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Design and use of public play-grounds in urban green spaces

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Abstract

This PhD thesis is based in landscape architecture and on research conducted at Forest & Landscape Denmark, University of Copenhagen. The focus is on the design and use of public playgrounds in urban green spaces.

In today's world, children are becoming increasingly urbanised and their contact with larger nature areas is decreasing. Playgrounds located in urban green spaces such as parks have the potential to provide everyday nature experiences, sensory stimulation, and play opportunities. As both play and contact with nature carry much potential to support healthy childhood development, frequent visits to such spaces can thus be important.

Due to parental concerns, younger children in particular are dependent on their accompanying adults' motivation for visiting playgrounds. It is hence important to explore what factors influence adult motivation and playground use. It is also increasingly recommended that landscape architects and others working in the field of planning adapt to the approach of evidence-based design. This is especially important when designing for certain functions and for certain user groups, as is the case with playground design. One of the aims of the thesis is, therefore, to increase the evidence-base on playground design, especially in a public Danish context by producing new evidence and by testing and evaluating an evidence-based design approach. Another aim is to enable playground designers to transform children's developmental characteristics into well functioning settings.

The study comprises two parts; 1) an evidence-based design approach to a playground design, and 2) a multiple case study of selected playgrounds.

A playground in Vigerslevparken in Valby, Copenhagen due for a complete renovation was made available by the City of Copenhagen to be included in the PhD project. This enabled an evidence-based design process for a new layout of the playground. The design team primarily included the Danish playground company Copla and myself. We triangulated existing research evidence on children's play and development, previous playground design research, theory, knowledge on the specific site for the playground, and the requests and wishes of the municipality with our own best practice. The concepts of behaviour settings and affordances constitute the theoretical framework of the design as well as the rest of the thesis. The result was an evidence-based approach to the design of playgrounds, and a playground, referred to as PlayLab Cph, which was constructed in 2010. In the evidence-based approach developmental characteristics of children are interpreted and transformed into affordances. Previous playground research evidence was used to support the design of several behaviour settings which were intended to support opportunities for the identified affordances. Due to the park location we put much focus on the integration of nature features into the design.

In the second part of the PhD project, the use of PlayLab Cph was evaluated together with three additional public park playgrounds in Copenhagen. Two playgrounds in Cary, NC, USA were also selected for studying adult motivational factors to obtain a cross-cultural perspective. The method used for investigating this aspect was on-site self-reporting questionnaires (N 261) which were completed by accompanying adults. The four Danish playgrounds were further explored through behaviour mapping (N755) and semi-structured behaviour observations.

The main results from the questionnaire survey show that park playgrounds are important destinations even for people who have access to their own garden or to a playground in a court yard. There are, however, three factors in particular which can influence use in both positive and negative ways: 1. For Danish respondents, location is very important. Pleasing green surroundings and a nearby location tend to result in more frequent visits. 2. All respondents stay longer and visit more often if they like the social atmosphere of the playground. 3. Male respondents, who are most active with their children, stay shorter if they dislike the play equipment design and variety.

The observation studies show that boys are more frequent users than girls. Only one of the playgrounds is able to attract as many girls as boys. In general, different behaviours take place depending on whether the children are solitary visitors without actively involved adults, if they are part of a group, or if they are engaged in play with adults and/or siblings. Solitary users tend to stay close to the playground centre, whereas the others are much more mobile and use the entire landscape. This calls for attention towards implementing, e.g., vegetation into the playground design and not just in the surroundings for all visitors to gain the potential benefits of such settings.

The observations also indicate that integrating settings such as play equipment, topography and vegetation as closely together as possible is important as it increases the number of potential functionalities and sensory stimulation of the settings. In this connection, efforts should be made to mix ambiguous and defined settings.

The evaluation of the PlayLab Cph shows that many of the intentions are fulfilled. Even though there were requests from parents for more opportunities for young children, the evidence-based approach seems valuable, though it can be strengthened through further development. By taking the affordance and behaviour setting concepts into the evidence-based design process, the design embraces the relations between environment and behaviour.

