The Comparison of Cognitive Play Affordances Within Natural and Manufactured Preschool Settings

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Abstract

Development of urban areas has lead to the degradation of outdoor environments affording daily play opportunities for children (Johnson & Hurley, 2002). This is partly due to possible hazards of outdoor urban spaces, destruction of close natural spaces, and parental fear of danger. These conditions create demands for child-friendly neighborhoods and city spaces where children can play freely while they have daily experience and contact with nature (Moore and Wong, 1997).

Outdoor environments contribute to the development of visual motor integration, verbal and social skills, assertiveness, and imagination (Striniste & Moore, 1989). Additionally, literature has revealed that interacting with nature and the community during childhood can develop "mental and physical well being, experiential learning, place attachment, community participation, cultural awareness, and ecological literacy" (Johnson & Hurley 2002, p. 111). Despite these benefits, reduced supervision time for adults has led to an increased number of children spending time in preschools. On one hand, it is necessary for landscape architects to design preschool spaces as a medium that can afford various developmental aspects, facilitate free play freely, and afford their developmental requirements. However, dominated by traditional playgrounds, outdoor environments as learning spaces for children in preschools are often neglected (Francis, 1990). Researchers agree that providing specific elements in the outdoor space for children will increase the quality of space and influence children's cognitive development (Stine, 1997). This study focused on afforded cognitive play behavior of a preschool setting composed of natural and traditional playgrounds to hypothesize about the potentiality of each in stimulating cognitive play, and consequently learning. The results indicate the potentiality of natural elements to afford more cognitive play behavior opportunities compared to the manufactured ones.

Play and Cognitive Development

Play is the "intrinsic motivation, active engagement, attention to means rather than ends, non-literal behavior, and freedom from external rules" (Chermayeff, Blanford & Losos, 2001, p. 47). In fact, play is a child's way of learning about the world through exploring and experiencing it (Piaget, 1951; Chermayeff et al., 2001). Subsequently, the physical environment must provide variable opportunities for children to engage and develop their skills (Moore, 1985). Research confirms the fundamental influence of play on children's social, cultural, affective, cognitive, language, and physical ability development (Monore, 1985). The greater the variety of experiences available and opportunities for creative and constructive play for children, the more they acquire cognitive development. On the other hand, not much is known about cognitive and social behaviors of children in outdoor space (Henniger, 1985). Smilansky (1968) has described cognitive play behavior based on Piaget's (1951) categories as follows: Functional play—simple repetitive muscle movements with or without objects; Constructive play—manipulation of objects to construct or create something; Dramatic play—the substitution of an imaginary situation to satisfy child's personal wishes and needs; and Games with rules—the acceptance of prearranged rules and adjustment to these rules.

Outdoor Learning Environments

Children require outdoor learning environments that support their need to explore and attain knowledge and develop emotions for a place (Hart, 1979). Moreover, opportunities to solve problems and choose are significant factors supporting children's play behavior (Jones and Reynolds, 1992). Complex and varied outdoor environments endorse play activities while developing a sense of cooperation (Moore & Wong, 1997). They assist children with fewer skills and various learning styles to work together (Moore, 1986). With proper instruction, formal learning in educational settings can be transformed to other learning types, independent of the physical world (Moore, 1986). This learning that happens outside of the formal classroom is known as the "non-formal education." Activities that contribute to this education can include: "field observation; discrimination of sensory attributes; collecting; sorting; classification; record keeping; enumeration," and more (Moore & Wong, 1997, p: 195).

Comparing Natural and Traditional Playgrounds

In designing playgrounds, we should consider the fact that children not only need spaces to burn excessive energy but also to develop their social and cognitive abilities through various and potent physical environments (Ellis, 1970). Although contact opportunities with

natural elements in outdoor playgrounds are decreasing for children (Rivkin, 1990), natural playgrounds can provide these opportunities for children by affording them complex and exciting interactions that are not supported by other playgrounds (Frost, 1992; Parnell & Ketterson, 1980).

Children will learn and play more effectively in engaging places that can be created through landscape architecture. These spaces can be designed to motivate a sense of wonder through natural elements while children learn by involving spatial, experiential, and tempered qualities of nature (Johnson & Hurley, 2002). Three qualities make natural playground environments more complicated and attractive for children: diversity, not being built by humans, and a sense of timelessness (Prescott, 1987). The results of Fjortoft and Sageie's (2000) study of natural environments as a playscape for children indicated that children were aware of the functions afforded by the environment, while natural features afforded a variety of play types. They found a positive relationship between play activities and the diversity of the vegetation types and physical characteristics of trees and shrubs.

