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Affordances of Ditches for Preschool Children

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Abstract

This study aims to expand understanding of the affordances provided by ditches in a Danish preschool context. Affordances are defined as the meaningful action possibilities of the environment. At a forest preschool, a group of 21 children aged approximately 3 to 6.5 years accompanied by two or three staff members walked to various sites in the forest and stayed for two to five hours every day. The researcher observed the children's activities and the features they used at 15 different forest sites during all seasons, following an ethnography-inspired, participant observation approach. Ditches offered varied and changing action possibilities for the preschool children. The paper discusses the possible incorporation of this largely unrecognized design element by planners and managers of green spaces and playgrounds for children in preschool.

Keywords: ditches, affordances, preschool, forest school, outdoor play

> *It is seldom that a few square yards of land can be so joyful for people as in a preschool yard with its very intense social environment with so much activity going on* (Mårtensson, 2004, p. 132).

Introduction

For many years the number of Danish children aged 3-5 attending preschool on a daily basis has been rising. However, for the last six years the number has been stable at around 97 percent (Danmarks_Statistik, 2013). An increasing number of children are growing up in urbanized areas, given the fact that more than half of the world's population lives in cities today (United Nations, 2014). This constitutes a pressure on urban space that includes the institutional outdoor areas connected to preschools. In Denmark staying outdoors is regarded as healthy, and most preschool children stay outdoors at least two hours a day. Children's outdoor settings at preschools are most often playgrounds with traditional equipment such as swings, slides, sandboxes, playhouses, and climbing structures surrounded by bigger or smaller areas of green.

Visiting green settings such as public parks and nearby woodlands, either occasionally or on a regular basis, is a way to increase the outdoor action possibilities available for preschoolers. In Scandinavia and Northern Europe, for more than a generation alternative outdoor preschools have existed at which groups of children stay outdoors all day or part of the day, every day or most days, in woodlands, parks and other natural and semi-natural areas not originally planned for preschools.

Studying green settings and specific features used by outdoor preschools can contribute design ideas for green spaces and playgrounds (Lerstrup & Refshauge, 2016). An ethnographic study in a forest preschool resulted in the classification of ten types of affording features, including "Sloping Terrain" (Lerstrup & van den Bosch, 2016). The ditch is a special kind of sloping terrain made for drainage; it is hollow and has a direction in the landscape.

Ditches afford specific and attractive activities beyond the general affordances of sloping terrain (ibid.). We chose the ditch for further analysis, since it is a modest and underrated feature for children in preschools. Specifically, the research question of the present paper is: What are the meaningful action possibilities of ditches for children in preschool?

Literature Review

Outdoor Preschools

Several studies have investigated the impacts on preschool children of spending time in green settings during school hours. Sick leave was lower in preschools with rich green settings compared to paved settings in Sweden (Grahn, Mårtensson, Lindblad, Nilsson, & Ekman, 1997) and in outdoor preschools compared to traditional preschools in Denmark (Krøjgård, 1996; Vigsø & Nielsen, 2006). Children in Swedish preschools with rich and green outdoor settings were leaner

and slept better compared to children from preschools with more simple outdoor settings (Söderström et al., 2013), and in Sweden and the U.S. the level of physical activity was higher and the exposure to sun was lower in rich outdoor settings (Boldemann et al., 2011). Children attending outdoor preschools showed better gross motor skills in Norway (Fjørtoft & Sageie, 2000), Switzerland (Kiener, 2004a; Lettieri, 2004), Germany (Scholz & Krombholz, 2006), and Denmark (Vigsø & Nielsen, 2006). In one study, fine motor skills were better in outdoor preschools (Vigsø & Nielsen, 2006) and in other studies equally good (Berg, 2004; Kiener, 2004a, 2004b; Lettieri, 2004; Sandseter, 2009a; Scholz & Krombholz, 2006). In Switzerland, creativity was found to be equal or better in first grade for children from a forest preschool compared to children from traditional preschools (Lettieri, 2004) and compared to children staying in the forest for one day a week (Kiener, 2004a).

In Sweden, researchers observed that a natural setting offered good possibilities for gender equality in play, since the green settings were not gender coded (Änggård, 2011). Also in Sweden, preschool access to natural settings was reported to have a positive impact in relation to conflict level, regard for others, attention, and restlessness (Grahn et al., 1997; Mårtensson et al., 2009) and in the U.S. on self-determination, problem solving, self-regulation (Kochanowski & Carr, 2014) and spiritual development (Schein, 2014). In Wales, a varied outdoor setting initiated children's interactions with staff members (Waters & Maynard, 2010), and first grade teachers in Germany found that children from outdoor preschools performed as well or better than children from traditional preschools in a variety of skills (Gorges, 1999; Häfner, 2003).