This thesis provides valuable knowledge on public park playground user aspects which affect the way that such playgrounds should be designed and located, in terms of both children and accompanying adults. If the design fails to incorporate these different aspects, it may affect the use of and satisfaction with the playgrounds. The evidence generated can be included in an evidence-based design approach as the one suggested in this study.

Resumé

Dette ph.d.-projekt er baseret på forskning udført på Skov & Landskab, Københavns Universitet. Projektet er forankret i landskabsarkitektur og fokuserer på design og brug af offentlige legepladser i urbane grønne områder.

Flere og flere børn verden over vokser op i byer, hvorved afstanden til større områder med natur øges. Derfor er urbane grønne områder såsom parker, samt parkernes legepladser vigtige, da de har potentialet til at give børn i byerne naturoplevelser, sansestimuleringer og legemuligheder i hverdagen, og derved støtte barnets udvikling positivt. Mange børn er dog afhængige af deres forældres motivation til at besøge legepladser, da de ikke må gå alene derhen. Det er derfor vigtigt at undersøge, hvilke faktorer der eventuelt påvirker forældres motivation og brug af legepladser, så der kan tages højde for det i planlægningen. Det anbefales også, at landskabsarkitekter og andre, der arbejder med planlægning, i højere grad arbejder evidens-baseret. Dette er især vigtigt, når man designer til bestemte grupper og funktioner, som det er tilfældet med legepladsdesign. Et af formålene med afhandlingen er derfor at øge forskningsgrundlaget i en offentlig, dansk kontekst, ved dels at generere ny viden, dels at afprøve og evaluere en evidens-baseret tilgang til legepladsdesign. Et andet formål er at give legepladsdesignere redskaber til at omsætte børns udviklingskarakteristika til velfungerende fysiske rammer.

Projektet består af to dele: 1) en evidens-baseret tilgang til legepladsdesign, og 2) et multi-casestudie af udvalgte legepladser. For at kunne udforske designprocessen og afprøve designtilgangen stillede Københavns Kommune en legeplads i Vigerslevparken i Valby til rådighed. Legepladsen var nedslidt og stod for en totalrenovering. Det primære design-team bestod af det danske legepladsfirma Copla og mig. Vi trianguleredе eksisterende forskning om børns leg og udvikling, legepladsdesign, teori, viden om den konkrete kontekst, og kommunens ønsker og krav til legepladsen, med egen 'best practice'. Koncepterne 'behaviour settings' (rammer for udfoldelse) og 'affordances' (det fysiske miljøs egenskaber) udgjorde den teoretiske ramme for både designet og resten af ph.d.-projektet. Resultatet blev et forslag til en evidens-baseret tilgang til legepladsdesign, samt den fysiske legeplads anlagt i 2010, som i projektet omtales som PlayLab Cph/Vigerslevparken syd.

I den evidens-baserede tilgang til legepladsdesign blev børns udviklingsmæssige karakteristikker fortolket og transformeret til 'affordances'. Eksisterende forskning blev siden evalueret og brugt som grundlag for designet af forskellige 'behaviour settings', som skulle fremme mulighederne for at de identificerede 'affordances' kunne finde sted. Pga. placeringen i en park blev der lagt vægt på at integrere naturelementer i designet.

I projektets anden del blev brugen af PlayLab Cph samt dertil tre offentlige parklegepladser i København evalueret. Desuden blev to legepladser i

Cary, North Carolina, USA undersøgt i forhold til de ledsagende voksne for at få et tværkulturelt perspektiv på dette. Selvvurderingsspørgeskemaer, udfyldt på stedet (N261), blev valgt som metode til denne del af studiet. Derudover blev de fire danske legepladser undersøgt vha. metoderne 'behaviour mapping' (adfærdskortlægning, N755) og semi-strukturerede observationer.

De primære resultater fra spørgeskemaundersøgelsen viser, at parklegepladserne er vigtige destinationer selv for brugere, der har adgang til egen have eller til en gård med legeplads. Der er dog især tre faktorer, der kan have indflydelse på brugen af parklegepladserne i både positiv og negativ retning: 1) For de danske respondenter er placeringen meget vigtig, da smukke grønne omgivelser og kort afstand til legepladsen resulterer i hyppigere besøg. 2) Især kvinder ser ud til at blive længere og besøge oftere, hvis de kan lide den sociale atmosfære på legepladsen. 3) Mandlige respondenter er mest aktivt involverede i at lege med børnene, men bliver i kortere tid, hvis ikke de synes, at legeredskabsdesignet og variationen er god nok.

