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# At the Intersection of the Social and Physical Environments: Building a Model of the Influence of Caregivers and Peers on Direct Engagement with Nature

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**Abstract:** The movement to reconnect children to nature touts the many benefits associated with exposure to nature and encourages designers and planners of the physical environment to incorporate more nature into the daily lives of children. However, connecting children with nature may not be as simple as designing more nature into the physical environment. Variables beyond convenient availability of natural environments affect children's engagement with nature. Of particular interest is the influence of the social environment. The research seeks to build a model to understand the influence of caregivers and peers on a child's direct engagement with nature. An initial model of social influences was constructed from existing literature and refined from findings from an original research study, a qualitative investigation exploring the highly imaginative and social experience of a group of boys who played in a neighborhood creek (n = 3, boys, n = 2, parents). The most meaningful social influence on the boys' direct engagement with nature was the level of autonomy granted by caregivers; however, the physical environment supported the autonomy as well. The autonomy afforded an opportunity to navigate risks, forge long-term friendships, and support higher-order cognitive play behavior.

**Keywords:** children; dramatic/imaginative play; autonomy; hierarchical relationships; social identity relationships; attachment; reciprocal relationships

# 1. Introduction

In his 2005 novel, *Last Child in the Woods*, Richard Louv sparked a nationwide movement to reconnect children to the natural environment to combat what Louv describes as nature-deficit disorder which is not a medically diagnosed condition but more of a statement about the effect of children being isolated from the natural environment. Numerous studies may support Louv's assertion. Research suggests that children experience myriad benefits from engagement with nature. Exposure to nature may be a protective factor against myopia [1–4] and allergies [5–7]. Walks in natural environments, e.g., a park as compared to an urban downtown or neighborhood, have been correlated with improving scores on concentration tests in children clinically diagnosed with ADD/ADHD [8]. Living near natural elements in an inner city environment may improve self-regulation ability in girls [9]. Unstructured free play in nature during childhood may develop an affinity for nature that is associated with caring for the environment in adulthood [10,11].

Creating opportunities for children to engage with nature in the urban environment may become more and more difficult. The United Nations predicts that by 2050, 70% of the world's population



will live in urban areas [12]. With the trend of our society moving toward urbanism, nature may be pushed farther from children's daily lives. The solution may not be as simple as designing more nature into the urban environment. Variables beyond convenient availability of natural environments affect children's direct engagement with nature. The social environment, namely caregiver and peer interactions, influences the way in which a child engages with nature.

The article seeks to develop a model documenting the social environmental influences on a child's direct engagement with nature. An initial model was created from the existing literature through the lens of the four domains of social life: attachment, hierarchical, social identity, and reciprocal relationships [13]. Findings from an original research study further developed the model, namely the influence of the absence or presence of caregivers. The behavior described in the original research represented the highest forms of cognitive and social play, i.e., socially cooperative dramatic play and games with rules, according to Rubin [14]. Since these play experiences positively contribute to healthy child development, understanding how the social environment facilitated this play experience in nature is worth pursuing.

## 2. Methods

To begin the process of building a model of the influence of caregivers and peers on direct engagement with nature, an initial review of the literature was conducted. Searches utilized the following key terms: "parental influence" AND "nature", "nature recreation", "nature play", and "environmental socialization", in the following databases and journals: Google Scholar, psycINFO, psycARTICLES, Environmental Sciences and Pollution Management, the Summon, and Children, Youth and Environments Journal. A search of the citations within the search results and a search of citations which referenced the search results identified additional relevant articles. Selected articles provided details concerning the influence of the social environment on direct engagement with nature. Articles reported double-blind peer-reviewed original research; literature reviews, theory articles, and dissertations and theses were eliminated. The greatest sources of data were qualitative studies investigating environmental socialization. These articles typically included reflections of childhood pastimes which contributed to environmental pursuits in adulthood.

Data illuminating the influences of the social environment on direct engagement with nature were coded and sorted based on the four domains of social life: attachment, hierarchical, social identity, and reciprocal relationships [13]. Attachment relationships refer to the proximity between caregivers and a child during times of stress to protect the child's welfare [13,15,16]. Hierarchical relationships refer to adult control over resources to encourage submission and obedience from the child. Social identity relationships are ones which involve belonging to a group with a shared identity, rules, and customs. Reciprocal relationships refer to interactions which involve a mutual exchange of benefits that have a positive effect on emotions [13]. For adults, reciprocal relationships involved satisfying a child's reasonable request to ensure future compliance. For peers, reciprocal relationships involved engaging in activities which were mutually satisfying. Once sorted into the relevant domain of social life, similar data were grouped and themes emerged utilizing axial coding [17]. The themes addressed the ways in which caregivers and peers influenced a child's direct engagement with nature through attachment, hierarchical, social identity, and reciprocal relationships.

