachments is significant, as it is through these activities that a child has capacity to make meaning of the space, and their relationship with each other on a broader scale.

The location and scale of place attachments evolve throughout a child's development. Middle school children (aged 8-12 years) expand their level of exploration from the home and backyard to the local neighbourhood [4]. Children tend to build attachments for natural places as they provide an unpredictable and ever changing play-scape of sights, sounds, smells and tactile experiences that satisfy a child's physiological, creative, cognitive and social explorations [4, 6].

3.1 Rising Disconnect with Nature

Opportunities for regular, social, child-centred interactions in nature required to build place attachment are diminishing [7, 8]. Rising urbanization has reduced access to natural areas for many children, and social anxiety and safety concerns are preventing parents from allowing their children to explore the local neighbourhood without adult supervision [7, 8]. 'Free time' available to children after school and on weekends is more frequently being consumed by organized, extra-curricular activities, removing the time available for child-centered playful interactions [7]. In addition, most children are spending an increasing amount of time engaging in indoor, online recreation that enables independent, social, child-centred experiences [7, 8]. Addressing the rising disconnect with nature, therefore requires an understanding of how to both *motivate* and *enable* regular, child-centred engagement.

3.2 Role of Technology

Mobile and ubiquitous computing have been applied across many fields to reconnect people to the physical environment. Well-designed examples are inherently engaging and promote embodied, context-specific experiences providing richer experiences for individuals (e.g. geocaching) [2]. Although the majority of interactive, outdoor technologies for children have been designed for formal educational settings, some recent designs have inspired more playful interactions in children to address the need for positive experiences in physical outdoors. [e.g. 13, 14]. Emerging technologies, e.g. tangible computing and sensors and actuators, have the potential to encourage even more direct interactions with the physical environment.

The aim of our overall study is to investigate the role that technology may play in engaging children with their local nature to form place attachments, and evaluating an interactive system to understand how it may achieve that. The initial stages of the investigation, reported in this paper, consequently involve

understanding children's current experiences and connections with local nature, and the key *motivators* that inspire these interactions.

4. THE STUDY

Research was conducted with 15 Danish children (8-12 years) each with an accompanying parent, from two different primary schools in Aalborg, Denmark. Six boys and nine girls participated in the study, which involved two separate research inquiries: a focus group and a follow-up interview. Parents participated in the focus group and the interviews. The two main researchers spoke only English, the children spoke only Danish. To overcome the language barrier, eight assistant researchers from Aalborg University and the parents, who spoke both Danish and English, helped with translations between the children and the main researchers.

4.1 Data Collection

4.1.1 Focus Groups

The fifteen children were divided into two focus groups of ninety minutes duration, held on different days at different locations, for the two schools. The aim of the focus group was to introduce the project and investigate key motivators that inspire interest in a child, specifically toward the natural environment. Fictional inquiry [5] was applied to engage children in the task, introducing a "visitor" from a foreign country (Australia) who was unable to speak the language and unaware of local behaviours. The children were encouraged to explain their "world" to the "visitor" through local interpreters.



Figure 1. Drawing activity in children's group

The session began with an ice-breaker activity between children, parents and researchers. Parents and children were then separated into two groups, in two separate rooms.

In a group, children were asked to: a) draw a picture of something you enjoy doing with your parents (see Figure 1); and b) draw a picture of an activity you enjoy doing in nature. Each task was followed by a brief presentation by the child in Danish (translation mediated by an assistant researcher), which facilitated further discussion and questioning to gather insights into the types of activities that children enjoy, and elements that motivate them, as they explained their pictures to the "visitor".

In a separate focus group, parents undertook two activities: a) list elements that motivate your child to take part in an activity (followed by a discussion to compare the motivators among children); and b) describe a positive experience you have shared with your children in nature, (followed by a discussion of these positive experiences to identify the key elements that motivated

their child to take part in that activity). Motivational elements identified were then organized into an affinity diagram.

Finally, the two groups came together for a short time, where children explained their drawings to their parents, and parents commented to the researchers on the children's views, and motivations.

4.1.2 Follow-up Interviews

Each child-parent unit then participated in a 30-minute semi-structured follow-up interview, aimed at understanding the meaning and connection children felt for local parks and forests, and the motivating factors that led to interactions with nature. Each child participated in two separate activities in the interview, during which parents played the role of 'translator' between the researcher and their child.

Children were presented with a series of photographs of various natural scenes and landscapes within urban, rural and wilderness areas, and asked to identify the photo that represented the type of nature they visited most often, the frequency of visits, activities, and motivational factors that led to this interaction.

As a final activity, children were asked if they had a 'special place' in the nature they visit most often. If they could identify a special place, they were asked to draw this place and include all the elements that held significant meaning for the child. Children were given ten minutes to draw this place and were then asked why this place held significant meaning for them, and what motivated and enabled the types of interactions that led to this meaning.