Affordances

"Affordance" is a term conceptualized in ecological psychology by Gibson in his studies of the environment as perceived in action (Gibson, 1979). Gibson pointed out that features have to be described in relation to activities of real people in real environments. Gibson stated that living beings have awareness of what the environment may offer—or afford—for good or for bad, which implies that some features will be sought and others avoided. What humans directly perceive is not form and measurements, but the functional significances in the environment: the affordances (ibid.). The definition of affordances varies between different professions and perspectives. In this study affordances refer to *the meaningful action possibilities of the environment*.

Describing affordances and affording features is a user-centered way to view the action possibilities of the environment, in this case for preschoolers. Affordances can be described by the triad of 1) person or group of persons, 2) affording features, and 3) afforded actions. When using this term in research and design, researchers must choose levels of description, and decide on the source of knowledge: observed, personally experienced, surveyed or imagined. By observing activities and features in use, the focus is on the positive affordances of the setting.

Methods

To make observations of activities and features in use in a forest preschool, we chose a method inspired by anthropology, where it is important to be present in search of patterns, preferably for longer periods of time (Graue & Walsh, 1998; Gulløv & Højlund, 2003). We conducted a field study in a forest preschool at the edge of a small Danish town. In order to see a variety of forest sites, we chose a preschool that uses more than 25 forest sites defined as named places in accessible forests and other green spaces where groups of preschool children stay on a regular basis (see Lerstrup & Refshauge, 2016). The boundaries of the forest sites are decided by staff members, but usually not marked. In the chosen forest school, a group consisting of 21 children aged 3-6.5 and three staff members went to the forest approximately four out of five days a week for two to five hours, depending on weather and season.

The forest sites were situated in an old mixed forest close to the home base of the preschool. The forest is open to the public, primarily used for wood production and owned by a foundation. The forest sites were thus not designed with preschools in mind, but rather were chosen by the staff as usable places "designed" by nature. The first author visited each of 15 forest sites from one to four times for one to two hours in all seasons. Observed activities and used features were registered in field notes and video recordings.[1] The researcher used participatory observation, sharing the place and weather conditions and looking in the same direction as the children. The children knew that the researcher was present but soon realized she was neither a playmate nor a staff member. Activities were noted in everyday terms in an attempt to limit interpretations of intentions. At later visits to the forest sites, the researchers measured the ditches used by the children, including the breath, depth and steepest side angle.

The analysis of field notes and video recordings consisted of reading and rereading notes and viewing and reviewing the recordings in order to find patterns; in this case in the relationships between ditches and children's activities. The researchers examined the specific activities afforded by ditches, correlated them to the characteristics of the ditches, and then described and illustrated them.

Methodological Limitations

The limitation of using the concept of affordances in a design and playspace management context is that action possibilities do not inevitably lead to actions; the relation between features and activities is not a simple causality. We observed the affordances of ditches in an existing preschool group accustomed to stays in forest settings. Some features need time or introduction by peers or staff members to be perceived as affording. The way children watched and imitated each other underlined the importance of the actual company of peers and staff.

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[1] We obtained written permission from parents regarding observation and the use of video sequences for research and education. See www.skovtid.dk for video clips of children's activities around different types of ditches.

Results

Children's activities and choices of features with which to interact displayed the affordances and affording features of the sites. Children grouped themselves close to features offering meaningful action possibilities. Ditches were attractive features and were used by all ages and by girls and boys alike. Ditches with different characteristics afforded different activities as shown in Table 1. These affording features and observed affordances are described in the following paragraphs.

Table 1. Ditch characteristics and afforded activities

Ditch characteristics	**Activities**
Narrow ditches	Jumping, pole vaulting, swinging over; constructing bridges
Ditches with bridges	Climbing, crawling, balancing; looking out from; play fishing
Dry ditches	Gliding down, clambering up, following the track; hiding; rolling objects down, arranging objects, cleaning the ditch for objects; exploring sides and vegetation; excavating stones, finding "treasures"
Ditches with water	Throwing objects in, splashing; floating objects; picking up water, pouring, mixing, making mud, kneading, molding and smearing; exploration of water life, fishing, handling, observing, caring for and letting go of small creatures; gliding, crushing, tasting and molding ice. For flowing water: letting objects flow down the stream, dam building

Later we deal with especially attractive ditches and the importance of dimensions of ditches in relation to eyelevel.