There were two main limitations of the literature review used to construct the initial model. First, the literature that framed the initial model largely utilized qualitative research methods and data analysis. The criterion of 'direct engagement with nature' precipitated the selection of articles disseminating qualitative research largely relying on recollections of childhood time spent in nature. The reliance on qualitative research was exacerbated by the original research study utilizing qualitative research methods and data analysis techniques to refine the initial model. The almost exclusive focus on qualitative research approaches highlights the need for a quantitative study to test the model since qualitative and quantitative research work together; qualitative research builds theory, and quantitative research generalizes to a larger population [18]. Future research should focus on quantifying the assertions of the qualitative data.

Second, the article utilized qualitative data analysis approaches, e.g., axial coding, so that data mined from the existing literature were not tallied but groups of similar data were identified, and themes emerged which illuminated the intersection of the social and physical environments. While tallies were not taken, three articles [19–21] from which data were mined produced many examples of direct engagement with nature. These articles also shared a data set; however, James et al. [20] and Vadala et al. [21] included additional research participants (n = 10) who represented a contrast group or people who did not seek opportunities to engage with nature as adults. The reliance on the three articles reiterates the necessity of quantifying the theory established by the qualitative research.

The initial model was tested using data from an original research study. A qualitative study investigated the experience of children living, playing, and exploring Raleigh, NC (n = 5; n = 3 boys and n = 2 parents) between 2002 and 2006 while they attended a local elementary school. The researcher became aware of the activity from a YouTube video [22] that Donna, a parent in the study, created to present at a conference. After contacting Donna, a snowball sampling technique was utilized to recruit participants; in snowball sampling, an insider or initial participant facilitates recruiting future participants [23]. The sample represented a chronological account of the activity, and the names of research participants were changed (see Figure 1). Chris had an older brother who played at the creek after school. Matt had a younger brother who played in the creek with the study cohort but could not find peers interested in playing in the creek once his brother graduated from elementary school. Chris, Matt, and their mothers were interviewed about the experience of the boys' siblings to document the uniqueness of the boys' experience at the creek.



**Figure 1.** The sample represents a timeline of the creek play. The uniqueness of the study cohort's play was established by the accounts of the experiences of Tom and Mickey.

The way in which these boys engaged with nature was unique. According to the boys and their parents, no generation before or since engaged with the creek in a similar capacity. Given the research's ontological assumptions of a Constructivist-Interpretivist account of reality where multiple versions of truth exist [24], the goal of the investigation was to neither prove nor disprove this claim of uniqueness; instead the participants' socially-constructed reality was accepted as legitimate. The physical environment supported the creek play for generations; however, the physical environment

alone does not completely account for the uniqueness of the boys' experience at the creek since no other cohort played in a similar fashion. Understanding the social influences of this unique experience of engaging with nature clarifies the influence of the social environment in how a child engages with nature, specifically how the presence or absence of caregivers influence children's activities in nature.

After receiving approval from North Carolina State University IRB, semi-structured interviews occurred in summer 2014 while the boys were attending college. A consistent level of information was gleaned from each participant, but the interview proceeded more like a conversation; interesting topics revealed within the interviews that were not pertinent to the interview questions were pursued in more detail. Interviews lasted between 1 and 2 h and were recorded and later transcribed. Data were analyzed utilizing the method conducted in the literature review; data were organized by the four domains of social life: attachment, hierarchical, social identity, and reciprocal relationships [13]. Similar data within these domains were grouped together and themes emerged.

Data saturation happened early in the interviews. In grounded theory research, data saturation refers to the point where the data contribute no new information to the understanding of the activity [25]. After interviewing the 5 participants, the data were saturated; the interviews revealed the same basic information. A limitation of the original research study is the early saturation of data which could be a product of the influence of the YouTube video. All participants watched the video multiple times, and the strength of this shared experience that cultivated long-term, intimate friendships could have influenced the boys' memory of events. From the beginning, the video introduced the school day was controlled by adults. The creek represented freedom; a place free from adult control. Childhood autonomy was highly promoted in the video. The cohort members interviewed saw the video and acknowledged the influence of the video on their reflection of this shared experience. The possible influence of the video may explain the influence of autonomy present in the interview data.