Observationsstudierne viser, at drenge oftere kommer på legepladserne end piger. Kun én af legepladserne er i stand til at tiltrække lige så mange piger som drenge. Legepladserne bliver brugt på forskellige måder, alt efter om det er grupper af børn eller børn med aktive forældre og/eller søskende, der besøger legepladserne, eller om det er individuelle børn uden aktive forældre og/eller søskende. Individuelle brugere har tendens til at opholde sig centralt på legepladserne, hvorimod de andre er mere mobile og bruger hele land-skabet. Dette indikerer, at det er vigtigt at integrere for eksempel vegetation i selve legepladsdesignet og ikke kun i omgivelserne, således at alle brugere får gavn og glæde af disse komponenter. Observationerne indikerer også, at det er vigtigt at integrere elementer såsom vegetation, topografi og legeredskaber så omhyggeligt som muligt, da det øger antallet af potentielle funktioner og sansestimuleringer. Her er det også vigtigt at mikse elementer, som er lette at afkode, med elementer som har flere fortolkningsmuligheder.

Evalueringen af PlayLab Cph viser, at mange af intentionerne blev opfyldt. Og selvom der var efterspørgsel fra nogle forældre på flere muligheder for de yngste børn, synes den evidens-baserede tilgang at være brugbar, selvom den kan styrkes og udvikles yderligere. Ved at inkludere 'affordance' og 'behaviour setting' koncepterne i den evidens-baserede tilgang inkorporeres relationen mellem det fysiske miljø og den menneskelige adfærd.

Dette ph.d.-projekt tilfører derfor værdifuld viden om brugerne af offentlige legepladser i grønne områder, hvilket har betydning for hvordan disse legepladser bør designes og placeres både i forhold til voksne og børn. Hvis ikke der tages hensyn til disse aspekter, kan det føre til utilfredshed og lav brug af legepladserne. De forskningsresultater, som projektet har genereret, kan bruges i fremtidige evidens-baserede legepladsprojekter, eksempelvis med udgangspunkt i den tilgang, der foreslås i dette projekt.

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Background

The importance of playgrounds in urban green spaces

Play is a natural part of childhood and through play children interact with the environment in various ways. Play is valuable simply because of the joy involved and children do not need to have a specific purpose in mind to have fun whilst playing (Maxwell et al. 2008). Play also has the potential to be an important catalyst in developing children's abilities such as creative thinking, problem solving, flexibility, and improved cognitive, social, and emotional wellbeing (e.g. Burdette & Whitaker 2005;Wortham 1985).

More and more children are growing up in cities (UN Habitat 2008), thereby increasing the distance to larger nature areas (Louv 2008). Contact with nature seems valuable due to benefits such as improved mental wellbeing and relief from stress (Kaplan 2001;Nilsson et al. 2011;Ward Thompson 2011;Wells & Evans 2003), and improved physical and cognitive development (Fjørtoft & Sageie 2000;Grahn et al. 1997;Herrington & Studtmann 1998). Playing in nature areas may also create a positive cycle, as it is more likely that children will visit similar places as adults (Ward Thompson et al. 2008) and eventually bring their own families. Further, vegetation of various types and a walk in the forest can stimulate numerous senses (Bell 1999;Moore 2007). In addition, play in environments with natural features seems to offer many potential affordances[1] and opportunities for physical activity and improved motor development (Boldemann et al. 2006;Boldemann et al. 2011;Cosco 2006;Fjørtoft 2004;Moore & Cosco 2010). For the increasingly urbanised children, visits to nature areas such as forests are, however, not a daily routine (Schipperijn et al. 2010a).

This is a problem as children experience a general decrease in health status, such as physical activity level and motor skills, which is also the case in Denmark (Pedersen & Brodersen 2008;The Danish National Board of Health 2010;World Health Organization 2007). Poor motor skills can be a result of a lack of sensory stimulation during childhood, and children who suffer from this may face severe learning difficulties when they start school (Ayres 1979). It is, therefore, important for children to develop sensory integration through interaction with many things in the environment and to adapt both the brain and body to all physical challenges during childhood (*ibid*.).

