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"We Are Nature": Exploring Nature Conceptualizations and Connections through Children's Photography

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Abstract

In an increasingly technological age, photography provides a medium for exploring and engaging with nature. This study examines children's conceptualizations and avenues of engagement using children's nature photographs and comments as documented through the school-based Focus on Nature program in Ontario, Canada. We find that children can view nature literally (i.e., as consisting of living, non-living, dead, or human-made things), symbolically (i.e., representing other things or prior experiences), and as a dynamic and static entity. Avenues of connection to nature through photography extend the cognitive-behavioral-sensory-affective model of experience via imagination to include artistic connections such as symbolism, photo-editing, and perspective-taking.

Keywords: photography, children's perspectives, nature connection, elementary students, children's conceptualization of nature

> *Photography gives children new ways of appreciating nature and opens up new windows of possibility in their lives* (Simon Bell, Executive Director of Focus on Nature, personal communication).

Introduction

Many urban children have limited opportunities to connect with nature (Hand et al., 2016). A growing body of observations (Louv, 2008; Sampson, 2015; Taylor, 2017; Pacini-Ketchabaw & Khattar, 2018) suggests there is a divide between children and nature. Soga and Gaston (2016) suggest that this divide results from a loss of opportunities for children to be directly exposed and oriented to nature.

The literature identifies numerous factors that make it difficult to foster child-nature connections, including fear, space, technology, time (Soga, Yamanoi, Tsuchiya, Koyanagi, & Kanai, 2018), and structural influences. Soga and Gaston (2016) note that most of these factors result in a lack of direct exposure of children to nature (i.e., a loss of opportunity), whereas other factors are related to a loss of nature-orientation. Fear-based barriers, or biophobia, a fear of or an aversion to nature (Shaw, Anderson, & Barcelona, 2015) by children, parents (Hand et al., 2018), and/or teachers can result in children spending decreased time outdoors. Fear of allergies or harsh weather can also impact the amount of time children spend outdoors. Fears can also be result from accessibility issues or safety concerns (Cronin-de-Chavez, Islam, & McEachan, 2019). Further, children who live in environments or communities that are perceived as unsafe due to elevated levels of crime or violence may be less willing or able to spend time in natural areas (Adams, Savahl, & Fattore, 2017). Spatial barriers limit access to (Aziz & Said, 2017) and reduce the quality of green spaces (Carson, Kuhle, Spence, & Veugelers, 2010), resulting in a loss of opportunity to experience nature. These factors are often not isolated from each other. For example, when parents have a good perception of the quality of their local sidewalks and parks, their children have been shown to decrease their screen time (Carson et al., 2010). Time barriers may relate to the overscheduling of time or perceived lack of time; technology may also play a role, as when indoor screen time competes with time outdoors (Larson et al., 2018). Structural barriers between children and nature can include the absence of or cost of programming or equipment. Another common structural barrier is a lack of teacher knowledge or skill with nature-based pedagogies, such as Indigenous Land Pedagogy (e.g., MacEachren, 2018; Styres, 2017), Place-based (e.g., Christiansen, Hannan, Anderson, Coxon, & Fargher, 2018; Lloyd, Truong, & Gray, 2018), Forest Schools (e.g., Waite & Goodenough, 2018), Wild Pedagogy (e.g., Jickling, Blenkinsop, Morse, & Jensen, 2018), and the like.

This child-nature divide is problematic from two perspectives. First, it prohibits children from accessing the immediate and life-long health benefits that can be derived from a nature connection. Current research indicates that children benefit in many ways by spending time outdoors in a natural environment: better mental and physical health (Sampson, 2015; Tillmann, Tobin, Avison, & Gilliland, 2018); lower myopia (Yang et al., 2018); lower obesity (Louv, 2011); increased ability to deal with the challenges of ADHD (Taylor & Kuo, 2009); and better indoor classroom learning (Kuo, Browning, & Penner, 2018). Nature experiences also

inspire problem-solving while building confidence (Walmsley & Westall, 2018). Some doctors today are prescribing "Vitamin N," a term coined by Louv (2016), meaning a regular dose of nature, as part of their treatment plan for both adults and children seeking health and vitality (Maller, Townsend, Pryor, Brown, & St Leger, 2006; Miller, 2009; Nisbet & Lem, 2015; Coffey & Gauderer, 2016; Louv, 2016). "Nature deficit disorder," a term also coined by Louv (2008, p. 10), describes how children's health is affected negatively by remaining indoors rather than spending time outdoors.

Second, the divide has implications for ecological/environmental and societal sustainability for future generations of society and the environment upon which that society depends. Society benefits from nature-child connections through children's increased ecological literacy (Pitman, Daniels, & Sutton, 2018) and likelihood of adopting ecologically sound practices (Cumbo, Paay, Kjeldskov, & Jacobs, 2014).

Given the importance of children's connection with nature, it is vital to understand how they form that connection, and how they conceptualize nature. This study investigates the potential for photography to inspire children to connect with nature, as well as how research on the photographs children take can give us insight into their conceptualization of nature. Specifically, an Ontario child-based photography program, Focus on Nature, provides a vantage point from which to explore these questions:

1. How do children connect to nature through photography?
2. What do children construct as "nature" in their photography?

To help set the context for this paper, the following literature review presents a range of models of the processes through which children may connect to nature, as well as the ways they may conceptualize nature. Next, we highlight research demonstrating the role that photography may play in fostering children's connection to nature. Finally, we discuss the potential for photography-based research methodologies to provide insight into children's conceptualization of nature.