In contrast to natural playgrounds, fixed traditional equipment shows low attendance and can offer a limited type of play forms (Naylor, 1985). These types of playgrounds have limited natural features and lack experimental opportunities for children (Parnell & Ketterson, 1980). In fact, children find natural landscapes more attractive than traditional playgrounds (Moore and Wong, 1997).

Conceptual Framework and Research Questions

The main concern in this research is identifying the cognitive play behavior affordance of playground settings based on predefined objective codes. Referring to Gibson's (1986) point of view of affordances and ontological aspects of this research, we can assume that the cognitive play affordance in the playgrounds are potential real qualities and meanings, independent from the researcher and existing in the setting that can be actualized and knowable (Groat and Wong, 2002). Based on the conceptual framework described, this study will explore this main question:

How do natural playgrounds, compared to traditional ones, afford cognitive play behavior for preschool children? Also, these sub-questions were analyzed: (1) How do the playground elements afford cognitive play behavior? Is there any difference between natural and manufactured elements? (2) What activities do the natural and traditional elements in the playground afford? Is there any difference? (3) What elements do children prefer (natural or manufactured)?

Methodology

The Bright Horizons SAS preschool located in Cary, N.C., was purposefully selected for this study. The playground of this preschool setting has been designed by the NLI team to function as a natural and traditional playground that could provide a desirable comparison opportunity. Through behavior mapping, empirical data about occurring behaviors and the associated physical environmental features were obtained. The recess for all children occurred simultaneously. Also the 4 to 5 year-old children played in a certain part of the playground. However, for this age group, the classes were divided into two different time intervals to play in each playground equally.

Procedure

The observation procedure was through a systematic circulation of the observer within the playgrounds based on pre-defined zones (Figure 1). This procedure included following a predefined path and the recording of behaviors in preselected zones within defined locations. Locations and interval numbers were recorded within the map while variables were entered into the other paper. Additionally, in some instances photographs of children were taken to capture fast movement behaviors. Overall observation sessions took place within the time sequence of 9:30 to 11:00 a.m. The observation sessions included 11 observation rounds, while each observation was based on a three-minute period in order to allow the observer to record the data. When one round finished, the observer was in the first place she started. Also, the observer refrained from contacting and communicating with the children. After the behavior mapping had been completed, the data was put into GIS software indi-

Figure 1. Predefined zones within the setting

cating locations of observation data points with their attributed data for further interpretation. In this way, the analysis of activities occurred in association with cognitive behavior and playground elements and became more convenient. Coding of the cognitive behaviors was based on Smilansky (1968). Activity coding was based on previous affordance categorizations. Manufactured features coded were benches (benches, seat or table), box, club house, hard paved surface, pergola, pipe, poles, raised platform, rope, shelter, slide, spring, statue, steps, and jungle gym platform (structure platform). Natural elements were coded as trees (trees, bushes or leaves), wood chips, raised garden, soil, and sand. The analysis of the results was based on chi square correlation formulas for nominal values.

Results

The behavior mapping data collection resulted in 234 data points based on children's cognitive play behavior and affordance provided by the playground features (Figure 2). The results categorized based on research questions are as follows.

(1) How do the playground elements afford cognitive play behavior? The coded cognitive play behaviors afforded by the playground elements is displayed in Table 1. These results indicate that proportionally, soil and hard surface afford more cognitive play behavior, while shelter, statue, pipe, and poles afford the least. This means that that the actualized afforded behavior by elements is significantly diverse. Moreover, the findings indicate a distribution difference within cognitive play behavior types afforded by elements. For instance, the results reveal that hard paved surface affords the most functional play behavior; sand affords the most constructive behavior; soil affords the most imaginative behavior; and raised platform and play structure platforms afford the most games with rules.

Categorizing the elements into natural and manufactured elements (Table 2), the results imply that the overall proportion of afforded cognitive behavior types is not significantly different in both element types. However, overall natural elements significantly afforded 25 percent more cognitive play behavior opportunities than manufactured elements.

(2) What do the design elements in the playground afford? The results of the behavior mapping based on the affordance provided by the features influencing children's activity is displayed in Table 3. They indicate that sand, soil, tree (and vegetation), and box are the elements affording the largest variety of activities (Figure 3). Additionally, elements like pole, steps, or shelter afford the fewest types of play behaviors. According to

