ARCHDESIGN '18 / V. INTERNATIONAL ARCHITECTURAL DESIGN CONFERENCE

ARCHDESIGN '18

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OUTDOOR PLAYGROUND LANDSCAPE DESIGN AND CHILDREN'S COGNITIVE DEVELOPMENT

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Abstract
Active play is important for the overall development of children and specific types of play have been linked to different aspects of development. In particular, previous research has linked constructive and pretend play to cognitive development. To date, the impact of outdoor playground landscape design on play behavior and children’s development has received little attention. Thus, this study investigates the potential impact of the landscape design of playgrounds on the occurrence of constructive and pretend play and on children’s cognitive development.

The research was carried out in two playgrounds in Cairo, Egypt. The two playgrounds were selected to be similar in terms of socio-economic context and play equipment but different in terms of landscape design. Structured, person-centered observations of 30 randomly selected children playing on each of the two playgrounds were conducted to measure differences in the occurrence of constructive and pretend play. With another sample of 14 children from each playground, cognitive development was assessed through a drawing cognitive skills assessment test. Results indicate significant differences in the amount of constructive and pretend play occurring in the two playgrounds. There were also significant differences in the evaluations of cognitive skills between the children of two playgrounds. The results strongly suggest that the appropriate landscape design of playgrounds can help promote the occurrence of constructive and pretend play and, consequently, help promote the cognitive development of children.

Keywords: Playground Landscape Design, Pretend Play, Constructive Play, Children's Cognitive Development.

1. Introduction
Children explore, discover, and understand the world around them primarily through play. Active play is also recognized to be important to the proper development of children (Moore & Wong, 1997; Frost et al., 2001; Blinkert, 2004). The literature distinguishes between different types of play including functional play, constructive play, dramatic play, and games-with-rules (Hughes, 2010; Rubin, 2001). Specific types of play have been shown to promote different aspects of child development (Metin, 2003). For example, functional play has been linked to physical and motor skills development (Weilbacher, 1981; Barbour, 1999) and games-with-rules have been linked to social development (Reifel & Yeatman, 1993; Coplan et al., 2015). More specifically
relevant to the current study, constructive and pretend play have been associated with cognitive development (Susa & Benedict, 1994; Petrakos & Howe, 1996; Wardle, 2000; Bergen, 2002; Zamani, 2013, for recent review see Lillard et al., 2013).

Outdoor playgrounds are one of the main settings specifically designed to accommodate children’s active play. Accordingly it is certainly important to investigate the potential impact of playground design on the occurrence of different types of play and on the development of children (Maynard & Waters, 2007; Berg, 2014).

Previous research that has looked at the impact of playground design on play behavior and child development has tended to focus on play equipment design (Moore, 1985; Susa & Benedict, 1994; Ihn, 1998; Barbour, 1999; Metin, 2003; Afsharlahoori, 2007; Maxwell et al., 2008). However, to date, the impact of playground landscape design has received little attention (Moore & Wong, 1997; Cosco et al., 2010; Kuh et al., 2013; Luchs & Fikus, 2013; Podolska, 2014; Alaa, 2015).

The objective of this study is to investigate the potential impact of playground landscape design on the cognitive development of children. More specifically, the study looks at the impact of playground landscape design on (1) types of play behavior that have been associated with cognitive development, namely constructive and pretend play, and (2) the cognitive development of children as measured through a drawing cognitive skills assessment test.

2. Method

2.1. Research design

The study relies on a causal comparative survey research approach (Groat & Wang, 2013). It compares two outdoor playgrounds located in Cairo, Egypt, in terms of occurrence of constructive and pretend play and in terms of children’s cognitive development as evaluated through a drawing cognitive skills assessment test. The two playgrounds - the playground of Heliopolis Sporting Club (HSC) in Heliopolis and the playground of the Al-Ahli Sporting Club (ASC) in Nasr City - are similar in terms of socio-economic context (middle to upper middle socio-economic levels) and total area (about 2000 m² each). The two playgrounds also feature very similar play equipment including composite structures, merry-go-round, climbers, seesaws, slides, and swings. In terms of play equipment design, they can be both characterized as "traditional playgrounds" rather than "contemporary playgrounds" or "adventure playgrounds" (see Erikson, 1985; Heseltine & Holborne, 1987; Susa & Benedict, 1994; Wardle, 2000). However, as detailed in the following section, the two playgrounds are clearly different in terms of landscape design.