4.1.3 Data Analysis

Data collected from the focus group and follow up interviews included video and audio recordings of all sessions, notes on the session written in English by an assistant researcher, drawings produced by the children, and two affinity diagrams produced during the parents' focus group session. Audio files were translated and transcribed in detail by the assistant researchers. Text and images were coded and analyzed to identify the common and contrasting motivators that led to interactions in local nature.

5. FINDINGS

Drawings depicting activities children enjoyed doing with their parents included going shopping with mum, going to a pizzeria together, going to the pet store and learning about the animals with dad, going sailing with dad, mountain biking with dad, playing ball with dad in the backyard, going to the beach with the family, being tickled by dad, and baking a cake with parents. Drawings showing what they enjoy doing in nature included: making a bonfire in the forest with the school class, picnic in the

forest with friends, going to the beach with friends, fishing for crabs with sisters, swimming in the sea, and making a tree house in the forest (Figure 2).

A series of key motivators were identified through both drawing tasks, which included: opportunities to learn, special attention from parents, connecting with animals, feeling peaceful, comfortable and safe, new experiences and social opportunities. An interesting element of these drawings was the role parents played in motivating and enabling children to engage in everyday activities and activities in nature. Children were motivated to engage in activities when parents took time to do small things exclusively with them, creating an experience where they get to feel "special" for a day. Child experiences in nature were generally everyday and local, but often motivated by opportunities to socialize with friends, rather than parents. However, parents were frequently the enablers of these experiences, providing children with the idea, transport or financial support to engage in these activities.

The affinity diagrams produced during the focus groups with parents in response to "My child is motivated by..." elicited the following main themes: *Having fun* (activities should be fun); *Being social* (children like to mix with others); *Drawing and creating* (children like to use their imagination to create both tangible and abstract things); *Rewards* (either physical or virtual - effort or skill should be rewarded); *Being outside* (especially relevant when playing with others); *Competition* (preferably in groups cooperating to win, or against parents); *Achievable wins* (children are easily discouraged if it is too hard to win); *Family time* (children like spending time with their family); *Skills and learning* (children will spend time gaining new or enhanced skills); and *Narrative* (children like stories, and being involved in them). In the discussion part of the session two additional concepts emerged: *One-on-one time* (children really like it when they have sole access to one parent, making them feel special); *Divergence from everyday routines* (children generally have quite routine lives - even a small divergence from the routine is seen as exciting and memorable).

From the follow-up interviews we gained a deeper understanding of the common motivators that connect children with their local, natural environment. In the following quote a child participant (girl, 10 years) describes an experience she undertakes regularly with her friends in her local natural area, a forest behind her local school.

My favourite part of the forest is to go to the tree-house we (my friends and I) built together. We have hidden it amongst the leaves in the forest so no one can find it. It's very different to other tree houses... (When we are there) we race each other to see who can climb the tree first, and who can take the hardest route. We play a lot of games here that we make up...Every Friday we get off school early, and go and have our lunch up there. Only the four of us (girls) that made the tree house know where it is. It's secret. [Girl participant, 10 years old].

The experience described by this girl highlights a range of motivators for connecting with nature such as opportunities to socialize with friends, problem solve and learn, engage in physical activity, and team work/collaboration. By hiding their creation from others the children are exercising imaginative play, creating a world separate from others. By completing this tree house and having a place to play together, the child has expressed a strong sense of accomplishment and independence, free from the common constraints of adult-directed activities.



Figure 2: Child's drawing of her special place in nature.

DISCUSSION & CONCLUSIONS

In this study, the role in the design of new technology for the children has been as “informants” [5] to understand current practice. The children have been involved in talking and drawing to communicate to researchers their relationship to nature and participation in recreational activities. During focus groups and interview sessions the parents of the children also played an important role in that communication, acting not only as language interpreters but also as interpreters giving context to the children’s responses.

Although this is early work, the outcomes of this study have identified important considerations for designing technology to motivate children to engage with their local nature. Previous research, along with our findings here, have identified that independent, child-directed interactions are essential for motivating the types of experiences in nature that build meaning and attachment. Our findings have revealed great diversity in the types of independent, child-directed activities that engage children with nature, including opportunities for abstract or tangible expressions of creativity, learning or collaborations with peers. However, the validity of these initial findings requires more investigation. During the next stage of research we will explore in depth the types of common and contrasting motivators that engage children with nature, and ways technology can be designed to enhance these motivational elements.