As was also the case in the days of industrialisation and increasing city populations a century ago (Coninck-Smith 2011), playgrounds located in urban green spaces seem once again to have become important places as they can provide everyday nature and sensory experiences and opportunities for play, and hence, support healthy childhood development, at the same time as

[1] Affordances are functional properties of the environment (Gibson 1979). The concept is presented in the chapter on Theoretical framework.

providing children with a sense of continuity in the changing urban realm (Moore 1986).

The users: Children and accompanying adults

For especially older age groups, playgrounds function as a starting point for further exploration of the surrounding environment (Moore 1986), whereas for other age groups, public playgrounds are inaccessible without the company of an adult due to the fear of, for example, traffic and strangers (Clements 2004;Veitch et al. 2006). This makes the accompanying adult an inevitable part of the public playground realm. Previous studies have examined factors that parents consider when choosing which public playground to visit together with their child such as opportunities for activity, safety, social interaction, experience of nature/peacefulness, availability of toilets, drinking water, lighting, shade, and variation in play equipment (Berglund & Jergeby 1989;Jansson 2010;Sallis et al. 1997;Veitch et al. 2006). Less is however known about how much these factors influence the actual use and what characterises adults' behaviour when they visit playgrounds.

Families are not the only user groups of public playgrounds as childcare centres also use them as destinations when, for example, making a trip to the local park (Holm 2001). This makes the user group very varied, including one single child who may not know anyone at the playground, families with one or several children, and groups of children of various sizes who know each other well either as friends or as part of the same group (childcare, school class, etc.). These different user groups may, however, have different ways of using playgrounds also in relation to, for example, gender (Karsten 2003).

Aims of the thesis

The main aim of this thesis is, eventually, that playgrounds become as attractive as possible to entice children and their families/caregivers to make frequent visits and thus benefit from these places. Good playground design is important because if something in the design impedes certain behaviour or dampens the excitement of being at the playground, it might result in low use and dissatisfaction with the place (Jansson 2008), or it can negatively effect the progress in children's play (Grahn et al. 1997). Information on what constitutes good design and what characterises the use and users of the design can inform decision-making in evidence-based design projects (Brown & Corry 2011), thus also playground design. Evidence-based design is an approach to design which is slowly gaining ground in the field of planning inspired by the positive results in other related fields such as health care architecture (Zimring et al. 2008). It is also recommended that it becomes practice in landscape architecture (Brown & Corry 2011). In the evidence-based design process, practice decisions should be based on an integration of

best available research evidence, practical expertise, and knowledge of client and user characteristics (Brown & Corry 2011;Hamilton & Watkins 2009). This research provides the opportunity to obtain a better understanding of certain characteristics of users and their behaviour in relation to the design of public park playgrounds, which may inform decision-making in future evidence-based design projects.

Research questions

The overall research questions to be answered in the PhD project are:

1. a) What characterises the users and the use of public park playgrounds?
   b) What are the users' motivations for visiting playgrounds and for choice of playground?
   c) What characterises the accompanying adults' preferences and are there any relations to the use?
   d) Are there any connections between the above and the physical layout and location of the playgrounds?
   (Paper I)

2. a) Which types of play take place at the playgrounds and are there any characteristics or special relations between the users, e.g. regarding peers and adults?
   b) In what ways does the design of playgrounds influence play and behaviour?
   (Paper II)

3. Are there certain relations between settings and their coding[2] which may create more affordances for play?
   (Paper III)

4. a) Is it possible to intentionally design certain potential affordances into a playground design and have them actualised by the users?
   b) How well do evidence-based design (EBD) intentions comply with the actual use?
   c) Is EBD an approach which could be valuable to practitioners in future playground designs?
   (Paper IV)

[2] In paper III, the analysis of settings includes an evaluation of their coding as either ambiguous, defined or mixed, based on Moore & Cohen (1978) and Kirkeby (Kirkeby 2006)

Introduction

Before going into details on how the presented research questions have been answered, I will provide a state of the art of public playgrounds, children's play, and playground design.