#### 3. An Initial Model of Social Environmental Influences on Direct Engagement with Nature

The current body of knowledge was consulted to propose an initial model exploring the influence of the social environment, namely caregivers and peers, on a child's direct engagement with nature. Clarifying what constitutes 'nature' is important. Kaplan and Kaplan [26] define 'nature' as any outdoor space where natural elements are present; however, the article utilized a more focused definition. For the article, 'nature' specifically referred to natural elements, i.e., a child's direct, tactile engagement with natural elements. Research with children that focuses on 'nature' involves identifying outcomes from simply viewing nature from a window [27,28] or having a close proximity to nature [9,28] or neighborhood greenness [29] to name a few. Views of or location near nature does not correspond with direct, tactile engagement with natural objects. Furthermore, articles investigating pro-environmental attitudes/habits, outdoor play/time spent outdoors, or physical activity do not equate to directly engaging with nature. This distinction may become more important as the body of knowledge concerning children and nature grows. Understanding correlations between outcomes and the precise ways in which children interact with nature may illuminate a more instructive route to designing the physical environment or providing experiences for children to interact with nature which may produce specific outcomes.

From the literature, caregivers and peers influenced a child's direct engagement with nature (see Figure 2). Adult influence on a child's engagement with nature occurred within the attachment, hierarchical, and social identity relationships. Perhaps the greatest influence of caregivers may derive from the level of autonomy granted. Peer influence on a child's engagement with nature occurred within the reciprocal and social identity relationships. No data conveyed details of peer influence within attachment and hierarchical relationships. The greatest influence of peers on a child's direct engagement with nature was a willingness to engage with nature. If a peer was not interested in engaging with nature, then they would neither lead nor facilitate engagement with nature.



**Figure 2.** Caregivers influenced children's direct engagement with nature by providing opportunities, controlling how children spent their time, granting autonomy, modeling behavior, and valuing playing in nature. Peer influence was seen in leading friends to nature, facilitating playing in nature and using nature play as a way to distinguish themselves and find friends.

# 3.1. The Influence of Caregivers within Hierarchical Relationships

Within hierarchical relationships, caregivers control resources, e.g., money, opportunity, and time, to encourage submission and obedience from the child [13]. Two themes within hierarchical relationships emerged: caregivers created opportunities to engage with nature and controlled a child's time. Caregivers created opportunities to engage with nature in myriad ways. They elected to live near nature [19–21,30–32] and chose natural vacation destinations [21,30,33], nature-centered child care programs [34], and forest schools [35]. They tolerated playing in nature by allowing children to come home muddy, permitting the collection of natural objects, and providing opportunities to play in nature [19–21,30,36–41]. Caregivers assigned outdoor chores involving nature, such as weeding planting beds and chopping wood [19] and controlled participation in structured activities with a focus on the natural environment [42].

Even if caregivers created opportunities for children to engage with nature, these experiences were not always positive, especially if participation was forced [43]. James et al. [20] described a participant forced to engage with nature under the regimented control of their father which cultivated an intense dislike of the outdoor environment in adulthood. "My father—he would always make us go to all these state parks and he'd read every single sign—we were bored to tears" [21]. These adult-controlled experiences negatively influenced the participants' propensity to engage with nature in adulthood [20,21]. Unlike the attachment relationship experiences where engagement with nature was facilitated through autonomy, engaging with nature through regimented or overly controlled hierarchical relationships may produce the opposite result. Without autonomy, adult influence over a child's engagement with nature within hierarchical relationships may negatively influence the child's engagement with nature in adulthood.

The second theme which emerged within hierarchical relationships was control. Implicit in the hierarchical relationship is adult control over a child's time and activities [44]. The literature revealed that adult control has changed over time. Skår and Krogh [42] conducted research with three

groups of Norwegians (n = 20; 18–72 years old): people who were children from 1945 to 1960, people who were children from 1960 to 1980, and current parents with children between 5 and 11 years old. Where previous generations had more autonomous time in nature, contemporary children had limited autonomous experiences in nature due to adult control of time. Home range, or the distance from home a child can travel autonomously, was not a variable in the lives of contemporary children since transport was provided exclusively by parents. In fact, contemporary parents were very present in their child's lives. Participants reported spending substantial amounts of time supervising children. In the narrative from Skår and Krogh [42], examples of parental control greatly increased from 1945 until now which limited a child's autonomous engagement with nature in Norway.