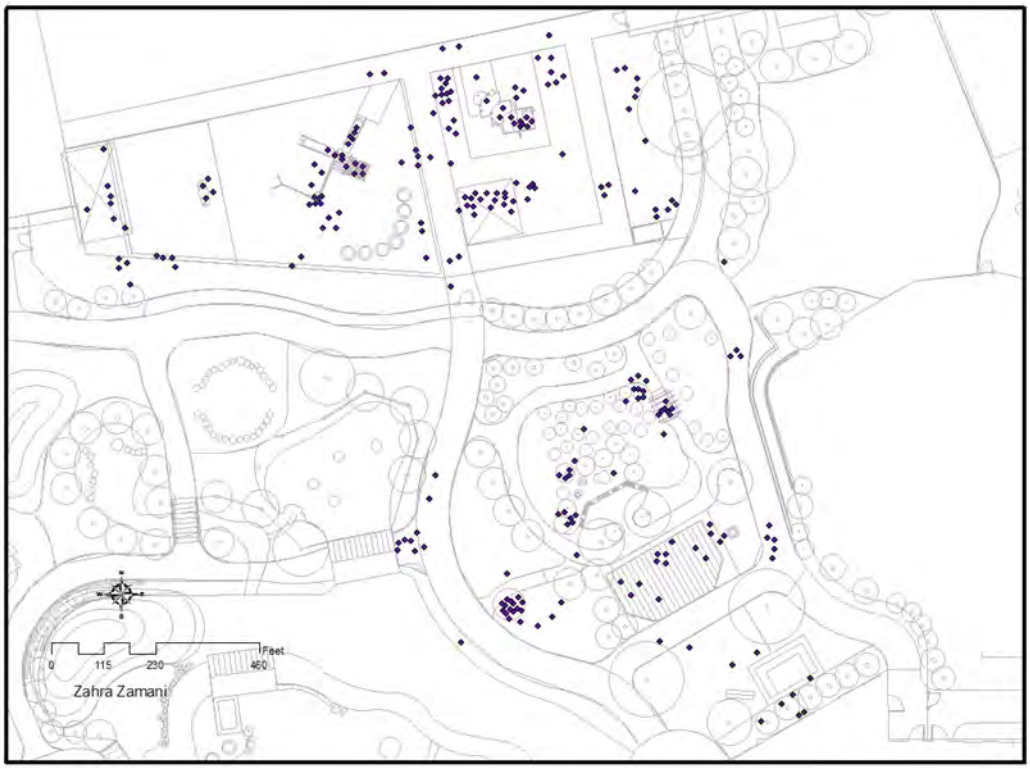

Figure 2. The results of the behavior mapping

the sum of afforded behaviors, soil, trees, sand, raised platform, and the hard pathway surface have the most actualized affordances. However, springs, steps, pipe, and shelter show the least number of actualized affordances. The results also reveal that sand significantly affords more manipulative behavior compared to other elements. Additionally, the hard pathway surface meaningfully affords more walking behavior than the other elements.

element	Functional	constructive	imaginative	group	no play	sum
bench				3	4	7
box	7	1	3			11
club				5		5
garden			3			3
hard surface	32				1	33
pergola			5			5
pipe		1				1
pole	2		1			3
raised platform	8		4	8	4	24
rope	2					2
sand	7	29	2		3	41
shelter					1	1
slide	2					2
soil	10	11	8	5	2	36
spring	2					2
statue			1			1
steps	4			3		7
structure platform			3	4	4	11
tree	15	5	3		1	24
wood chips	9	4			2	15

Table 1. Cognitive play behaviors afforded by playground elements

The overall actualized affordance of the natural and manufactured elements show no significant difference (Table 4). The outcomes also reveal that natural and manufactured elements have different potentiality in affording some behaviors. In other words, manufactured elements significantly afford more balancing, catch play, cycling, sitting, supporting, and walking. However, running, picking fruit, manipulating, and exploring were significantly afforded more by natural elements. In fact, manipulation affordance is shown to be 31 percent greater in natural elements compared to manufactured ones. Additionally, it was interesting to find "running" to be afforded 6 percent more by natural elements than manufactured ones.

Discussion

Natural settings also provide a variety of "loose parts" that enable children to shape their environment, developing their creative and constructional cognitive abilities (Moore, 1985; Moore and Wong, 1997). The results confirmed previous studies about the potentialities of loose elements for children's cognitive development. Additionally, it indicated that fixed manufactured elements afforded the least cognitive play behavior for children (Campbell & Frost, 1985; Fjortoft & Sageie, 2000). The findings support previous research that explains how the implication of diverse environments (natural and manufactured) affords diverse play behavior (Cosco, 2007). In fact, children actualized both natural and manufactured elements for their associated cognitive play affordance. This was because each element afforded different behavior more potentiality. It was interesting to find that the cognitive play behavior categories within natural or manufactured elements were not different. However, the results confirmed the predefined hypothesis that natural playgrounds afford more cognitive play behavior for children.

element	functional	constructive	imaginative	group	no play	sum
manufactured	82	98	32	10	16	238
natural	130	176	50	15	27	398
z	0.46	0.38	0.32	0.27	0.03	8.97
	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	P<0.05

