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Beyond Physical Activity: The Importance of Play and Nature-Based Play Spaces for Children's Health and Development

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Abstract The reduction of child obesity continues to be a challenge worldwide. Research indicates that playing outdoors, particularly in natural play spaces, boosts children's physical activity, potentially decreasing childhood obesity. We present evidence that natural play spaces also provide for more diverse forms of play for children of varying ages and competencies. This is crucial because play spaces designed expressly for physical activity may not increase physical activity among less active children. Moreover, when researchers only examine physical activity in play, they overlook the valuable contributions that play makes to other aspects of children's health and development. To enhance research on children and their play environments, we introduce the theory of play affordances. To assist in the creation of more natural play spaces, we describe the Seven Cs, an evidence-based approach for designing children's play spaces that promotes diverse play. We end with some preliminary insights from our current research using the Seven Cs to illustrate the connections between play, nature, and children's healthy development.

Keywords Playground · Environment · Design · Landscape architecture · Obesity · Natural

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Introduction

Multi-disciplinary research on children's play has identified the cognitive, social, and physical health and developmental benefits that it affords children [1–5]. Children's play is self-motivated, and children engage in play for their own sake of enjoyment. Structured play usually occurs at a specific place and time scheduled by adults (the school soccer field at three o'clock, for example). Adults typically organize and monitor structured play as well. Unstructured play or free play can occur anywhere. It is not planned or led by adults, but is spontaneous and directed by the children themselves. In fact, play has been deemed so critical and fundamental to childhood that the right to play has been enshrined in the United Nations Convention on the Rights of the Child [6]. In recent decades, outdoor play has been encouraged as a means to promote physical activity and stave off risk factors such as obesity, hypertension, and dyslipidemia [7, 8]. For example, the Director of the Obesity Center at the U.S. Centers for Disease Control considered play the "only requirement" for promoting physical activity [9]. Likewise, the 2012 Canadian annual report card on the determinants of children's physical activity focused on engagement in active play [10].

Active play involves physical activity that produces moderate to vigorous spurts of energy that can increase a child's heart rate. The duration and intensity of active play changes as children develop. Research indicates that children are more physically active when playing outdoors [11–14]. A recent systematic review examining the relationship between outdoor play, physical activity, and sedentary behavior found positive effects of time spent outdoors on physical activity and fitness outcomes [15]. While participating in organized physical activity (e.g., sports, classes) is important, it is unlikely to sufficiently meet the recommended 60 min per day of moderate-to-vigorous physical activity [16]. Children are

typically active less than 25 % of the time spent in organized activities, whereas time spent in outdoor play tends to be proportionately more active [17, 18]. One study reported that 6- to 11-year-old children were active ~41 % of time outdoors compared to 18 % indoors [11].

On the whole, the evidence indicates that promoting outdoor play can have a significant impact on children's physical activity. Our concern is that in limiting the scope of interest in play to children's involvement in physical action or movement, a more nuanced understanding of the value and importance of play might elude research and policy work in the area. Moreover, this limited scope might hinder efforts to create outdoor play spaces that provide for a rich variety of play opportunities that support broad developmental and health outcomes.

Researchers have proposed that the focus on play as a means to promote physical activity and health can devalue play as an end in itself [19, 20]. Limiting this diverse and complex behavior to a specific instrumental purpose can marginalize diverse forms of play that are not active, and reshape children's conceptions of play as purposeless—a defining characteristic of play [19, 21]. Recent research indicated that this instrumental notion of play has influenced children's descriptions of play. In interviews with Canadian children aged 7 to 11 years old, Alexander et al. found that some children reproduced active play messages and construed physically active play as superior to other types of play [22].

We suggest that this discourse can have unintended negative consequences for the promotion of physical activity, particularly for children who are the *least* active. While the American Academy of Pediatrics recommends that physicians and health care professionals promote a wide variety of healthy activities, they recognize that children are more likely to comply if the activities are mostly unstructured and fun [23]. In this paper, we provide evidence that supporting diverse forms of play is the optimal approach for ensuring that children maintain the sense of play as intrinsically motivated, purposeless and fun, and that other developmental and health benefits, including physical activity, will naturally follow. We further propose that natural play spaces are among the most versatile venues for strengthening the link between children's health and development and play. To this end, we outline the theory of play affordances, features of the environment that enable play, and the Seven Cs, a practical evidence-based approach for designing children's play spaces that promote diverse play. We also present preliminary findings from our research on two play spaces designed using the Seven Cs to illustrate the influence on children's play behavior.