Control is a cornerstone of hierarchical relationships; however, with control, comes the potential for rejection of the control. Nature was portrayed as a refuge from control, a place to get away from adults and spend time with friends [21]. In investigating why certain playgrounds were visited, Jansson [45] posited that lack of use may be attributed to adult control of playground design. Children may recognize that playgrounds were designed by adults instead of children which may account for lack of use. "In playgrounds where variation and opportunities for fun activities had taken a back seat to safety and tidiness, children reacted negatively. Boring, predictable playgrounds lead to frustration and low use" [45]. The design of the physical environment may provide an antidote for these boring adult-controlled playgrounds. Jansson [45] found that natural areas adjacent to playgrounds created opportunities for den construction and imaginative play. These adjacent natural areas afforded the opportunity for children to create their own space which may diminish the boring aspects of playgrounds designed by adults.

In hierarchical relationships, caregivers influenced how a child engaged with nature by creating opportunities to engage with nature and controlling a child's time to spend in nature. Autonomy seemed to be important in creating these opportunities; experiences in nature under regimented adult supervision produced negative memories in a research participant. Rejection of adult control was present. Nature was reported as a place to flee from adult control or to reject adult-controlled environments since natural environments are malleable, e.g., den construction.

#### 3.2. The Influence of Caregivers within Social Identity Relationships

In examples of social identity relationships, two main themes emerged: value and modeling; caregivers assigned value on being in nature and modeled the type of behavior in nature that they expected from children. Caregivers assigned value on children playing in nature because they played in nature as children [19,46,47]. Caregivers allowed children to get dirty without negative consequences [19,21], tolerated interest in the outdoors [40], saved jars for children to collect insects and wildlife [21], and fostered an interest in the natural world [10,19,20,36,48].

Caregivers modeled the type of behavior in nature expected of children. A participant in the Bixler and Morris [30] study recalled that their parents modeled tolerance of inclement weather, "'My parents, they're very outdoorsy people. We've always done things outdoors. It's like my parents' philosophy, rain or shine. Tomorrow will be a better day, you wait and see and if it is still raining, but we always had fun and that was never a factor'" [30]. The value caregivers placed on engagement with nature was worth the risk of getting wet. Caregivers modeled behavior by directing a child's attention to natural elements, such as berry picking, plant identification, gardening, and hunting [10,21,36–38,41,48–51] and modeling good stewardship of the earth [10,20,36,41]. However, Evans et al. [52] found no correlation between the environmental values of parents to the values and behavior of children. Evans et al. [52] contributed the lack of correlation to the age of the participants (mean age = 6.8) in that as children age and mature, their values and behaviors may be more reflective of the parents.

Key to modeling behavior was the presence of scaffolded opportunities in nature. Scaffolding refers to offering children tasks which exceed their current ability level where peers and/or caregivers assist the child in accomplishing the tasks [53]. For example, caregivers scaffolded children's engagement with nature by teaching how to distinguish ripe berries from unripe berries and how to fish [10]. The result of the scaffolding experiences may be autonomy. The more scaffolding experiences children had in nature may led to more autonomous experiences in nature.

In social identity relationships, caregivers influenced how a child engaged with nature by assigning value to being in nature and modeling the type of behavior in nature expected of children. Like in hierarchical relationships, autonomy may be influential in social identity relationships. When caregivers modeled behavior in nature, they provided scaffolded learning opportunities that may support future autonomy. For example, if an adult believes that a child can effectively model appropriate behavior in nature, then they may be more apt to grant autonomy in nature.

## 3.3. The Influence of Caregivers within Attachment Relationships

Autonomy emerged as the main theme illustrating the influence of attachment relationships over engagement with nature which makes sense given that caregivers encourage children to become more autonomous with age in secure attachment relationships [54]. Autonomy is evident in the concept of home range [19,21] also referred to as field of promoted action [36]. Home range refers to the distance from a base, e.g., home or tent in a campground, a child can travel without adult supervision. Home range is a scaffolded experience; the range is smaller for younger children and increases with age and ability. Within this autonomous range, the quality of play tended to be imaginative and exploratory. "The novelty and freedom afforded by natural spaces motivated searching and exploring. Evident in the data was fantasy play that was facilitated by the availability of many objects to manipulate, live animals and few, if any, rules. The experiences are typified by a lack of adult supervision, orchestration, or structure" [20].

The presence of caregivers negatively influenced the way children engaged with nature. With autonomy, children engaged freely with nature without the worry of caregivers telling them, "'Don't touch that!' or 'Don't get that dirty!'" [36]. Tapsell et al. [55] recorded that children altered their behavior while playing in nature if caregivers were present. "As the children commented they would have behaved somewhat differently if they had been there with their friends unsupervised by adults".