Table 2. Cognitive play behavior afforded by natural and manufactured elements

Table 3. The activity affordance provided by each element in playgrounds																				
	balancing	catch	climbing	Cycling	exploring	picking up	hiding	imagining	jumping	look out	manipulate	picking up	pulling	Running	standing	sitting	sliding	supporting	walking	sum
bench	2															3		2		7
box	4								3		2					1		1		11
club								5												5
garden					1			2												3
hard surface				5						1				5					22	33
pergola			1								2				2					5
pipe					1															1
pole																		3		3
raised platform	6	8						4	1							4				23
rope													2						1	3
sand					2						29			2	3				5	41
shelter															1					1
slide																	2			2
soil		2			6			4		1	9			5	4	1			4	36
spring	2																			2
statue								1												1
steps			7																	7
structure platform							3			3					5					11
tree			3		6		2		1			11						1		24
wood chips											4			6	1				4	15

Table 3. The activity affordance provided by each element in playgrounds

Table 4. The activity affordance of manufactured and natural elements																				
	balancing	catch	climbing	Cycle	exploring	picking up	hiding	imagining	jumping	look out	manipulate	picking up	pulling	running	standing	sitting	sliding	supporting	walking	sum
manufactured	14	12	8	5	1	0	3	10	4	4	4	0	2	5	8	8	2	8	23	121
natural	0	2	3	0	13	0	2	6	1	1	42	11	0	13	8	1	0	1	13	119
z	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-	1.75	0.18
P (one tail)	P<0.05	P<0.05	-	P<0.05	P<0.05	-	-	-	-	-	P<0.05	P<0.05	-	P<0.05	-	P<0.05	-	P<0.05	P<0.05	p<0.05

Table 4. The activity affordance of manufactured and natural elements

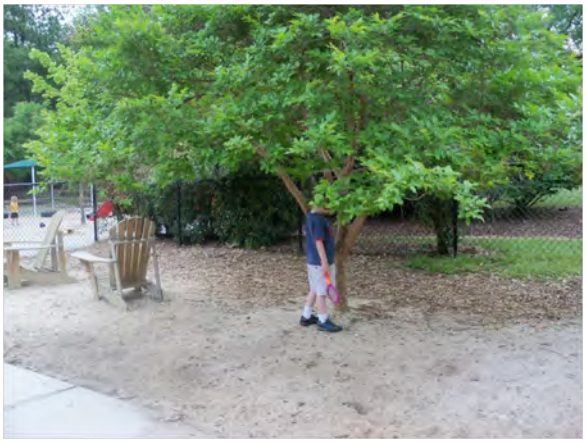

Figure 3. A child exploring a tree

Studies have shown that children are attracted to elements that afford complex play activities and manipulation (Campbell & Frost, 1985). These activities are supported by the existence of loose elements, in which children can imagine various functions and stories for an associated element (sticks, rocks, etc.) Results of this study indicated that loose parts afforded more diverse activities, especially natural elements (Cosco, 2007). In fact, previous research has also found that children find natural environments to be less boring than manufactured ones due to the variety of activity they afford (Lee, 1999; Frost & Strickland, 1985).

The results support the potentiality of natural environments for exploration, manipulation, and gross physical activity (Moore & Wang, 2007; Cosco, 2007). In fact, the findings of Fjortfoft and Sageie (2000) show that the existences of natural feature in playgrounds (trees, hills, grass, and sand) have a positive relationship in the amount of children's gross motor activities. Observing running activity to be more afforded by the natural surfaces supported this finding. Additionally, the way elements such as trees or sand afforded a variety of activities and movements intensifies the significance of these natural features in creating complex and diverse playground environments.

Conclusion

Utilizing the framework of ecological psychology, especially the concept of affordances, the results confirm the significance of natural elements in children's playground environments. In fact, natural elements actualized more constructive and imaginative play behav-

ior than manufactured elements, while supporting more diverse opportunities. Also, children preferred play elements that offered something to do (is movable), or are complex (several play choices) that can be adapted to their play themes rather than stationary ones that limit their play choices. Hence, playground designers should combine these essential elements within the setting, in a diverse pattern, to create an effective learning environment. Additionally, when combining natural elements within playground settings specific safety guidelines should be followed. However, it should be considered that the safest playgrounds are weakest in providing the affordances and challenges for children (Fjørtoft and Sageie, 2000). Moreover, research on various preschool outdoor settings and age groups can solidify the conclusion. Furthermore, the implication of behavior mapping facilitated the understanding of affordances and the way children perceive and actualize them. Hence it can be an effective tool to evaluate the actual use (actualized affordances) of spaces after they have been created.

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