Public outdoor playgrounds and their history

Why do playgrounds even exist and how have they developed? Playgrounds have been a part of the public realm for many years, also in Denmark. They emerged in the second half of the 19th century as a reaction to increased traffic and of too many children playing in the streets (Goodman 1979). In the beginning, they were often placed in less visible corners of parks and consisted of simple features such as fields of gravel and a pile of sand (Coninck-Smith 2011). That children were granted such spaces in the first place was also a consequence of the recognition of play and active outdoor behaviour as important for children's development (*ibid*).

In 1891, Copenhagen's Playground Association was founded (*ibid.*), which promoted playgrounds with more equipment, inspired from both gyms and amusement parks (*ibid*). In the beginning of the 20th century, city life in Copenhagen had become rather unhealthy due to industrialisation and an increase in population (*ibid.*). Thus, inspired by a similar movement in the USA, public parks close to people's homes were seen as important spaces to counterbalance the unhealthy life (*ibid*). Further, playgrounds were from then on centrally located in the parks rather than stuck away in a corner (*ibid*).

In 1959, the Danish Playground Association was founded with the aim of promoting better outdoor play opportunities for children (Danish Play Association 2012). The association played an important part in the founding of the International Play Association in 1961 (Danish Play Association 2012;International Play Association 2012).

Different types of public outdoor playgrounds

During the years, many different types of playgrounds have been identified and described by researchers and others working in the field. This seems to have been mainly aimed at criticising some and promoting others in terms of how they function in relation to play and design.

One of the earliest examples of a playground type which distinguished itself from others at that time is the *adventure* playground. It was suggested by the Danish landscape architect C. Th. Sørensen already in 1931 in his book 'Parkpolitik i Sogn og Købstad' (Park Policy in Parish and Town) (Sørensen 1931). Sørensen was also the first president of both the Danish and the International Play Associations. The earliest adventure playground was not con-

structed until 1943 during the Second World War (Brett et al. 1993) where it became a refuge from the ongoing German occupation (Coninck-Smith 2011). This playground type with no pre-fabricated play equipment, just loose play material for construction, is often described as being the most popular and best functioning among children (Hayvard et al. 1974;Naylor 1985), but it is also a playground type which requires employed play workers and is one of the most challenging to implement (Brett et al. 1993). Adventure playgrounds are now found in many parts of the world, but especially in Europe (*ibid.*).

Another playground type is the *traditional playground* which mainly consists of single functioning manufactured equipment, such as jungle gyms, swings, slides and so forth (Frost 1992;Hayvard et al. 1974). The equipment is placed on a flat surface which used to be asphalt or concrete (*ibid.*). These playgrounds have often been criticised for only providing exercise and few types of play (Frost & Klein 1983), but they are still wide spread as they are easy to maintain (Brett et al. 1993). The term emerged in the 1960s, but the description may fit many of the earlier playgrounds as well. At the same time, the criticism of traditional playgrounds seems to have caused reluctance towards manufactured play equipment. *Designer playgrounds* thus emerged as a result of this disinclination and are, as the name may imply, playgrounds designed to aesthetically match the surrounding environment and to meet the needs of children in an innovative way (Brett et al. 1993). This term has its origin in the USA in the 1960s and often consists of sculptural elements that are designed and built for a specific site (Brett et al. 1993;Hayvard et al. 1974). Similar playgrounds were built in Denmark at that time as well (Heldt 2009). It has been suggested that these playgrounds are more versatile than the traditional playground, but that they do not provide as many opportunities as the adventure playground (Hayvard et al. 1974). *Creative playgrounds* is another term from the USA which broadly refers to a fusion of traditional and designer playgrounds, but also at times with some aspects of adventure playgrounds (Brett et al. 1993). *Playscapes* are play environments which do not have fixed-equipment, but which consist of areas characterised by diversity in landscape elements and affordances for play (Fjørtoft 2004;Fjørtoft & Sageie 2000). *Nature playgrounds* is a similar term and these emerged in the 1980s as a reaction to a changing world, pollution, and declining health status among children (Coninck-Smith 2011). It seems, though, as if the term can refer to both very naturalised areas, where equipment has almost been banned (Hendricks 2001), and to play areas which consist of manufactured wooden play elements where the equipment material and not the context constitutes the 'nature' in the playground.