The Diverse Play Affordances of Natural Play Spaces

Outdoor play consists of a combination of sedentary, light, moderate, and vigorous activity. When children are asked about play, they highlight the importance of fun, pleasure, choice, and freedom [24•, 25]. If these qualities are absent, they no longer consider it play, and it can influence their interest and engagement [25]. The types of play children enjoy are as diverse as children themselves and differ based on their competencies and developmental stages [22, 25]. Some children may prefer physically active play with other groups of children, others may prefer imaginative play with one or two friends, or may prefer both of these kinds of play at different times. Play spaces that provide for different kinds of play opportunities (i.e., affordances) are more likely to engage a greater proportion of children and for longer amounts of time [26–29].

Psychologist James J. Gibson's theory of affordances has provided a useful framework for designing and studying children's outdoor play spaces. He proposed that the environment and the objects and features of that environment *afford* the possibilities for numerous types of actions [30]. A tree with reachable, sturdy branches affords climbing, for example. Gibson also argued that affordances were particular to the type of environment and the type of user. The tree will not afford climbing for an infant or a person in a wheelchair. Since the concept of affordances is also based on the individual, it is particularly valuable when considering children because they are developing, and the affordances of their environments change as they develop.

Evidence indicates that natural play spaces and natural elements in children's play spaces can increase affordances for play, providing for more engaging play spaces [31, 32]. Natural play spaces are outdoor playgrounds that contain plants, sand, terrain, rocks, water, or other natural elements as sources of play. Play spaces where natural elements are installed for decorative purposes only, or where children are prohibited from engaging with the material, are not natural play spaces. Another aspect of natural play spaces is the integration of any play structures with these natural elements. Natural outdoor play spaces differ from play-equipment-based playgrounds, which comprise standardized equipment and rubber matting, also referred to as KFC—Kit, Fence, and Carpet playgrounds [33]. Natural play spaces *afford* unstructured play while KFC playgrounds typically provide prescribed activities. The slide on a KFC playground is designed for the express purpose of sliding in a seated position, and adults will often prevent children from using the apparatus in other ways, such as climbing up the slide or sliding down headfirst. In contrast, at a natural play space, boulders arranged in a field can provide for multiple uses, such as climbing, jumping, sitting, scaling, etc.

Barbour examined the play behaviors and peer relationships of high physical competence children and low physical competence children on two different playground designs [34]. In playground A, all of the equipment was exercise-oriented with limited space for other forms of play, and the only loose part was a ball that could be requested for play in

the adjacent sports field. The equipment on playground B also supported various types of active play, but the configuration accommodated children engaging in other activities, and included various loose parts (e.g., blocks, planks, tires, pails, sports equipment), thus providing more affordances for play. Findings indicated that playground A promoted the physical activity of the high physical competence children. In contrast, the low physical competence children, who lacked the skills or confidence to engage in the limited activities afforded by this playground, had less opportunities for physical activity and motor development. In addition, the limited options for play resulted in increased segregation based on physical competence. Because playground B provided more affordances for play, there was less segregation, and more opportunities for children with low physical competence to gradually develop and master their physical skills [34].

Herrington et al. describe "channel surfing" play as characteristic of children who are struggling to find an engaging play activity [35]. This occurs when children rapidly shift from one activity space to another, just like a person in search of something interesting to watch on television. While channel surfing can be very physically active, it can also result in shorter durations of play because children are less engaged [36•].

An observational study of 59 children (26 girls and 33 boys) compared play on a contemporary (KFC) playground versus a nature-based playground [37•]. Researchers measured play episodes and play duration, and found that the two types of play spaces afforded different types of active play. Almost 60 % of play episodes on the contemporary playground lasted 5 min or less, and 35 % lasted 6–11 min. No play episode lasted more than 15 min. In contrast, play episodes on the nature-based playground were longer, with more than 7 % of episodes lasting beyond the 30-min observation period. They also noted that children playing on the nature-based playground were engaged in more complex and diverse play, while children in the contemporary playground spent a lot of time queuing to use the equipment, an activity not witnessed on the nature-based playground [37•].