In attachment relationships, caregivers influenced how a child engaged with nature by granting the freedom to explore autonomously. By granting a large home range, children had the freedom to explore nature without the adult supervision that was shown in some cases to alter a child's experience in nature. Additionally, home range is a scaffolded concept in that range increases with age and competency. In each social life domain involving caregivers and children, autonomy influenced the way children engaged with nature.

#### 3.4. The Influence of Peers within Reciprocal Relationships

In examples of reciprocal relationships in the literature, two main themes emerged: peers acted as leaders and facilitators in influencing peers to engage with nature. The influence of peer–peer reciprocal relationships was typified by children leading other children to engage with nature and facilitating play in natural environments. Peers acted as leaders by creating opportunities to engage with nature. Peers who were granted the opportunity to engage with nature either through attachment or hierarchical relationships with caregivers provided opportunities to engage with nature for their peers [19,30,37,38]. Certain peers led others in engaging with nature by establishing what was cool, e.g., being the dirtiest or muddiest [20,55]. The leadership role happened beyond peers of similar ages. Older peers were reported to escort younger children to these opportunities [45]. The leadership aspect of peer reciprocal relationships was not always positive. Sometimes peers led other peers to engage with nature to counteract a negative interaction. "And it's also the fact that these trees are here, and they've been here for hundreds of years, and okay, you've had an argument, your boyfriend's dumped you—but that tree is going to be there when you come back next time, so I think its [sic] almost like you know, kind of steady" [56].

A key aspect of reciprocal relationships is the mutual exchange of benefits. Peers facilitated the mutual exchange of benefits, i.e., engaging with nature by facilitating the exploration of the natural environment [20,21,30,55], fostering an interest in the natural environment [19,57], creating and achieving play objectives within the natural environment, e.g., jumping a creek or moving a boulder [36], and influencing the choice of play location, which may be in nature [45].

Regardless of the type of peer influence within reciprocal relationships, i.e., leader or facilitator, the peer must be interested in and/or willing to play in nature [21,31,36,55]. In order for the exchange of mutual benefits to occur, every party must be interested in or willing to engage with nature. Having a group of peers with a common interest in nature seems crucial for engaging with nature [21].

#### 3.5. The Influence of Peers within Social Identity Relationships

In examples of social identity relationships, two main themes emerged: peers engaged with nature to distinguish themselves and to find friends with common interests. The ways in which children engaged with nature distinguished themselves from other peers and assisted in finding friends. Peers engaged with nature to distinguish themselves. Children distinguished themselves by getting the dirtiest or the muddiest [55] and displaying bravery in the natural environment, e.g., not running away from a snake [19] or jumping a creek [55].

Gender may influence how children distinguished themselves when engaging with nature within social identity relationships. In the literature, boys often teased or chased girls with creatures, such as a snake [19] or slugs [37]. Additionally, a girl identified as a 'tom boy' since she preferred playing in nature. "I always kind of had more of a tomboy as far as ... playing monkey tag up in the trees, climbing trees, stuff like that. I probably always did more boy things than anything growing up" [21]. However, the use of social identity relationships to distinguish may transcend gender. Perhaps engaging with nature developed skills that children who did not engage with nature did not possess, such as observing nature. One participant (gender unknown) explained, "I'm different in that I see that much more. Driving down the road, what I see is much different from what other people see. My sister would drive home and not see a thing" [19].

Engagement with nature afforded the opportunity to find friends by connecting with like-minded people [19]. The natural environment afforded the opportunity for children to manipulate the environment through self-directed, unstructured play, such as fort building, exploration, and imaginative play, without the presence of adults [20]. "We did build forts. We had the same group of guys, so I remember we had bases set up at some point, you know, different points throughout the woods. And there were natural forts. We'd just gather sticks together and play behind them" [21]. In social identity relationships, peers engaged with nature to distinguish themselves from others. This distinction helped children to connect with like-minded peers to find friends.

### 3.6. Summary

From the literature, an initial model of the influence of the social environment on a child's direct engagement with nature emerged (see Figure 2). Caregiver influence occurred in five main ways: opportunity, control, value, modeling, and autonomy. Within hierarchical relationships, caregivers created an opportunity and controlled the amount of time and resources invested toward engaging with nature. Within social identity relationships, caregivers placed a value on playing in nature and modeled the type of behavior expected in a natural environment. Within attachment relationships, caregivers granted autonomy which facilitated a child's direct engagement with nature.