The context for our research is unique, as we intend to inspire child-nature interactions within an informal context (during their free time, outside school hours) instead of within an institutional framework. Thus, interactions with nature are facilitated by *motivation*, and also *enablement*. The range of barriers preventing children from engaging with nature is an issue of far greater significance in an informal context, than a formal or institutionally supported context. During school or organized outdoor programs, children are operating in the same space, and timeframe, with a consistent objective, enabling them to take part in any activity. Once removed from these formal structures, children face a range of barriers to engaging with nature, such as capacity to coordinate free time to play together, lack of independent access to natural areas and safety concerns of parents, which may prevent the most motivated child from engaging with nature. In the next phase, we intend to investigate the role of technology in overcoming the barriers to engagement with nature present in informal contexts, a novel contribution to the field of child-computer interaction. Outcomes of this preliminary study suggest that parents may be significant ‘enablers’ of child-nature interactions. Technology may have an important role in assisting parents enable their children to engage in meaningful interactions with local nature.

Although some of these are not new understandings for designing interactions for children, we think it is worth presenting them as issues that were interwoven with children’s’ perceptions of their natural environment, motivating them to spend time there.

6. FUTURE WORK

In our future research we intend to apply the model of Ecological Inquiry [11], an interventionist approach to social practice, place and technology through the co-design of technologies ‘in-situ’, to investigate how technology may motivate children to engage with their local nature. We also intend to expand the Ecological Inquiry model to include ‘barriers to engagement’ with local nature, and explore potential applications of technology to address these barriers. For example, the safety concerns of parents may be addressed by increasing community connectedness, or enabling

child monitoring practices. Understanding what motivates and enables children to engage with local nature may have long-term applications for urban planners and policy makers responsible for natural urban spaces.

7. ACKNOWLEDGMENTS

Our thanks to the children and parents that participated in this study, and Informatics students from Aalborg University: Daniel Kappers, Simon Iversen, Richard Trondheim, Christian Pilgaard, Adam Gistrup, Dennis Dalgaard, Frederick Nielsen and Casper Sorensen.

8. REFERENCES

- [1] Baskin, Y. 1997. *The Work of Nature: How the diversity of life sustains us*. Island Press, Washington.
- [2] Brown, E. (Ed.). 2010. *Education in the wild: contextual and location-based mobile learning in action*. A report from the STELLAR Alpine Rendez-Vous workshop series.
- [3] Carver, S., Evans, A.J. and Fritz, S. 2002. Wilderness Attribute Mapping in the United Kingdom. *International Journal of Wilderness* 8, 1 (2002), 24-29.
- [4] Chawla, L. 1992. Childhood Place Attachments. In Altman, I. & Low, S.M. (Eds.). *Place Attachment*. Plenum, London.
- [5] Dindler, C., Eriksson, E., Iversen, O., Lykjkje-Olesen, A. and Ludvigsen, M. 2005. Mission from Mars - A Method for Exploring User Requirements for Children in a Narrative Space. In *Proc. IDC '05*, ACM (2005), 40-47.
- [6] Druin, A. 2002. The Role of Children in the Design of New Technology. *Behaviour and Information Technology*, 21, 1 (2002), 1-25.
- [7] Kellert, S. R. 2002. Experiencing Nature: Affective, Cognitive, and Evaluative Development. In Kahn P. & Kellert, S.R. (Eds.) *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations*. The MIT Press, Cambridge, MA.
- [8] Louv, R. 2005. *Last Child in the Woods: Saving our Children from Nature Deficit Disorder*. Algonquin Books, Chapel Hill, USA.
- [9] Rogers, Y., Price, S., Fitzpatrick, G., Fleck, R., Harris, E., Smith, H., Randell, C., Muller, H., O'Malley, C., Stanton, D., Thompson, M., and Weal, M. 2004. Ambient wood: designing new forms of digital augmentation for learning outdoors. In *Proc. IDC '04*, ACM (2004), 3-10.
- [10] Ryokai, K. 2013. Off the Paved Paths: Exploring Nature with a Mobile Augmented Reality Learning Tool. *International Journal of Mobile Computer Interaction* 5, 2 (2013), 21-49.
- [11] Smith, R., Iversen, O., Hjermitsev, T. and Lynggaard, A. 2013. Towards an ecological inquiry in child-computer interaction. In *Proc. IDC '13*, ACM (2013), 183-192.
- [12] Tuan, Y-F. 1978. Children and the Natural Environment. In Altman, I. & Wohlwill (Eds.) *Children and the Environment*, Springer, New York.
- [13] Verhaegh, J., Soute, I., Kessels, A. and Markopoulos, P. 2006. On the design of Camelot, an outdoor game for children. In *Proc. IDC '06*, ACM (2006), 9-16.
- [14] Williams, M., Jones, O., Fleuriot, C. and Wood, L. 2005. Children and Emerging Wireless Technologies: Investigating the Potential for Spatial Practice. In *Proc. CHI '05*, ACM (2005), 819-828.