The direct link between natural elements in play spaces and physical activity has also been investigated. A study of sedentary behaviors and moderate-to-vigorous physical activity levels in preschoolers before and after a KFC playground was redesigned with more natural material found that a significantly greater proportion of children engaged in moderate-to-vigorous physical activity after the redesign compared to pre-design use [38]. A study of the effects of greening elementary school grounds in Canada found that 50 % of the respondents reported that their school grounds promoted more vigorous activity after greening, and 70 % reported increases in light and moderate physical activity among children [39].

Designing for Play Affordances

Since equipment-based or KFC playgrounds are so prevalent in North America, efforts to enhance the play affordance of children's outdoor play areas can be challenging. Adults often have very fond memories of playing on trees, rocks, and in ditches, streams, and forests as children [40]. However, it can be difficult to visualize ways to introduce these elements into current play spaces to create an unstructured nature-based play space. In response, Herrington et al. developed the Seven Cs criteria for designing such play spaces [35, 41]. The Seven Cs criteria were developed through a review of the literature, and research examining the affordances for outdoor play for toddlers and preschoolers at 16 outdoor play spaces at childcare centers in Vancouver, Canada. Research included field observations, focus group interviews, center-wide workshops with early childhood educators (ECEs), and videotaping children using the play spaces [35, 41]. We are currently scaling up the Seven C's to address older children playing in school grounds and parks.

The Seven Cs consist of:

Character indicates the overall feel of outdoor play spaces and includes light quality (is the light balanced or dappled?), color differentials, and the presence of soft material.

Context involves how the play space interacts with its surroundings. Is the play space on a rooftop, at-grade, or below grade? Have climatic conditions been addressed, and are there physical or visual connections to the surrounding context? For example, rooftop play spaces that allow for views down to a city can provide opportunities for understanding the workings of a city itself. In an at-grade or below grade context, if the center is in a dangerous neighborhood, has the play space been screened from its surroundings?

Connectivity indicates the physical and visual connectedness of the play space. Connectivity is linked to physical and cognitive development. For example, a hierarchy of pathways can chart movement in a play space and helps children understand the play area in time and space. Another example of connectivity is the linkage between indoors and outdoors. According to Reggio Domes Academy Research Center, children inside the center should be able to sense what is happening outside—from natural changes, such as the seasons, to cultural changes, such as the daily activities of neighbors [36•].

Change refers to the range of differently sized spaces designed in the play area and how theses spaces change over time. Change is linked to cognitive and emotional development. By age three, most children are able to distinguish orders of magnitude, such as scale [42]. A range of spaces that accommodate varying amounts of

children should be provided in the outdoor play space. Likewise, Olds points out that private spaces for children at child care centers are crucial to development because they allow retreat and enable children to accommodate their mood and temperament [43].

Time change refers to change in the play space over time and is linked to cognitive and emotional development. By age three, many children engage in careful watching and observing of their daily environment; its patterns and sequences over time. Living things from plants to animals can signal changes in the seasons and growth in general. Plants not only modify sun and wind in the outdoor play space, but the flowers, seeds, and leaves produced by this living material can provide play props for children.

The *Chance* criterion provides an opportunity for children to create, manipulate, and leave an impression on their outdoor play space. By age three, many children are developing their fine motor skills and they are capable of creating other worlds, and even people [42]. An example of chance opportunities are what Greenman refers to as messy zones [44]. These are areas of the play space that have sand, mud, water, and loose parts that enable children to manipulate their environment. [39]. Chance also accommodates spontaneous exploration, which links physical and cognitive development by prompting children to explore and discover [45].

Clarity integrates physical and perceptual legibility. By age five, for most children, visual tracking and binocular vision are still not well developed, so play spaces should create enough mystery to promote spontaneous exploration, but not confusion that will detract children from investigating the play space. Shaw finds that isolated equipment fragments play, interrupting the continuous flow of activities [46]. Likewise, when a large play apparatus is installed at the geographical center of a play space (a common location for these structures), children have trouble maintaining play involving movements like tag. Additionally, early childhood educators have difficulty seeing the whole play space.