Literature Review

How Children Connect to Nature

Literature regarding modes of connection to nature is scarce, even more so that which examines how children connect to nature. Schultz (2002) proposes a psychological model for human inclusion with nature, consisting of cognitive, affective, and behavioral components. Here, the cognitive aspect denotes the degree of acknowledgement or awareness that one is a part of or connected to nature; the affective component is the degree to which one cares about nature; and the behavioral piece reflects the degree to which people are committed to acting in a way that benefits nature. Schultz states the cognitive element is required for the affective and the affective for the behavioral component.

Using what they term a multidimensional model for understanding children's experiences with nature, Linzmayer, Halpenny and Walker (2014) found children's

connections with nature to consist of cognitive (thoughts), affective/emotional (emotional evaluation of or reaction to stimuli), behavioral (actions), and sensory (information received through the senses) components.[1] Their study is based upon interviews with five children aged 6-10 years regarding how they experienced nature in a botanical garden setting throughout five days at a camp in Alberta. The researchers conducted the interviews primarily in the garden itself—eliciting responses using photographs, drawings, clay sculptures and sand tray pictures that the children had made just prior—as well as before and after the camp, without prompts. Children were asked broadly about their experiences conducting those activities, how the activities made them feel, and what their creations expressed about what was important about their nature experience that day. Children reported that the affective and sensory avenues of nature connection were more significant than the cognitive and behavioral. Linzmayer and colleagues (2014) note that the senses are what bridge a child's affective experience to the external environment, but that both the child's previous cognitive schema and their affective evaluation of stimuli as good, bad, or neutral, influence behavior in response to a stimulus. Cognition was related to meanings constructed from experiences and the influence of socio-cultural factors, and behavior was used to regulate levels of stimulation, though behavior alone was not found to be significant.

Emphasis on the affective dimension was also found by Bonnett and Williams (1998). Conducted in the East Anglia region of the UK, this study employed two parallel group interviews with four and six grade 5-6 students, using verbal and written activities and photographs as prompts. Here, appreciation of natural places was said by children to vary according to mood. Children also reported that nature can be important for relaxation, escape, sanctuary, or for a place to play, depending partially upon the features of the environment itself.

Children's connections to nature may also be facilitated through social relationships. In a survey of 56 environmental leaders, most attributed their commitment to the environment to a combination of two sources in childhood or adolescence: many hours spent outdoors in wild or semi-wild places, and a mentoring adult who taught respect for nature, thereby orienting children's nature connections (Chawla, 2006).

How Children Conceptualize Nature

Literature examining children's conceptualizations of nature highlight differing understandings of *what is natural* and *what natural means*. Children often see living things as part of nature (Bonnett & Williams, 1998; Payne, 2014; White, 2015), though some differentiate between living things in these conceptions: some suggest that plants are the only natural living things, though animals may be included (Bonnett & Williams, 1998), as well as humans (Bonnett & Williams, 1998; Gebhard, Nevers, & Billmann-Mahecha, 2003; Payne, 2014). Bonnett and Williams (1998) found some children offered reasoning for why they incorporated humans in their definition of nature, such as the ideas that people are animals, people have similar needs to animals, or that people and animals are mutually dependent. Further, some children suggested that things possess "degrees of naturalness,"

[1] For visual representations of the model, see pages 483 and 485 of Linzmayer et al. (2014)

where things grown by themselves are more natural than those cultivated by humans, which in turn are more natural than human-made, non-living things (Bonnett & Williams 1998, p. 163). However, Payne (2014) found that some children see human-made things as part of nature. Payne's study drew upon participants' in-class and after-class verbal, written, and illustrated reflections throughout a weekly, five-month series of society-and-nature-based philosophy classes with 28 grade 6 students. Here, one child discussed that human-made things can co-exist with living things throughout their use or return to nature after their use. Further, some children were found to conceive of nature as an ecosystem, which is more than the sum of its parts. Thus, some children appear to conceive of nature in an abstract as well a literal sense.

Additionally, the literature reflects children's conceptions of nature as either a dynamic or static entity. Some children view nature more as an unchanging entity, expressing that it is something that has always been there and will continue to exist in the future—referring sometimes to their local environments and sometimes to nature in general. However, some children acknowledge growth and change in nature, referring specifically to changing states of life and death (Payne, 2014). Similarly, White (2015) found that children can view dead things as part of nature. In her study, a home-educator employed individual stimulated-recall interviews with four children of ages 3-4, using photographs taken by each child during outings that were integrated with a Maori outdoor educational program (*Kimi Haere*) in which the children were already participating. White discusses the interest that many children had in observing a decomposing rat throughout various visits to a farm, highlighting comments by a child who expressed that seeing this rat helped them understand death more fully. This child related their experience with the rat to seeing an earthquake on television. White describes this child's experience as exemplifying a symbolic connection to nature, alongside other participants' experiences with natural objects, which the children saw as symbolizing past experiences, or as resembling other objects based on similar colors or shapes.

Harwood, Whitty, Elliot, and Rose (2020) also explore children's conceptualizations of death and life in nature. These authors discuss children's experiences and reflections throughout three nature-based education programs in British Columbia, New Brunswick, and Ontario. Educators documented these experiences by taking photographs and recording children's comments. Encounters with a dead racoon, a dead owl, and a living weasel were highlighted—the latter believed by the children to have killed a family of squirrels they had visited previously. Guided through these encounters by the educators, the children discussed and reflected upon death as part of the natural cycle of life. Harwood and colleagues (2020) note that such practices are contrary to common avoidance in Western cultures of reflecting on death. They state that reflecting on these encounters was especially pertinent in fostering understandings and relationships with and between the children and non-human beings, as they brought notions of mutual vulnerability and entanglement to the fore.