It should be noted that, in Cairo, the access to clubs such as those where the two playgrounds are located is strictly restricted to members and their children, for whom these clubs tend to be the main destination for the practice of sports as well as for recreational and social activities. Therefore, they are visited quite frequently. In fact, it was confirmed by parents of children playing in the two playgrounds that, along with playgrounds that may exist in their schools, the club playgrounds are the playgrounds their children have most frequent and regular access to (from 2 to 3 times a week when school is in session to almost every day during school
vacations). It appears then reasonable to assume that the two playgrounds selected for the study have an important role in the lives of the children sampled from the playgrounds for data collection.

2.2. The landscape design of the two playgrounds

As mentioned above, the two playgrounds selected for the study are very similar in socio-economic context, total area, and type of play equipment, but they vary greatly in terms of landscape design. More specifically, the two playgrounds differ in terms of (1) the spatial definition of play sub-areas, (2) the definition of pathways, (3) variety in ground materials used, (4) variability in ground level, (5) amount and type of vegetation, and (6) the amount of shading provided.

The playground of HSC (see figures 1 and 2) is subdivided into a number of play sub-areas. There is a pathway network connecting between the three entry points and the different sub-areas of the playground. The pathways are well defined with the use of a distinct material – stamped concrete. In fact, the design of the playground features a variety of ground materials including, in addition to concrete for the pathways, artificial grass in the different play sub-areas and rubber tiles at the locations of play equipment. The playground is also characterized by variability in ground levels through the presence of steps and slopes. For example, there is an area of seating steps. Also, the play sub-areas are designed into small hills slightly sloping up from pathway level. There is a large amount of vegetation in the playground including shrubs and flowery plants, palm trees, and large shading trees. These shading trees provide relatively large shaded areas. The use of various ground materials, varying ground levels, well-defined pathways, and vegetation helps achieve a good spatial definition for the different play sub-areas.

On the other hand, the playground at ASC (see figures 3 and 4) is designed as a flat large single undivided space with a single entry point. It is depressed a few steps below club level and it is surrounded by a granite-covered parapet. For the entire playground, rubber tiles is the only ground material used. There are no defined pathways. Also, the playground features only a limited amount of vegetation, primarily small trees. These small trees do not really provide shading. Dispersed around the playground, there are seven elevated granite-covered bases, 4 of which are designed as tree planters, the remaining 3 are lamp post bases.

In sum, compared to the ASC playground, the HSC playground is characterized by better spatial definition of play sub-areas, better definition of pathways, greater variety in ground material used, greater variability in ground levels, more vegetation, and more shading.

2.3. Data collection

For both playgrounds, sessions of data collection were conducted on similar days of the week (including week days and weekends), at similar times of the day, and in similar weather conditions between January and June 2017. Data collection included both structured child-centered behavioral observations to measure the occurrence of constructive and pretend play on the two playgrounds and a drawing cognitive skills assessment test to evaluate the cognitive development of children.
Figure 1. View of HSC playground

Figure 2. Layout of HSC playground
Figure 3. View of ASC playground

Figure 4. Layout of ASC playground
2.3.1. Structured observations

For each playground 30 randomly selected children of 6 to 12 years of age were observed. The selection of the children insured a similar number of girls and boys in each of the two samples (15 girls and 15 boys). Furthermore, the two samples were perfectly matched in terms of age (a similar number of children of a particular age in each of the two samples). Consent for participation in the study and ages of the children were obtained from accompanying parents. On the two playgrounds, each child was observed for 40 minutes. The observational table used was adopted from the tables developed by Cosco et al. (2010) and Podolska (2014). The table helped to record in one-minute increments the amount of time the child engaged in different types of play: functional play, constructive play, pretend play, games-with-rules, and no play. Based on the definitions provided by Rubin (2001) the different types of play were operationalized as follows:
1. Functional play: simple repetition of muscle movement, with or without objects.
2. Constructive play: the child links previous knowledge of functional play to manipulate objects towards a direct goal, which can be construction or creation.
3. Pretend play: an imitative activity in which a child imagines and acts out various internal and social roles and situations, such as rocking a doll, pretending to be a doctor, nurse, or school teacher.
4. Games-with-rules: is a level of play that imposes rules that must be followed by the players. Games-with-rules are often characterized by logic and order, and, as children grow older, they can begin to develop strategy and planning in their game playing.
5. No Play: coded during on-looking, transitional, conversation, or unoccupied behavior.