Challenge refers to the available physical and cognitive challenges that a play space provides. A growing body of research indicates that risk taking in play is important for children's health and development, helping them learn about their own potential, how to navigate the environment, and manage risks in other settings [47–50]. Play spaces should challenge children to take risks without being hazardous. The difference between "hazard" and "challenge" must be understood when creating play settings. Hazards are potential sources of harm where the potential for injury may not be readily apparent to children. Challenges can be recognized and evaluated, allowing children to decide whether and how to engage with the activity [49]. Regardless of design intentions, children will use equipment and explore play spaces to maximize potential affordances, testing the environment and themselves to the limit of their abilities [47]. Specifically, challenging play spaces should have equipment at varying heights, there should be climbing opportunities, an ample flat open space for running and playing ball, bike paths that are defined and looped, grassy slopes to roll down, stepping stones or logs, swings, bars to hang from, and slides that are at a challenging height.

Seven Cs On the Ground

In our study, Risky Play Meets Nature Play, we used the Seven Cs to install natural, challenging material in the outdoor play spaces of two preschool childcare centers that were lacking these elements. In addition to collecting data on socio-metric status and social competence evaluations, focus groups with ECEs, accelerometry, and videotaping, we also created behavioral maps to study children's movement before and after the installation.

Figures 1 and 2 are aerial views of one of the outdoor play spaces before and after installation. These maps illustrate the existing play equipment, boulders, sand area, vegetation, and

Fig. 1 This is a plan view of the outdoor play space showing movement and pauses of the same child playing for thirty minutes before the installation. The *red line* is the movement and the *red dot* is the pause. Drawn by Sara Brunelle

Fig. 2 This is a plan view of the same outdoor play space showing movement and pauses of the same child playing for thirty minutes after the installation. The *red line* is the movement and the *red dot* is the pause. Drawn by Sara Brunelle

fencing as if flying over the play space. The lines trace the same child's movement during a 30-min play session. Dots indicate a pause to engage with an element. Our preliminary data analyses on these maps suggest changes in the patterns of children's spatial movement, directionality, and pauses before and after installation. We noticed that prior to the installation, children were more likely to engage in channel surfing and repetitive movements such as walking back and forth, which indicates boredom. In Fig. 1, prior to installation, the child is pacing back and forth in several locations, and engages with the elements in the play space only three times. In Fig. 2, post-installation, the dots indicate that there are more pauses to engage with the environment. In the post-installation, the pattern of movement is spatially more complex and intense as the child weaves in and out of the planted areas.

These preliminary analyses suggest that the children were more engaged with play post-installation, even though we waited at least 2 weeks (to reduce the effects of novelty) to begin videotaping, mapping, and use of the accelerometers. This was also reflected in the focus groups with staff. One of the complaints expressed by ECEs at both centers was children's reliance on the adults to create play experiences and limited ability to play on their own in the pre-installation play space. After installations, ECEs at both centers reported that children were less bored and did not need to rely on ECEs for their play ideas. In short, our preliminary findings add to the evidence base in illustrating the connection between children's diverse play and natural play spaces, and indicate the utility of the Seven Cs in promoting affordances for play.

Conclusion

Unstructured outdoor play is one of the most valuable play activities for children, but opportunities have diminished over the years [51–53]. A Harris Poll Online of 355 pediatricians found that the majority of pediatricians (88 %) agreed that the availability of quality play spaces for unstructured play was important to children's overall development, and 59 % believe that unstructured play has an important role in reducing childhood obesity [54]. Unfortunately, 75 % reported that the amount of time their young patients spend engaged in unstructured play had decreased in the previous 5 years.

Promotion of physical activity should not be the only objective when designing children's outdoor play spaces, nor the sole outcome measure in research. Supporting diverse affordances for play through the thoughtful design of play spaces can encourage children's engagement in play, with physical activity as a side effect. Natural elements, such as trees, shrubs, water, boulders, and sand in outdoor play spaces, can offer more play opportunities and moderate environmental conditions, such as sun and wind, compared to outdoor play spaces that lack these features. Increased engagement with the environment can potentially counter boredom or channel surfing, and thoughtfully designed play spaces with natural elements are effective in prompting this engagement for a greater diversity of children. As the "secret ingredients" of children's health and development, play and nature cannot be substituted with other measures or materials.

Compliance with Ethics Guidelines

Conflict of Interest Susan Herrington and Mariana Brussoni declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article contains information from the Risky Play Meets Nature Play study, which involved human subjects. Consent was given by the parents of children observed and with the Early Childhood Educators interviewed. The Children's and Women's Health Centre of British Columbia Research Ethics Board approved these procedures.

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