



Responding to nature: Natural environments improve parent-child communication



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ABSTRACT

Numerous studies have demonstrated that natural environments have a profound effect on a range of human behaviours and states, but most of those studies have examined how natural environments affect individuals rather than interactions. We examined whether natural environments affect communication between parents and their 3- to 4-year-old children. Using a novel experimental design, we show that parent-child communication is more responsive and connected in a natural environment compared to an indoor environment. This study is the first to demonstrate that human communication is influenced by natural environments. Natural settings may constitute optimal environments for communication.

1. Introduction

Natural environments such as gardens, parks, and woodlands positively influence a range of psychological processes and states (Bowler, Buyung-Ali, Knight, & Pullin, 2010; Bratman, Hamilton, & Daily, 2012; Hartig, Mitchell, de Vries, & Frumkin, 2014; Kaplan, 1995). For example, Ryan et al., 2010 asked university students to evaluate their energy levels before and after taking a 15-min walk. A researcher led individual students on a silent walk, either indoors through hallways and tunnels, or outdoors along a tree-lined path. Students who walked outdoors reported higher energy levels after the walk compared to before the walk, whereas students who walked indoors reported similar energy levels before and after the walk. Similarly, Berman, Jonides, and Kaplan (2008) compared university students' performance on an attention-demanding cognitive task, the backwards digit span, before and after a 50-min walk in an arboretum, and one week later, along city streets (or the opposite order). Students' performance on the digit span task improved after walking in the arboretum compared to before the walk, but did not improve after walking along city streets, thus demonstrating a positive effect of natural environments on attention. In another study, adults who took a 50-min walk through grasslands and trees reported greater decreases in anxiety, negative affect, and rumination and greater increases in positive affect compared to those who

took a 50-min walk on an urban street (Bratman, Daily, Levy, & Gross, 2015). The results of numerous correlational studies are also consistent with the hypothesis that natural environments, including both green spaces such as gardens and parks and blue spaces such as coasts and rivers, benefit human health and behaviour (e.g., Bai, Wilhelm Stanis, Kaczynski, & Besenyi, 2013; Biedenweg, Scott, & Scott, 2017; Groenewegen, van den Berg, de Vries, & Verheij, 2006; White, Alcock, Wheeler, & Depledge, 2013; White, Pahl, Ashbullby, Herbert, & Depledge, 2013).

Natural environments are also associated with positive developmental outcomes for children (Chawla, 2015; Evans, 2006; Gill, 2014). In a large-scale epidemiological study, Davdand et al. (2015) used satellite data to quantify 7- to 10-year-old children's exposure to green spaces at home, at school, and along the route between home and school. Exposure to green space (school greenness and a greenness index which combined greenness across residential, commuting, and school areas) was positively related to cognitive development, defined as increases in working memory and attention abilities over a 12-month period. Other observational studies have reported positive associations between natural environments and children's attention, behaviour, learning, psychological well-being, and self-regulation, as well as a reduction in the symptoms of attention deficit disorder (Coley, 2012; Faber Taylor, Kuo, & Sullivan, 2001, 2002; Flouri, Midouhas, & Joshi,

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2014; Ulset, Vitaro, Brendgen, Bekkhus, & Borge, 2017; Wells & Evans, 2003; Wells, 2000). A small number of experimental studies have compared the influence of walking in a natural versus urban environment on children's attention and cognition in designs similar to those used by Berman et al. (2008) and Bratman et al. (2015). Walking in natural environments has generally led to better performance amongst children, though not on all measures (Faber Taylor & Kuo, 2009; Schutte, Torquati, & Beattie, 2017). Some evidence from outdoor learning programmes also suggests that natural environments can improve attainment in the primary school years (Quibell, Charlton, & Law, 2017). The existing evidence thus suggests several potential benefits of natural environments for child development, but is still preliminary, in particular due to limited experimental evidence demonstrating causal relations between natural environments and children's behaviour and skills.

The vast majority of studies investigating the potential benefits of natural environments have examined how environments affect individuals, rather than interactions between people. Some evidence indicates that attractive and safe natural environments can increase levels of social interaction, as well as a sense of community (Hartig et al., 2014). Coley, Kuo, and Sullivan (1997) observed more people outdoors in public spaces with trees compared to spaces without trees in two urban housing authority sites, and argued that trees and other vegetation in public spaces increase opportunities for social interactions amongst people living in urban settings. In another study, greenness of public spaces in an urban housing authority site was positively associated with neighbourhood social ties and self-reported use of public spaces, and negatively related to stress (Kuo, Sullivan, Coley, & Brunson, 1998). Neighbourhood quality, measured objectively and including features such as birdlife, lawns, and water, is positively related to people's subjective sense of community (Francis, Giles-Corti, Wood, & Knuiman, 2012). Other evidence indicates that social cohesion and stress together mediate the positive relations between natural environments and human health (Sugiyama, Giles-Corti, & Owen, 2008; de Vries, van Dillen, Groenewegen, & Spreeuwenberg, 2013).