The observation table was tested through pilot study sessions in the two playgrounds. For this pilot study, the same observations were conducted independently by two observers which allowed checking for reliability. Reliability was calculated by dividing the number of minutes agreed on by the total number of minutes of observation and was found to be quite high (0.91). The analysis of the data collected included the performance of Student’s t-tests to evaluate differences in play behavior between the two playgrounds.

2.3.2. Drawing cognitive skills assessment test

Another sample of 14 children from each of the two playgrounds was randomly selected to conduct the drawing cognitive skills assessment test. Children selected were 5 to 12 years of age and the two samples were exactly matched by age. Also, the selection of the children insured a similar number of girls and boys in each of the two sites (7 girls and 7 boys). Consent for participation and the age of the children was obtained from accompanying parents.

To break the ice before being asked to take part in the test (Christidou et al., 2013), each child was engaged in a brief friendly conversation by one of the researchers with experience in working with young children. Then, each child was given the same drawing material and instructed to draw the playground as it currently exists and the activities that typically take place there. No time restriction was put on the children to complete their drawings.

A large developmental psychology literature confirms that drawings can be used to assess the cognitive development of children (Luquet, 1927; Piaget, 1956; Kellogg, 1970; Silver, 1983). However, because both the
drawing abilities and cognitive skills of the children develop with age, the assessment of cognitive development from drawings needs to be age-related (Luquet, 1927; Matthews, 1984; Cox, 1992). Therefore, the 14 children from each playground were divided into two age groups of 7 children; a group of 5 to 7 years old and a group of older than 7. For each age group, a different set of criteria was used to evaluate cognitive development. Children from the age of 4 to the age of 7 correspond to a pre-schematic drawing stage. Accordingly, for the younger age group, cognitive skills were evaluated by rating drawings in terms of two criteria: (1) accuracy of elements represented and (2) amount of detail in elements represented (see Luquet, 1927; Piaget, 1956; Kellogg, 1970; Silver, 1983). On the other hand, children older than 7 enter the schematic drawing stage. Accordingly, for the older age group, cognitive skills were evaluated by rating drawings in terms of six criteria: (1) accuracy of elements represented, (2) amount of detail in elements represented, (3) accuracy of overall playground scene, (4) amount of detail in overall playground scene, (5) visual realism in terms of accuracy of spatial relationships, and (6) visual realism in terms of perspective and representation of depth (see Luquet, 1927; Piaget, 1956; Kellogg, 1970; Silver, 1983).

For each child’s drawings, each of the criteria was independently rated on a five-point Likert scale by three raters: two university faculty with experience in the teaching of visual studies courses for architectural students and a kindergarten and primary school art teacher. For each drawing, the measure of each of the criteria was taken as the average of the three independent ratings. Student’s t-tests were conducted to analyze differences between the two playgrounds.

3. Results

The following sections present the results of the analysis of the data collected in the two playgrounds through the structured observations of play behavior and the drawing cognitive skills assessment test.

3.1. Differences in play behavior between the two playgrounds

While no real difference in occurrence of “functional play” and "games-with-rules" was observed between the two playgrounds, the occurrence of both "constructive play" and "pretend play" was much greater at HSC than at ASC. In addition, there was much more "no play" at ASC than at HSC (see Table 1).
Table 1. Differences in play behavior between the two playgrounds

<table>
<thead>
<tr>
<th>Types of play behavior</th>
<th>HSC playground n=30</th>
<th>ASC playground n=30</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of children engaged</td>
<td>Mean minutes per child</td>
<td>Standard deviation</td>
<td>No. of children engaged</td>
</tr>
<tr>
<td>1- Functional play</td>
<td>25</td>
<td>11.30</td>
<td>7.69</td>
<td>27</td>
</tr>
<tr>
<td>2- Constructive play</td>
<td>15</td>
<td>7.60</td>
<td>9.61</td>
<td>2</td>
</tr>
<tr>
<td>3- Pretend play</td>
<td>19</td>
<td>10.43</td>
<td>9.85</td>
<td>3</td>
</tr>
<tr>
<td>4- Games-with-rules</td>
<td>12</td>
<td>5.73</td>
<td>9.02</td>
<td>3</td>
</tr>
<tr>
<td>5- No play</td>
<td>18</td>
<td>4.93</td>
<td>6.07</td>
<td>18</td>
</tr>
</tbody>
</table>

Although the same number of children were observed to engage in "no play" behavior at both playgrounds (18 children in each playground), there was a very clear difference between the playgrounds in the observed total number of minutes of "no play". The total number of minutes of "no play" behavior recorded at the HSC playground was 148. However, at the ASC playground, as much as 594 minutes of "no play" behavior was observed. The difference between the two playgrounds in mean minutes of "no play" behavior per child (4.93 for HSC and 19.8 for ASC) was found to be statistically significant.