Peer influence occurred in four main ways: leaders, facilitators, distinguish, and find friends. Within reciprocal relationships, peers acted as leaders by directing others and as facilitators by enabling others to engage with nature. Within social identity relationships, peers used engaging with nature as a way to distinguish themselves among peers and to find friends with mutual interests.

In the literature, autonomy influenced the way children engaged with nature. In hierarchical relationships where caregivers created opportunities to engage with nature, the level of autonomy seemed to influence the quality of the experience, e.g., regimented adult supervision produced negative memories. In social identity relationships, caregivers provided scaffolded learning opportunities that

may support future autonomy in natural environments. What cannot be determined from the literature is the influence of autonomy granted within caregiver-child relationships on the engagement with nature in peer-child relationships. Examples exist within the literature that comment on the presence of caregivers altering the behavior of children e.g., [36,55], but no specific details are given as to how caregivers alter behavior; however, findings from an original research study clarify the influence of caregivers.

# 4. Model Refinement: Original Research

Findings from an original research study further developed the model of the social influences on a child's direct engagement with nature. A qualitative study investigated the experience of children living, playing, and exploring in Raleigh, NC (n = 5; n = 3 boys and n = 2 parents). The creek across the street from an elementary school became an after-school playground for children. Caregivers who collected their children after school avoided the long line of cars waiting by parking across the street at the creek. Once school ended, children safely crossed the street with the assistance of a crossing guard and joined their caregivers. Caregivers socialized or supervised children for approximately 30 min before leaving for home. Activity at the creek was typically functional play, i.e., very physical, and involved venting off the steam that had built over the course of the school day. The after-school creek play of the children has been a celebrated community activity for many generations. Some caregivers of children who currently play in the creek played in the creek as children.

The physical environment supported the creek play. The creek was not channelized or directed into a culvert but remained natural, above ground, and accessible. The creek was adjacent to an elementary school, and the presence of a crossing guard ensured the children's safe passage between the school and the creek. The topography, presence of neighboring homes, and surrounding vegetation provided a feeling of containment and contributed to a feeling of otherworldliness. While parents were keen to encourage engagement with nature, there was some initial concern about playing in a potentially polluted urban stream; however, Donna, a parent who participated in the study, expressed that the benefits of engaging with nature ultimately outweighed any concerns over water quality. "I had some concern about the creek being not clean, the water, but I wanted there to be more creeks and more options since this was really the only one around. I was looking for places like the creek, and we didn't have enough of them. The free places for kids to play. They were always being chased off property, so I thought it was a real gift to have the creek for them to play in". The neighborhoods were developed around the 1920s when neighborhoods were designed for pedestrians and not automobiles and were directly adjacent to downtown Raleigh, were walkable, had a well-connected sidewalk network, and supported independent mobility.

One cohort of boys had a very different experience at the creek; the boys who played in the creek from 2002 to 2006 engaged with nature in markedly different ways according to interview data. The study cohort was allowed to travel to and from school independently since they lived within a  $\frac{1}{2}$  mile radius. Their peers commonly played for approximately 30 min after school while their parents waited. Since no caregivers were waiting for the boys since they traveled to and from school independently, they played for another 1.5 to 2 h after their classmates and caregivers left. This extra time afforded by their autonomy greatly influenced how they engaged with nature. The play, which was functional or physical at first, evolved into the creation of a society complete with group affiliations, rules for trade, and currency. One boy developed 'Creek Currency', which was modeled on the US dollar. He printed and distributed the bills to be used during trade negotiations over objects found in the creek. Most of the negotiations occurred within store fronts that the boys constructed from dens created within an Elaeagnus hedge growing on the creek bank. After Christmas, the boys dragged discarded Christmas trees from the curb to the creek. They decorated the trees with found objects and celebrated Creek Christmas. The absence of caregivers fostered the boys' imaginative play.

#### 5. The Final Model: The Influence of Autonomy

The qualitative study supported the initial model but provided more clarity about the influence of caregivers on a child's direct engagement with nature, specifically the presence or absence of caregivers. The most meaningful experience that influenced the boys' engagement with nature was the level of autonomy granted by parents. The level of autonomy granted correlated with the imaginative nature of the play, confidence in navigating risk, and strength of friendships. Autonomy mediated the intersection of the social and physical environments (see Figure 3).