In recent years, there has been a tendency to consider safety higher than play value. This has resulted in playgrounds which fall under the term *KFC playgrounds*, originating in the U.K. (Woolley 2008). These consist of a *Kit*

of play equipment, surrounded by a *Fence*, and placed on a *Carpet* of rubber surface (*ibid.*). They thus resemble the traditional playground in certain ways, except for the soft ground and the fence. KFC playgrounds are mostly criticised for being excessively safe with no concern for the local setting (Woolley 2008). Another recent category of playgrounds are *interactive playgrounds* that try to combine playground play with modern childhood and the widespread use of digital media (Coninck-Smith 2011). The term can both refer to computer controlled play equipment and to virtual play environments made available through digital devices (Petersen 2010). Little research has been carried out on interactive playgrounds yet, and it is thus hard to tell if these playground types can act as the intended solutions for the increasingly unhealthy lifestyles of children (*ibid.*). Preliminary findings indicate that they currently afford physical activity, but lack in opportunities for using imagination and creativity (*ibid*).

In this thesis, I have studied the combination of physical features at playgrounds instead of playground types selected from the aforementioned. Studying playground features is a more informative task than studying playground types because few playgrounds fit perfectly into one type (Brown & Burger 1984;Pellegrini 1987). The review of the different types has instead served as a basis for critical reflection and an awareness of the development and discourses.

Public outdoor playgrounds and critical voices

When studying public playgrounds, it is difficult to avoid critical voices from, for example, research. These voices criticise playgrounds for being spaces that isolate children from the rest of society (Nochis 1992) and as one of grown-ups' ways of controlling children's experience of public space due to safety concerns (Woolley 2008). Playgrounds are often also criticised for their design, i.e. for being too static and uniform with no concern for the local landscape (Moore 1989;Woolley 2008). This especially concerns traditional playgrounds due to often mono-functional equipment which only promotes functional play and exercise (Frost & Klein 1983). Others emphasise the importance of additional informal public spaces where children are allowed to play such as vegetated areas or empty space between buildings for building dens (Kylin 2004).

Safety has also been an issue in the debate on playgrounds as first being too undervalued (Reichelderfer et al. 1979) to becoming too exaggerated (Herrington & Nicholls 2007;Woolley 2008) and leaving children more at risk as their motor development for example is not sufficiently challenged (Frost et al. 2001).

Children's play and development

Why is play even important in the first place? And what constitutes play? Early classic theories on play suggested various and contradictory purposes such as expending surplus energy, restoring energy expended in work, or practicing vital skills required for adult life (Johnson et al. 1999). The early theories focused on the biological aspects of play, whereas later theories stressed the emotional, intellectual, and social benefits of play (Hughes 2009). All of the theories contain some elements of truth, but none of them are alone able to describe the significance of play (*ibid*). As Hughes suggests, the theories on play are instead helpful frameworks within which children's behaviour can be better understood.

This PhD thesis makes use of one of the later theories with a cognitive-developmental approach to play. The approach is based on Piaget's (1962) and Smilansky's (1968) work. The play categories chosen for this study include; 'functional', 'dramatic', and 'constructive' play, and 'games with rules'. Functional play includes muscle movement such as running, jumping, spinning and climbing, but also the use of objects in a stereotyped manner (Smilansky 1968). A child in dramatic play adopts a role or uses objects to represent make-believe things (*ibid*.). In constructive play, the child is engaged in constructing something; while in games with rules, children consent to prearranged rules (*ibid*.). 'Non-play', meaning a child engaged in transitory activities, such as watching others or performing other activities unrelated to play (Maxwell, Mitchell, & Evans 2008), was also included in this study. To be able to describe an activity as play in the first place, it must contain five essential characteristics (Rubin et al. 1983). 1) Play is intrinsically motivated and an end in itself. 2) It is freely chosen. 3) It must be pleasurable. 4) It is non-literal, that is, involving an element of make-believe. And 5) the player is actively engaged (*ibid*).