Narrow Ditches

It was attractive to jump over a ditch and this was often done as a group activity. Narrow ditches made jumping possible (Figure 1). Children also jumped with poles. No ditch was too small to be jumped over. Broader ditches were also jumped if the sides were not too steep. Unlike jumping from boulder to boulder or from stump to stump, the ditches had a sloping surface for landing which made them jumpable for children with varying jumping abilities. Often it turned out that someone who observed the jumping later tried it out on her or his own.

Figure 1. A narrow ditch affords jumping over; the others observe and try later

Narrow ditches were used for bridge construction, often as teamwork, carrying long branches, as well as discussing and arranging them (Figure 2). The conversation accompanying the situation in Figure 2 is illustrative:

> *Boy A (carrying a long stick): Jus take care, Magne*
> *Boy B (puts one end of the stick in the ground): Now I begin here*
> *Boy B (on the other side of the ditch): We try to stop that water*
> *Boy A (raising the stick to vertical position): No, take care Magne*
> *Boy B: Try to get it over here*
> *Boy A (still holding the long stick upright): Move a bit back…and Magne, you have to go much further back (Boy B moves further back)*

Boy B: Try to get it over here (Boy A let go his hold on the stick, it lands with a splash)
Boy B: Then you'll move it a bit up (they both try to get hold of the stick)
Boy C (has been observing all along): What are you making?
Boy A (while he continues to arrange): A bridge… a bridge

Figure 2. Children collaborate in constructing a bridge over a narrow ditch

Ditches with Bridges
Bridges increased the affordances substantially, whether they were in the form of a fallen tree or a construction made of branches by the children or built by the staff.

Some bridges were constructed with handrails and others were just a bunch of branches thrown into the ditch. Once it was there, the bridge afforded walking,

balancing on, crawling over and sometimes functioned as a meeting place. In dry ditches, bridges were also approached from the bottom of the ditch and crawled under. Bridges were used to sit on, hang from, play fishing from, and for poking in the water, often in groups. For the single child, passing was often accompanied by considerations about how to move forward (Figure 3). The boy in Figure 3 approached the bridge and hung on to both rails. Then he let one hand go, and then used both hands to move freely ahead. While attempting to cross a ditch, another child realized that the branch was unstable, then backed up and found another place to cross. Another child who was losing his balance sat down to slowly continue sideways; later some bark loosened and one hand slipped, but eventually he reached the other side. Children soon crossed with ease and then began carrying out experiments such as a girl crossing a rugged bridge with her eyes closed.

Figure 3. Bridges increase the affordances of ditches

Dry Ditches

Dry ditches offered possibilities to get up and down in various ways. If a side was steep enough, the ditch could be glided down. Ditches with smooth brinks were glided down, as were slopes with grass or leaves. The ground cover influenced how steep the ditch had to be in order to glide: the rougher, the steeper. Dry ditches were used to hide in, as places to gather, or to follow a track (Figure 4). Children also poked the sides from the bottom. New "treasures" like stones, small creatures and special plant parts were found in the brink or at the bottom of the ditch, where the microclimate was different and hosted different plants and creatures. Getting up and out of the ditch was performed by clambering, grabbing grass and other protrusions or by getting a hand. Other ditch activities were rolling down loose objects or throwing sticks over and in, and later emptying the ditch again.

Figure 4. Children follow a dry ditch and are eventually hidden from view

Ditches with Water

Some ditches were dry almost all year, but most were filled with water for shorter or longer periods of time during autumn, winter and spring. Ditches with water made it even more attractive to play fish, throw things in, balance over, swing or jump over. Ditches with low brinks and water offered activities such as picking up water, pouring, splashing, mixing (Figure 5) and letting objects float. Water made it easy to turn soil into mud and to do things like kneading, molding and smearing. When the brinks and the areas close to ditches were unstable or slippery, it made moving up and down hard and fun. Sometimes a boot got stuck causing a struggle to get it free again, and once in a while children got their socks wet or fell into the water. Ditches with water hosted various plants and creatures and afforded activities such as fishing, catching, handling, observing, caring for and letting go of small creatures. In frosty weather ditches with ice offered crushing, molding, constructing, tasting, and gliding on (Figure 6). When water was flowing in the ditches, actions with sticks, leaves or foam floating down the stream were attractive, as were dam building and changing the sounds of gurgling.