At the HSC playground, 25 children were observed to engage in "functional play" for a total of 339 minutes. The numbers for the ASC playground were not very different as 27 children were observed to engage in "functional play" for a total of 438 minutes. In fact, the difference between the two playgrounds in mean minutes of "functional play" per child (11.3 for HSC and 14.6 for ASC) was not found to be significant.

For "games-with-rules", 12 children were observed to engage in this type of play behavior at HSC for a total of 172 minutes. At ASC only three children engaged in "games-with-rules" for a total of 85 minutes. However, the difference between the two playgrounds in mean minutes of "games-with-rules" per child (5.73 for HSC and 2.83 for ASC) was not found to be significant.

More directly relevant to the objectives of this study, 15 children were observed to engage in "constructive play" at HSC for a total of 288 minutes. At ASC there was clearly less occurrence of constructive play. Only two children were observed to engage in this type of play at ASC for a total amount of time of 31 minutes. The
difference between the two playgrounds in mean minutes of "constructive play" per child (7.6 for HSC and 1.03 for ASC) was found to be statistically significant.

There was also a clear difference in the occurrence of "pretend play" between the two playgrounds. As many as 19 children were observed to engage in this type of play at HSC for a total of 313 minutes. At ASC, only three children engaged in "pretend play" for a total of 52 minutes. Here again, the difference between the two playgrounds in mean minutes of "pretend play" per child (10.43 for HSC and 1.73 for ASC) was found to be statistically significant.

Differences between girls and boys in relation to both "constructive play" and "pretend play" were also analyzed. For both types of play behavior no significant difference in mean time per child was found at the ASC playground. At the HSC playground, while there was no significant difference in relation to "pretend play", there was a significant difference in relation to "constructive play" between girls and boys with girls observed to engage more than boys in this type of play behavior.

Across playgrounds, for both "constructive play" and "pretend play", the differences were found to be statistically significant in favor of both girls and boys of HSC.

3.2. Differences in evaluations of drawing cognitive skills assessment tests

In general, for both age groups (5 to 7 and older than 7), drawings of the children from the HSC playground tended to be of a higher complexity, including a greater number of elements represented and a greater amount of detail than the drawing of the children from the ASC playground. Furthermore, the drawings from the HSC playground tended to show a greater use of colors and tended to feature more natural elements (such as grass, flowers, and trees) than the drawings from the ASC playground (see Figures 5 and 6).

As previously mentioned, for the "5 to 7" age group, cognitive skills were assessed by evaluating drawings in terms of two criteria: (1) accuracy of elements represented and (2) amount of detail in elements represented. For both criteria, mean ratings of HSC drawings were higher than those of ASC drawings and the differences between the two playgrounds were found to be statistically significant (see Table 2).

For the "older than 7" age group, cognitive skills were assessed by evaluating drawings in terms of six criteria: (1) accuracy of elements represented, (2) amount of detail in elements represented, (3) accuracy of overall playground scene, (4) amount of detail in overall playground scene, (5) visual realism in terms of accuracy of spatial relationships, and (6) visual realism in terms of perspective and representation of depth. Here again, for all six of the criteria, mean ratings of HSC drawings were consistently higher than those of ASC drawings and the differences between the two playgrounds were also found to be statistically significant (see Table 3).

4. Discussion and conclusion

As detailed above, the analysis of the data collected yielded significant differences between the two playgrounds in amount of constructive and pretend play occurring and in the cognitive development of children as evaluated through a drawing cognitive skills test. These results thus show an association between landscape design and the occurrence of constructive and pretend play, an association between landscape design and cognitive development, as well as a positive relationship between the amount of constructive and pretend play
and cognitive skills. The causal-comparative survey research design on which this study relied cannot permit to establish causality (Groat & Wang, 2013). Nevertheless, results of the study appear to confirm that increased constructive and pretend play contributes to the cognitive development of children (see also Wardle, 2000; Bergen, 2002; Lillard et al., 2013; Zamani, 2013). Furthermore, results of the study strongly suggest that the landscape design of outdoor playgrounds, independently from play equipment, can make a difference in the amount of the time children engage in constructive and pretend play. Consequently, this study suggests that the appropriate landscape design of playgrounds can help promote the cognitive development of children.