Children's development and play needs change over time (Frost et al. 2004), not only because of physical and cognitive changes, but also because children seek arousal and more and more complex play interactions with the environment (Ellis 1973;Wortham 1985). Toddlers are, unlike infants, for example able to participate in simple dramatic play with peers (Johnson et al. 1999). They are also interested in sensory exploration and in feeling the play materials (Hughes 2009). When they reach school-age (6-12 years old), children have become logical thinkers which enables them to play more complicated games with rules (*ibid.*). The older the child, the more advanced the game (Pollowy 1977). This is also the essence of the cognitive development – the child mainly engages in play which best matches his/her developmental stage (Johnson et al. 1999). A more thorough description of the different stages in children's play and development can be found in paper IV.

How play theories have developed is also partly reflected in how playground design has developed. The first generations of playgrounds reflect a

bodily focus, whereas the adventure playgrounds were a sign of a democratically developing focus (Coninck-Smith 2011). The designer playgrounds reflect a view on children as individual members of society who need special attention (*ibid.*). With the origin of nature playgrounds, all views are combined, but also influenced by a view on play as children's lifestyle, not having to point towards adult-hood (*ibid.*). Also, the increase in unhealthy lifestyles influenced the emergence of nature playgrounds (*ibid.*).

Playground design research

The research conducted in this PhD project feeds into a large body of research within playground design and how it affects children's behaviour and development. Much of it has had different focal points and has been carried out within childcare research. For example, physical activity was the main objective of the studies by Cosco (2006), Moore & Cosco (2010) and Boldemann et al. (2006;2011). Children's motor development has been another focal point, e.g. in Grahn et al.'s (1997) and Fjørtoft's (2004) studies. How both built and natural environments affect play has also been studied in childcare contexts (Brown & Burger 1984;Fjørtoft 2001;Fjørtoft & Sageie 2000;Mårtensson 2004), together with intervention studies (Herrington & Studtmann 1998) which focus on how nature elements can improve cognitive play. Nature elements alongside built elements and children's preferences for enclosed spaces were the objectives in a study by Kirkby (1989).

Some playground studies have also been carried out in the public realm. They too have had different primary perspectives, e.g. use and perception of neighbourhood settings such as parks and playgrounds (Moore 1986). Factors that parents consider when selecting playgrounds (Sallis et al. 1997), and play environments' relations to active free play (Veitch et al. 2007) have been other subjects. Karsten (2003) explored the gendered world of public playgrounds, whereas Jansson & Persson (2009) focused on management as the primary perspective. Universal design (Moore & Cosco 2007) and independent mobility in housing estates (Carstensen 2004;Wilhjelm 2002) have been other topics. Hayvard et al. (1974) studied different playground types and their relation to play and preferences. Norén-Björn (1977) studied a variety of publicly accessible playgrounds regarding equipment types and their interaction with the setting.

Many of the aforementioned studies have had an ecological perspective, which is also the case in this PhD project. The focus is thus on the dynamic reciprocal relationship between humans and the environment (Heft 2010). The viewpoint is that human behaviour is affected by various environmental factors such as social, physical and individual (Tudge et al. 1997;Ward Thompson 2010).

Research gaps

What is relevant to study in the field of playground design which has been the subject of research for many decades now? First of all, there is a lack of research in a Danish context especially with a public perspective on playgrounds. There is also little knowledge of how different user groups respond to playgrounds in this public context. The American study by Hayvard et al. (1974) did focus broadly on different affiliations and age groups including adults, but it did not take, e.g. gender into consideration in either of these groups. This aspect is treated in paper II. Sallis et al.'s (1997) American study of parental factors for choosing playgrounds does not provide answers to how these factors actually influence the use of playgrounds. Jansson's (2010) study does this to some extent, but in a Swedish context with two smaller towns as study objects. This aspect is treated in paper I. However, the prime focus in this PhD thesis is on the design of public playgrounds located in urban green spaces. It thus builds upon the work conducted by, e.g. Norén-Björn (1977), but also the studies conducted in childcare research (Brown & Burger 1984;Fjørtoft 2001;Fjørtoft & Sageie 2000;Herrington & Studtmann 1998;Kirkby 1989;Mårtensson 2004), with a strong focus on the interplay between nature and play equipment. Previous studies have provided different suggestions as to what constitutes high quality playground design in different contexts (e.g. Grahn et al. 1997;Woolley 2008). Nature elements are repeatedly highlighted and suggestions have been made to how play equipment and nature elements could interplay (Moore et al. 1992;Norén-Björn 1977). Even so, increasing the evidence-base of this interplay and how designers could approach this aspect seems beneficial. This part of the thesis is a further development of Moore et al. (1992) whose work, although with a strong focus on universal design, is based on evidence from both research and practice.