Figure 5. Children enjoy picking up, pouring and splashing in ditch water

Figure 6. Ice in ditches affords gliding and acquaintance with ice

Attractive Places by Ditches

In all the aforementioned categories, the most attractive places in and around ditches had special qualities: bends, forks, good places for jumping, places where the side changed character, places in connection to bridges, places where bridges could be constructed, and places where the ditch contained interesting things such as water, water plants, and creatures. It could also be a special place where a tree was growing right at the side or in the bottom of the ditch. These special places functioned as points for gathering.

Novelties in the features made ditches more attractive, such as changes in the vegetation or muddiness on the sides of the ditch and the content of water or ice due to changes in weather and season, as well as changes made by the children or staff such as various bridges and temporary swings or rope tracks over the ditch. When a tree had fallen overnight across a ditch with water, spirits were exceptionally high and many new possibilities were explored.

Dimensions of Ditches

The ditches at the studied forest sites varied from 35 - 125 cm in depth and 90 - 400 cm in width from the place where the surface began to slant. The gaps at the places used for crossing were often less wide because it was possible to go down the sloping sides before jumping. Most of the ditches were either 40-50 cm or 90-100 cm in breadth at the bottom. The side slopes varied from 30 to almost 90 degrees at the steepest places. The surfaces were covered with moss, grass, other plants, leaves, soil, or mud; however, the surface had to be steeper for gliding when it was uneven or rough. Even shallow and narrow “ditches” down to the range

of a track from a vehicle added attractive action possibilities such as following the track, jumping over, water activities, or gliding on ice.

Ditches and Growing Competences

Children new to the forest often stumbled because of small differences in the terrain or when a slope was muddy, but generally children were attracted to new challenges and their skills grew quickly.

The observed children were quite optimistic; if they had a desire to do something, they did not give up, even when obstacles were of considerable size. Examples of this optimism in other classes of affording features were trying to move or carry heavy stones, and climbing big logs or high trees. A short dialogue between two boys jumping a ditch illustrates this:

> *Boy A: We are practicing flying (jumping)*
> *Boy B: Yes, we are practicing flying*
> *Boy B (jumping and then stopping): But oh, humans can't fly—they actually can't fly!*
> *A (jumping): That is why we have to practice*
> *B (jumping again): Yeah that is why we have to practice*

Sometimes a child was a bit uneasy when crossing a bridge of branches or when getting down a steep slope. Observations over a year showed remarkable growth in competences, even for the more cautious children. The researcher had the impression that children through acquaintance with slippery slopes, ditches with water, uneven ground, loosening bark and unstable branches developed preparedness and capabilities to cope with unforeseen events.

Children by ditches often seemed to be alert and thrilled, and they reacted instantly when a branch in the bridge moved or a foot slipped in mud on the side or on a slippery branch. In this way ditches and bridges were tempting and at the same time functioned as places for obtaining skills as balance, coordination, and preparedness for new situations.

Discussion

The possible benefits and disadvantages of ditches for children and staff and the question of incorporating ditches into green spaces and playgrounds are discussed in this section.

Pros and Cons of Ditches

Ditches were observed to belong to the group of features mentioned by Fjørtoft and Sageie (2000) and Mårtensson (2004) as specific places in the landscape being of special interest. Ditches were attractive to children, probably because they were suited for many, varied and changing activities. The activities connected to earthwork mentioned by Moore (2014), including rolling, crawling, sliding, balancing, looking out from, and three-dimensional chase games were all observed in connection with ditches apart from "looking out," which was substituted by "looking along and down" from bridges. In a Dutch study, children aged 7-11

preferred jumping over gaps, even when they could easily walk over, and they preferred to jump down instead of other ways of getting down (Prieske, Withagen, Smith, & Zaal, 2015). The authors stated that, "Indeed, jumping expresses a liveliness that is part and parcel of playing" (ibid. 109) and jumping over is one of the affordances of ditches. The fact that the action possibilities changed during the year with changes in plant cover, water level, frost, and modifications by the children may explain the observation made by Derr and Lance (2012) that ditches were inspiring year round.

First-hand knowledge of ditches and bridges may later in life deepen the understanding of expressions such as "point of no return," "look before you leap," "crossing the creek," and of the basic narratives connected to ditches and creeks, bridges and bridging. Tales and novels are filled with creeks and bridges for good or for bad, as adventurous and secret places of freedom, but also as hiding places for ill deeds.