Harwood's research utilizes a "common worlds" approach: a post-human framework, drawing upon localized (including Indigenous) knowledges, which

emphasizes being and learning with nature. Importantly, Harwood's research and the common worlds framework serve to bridge the two research questions in this study, wherein we examine how children conceptualize and connect to nature. According to Harwood and Collier (2017, p. 338), a "common worlds approach encompasses theories that help us think about the indivisible worlds that humans, materials, places and non-human species share...."

Thus, connecting with and conceptualizing—or being and learning-with—nature can be contingent practices. And, importantly, both are vital means of fostering healthy relationships in and with the natural world, as well as specifically with other humans.

Elliot and Krusekopf (2017) offer reflections in a similar vein, discussing their creation and study of a Nature Kindergarten program (one of the three programs examined in Harwood et al. (2020)), in Sooke, British Columbia. The program draws upon the local traditional knowledge of the Coast Salish peoples who are indigenous to the territory on which Sooke is located. Coast Salish First Nations Elders and educators helped create the program and acted as guides for the children during weekly outings. The authors suggest that the program creates an opportunity "to articulate a pedagogy of place that embraces complexity and uncertainty" (p. 387). They attribute this in part to the variety of spontaneous and on-going experiences that natural settings offer, which can foster healthy and meaningful relationships with people, places, and non-human beings. This comes via processes of learning, doing, and being-with, where learning one's limits and fostering a sense of responsibility for oneself and others is a key aspect of the program.

Gebhard and colleagues (2003) offer a further bridge between our research questions. These researchers found that elementary school children (i.e., 6-12-year olds) can attribute mental and emotional qualities (such as being able to think or feel pain) or project anthropomorphism onto trees. These responses were elicited during separate small-group discussions between approximately five participants of ages 6-8, 10-12, and 14-16 years—with a total sample of 285. The discussions were prompted by the researchers telling a story that expressed a conflict of interest between a child or adolescent (depending on the participant age group) and a plant, animal, or ecosystem. The aforementioned tendencies were found less as students grew older, and not at all among the adolescents. These researchers found that some participants conceived of ecosystems as machines, as a way around the participants' perceived immorality of not conserving/protecting nature. Moreover, they found that children can switch back and forth between anthropomorphic and more scientific conceptions of nature. The researchers suggest that anthropomorphic conceptualizations of nature reflect an affective connection with nature.

We note that the difference in results between age groups in Gebhard and colleagues' (2003) work suggests that it is pertinent to foster affective connections with and anthropomorphic conceptions of nature at an early age. This is affirmed by Payne (2014), who found that some children expressed contradictory conceptions

of nature throughout the course of his research with grade 6 students, and suggests that this may be due to conceptions of nature/environment not being fully formed at that time in their lives.

Fostering Child-Nature Connection via Photography

Louv (2016) suggests that today's "wired generation" of children need connections to nature in a way that is unprecedented. Many parents and educators experience the dilemma of children resisting the invitation to play outdoors, particularly children who are deeply connected to their phones and video games (Sampson, 2015). For Focus on Nature, introducing children to digital nature photography was intended to intentionally connect these children more deeply with nature. When tech-savvy children are invited to learn about digital photography they may engage with nature in new and exciting ways (Spencer, 2012). The camera helps children fine-tune their vision (Slemon et al., 2018) and allows children to "memorialize moments" of nature experiences they find meaningful (FitzSimmons, 2012). Recent studies explore the relationship between digital nature photography and children's connectedness to nature (e.g. Linzmayer et al., 2014; Spencer, 2012). Qualitative and anecdotal data suggest that children's use of digital cameras can enhance their connectedness to nature (Spencer, 2012). In fact, previous research on the Focus on Nature program suggests that children are inspired to make personal connections with nature through photography-based programming (Shakespear & Varghese, 2018) and that children learn more about nature due to their relationship with the trained adult volunteer mentors (Slemon et al., 2018).

Researching Child-Nature Connection and Conceptualization through Photography

Our study examines photographs taken by children participating in Focus on Nature (FoN), a school-based photography program based in Guelph, Ontario.[2] FoN uses the implicit draw of technology to spark connections between children and nature by teaching nature photography. The key goals of FoN are to nurture an appreciation of nature through photography, to foster creativity, and to inspire young people to get outside and explore the outdoors as photographers.

Analyzing children's FoN photographs to better understand children's conceptualizations and connections with nature seemed a logical concurrent study to a broader evaluation of the FoN program (i.e., Slemon et al., 2018). Photography is an increasingly popular tool of academic research, and the interpretation of photos taken by children offers researchers the opportunity to explore their intended meaning (Barker & Smith, 2012). Langmann and Pick (2018, p. 21) note "both participant and researcher-generated images mainly serve as a channel for interview or other data, and seldom stand as data themselves." In our study, the participant-generated photographs are the primary source of data. Authenticity of the photos in our design comes from the fact that the photos were taken as part of the FoN programming, rather than specifically for this study. As the focus of the programming was on nature photography, we had an opportunity to

[2] Refer to the FoN website for more information: www.focusonnature.ca

get a glimpse of how the children connected with and conceptualized nature within and through their photography.

Gaps in Literature Examining Children and Nature via Photography

Previous studies have employed photo elicitation during interviews with children to inquire about their understandings of nature and the relationship between nature and sociocultural/human worlds. Application of this method ranges from simply using photographs of nature during group interviews with children (e.g., Bonnett & Williams, 1998), to eliciting responses in one-on-one interviews by using photos taken by children during their participation in an outdoor program (e.g., White, 2015).