**Figure 3.** The Final Model. The intersection of the social and physical environments is mediated by autonomy.

The level of autonomy the boys experienced was age appropriate and consistent with their skill level. In the initial model, caregivers provided scaffolding opportunities for children to interact with nature in social identity relationships. As mentioned previously, scaffolding refers to offering children tasks which exceed their current ability level where peers and/or caregivers assist the child in accomplishing the tasks [53]. The boys were presented with scaffolded experiences of autonomy. Chris, who initially led the cohort to play at the creek, was taken to the creek as a toddler by his mother, Rose, while his older brother played there after school. Rose's efforts of scaffolding Chris' early creek play supported Chris' future autonomy and the future creek play of the boys.

In addition to Rose's scaffolding the experience at the creek, other caregivers were motivated to grant autonomy which influenced how they interacted with the boys. Donna explained, "The weirdness in my mind is the worry and the overprotection, and I have always tried to be a voice for the other side. I see it hurting children when parents are overly protective, and they project their fears on the kids, and so the kids absorb those fears and have a fearful attitude towards the world. I think

that is sort of the abnormal behavior". Their motivation toward autonomy influenced their choice of neighborhood. Caregivers chose to live in a neighborhood that supported autonomy. Donna explained, "I think it is more of an attitude of not worrying and making sure that our kids have exposure to as much as we can expose them to. You know, not trying to sequester them too much in a controlled and exclusive environment, which is one reason they have always gone to public school and one reason we lived downtown".

The physical environment supported the creek play experience by fostering direct engagement with nature (e.g., the creek was accessible and not channelized) and autonomy (e.g., the neighborhood was walkable). The social environment also supported the creek play not only through the initial granting of autonomy but the continued granting of autonomy since caregivers recognized the influence of autonomy on the boys' experience. Rose explained, "There really wasn't much close supervision at all, and we found that they usually did better if there wasn't because they were much more creative. They knew what they were doing". Stories of the boys' creative experiences in nature captivated caregivers and perpetuated the continuation of autonomy. Donna recalled her first time visiting the shop area the boys created in the Elaeagnus shrub, "They set up these shops along the creek. I was just fascinated. I went down there and thought, 'Wow!'". Donna also fondly remembered her sons' imaginative accounts of playing in the creek, "I remember them coming back and saying how they had found these huge cliffs and 'How could there be cliffs?', but there were these large sort of big rock faces, which in their mind were cliffs".

However, autonomy did not always mediate the relationship between the physical and social environments in positive ways. At school, the presence of caregivers negatively impacted the boys' behavior in the physical environment. The boys' teachers utilized characteristics of the physical environment to limit autonomy. Matt explained, "I think a lot of it was wanting to be unsupervised and have the freedom to do whatever you want really and kind of go wild because after being in school all day and having teachers telling you: 'You can't go behind the trees', 'You can't go in like certain corners'. On the playground you just are ready to learn for yourself and have some freedom and not have someone tell you what to do all the time". The way the teachers utilized the physical environment to restrict the boys' movements highlighted the extraordinary level of autonomy the boys enjoyed and deepened the boys' feelings of their experience at the creek. Matt described the creek as, "It was just like a sanctuary we could go".

As the boys aged, their level of autonomy increased as did their home range. After graduating from elementary school, the boys began to explore other areas of Raleigh, NC. Chris explained, "As we got older and we all got bikes and our parents let us roam around Raleigh as opposed to just the creek. Raleigh—I would say became our creek in a way because it was just then that was our place to explore". The scaffolding experience of autonomy continued. Given the boys' successful handling of the autonomy granted at the creek, caregivers were willing to allow the boys to explore areas farther from home. The caregivers recognized that the explorations cultivated in childhood extended into emerging adulthood. When the boys graduated high school, they attended different universities; however, they planned a summer adventure every year and their home range continued to expand. Rose acknowledged the boys' ability to successfully navigate risk as an outcome of the boys' early creek play. "I think that's one of the reasons why they can go explore you know a backwoods trail in California or you know a different country because they're used to exploring starting from a little tiny creek to downtown exploring a little bit more and the world is just you know one more, one more thing to explore". The boys were interviewed in 2014 after returning from Peru; they expressed pride in taking a trip to a foreign country without the safety of a tour group. From their experiences of autonomy as boys, they felt confident in their ability to successfully navigate risk in emerging adulthood. David explained, "I think not that many people do that. Where they go with like a group of their friends just to like explore. A lot of my friends are at [Appalachian State University] for instance are going out of country but like everyone that was going was like going through like a program or something".