The specific differences between the two playgrounds investigated can help propose an interpretation for the differences observed in the amounts of constructive and pretend play. More constructive play and more pretend play were observed at the HSC playground than at the ASC playground. In contrast with the ASC playground, the HSC playground was characterized by a clearer definition of play sub-areas, a clearer definition of a pathway network, a greater variety in ground materials used, a greater variability in ground level, and a greater amount of vegetation including trees and other types of plants. The landscape design characteristics of the HSC playground may be promoting a greater range of play behavior by offering children a greater number of affordances (Gibson, 1977). For example, a greater variety in ground materials used will afford a greater range of play behavior. Soft materials such as rubber tiles and artificial grass permit tumbling and acrobatic moves while hard materials such as concrete permit running, biking, and playing with wheeled toys. Also, ground level variability through steps and slopes will afford sitting, jumping, sliding, and rolling. The presence of trees will afford climbing and, through the shaded areas provided, relaxing and conversing. In addition, the variability that characterizes the landscape design of the HSC playground may promote the imagination and creativity in play that are important to constructive and pretend play. For example, variety of ground materials may help create an island in the middle of the ocean, differences in levels may allow a child to sky-dive, tree leaves may help young cooks prepare a salad, a pathway network may become the streets of the city, and a well spatially defined sub-area may become a home or a fort to defend.
Figures 5. Cognitive skills assessment test, drawings of 5 to 7 age group
Figures 6. Cognitive skills assessment test, drawings of more than 7 age group
## Table 2. Difference in evaluations of drawings between the two playgrounds (5 to 7 age group)

<table>
<thead>
<tr>
<th>Drawing cognitive skills assessment test</th>
<th>HSC playground n=7</th>
<th>ASC playground n=7</th>
<th>T-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean rating</td>
<td>Standard deviation</td>
<td>Mean rating</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>1- Accuracy of elements represented</td>
<td>3.30</td>
<td>0.85</td>
<td>2.1</td>
<td>0.94</td>
</tr>
<tr>
<td>2- Amount of detail in elements represented</td>
<td>3.05</td>
<td>0.67</td>
<td>1.95</td>
<td>0.97</td>
</tr>
</tbody>
</table>

## Table 3. Difference in evaluations of drawings between the two playgrounds (older than 7 age group)

<table>
<thead>
<tr>
<th>Drawing cognitive skills assessment test</th>
<th>HSC playground n=7</th>
<th>ASC playground n=7</th>
<th>T-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean rating</td>
<td>Standard deviation</td>
<td>Mean rating</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>1- Accuracy of elements represented</td>
<td>3.62</td>
<td>0.97</td>
<td>1.71</td>
<td>0.90</td>
</tr>
<tr>
<td>2- Amount of detail in elements represented</td>
<td>3.67</td>
<td>0.80</td>
<td>1.52</td>
<td>0.68</td>
</tr>
<tr>
<td>3- Accuracy of overall playground scene</td>
<td>3.23</td>
<td>1.26</td>
<td>1.71</td>
<td>0.85</td>
</tr>
<tr>
<td>4- Amount of detail in overall playground scene</td>
<td>2.77</td>
<td>1.22</td>
<td>1.29</td>
<td>0.56</td>
</tr>
<tr>
<td>5- Visual realism in terms of accuracy of spatial relationships</td>
<td>3.44</td>
<td>1.28</td>
<td>1.38</td>
<td>0.67</td>
</tr>
<tr>
<td>6- Visual Realism in terms of perspective and representation of depth</td>
<td>3.24</td>
<td>1.30</td>
<td>1.43</td>
<td>0.60</td>
</tr>
</tbody>
</table>
A number of suggestions for future research can be made. First, there is of course a need for research to confirm the findings of this study and investigate the interpretation of the results proposed above. It cannot be claimed that the evaluation of the cognitive skills through the drawing test used in this study provides a complete assessment of cognitive development and future research will need to use more comprehensive assessments of children’s cognitive capabilities. In addition, there is a need for research to investigate the generalizability of the current findings to other socio-economic contexts in Egypt but also to other cultural contexts in other countries. Future research will also need to extend the scope of this study to other types of play behavior and other aspects of children’s development. Finally, there is a need for research to more specifically investigate the potential impact of various landscape aspects and various landscape designs of playgrounds on play behavior and children’s development to better inform designers and landscape architects.

References


Podolska, M. C. (2014). The impact of playground spatial features on children’s play and activity forms: An evaluation of contemporary playgrounds’ play and social value. West Pomeranian University of Technology (ZUT), Szczecin, Poland.