Photo-elicitation research that examines avenues through which children connect to nature is more limited. Like those of Linzmayer et al. (2014) and White (2015), our study analyzes children's comments on their photographs, although in our study the photographs are the primary source of data. Moreover, we gathered data from children's comments in a manner that was integral to the program in which the children were participating, rather than requiring children to spend extra time to take part in our study and to avoid disrupting the flow of the program. We use this data to gain a deeper understanding of what the photographs express about children's conceptions of and avenues of connection to nature. Similar to our study, other research (e.g., Elliot & Krusekopf, 2017; Harwood et al., 2020) examines both children's conceptualizations of and connections to nature. However, these studies use photographs taken by children during outdoor programs primarily to document experiences, rather than as a substantive aspect of analysis.

Other than Linzmayer et al. (2014), literature that explores photography as a mode of connecting children to nature is scarce. Our research aims to fill this gap, using Linzmayer et al.'s multi-dimensional model of experience as a starting point to understand the diverse ways in which children can connect to nature via photography, while also examining the range of children's conceptualizations of nature via their photographic depictions and their brief commentary on those photographs.

Methods

Photo elicitation (e.g., Harper, 2002), photo-narrative (Rose, 2012), photovoice (Wang & Redwood-Jones, 2001), and snapshot (Langmann & Pick, 2018) are some approaches in which photography has been used within research. This study draws on the snapshot approach and centers around children's photographs of nature. Photography has been increasingly employed for studies with children. Depending on how the photography is used, it can enable task-oriented data collection, serve as an icebreaker, help children communicate abstract ideas, center children's perspectives and shift power to children, etc. (Epstein, Stevens, McKeever & Baruchel, 2006; Böök & Mykkänen, 2014; White 2015). Some limitations/ challenges of children's photography noted in the literature include recognizing that what is not visible can be as meaningful as what is visible, that images are selective representations of social reality, and that relying solely on researcher's

interpretation can mis-capture what children were trying to convey (Rose, 2012; Böök & Mykkänen, 2014).

This visual sociology[3] study is based on photographs taken by children during the FoN photography program in June 2017. FoN workshops[4] intentionally link to Ontario curriculum guidelines, and were designed to provide specialized photography instruction and positive nature experiences for young people. To ensure equitable access and maximum participation, schools are the locus of program delivery. During each one-day program, children are partnered in small groups with trained adult mentors who possess significant qualities: affection for children, an appreciation of nature, a facility with digital photography (although not required), and a dedication to the overall mission of FoN. Every workshop is led by an experienced lead instructor and a team of Program Assistants who bring all equipment and materials needed to make a FoN workshop a rich learning experience. Recognizing the limits of school budgets, FoN program costs are covered by government grants, corporate sponsorships, and fundraising. As a result, FoN operates as an incorporated non-profit, charitable organization. FoN workshops have been well-received in classes from grades 3 to 11, including high school specialty arts programs. From inception in 2008 to now, FoN has delivered over 900 workshops in four regions in southwestern Ontario, reaching over 23,000 children in over 175 schools, with 65 volunteers and four full-time staff.

A FoN workshop is a full-day experience delivered in a dynamic, interactive format. Students are given the opportunity to practice what they learn in nearby parks in small, adult-led groups. Included in the workshop program are interactive talks/slideshows covering the elements of design, composition ideas, and the basics of using a digital camera; a morning adventure walk to a nearby natural area, including a hunt for the seven elements of design in nature; nature awareness and sensory activities such as building a nature sculpture and a photo scavenger hunt; and photo editing. Workshops then conclude with slide shows comprised of each student's top shots and a discussion of their favorite image. Ideas of activities for continuing children's nature connections are provided to the classroom teacher after each workshop. Children often engage more deeply as nature photographers and share their work with the larger community long after the workshop has ended.

As a community-engaged research project, we were cognizant of the need to limit the study's intrusion into the programming being evaluated as part of a broader study, so in addition to observation, we intentionally drew on existing aspects of the programming (photography and the slideshow) as our sources of data. Essentially, the slideshow comments could be framed as an "oral" version of the captioning of photos (Barker & Smith, 2012) and helped to ensure that within data analysis the children's interpretations were included along with the researchers'. Hence, the study draws on a participant snapshot approach with oral captioning.

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[3] Harper (2012) identifies two broad approaches to using visual sociology to study culture and social life: researchers creating visuals or researchers analyzing visuals created by others.
[4] Refer to the FoN website for more information: www.focusonnature.ca

The research dataset consisted of 86 photos and 61 comments. Each photo was taken by a different child between grades 3 and 6 at one of four Guelph FoN workshops between June 12th and 20th, 2017. During the collective slideshow, each child presented five photographs that they had taken[5] and edited earlier in the day, then provided comments on the photo that they selected as their favorite. Upon being prompted by FoN volunteers during the slideshow presentation, each child decided whether they would comment on the elements of design they could identify within it, why they took it, or what they liked about it. However, not all child participants commented on their favorite photo during the presentation. Hence, there are fewer comments than photos in the dataset. In this study, we analyzed each child's favorite photo and any accompanying comments the child provided. During the workshops, the first author observed the slideshows, viewed the pictures, and recorded the comments of participating children.[6]

We addressed the research questions by analyzing and categorizing both the visual content of the pictures and the comments made by participants. Photos and their corresponding comments were linked and coded within NVivo 11. We drew on two visual methodological approaches to analyze the photos produced by the children: content analysis and interpretive analysis. Content analysis was used primarily to capture what was found in the images—focusing on the beings, objects, and things they depicted—though also to sort comments regarding why children took or liked their photograph, or what self-described symbols in the photographs represented to the child. This content analysis of photographs and comments began as open, inductive coding, capturing what each contained. We then deductively developed broader categories, based in part upon children's conceptualizations of nature as found in the literature review (e.g. living things, non-living things, humans, non-humans, human-made things, etc.).