The presence or absence of caregivers influenced the boys' engagement with nature and each other. Under the watchful eye of caregivers, the imaginative society the boys created may have perished. Much like their classmates who played at the creek, the boys' play was initially physical mainly swinging from a rope tied to a tree. As they became more familiar with each other, their play evolved into the imaginative experience of the adult-free society. The excitement surrounding the co-created society perpetuated the activity. Playing with a consistent group of friends over time in addition to the level of autonomy facilitated the creation of long-term friendships. Matt explained, "When I think about my friends, like my neighborhood friends, that I grew up with we will just like never go away. It's not an option. They are close as family to me".

The experience of Mickey, Matt's younger brother, demonstrated the influence of autonomy on the intersection of the physical and social environments. As endearing as the stories were, the society did not persist past the study cohort even though Matt's younger brother, Mickey, who played in the creek with the cohort, still attended the elementary school. His lack of peers who were granted a comparable level of autonomy meant the end of the imaginative society. Donna, explained, "I think my younger son, he was part of this group, too, but his peers, the parents were a different mind-set. He suffered from not having other kids that he could play with outside because they were all indoors or being driven to some arranged event. So, the range was really huge, the contrast between the two. I think that is really important to have a social group of kids that you can grow up with ... you were comfortable outside".

#### 6. Discussion

The initial model examined the existing literature to understand the intersection of the physical and social environments, specifically how the social environment influences a child's direct engagement with nature. An original research study refined the initial model by providing insight into the influence of an adult's presence or absence on a child's direct engagement with nature, specifically absence and level of autonomy. Of all the ways the social environment influences the way a child engages with nature, autonomy may be the most meaningful variable. From both the existing literature and the original research study, autonomy mediated the intersection of the social and physical environments.

In the original research study, the caregivers granted autonomy for numerous reasons. First, they were inclined to grant autonomy. They provided scaffolded opportunities of autonomy which supported autonomy in later childhood; as the boys aged, their home range expanded. Caregivers did not schedule the boys in after-school activities; they allowed the boys to choose their extracurricular activities. Second, caregivers recognized that the physical environment supported autonomy. They chose to live in a neighborhood which supported autonomy with a well-connected sidewalk network and an elementary school in close proximity. They allowed the boys to independently travel to and from school.

The initial model found that play in nature was more exploratory and imaginative without adults present [19,20,45,55] which was supported by the original research. The absence of caregivers and the autonomy that the boys experienced greatly influenced the way in which the boys engaged with nature. Without adult supervision, the boys felt uninhibited and free to immerse themselves completely into their co-created fantasy world of their adult-free society. In that world, the boys gained confidence in their ability to manage risk and forged long-term friendships.

The influence of autonomy within the social environment on engagement with nature is interesting given the lack of autonomy experienced by the current generation. Research suggests that contemporary children experience less autonomy than previous generations. Children experience more time in structured adult-led activities when compared to children from previous generations. As mentioned earlier, Skår and Krogh [42] documented the decrease in autonomy over three generations in Norway. The trend is also common in the United States. Between 1981 and 1997 in the United States, a child's free time dropped by almost 25%, which is possibly due to an increase in time spent in structured activities [58]. In the age of tiger moms, helicopter parents, and smothers (smothering mothers), over-parenting is perceived as good parenting; however denying children autonomy has

developmental consequences. Lythcott-Haims [59] wrote about her experience as Dean of Freshmen at Stanford University and the shift she observed in parental involvement increasing to a point where undergraduate students lacked a strong sense of self and basic skills necessary to function in adult life.

Since children may receive myriad benefits from engagement with nature, finding ways to connect children with the natural environment is important; however, the way children engage with nature may be important developmentally. For example, the research site, the creek in Raleigh NC, has supported predominately functional play, i.e., physical play, for generations. Children are engaging with nature and getting physical activity, but is that enough? The cohort of boys who played in the creek from 2002 to 2006 engaged with nature in markedly different ways than preceding or following cohorts; their play was more socially cooperative and imaginative than the functional play of their peers. The distinction of play type may be important for healthy development. Rubin [14] classifies imaginative (dramatic) play and games with rules as requiring more mature cognitive resources than functional (physical), constructive, and exploratory play. Environments which support higher-order cognitive play may facilitate the development of cognitive skills and appeal to older children who are more cognitively mature than younger children. In addition to being concerned about connecting children with nature, the type of connection should also be considered. While functional play and physical activity level are important components of development, so are higher-order cognitive play. By granting children autonomy, play in nature tends to become more social and imaginative and supports higher-order cognitive functioning. Future research should focus on finding ways to design physical environments that support autonomy for children in addition to incorporating nature into their daily lives.

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