Weinstein et al. (2015) proposed that natural environments might promote a sense of connection or relatedness with one's surroundings, which includes not only the physical environment but also other people, and thereby enhance social interactions. They reported that in a large-scale online study with a nationally representative sample in Great Britain, self-reported contact with nature was directly and positively related to community cohesion, indicated by agreement with statements such as: "I feel connected to other people in my neighbourhood." Objective quality of nature was not directly related to community cohesion, however, raising the possibility that the association between contact with nature and community cohesion might be due to shared method variance or some other alternative explanation.

In this study we evaluated the possibility that natural environments influence the quality of human communication, specifically between parents and children. We focus on turn-taking and responsiveness as key indicators of communication quality (Hilbrink, Gattis, & Levinson, 2015; McGillion et al., 2017; Snow, 1977; Song, Spier, & Tamis-LeMonda, 2014; Zimmerman et al., 2009). Communication quality is important because it impacts child development. Numerous studies over the years have identified strong links between the quality and quantity of child-directed speech and subsequent language development (e.g. Borstein, Tamis-LeMonda, & Haynes, 1999; Hart & Risley, 1995; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Weizman & Snow, 2001). Studies also demonstrate that children's language skills benefit from opportunities to engage with conversational partners who are responsive to their communicative bids (i.e. by following in to the child's focus of attention) and to engage in balanced conversations where both the child and adult take on comparable amounts of the conversation (e.g. Hirsh-Pasek et al., 2015; Romeo et al., 2018). Furthermore, there is evidence to suggest that connectedness in conversation (that is, the extent to which conversational turns that are

meaningfully related to each other) is positively associated with cognitive development (e.g. Dickson, Hess, Miyake, & Azuma, 1979; Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991; Ensor & Hughes, 2008; Slomkowski & Dunn, 1996).

To date there have been no systematic studies of the effects of the physical environment on human communication, including parent-child language and communication. This is surprising since, as outlined earlier, natural environments have a positive effect on a number of psychological processes and states that are central to communication and social interaction, such as attention, working memory and self-regulation. We therefore predict that natural environments will promote connected and responsive communication between parents and their children.

2. The current study

We examined the effects of physical environments on parent-child communication during exploration of a natural environment and an indoor environment. We selected a city centre park for the natural environment and the park's nature-focussed education centre for the indoor environment. Our choice to contrast thematically-linked natural and indoor environments as opposed to two different outdoor environments (e.g. natural and built) was motivated by two factors. Firstly the natural/indoor contrast has provided important insights into the effects of the environment on cognition in both adults and children, as outlined in the introduction. Secondly, there are no studies of systematically-collected spontaneous parent-child communication in natural environments and therefore our first step is to compare parent-child communication in a natural environment with parent-child communication in an indoor environment that is both well-matched to the natural environment and broadly similar to the indoor settings in which previous research has examined parent-child communication.

Based on previous research displaying the beneficial effects of natural settings on cognition and social interaction, we reasoned that natural environments would enhance communication and connectedness. We therefore predicted that parent-child communication would be more connected and more responsive in the natural environment compared to the indoor environment. We defined connectedness as sequences of *conversational turns that are meaningfully linked*, and responsiveness as instances where speakers *follow in and respond to the content* of their social partner's utterances (Hoff-Ginsberg, 1991; Slomkowski & Dunn, 1996). To test these hypotheses, we conducted a within-subjects experiment to compare parent-child communication in our two family-friendly nature-oriented settings. Our measures include both interactional and individual language measures typical of the key measures used in studies of parent-child communication.

3. Method

3.1. Participants

Participants were 18 parent-child pairs (17 mother-child pairs, 1 father-child pair) (6 female children; mean age = 45 months, range = 35–56, SD = 5.72). Data from 3 additional pairs were excluded due to the child's reluctance to wear the recording equipment ($n = 1$) and to not adhering to the time allocated to each setting ($n = 2$). Table 1 displays information on the education level of the parents and also general information on the frequency of visits to parks in general and the test site specifically.

We focussed on three- and four-year-old children because basic language skills are generally established by this point, while more sophisticated communicative skills and social cognition are still emerging. At three and four years, children have the linguistic tools to engage in sustained conversational episodes but are still developing the interactional skills required for meaningful and balanced interactions. Our

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