Interpretive analysis involved looking at the image as a whole and interpreting what themes or messages about nature were found in the image and what symbols might be found in it. Again, this consisted of both inductive and deductive coding. Based on the child's comments, we inductively coded pictures that the child described as symbolic representations of other objects. Deductive coding was used by the researchers to interpret thematic meaning in the photographs, based on findings in the literature review. Table 1 provides a summary of the coding of children's comments regarding their rationale for why they each selected the photo as their favorite. Of the 61 participants who provided comments during the slideshow, 49 participants noted one reason for selecting the photo as their favorite, ten participants noted two reasons and two participants noted three reasons.

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[5] With permission, as part of the program, FoN uploads photographs taken by participating children to Flickr as a way of capturing and acknowledging the children's artistic contributions.

[6] Photos and comments were omitted from the study where parental consent or child assent was not given. This study was reviewed by the University of Guelph Research Ethics Board for compliance with federal guidelines for research involving human participants (REB17-05-036).

Table 1. Summary of rationale for children's photo selection

Why Photo Selected as Favorite:	Relative Frequency
Evoked an emotional reaction	1-4 participants
Liked how picture resembled a different place or time	
Noted symbolism in the picture	
Liked the edited effects	
Identified the perspective of the picture	
Liked the overall image	5-10 participants
Noted presence of a specific object or non-living thing	
Noted presence of a certain animal plant or living being	11-20 participants
Liked elements of design in the picture	

In considering how much information beyond the image itself was needed (Rose, 2007), within the research design, we included records of what the child said during the slideshow about their favorite image. These comments made by the participants provided insights into the child's thoughts and feelings related to the photograph itself and the subject matter captured within the child's photograph. This enabled us to link images with participants' thoughts about the images and enabled compositional interpretation to include the children's voice and not only the researchers'. Such methods are necessary as a form of triangulation beyond simply using photographs as a single unit of analysis, since aesthetic interpretations can vary between individuals. This can be even more important when analyzing children's photographs, since differences in interpretation between adults and children can be larger than between adults (Richards, 2009; White, 2015).

Findings

Our findings affirm what is found in the literature in that children both conceptualize and connect to nature in a variety of ways. We also found that these can occur while children are engaging in nature photography. As demonstrated in the first subsection below, children can use photography to connect to nature through symbolism, artistic practice, emotions, and through perspective-taking. As demonstrated in the second subsection below, through photography children can view nature literally (as consisting of living, non-living, dead, or human-made things), symbolically (i.e., representing other things or prior experiences), and as a dynamic and static entity.

How Children Connect with Nature through Photography

Nature photography provided an opportunity for the participating children to engage with nature in multiple ways. Through their photography, participants demonstrated connections with nature symbolically, artistically, and emotionally, as well as by taking the perspective of other living beings.

It is apparent that seeing certain symbols or representations in natural environments provides an avenue for connecting to those environments. Conversely, natural environments can be seen as providing a way of connecting to fictional stories in movies, as is the case with the child who photographed a water

droplet on a leaf (Figure 1) because it reminded them of a scene from the movie *A Bug's Life*.

Figure 1. Photograph of a water droplet on a leaf by participant 59. "I like it because it reminds me of a movie where people got caught in a droplet while trying to escape."

Artistic connections with nature were found to exist via the act of photographing natural environments and their constituents, and by utilizing elements of design in these photographs and editing them using computer software. Though not all children were asked by the FoN slideshow coordinator why they took their photograph or why it was their favorite, when this question was posed, the most common answer was because the child liked the elements of design in it. Though this is perhaps not surprising since the elements of design are one of the learning outcomes associated with FoN, it shows that connections between children and nature can be fostered through artistic means. As well, some children mentioned that they liked their picture because of the edited effects they added to it (refer to Figure 2).

Figure 2. Edited photograph of a flower by participant 8

An emotional connection with nature was demonstrated by a child who commented during a slideshow, "[My picture] makes me happy because there is a bunny in it" (participant 57; Figure 3). This was the only case in which a connection with nature was attributed to a specific emotional reaction. However, many children discussed that they liked their picture because of one or multiple specific living or non-living things that it depicted. In fact, when asked why they took their picture, the second-most common response of participants was because it depicted a specific living being. Although in these cases, the children discuss these connections with nature without explicitly mentioning their emotional reaction, the fact that these children chose their favorite pictures because they depicted a specific living or non-living being implies that these children affiliate a positive emotion to these connections.[7]

[7] If participants were asked how these elements made them feel or to attribute a specific emotion to these living or non-living things, it is highly likely that a positive emotion would have been mentioned in each case. In future studies, examining this in more detail would require that a question regarding children's emotional reactions to their photographs or the elements in them be asked every time.

Figure 3. Photograph of a bunny by participant 57

Lastly, children were found to connect with nature by depicting the perspective of living beings through their photographs. During the slideshow, this was captured by children in the following two cases: one of whom "took [their] picture from a bird's eye view" (participant 64; Figure 4a), and the other, "from an ant's view" (participant 56; Figure 4b).