Sandseter (2009b), in her studies from Norway, found that children were attracted to thrilling play involving great heights, high speed, dangerous tools, dangerous elements such as water and fire, getting lost, and rough-and-tumble activities. High speed was among other features connected to slopes and slides (Sandseter, 2009a). With the fall heights allowed by the authorities in mind, ditches could very well create thrilling affordances by "going deep" rather than by "going high." If risk assessment speaks against stationary swings or rope tracks over the ditches in public areas, trees or poles could be placed near the ditch making temporary rope swings and rope tracks a choice. This places the daily risk assessment on the preschool staff members who know the actual spirits and abilities of the group of children for whom they are responsible.

Ditches played a role as hiding places and are thus included in the on-going staff discussion about children's desire for private places such as nooks and huts and staff wishes for surveillance. Compared to hiding in dense vegetation, children hiding in ditches are easier to survey. In this way, ditches can combine possibilities for hiding and "getting lost" with staff wishes for surveillance.

Incorporating Ditches in Outdoor Areas for Children

When designing outdoor spaces with groups of children in mind, it is important to design and manage the spaces in ways that provide access to appropriate possibilities for different children, for now, for tomorrow, and into the future. This is most easily achieved with gradated features with a wide range of sizes and other characteristics. The spirits and quickly growing competences of preschool children should not be underestimated. They often approach obstacles that are too big or too hard, a state described as "unrealistic optimism" in estimating their skills (Sutton-Smith, 1997).

When creating new areas for preschoolers or incorporating affording features in existing settings, ditches are worth considering. As a simple design element, ditches can fairly easily be incorporated into new or existing areas, green spaces as well as preschool playgrounds. A ditch does not require much space, and "folding"

the ground increases the surface area and the impression of space. It is possible to make a ditch that is graduated in width, depth and slope gradient. This can make ditches attractive for children of different ages and abilities and with growing competences. By winding the ditch, letting it branch off or even making a network of ditches it is possible to vary the challenges, create more hiding places and make it attractive to follow the ditch. The depth of ditches can be chosen in accordance with staff wishes for surveillance.

Ditches with varied slopes, depths, and permeability may offer changes in water level and vegetation throughout the season and thereby give rise to new activities and continuous interest. Varied ditches supplemented with loose objects in abundance and allowance for modifications may well increase the meaningful action possibilities of the setting. Areas where digging is allowed can invite visitors to dig their own ditches and continue the work of others. By leaving felled or fallen trees, twigs, and other organic leftovers from the same or adjacent areas, park, nature, and playground managers can make possible activities such as the creation and reshaping of bridges in connection to ditches. Laths, boards and built bridges can add to the action possibilities.

The authors are aware that protective legislation regarding playgrounds is in place in some areas, which would prevent the use of ditches. However, we advocate an assertive attitude regarding ditches where risk is distinguished from hazards and weighed against play and learning value as described by Ball, Gill, and Spiegal (2008).

Concerning the general aesthetics of green spaces in urban areas, the ditch may be a rather harmless choice as it does not disturb the view and may keep sticks and other loose objects out of sight. Some park visitors may even find pleasure in detecting signs of children's activities such as bridges made of branches and signs of gliding down slopes.

A suggestion for future development could be to support the use of ditches in preschool areas by combining knowledge about ditch construction and soil permeability from engineering, about varied and changing vegetation from gardening, and about preschool children's interests, competences and learning from education to make easily applicable practical recommendations for incorporating ditches into areas used by preschools, whether they are playgrounds, green spaces or woodlands.

Conclusion

Ditches in forest settings were attractive and afforded many and varied activities for preschool children. A bridge made ditches even more affording, dry ditches afforded getting into and hiding, and water in the ditch increased the affordances and added thrill when crossing. Having a good time, improving skills and obtaining preparedness for new situations went on simultaneously around the ditches.
The observed affordances of ditches illustrated some of the qualities often found in forest features: variation and gradation in forms, sizes and other properties, as well as novelty caused by change in water levels and vegetation throughout the

seasons. Changes due to weather, season and modifications made by children and staff ensured continuous interest. Ditches have the potential to become an important design element in green spaces and playgrounds used by preschools. Based on the observations, the authors advocate considering ditches in green spaces and playgrounds used by preschools, and for management that supports changes and allows for manipulation and modification of ditches, loose objects, soil and water.

As stated in the introductory quote, even small areas rich in affordances for children are important for joyful activities. Ditches, with their multifarious and dynamic affordances, are simple forest features worth considering when designing outdoor areas with children in mind.

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