Figure 4a (left). Photograph of a flower from a bird's eye view by participant 64. "I took the picture in a bird's eye view; I like flowers; it has all seven elements of design."
Figure 4b (right). Photograph of a flower "from an ant's view" by participant 56

How Children Conceptualize Nature through Photography
Children's conceptions of nature as expressed through photography were based around three main themes: 1) what nature consists of, 2) understandings of nature as either literal or symbolic, 3) seeing nature as either a dynamic or static entity. Table 2 summarizes the relative frequencies with which children expressed these conceptions within their photograph.

Table 2. Relative frequency of how children conceptualized nature through their photographs

Children's Conceptions of Nature (*theme*):	Relative Frequency
nature includes dead things (*what nature consists of*)	1-9 photographs
nature includes humans (*what nature consists of*)	
nature includes human-made things (*what nature consists of*)	
understandings of nature as symbolic (*understandings of nature*)	
nature as dynamic entity (*type of nature entity*)	10-19 photographs
nature includes non-living things (*what nature consists of*)	20-29 photographs
nature includes living beings (*what nature consists of*)	71-85 photographs
understandings of nature as literal (*understandings of nature*)	
nature as static entity (*type of nature entity*)	

Children photographed living beings (Figure 5a), dead things (Figure 5b), non-living things (Figure 5c) and human-made things (Figure 5d). The living beings captured in children's photographs included plants, fungi, animals, insects, and—notably—humans. One participant commented, in response to why their picture, which

depicted some classmates in a natural area, was their favorite of the day: "It's my favorite because it has people in it. We are nature" (participant 33). In contrast, another child noted that while editing their nature photography: "I took it and had to cut out two people" (participant 12). This seems to imply that some children do not conceptualize humans as part of nature. Children took photographs of dead things as well, such as fallen leaves and branches, and tree stumps. Non-living things contained within participant photographs included dirt, water, rocks, clouds, the sky, and the sun. Human-made objects captured in photographs included chopped wood, train tracks, benches, fences, and buildings.

Figure 5a (left). Photograph of a snail by participant 81
Figure 5b (right). Photograph of a decaying leaf by participant 65. "I just like the way the leaf looks, and the way light comes through the leaf."

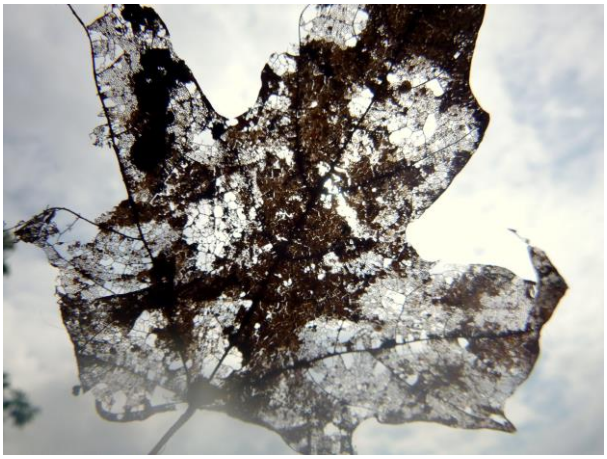

Figure 5c (left). Photograph of a rock by participant 43. "I like it because it looks like it was taken in the dark."
Figure 5d (right). Photograph of train tracks by participant 28. "I like how the color changes in the train tracks."

Children's perceptions of nature were either literal or symbolic. Literal conceptions were expressed in many instances through participant photographs of nature and comments regarding the subjects of their pictures, which in many cases referred to a specific living being. Symbolic conceptions of nature were found in three instances and were communicated by participants in their comments on their pictures. However, cases where children may have been viewing nature symbolically and expressing this through their photographs, though not discussing their picture as such, may have gone undetected by the researchers. Symbolic conceptions consisted of a view of natural beings as resembling an object or shape (such as a snail looking like a hat (Figure 6a), a group of daisies looking like a heart (Figure 6b), or the notion that a natural scene resembled a scene from a movie (see Figure 1, above).

Figure 6a (left). Photograph of snail by participant 31. "It's my favorite because the snail looks like a little hat."
Figure 6b (right). Photograph of daisies by participant 41 "[I] like it because the daisies are shaped like a heart."

Most of the children's photographs seemed to depict nature as a static, non-changing entity. However, some depicted nature as a dynamic or moving entity (Figure 7). This was expressed in several ways. First, photographs that explicitly focused on dead things, including a tree stump and a fallen leaf, express a view that nature consists of cycles of life and death. Second, some pictures focused on water droplets on leaves, invoking recognition that they were taken just after it had rained, thus prompting one to reflect on the water cycle.[8] Third, movement was

[8] These aspects of our analysis are not entirely thorough, since no quotes were provided by the children for these photographs. As such, we were not able to triangulate these interpretations. Another way in which evidence might have been provided regarding the dynamism of nature in terms of either life and death or the water cycle would have been to examine the series of five photographs taken by each child that were presented during the end-of-day slideshow. However, we decided to only include in our analysis the photograph that each child indicated to be their favorite given the children had an opportunity to comment on their favorite photo.

captured in photographs directly through depictions of plants blowing in the wind or ripples on water, and indirectly via utilization of the rule-of-thirds photography technique,[9] which enabled the children, for example, to use static images of swimming ducks to communicate that they were moving in a specific direction.

Figure 7. Photograph of grasses blowing in the wind by participant 80. "I like the way the wind is blowing it."

Discussion

For our purposes, the model proposed by Schultz (2002) regarding modes of connection to nature is limited in its ability to capture the cognitive, affective, and behavioral components of connection to nature. For example, cognitive does not need to involve knowledge of one's connection to nature, it could involve one's knowledge of nature; affective connections to nature could involve negative, neutral, or ambivalent emotional reactions to natural elements, rather than just positive ones or caring; and behavioral connections to nature do not have to necessarily benefit it. Although nature photography is in part a behavioral means of connecting to nature, taking photos of nature does not directly benefit it, though arguably it does indirectly by increasing love of or connection to nature (Schultz and Tabinaco (2007) suggest that increased love of or connectedness to nature leads to more desire to conserve or protect it). A further incompatibility of Schultz' (2002) model with our analysis appears to lie in its use of examining modes of connection to nature for predicting positive environmental attitudes or concern for nature.

In contrast, Linzmayer et al.'s multidimensional model of child-nature connections does not attach specific value orientations to connections to nature, and thus can

[9] FoN teaches the rule-of-thirds technique at the beginning of the workshop day.

encompass positive or negative conceptions, in addition to incorporating the sensory component. Our study affirms and expands upon the model posited by Linzmayer et al. (2014), alongside their finding that affective and sensory child-nature connections are the strongest avenues. As mentioned, the first and second most common reasons that children liked their pictures were because the child liked the element(s) of design or the living-being depicted, respectively. Thus, the affective and sensory dimensions are found to be of particular significance to children.

Avenues of child-nature connection via art, symbolism, and perspective-taking expand upon the cognitive-affective-sensory-behavioral model posited by Linzmayer and colleagues (2014). In the present study, nature photography is seen as a method to combine these avenues by capturing natural sensory information in creative ways, through the use of elements of design, meaning-making, and emotional or cognitive connections. When conceived in terms of Linzmayer et al.'s model, the former three avenues are exercised through the behavioral medium of nature photography and the editing and presentation of photos.

However, we argue that the artistic aspect of (nature) photography (and artistry in general) is not fully encapsulated within Linzmayer et al.'s model, since the latter does not adequately conceptualize the influence of imagination over behavior. Linzmayer and colleagues describe an interplay between affective-emotional evaluations and cognitive schema based on previous experience and memory as the central way in which meaning is attached to sensory information and behavior. We align with this insofar as the act of creation in art is comprised of a behavioral element, while the resources with which an artist gives meaning to the act of creation and artistic creations themselves can be sensory, affective, and cognitive. However, we go beyond Linzmayer et al.'s model when considering that imagination, a fundamental aspect of artistry, does not necessarily draw upon past experience or memory. In some instances, imagination is simply a reflection of experience/memory, but in others, it comprises more than prior experience and does not necessarily reflect sensory inputs from the environment. In other words, behavior in general and artistry in particular may not respond exclusively to sensory information from the external environment as interpreted via affect and cognition. Whether this second type of imagination should be considered to be made-up of a complex of sensory, affective, and cognitive interactions, or as an internal reality which provides sensory inputs similar to external sensory information is beyond the scope of this study and would require deeper psychological analysis. But for the purpose of understanding child-nature connections via art, our findings can be understood more clearly by drawing upon Linzmayer' et al.'s model alongside our distinction between these two types of imagination. Here, artistic avenues of connection to nature can consist of either or both of these two aspects of imagination. Seeing symbols in nature (such as a group of flowers that look like the shape of a heart, a snail that looks like a hat, or a water droplet on a leaf that reminds a child from a scene from a movie) and depicting these with photographs requires the first type of imagination, as it draws upon past experiences. Using the elements of design to compose photographs of nature would also fall under this first type of imagination, as it requires recall of

what the elements of design are, then finding those elements in nature and combining them in the act of taking the photograph. This first type of imagination and artistic creation can be understood wholly using Linzmayer et al.'s model. Meanwhile, taking the perspective of another being, such as an ant or a bird, requires a level of imagination that to some extent goes beyond lived experiences. We argue that a child's sensory information, cognitive schemas, and affective evaluation regarding an ant or bird could not alone contribute a photographic depiction of an ant or bird's perspective. The second type of imagination is required in this mode of creation. The act of editing photographs could fall under either or both of these types of imagination, since edits could be simple ones, such as cropping, that do not change much about the way nature is depicted. Or edits could be more complex, such as changing tone, contrast, texture, or colors, so that the resulting picture does not much resemble the original depiction of nature. The completed picture could result simply by chance based on how the photographer played with the edited effects, or the edited effects could be more thought out from the beginning and resemble either past sensory inputs the photographer has experienced, or the edited picture could be based entirely upon the second aspect of imagination and have no connection to prior experience in the world. Accordingly, we argue that artistry consists of an avenue of child-nature connection, or of experience in general, that builds upon, yet goes beyond, Linzmayer et al.'s model. Thus, photography simultaneously provides both an opportunity to connect with and orient within nature in multiple ways.

Our findings affirm the literature regarding children's conceptualizations of nature, in that photographs depicted living things (including humans), non-living, and dead things. However, as in Payne's (2014) study, some children conceptualized humans as part of nature, while others saw them as separate. Further, the pictures depicted both static and dynamic scenes in nature, reminiscent of Payne's findings that some children see nature as a changing entity, while others see it as staying relatively the same. Here, we found both movement—as in ripples on water, or plants blowing in the wind—and more holistic dynamism—as suggested by water droplets on a leaf that indicate there has been a recent rainfall. Our findings add to the literature in that children also depicted human-made objects in their nature photographs. Notably, no mention was made of any of these objects when the children gave the slideshow presentations of their pictures. In contrast, natural things were the source of many affective reactions, symbolic interpretations, and of perspective-taking—affirming arguments about nature being more conducive to affect and imagination than human-made environments (e.g., see Vasko, 2015). Moreover, our findings indicate conceptions of society and nature akin to the hybrid theory of Latour (1993), which sees no clear distinction between humans, society, technology, and nature. This is shown via children's use of symbolism, where natural objects (i.e., a snail or water droplet) are used to represent human-made things (i.e., a hat, or a scene from a movie). Thus, hybrid conceptualizations of nature were found to be avenues of connection to nature through symbolism. The act of using photography and computer editing software as an avenue of connection to nature is a further example of this.

Expressions of flows in nature were also depicted in the children's photographs—as in movement, weather changes, and conceptions of life and death. With this, and children's perspective-taking of living beings, and their conceptions of humans and human-made objects as part of nature, we see children being and learning with nature and living things. These findings lend credence to the "common worlds" approach, which emphasizes and examines the interconnectedness between human/social and natural worlds.

It is significant that the same conceptualizations of and modes of connection to nature found in the literature were also found in this study to take place via photography. Hence, engaging with nature through photography does not appear to diminish the multitude of ways in which children connect with and conceptualize nature. In fact, we find that photography can incorporate elements of artistic engagement with and symbolic conceptualizations of nature in ways that were not found to exist in the literature in the absence of the use of photography. Indeed, Slemon et al. (2018) found that, after participating in the FoN program, the majority of children viewed nature differently and noticed more details in nature.

Of note is the ability for photography to capture symbolic representations of and artistic modes of engagement with nature, as found in pictures that represent the perspective of other living beings, and in the process of editing nature photos. This perspective-taking of other living beings via photography is a novel finding and something that could be explored further as a mode of engaging children and people in general with nature. It would be pertinent to do so, since imagining the perspective of other beings increases empathy, environmental concern, and perhaps perceived interconnectedness with nature (Schultz, 2000). Though the mode of inquiry employed in our study does not utilize models that predict correlations between certain avenues of connection to or conceptualizations of nature, it appears that our findings could have applications in that area.

Conclusion

In this study, photography was utilized as the primary method through which children expressed their understandings of nature. The core element of FoN is nature photography, and by drawing on visual sociology methods we analyzed what children depicted in their photographs of nature. FoN sees photography as a way of bringing children back into engagement with natural settings, in a time where technology often obstructs connections between children (and people of all ages) and nature. The widespread fixation upon technology is utilized by FoN as a bridge between children and nature via the art of photography. Photography can therefore be used as both a mode of connection to nature (by increasing opportunity and orientation) and a way to express conceptualizations of nature. Notably, photography was found to facilitate much of the same range of engagements with and conceptualizations of nature as other activities in nature, and in fact provides ways to foster imagination as a mode of connection to nature in ways that other activities may not.

This study leads to a number of conclusions regarding children's modes of connection to and conceptualizations of nature, and photography as a mode of

connection to nature. First, our findings affirm Linzmayer et al.'s (2014) multidimensional model of experience as encompassing a broad range of ways in which children connect with nature. To a limited extent, art as a mode of connection is encapsulated by this model, as art engages all four of its dimensions. However, art also moves beyond this model as it requires imagination, which can but does not necessarily draw upon prior experiences. In this study, we found taking the perspective of non-humans (e.g., a bird or an ant) as an example of the latter aspect of imagination, and some image edits can demonstrate this as well. Though not examined in our analysis of FoN, the program also utilizes activities such as nature sculptures. Such avenues of connection offer even further ways to connect to nature artistically and could perhaps encompass either or both aspects of imagination.

Next, children's conceptualizations of nature were found to encapsulate living, dead, and non-living things, animals, plants, and humans—as found in the literature. In addition, however, human-made objects were included in children's nature photographs in our study. This perhaps indicates that children hold conceptions of nature and society as hybrids: as containing elements of one another, with divisions between these two categories neither strict nor easy to define. In relation, children saw nature symbolically, as depicting a scene from a movie or as resembling shapes or objects and these symbolic representations cross between human, natural, and technological worlds. Further, seeing and representing nature symbolically requires some level of imagination and artistic engagement. As such, broadening avenues of connection to nature to include art also facilitates expansion of the ways in which children can conceptualize and connect with nature and other beings.

As in Payne's (2014) study, children in this study were found to understand nature both in static and dynamic terms. Though many pictures were taken that represent nature as unmoving or unchanging, some photographs expressed movement—as in ripples in water, or plants blowing in the wind—while others expressed cycles and change—including expressions of life and death, and of the water cycle. Such conceptions and expressions of the entwined and dynamic nature of human and natural worlds are vital to fostering healthy experiences and relationships, both within and between such worlds. Photography was found in this study to act as a way to facilitate such conceptions, experiences and connections—perhaps even opening additional avenues via its affordance of art and imagination. Though other activities, such as FoN's nature sculptures, could perhaps act similarly, photography is notable here since it bridges the technological and the natural, acting to address the divide between humans and nature to which technology typically contributes.

Future research could examine in more detail the ability for photography to foster and express connections with and conceptualizations of nature for both children and adults, and, more broadly, the ability for other artistic mediums to do so. Moreover, researchers could examine the role of imagination in facilitating engagement with and perhaps conceptualizations of nature, in relation to, or apart from, the multidimensional model employed here (Linzmayer et al., 2014). In this vein, research could explore photography as a way to engage with nature via taking the

perspective of other beings, as an end in itself, or as a way of fostering pro-environmental sentiments and behaviors.

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