Evidence-based playground design

This PhD thesis has its base in *evidence-based design (EBD).* Recently *evidence-based landscape architecture* was introduced (Brown & Corry 2011) calling for a recognition of the concept's values as potentially improving the quality of built landscape architecture. If not embraced by the landscape architecture profession, there is a risk of otherwise falling behind other professions (*ibid*). The need to increase the evidence-base in academia is also emphasised (*ibid*), which is why generating more design-related knowledge is important. So far, there is no consolidated tradition for using research evidence to inform the design process in landscape architecture, although it could enrich the field of planning (Krizek et al. 2009). However, there is a tendency towards acknowledging that research can improve design, based on positive results in related fields such as evidence-based health design (Zimring et al. 2008). According to several definitions, EBD can be

characterised as a triangulation of best design practice, client information and relevant research evidence (Brown & Corry 2011;Hamilton & Watkins 2009). Practitioners of course already use evidence to back up their decisions, but this evidence is primarily from their own field (Hamilton & Watkins 2009). However, it is increasingly expected that they turn to new disciplines for additional evidence sources when designing for a specific user group or a specific type of site to strengthen their design decisions (*ibid*). In the case of park playground design, this would mean turning to fields such as child development research, play research, and to playground design research if not already known.

Space for play and PlayLab Cph

The research conducted in this PhD thesis is connected to the *Space for play* project, which is a large renovation project which was initiated by the City of Copenhagen in 2008. It includes all 129 public playgrounds in the city (City of Copenhagen 2008a;City of Copenhagen 2008c), and when it terminates in 2012, 42m DKK (~ 5.65m Euros) will have been allocated to the renovations. The project was initiated as Copenhagen had experienced a general increase in population during recent decades. At the same time, there has been a decrease in resources allocated for the renewal and maintenance of the city's playgrounds leaving them in a poor state.

Except for a number of playgrounds which could be categorised as designer playgrounds as they consist of unique play features created by artists (City of Copenhagen 2008b), the City of Copenhagen has not aimed to construct certain types of playgrounds. Instead, the Space for Play project has sought diverse solutions with different consultants having various approaches in order to meet the diversity of the city's population.

One of the playgrounds due for a complete renovation in 2009/10 was a playground located in Vigerslevparken in the district of Valby. This playground was made available by the municipality to become part of this PhD dissertation. The City of Copenhagen was thus interested in investigating new ways of approaching playground design. In a partnership between the municipality, the Danish playground company Copla, and myself, the playground was designed and has since been constructed. The use of the playground was then evaluated in order to answer research question 4 (see paper IV and the method chapter). During the design phase, the playground was referred to as PlayLab Cph. The idea of a lab reflects the opportunity of exploring the interplay between nature and manufactured equipment, and exploring the evidence-based approach in this process. The research is thereby also anchored in the tradition of applied research.

Theoretical framework

The thesis brings together theories from environmental psychology in order to explore the interaction between human behaviour and the designed space in a real world context. The theories chosen are *behaviour settings* and *affordances* by respectively Roger Barker (1968) and James J. Gibson (1979), both of whom worked with the human-environment interaction from an ecological perspective.

Behaviour settings

A way of analysing combinations of physical features is to identify behaviour settings. According to James Barker, human behaviour is highly situated and can only be predicted if the environment and context is known (Barker 1968;Barker 1976). This observation developed into the theory of behaviour settings. Behaviour settings refer to subspaces of geographical areas in which physical environment and behaviour are linked together in time and space (*ibid.*). The settings consist of entities and events, that is, objects, people, and behaviour, and the boundaries are defined by the predictable and congruent patterns of the behaviour they afford or constrain (*ibid.*). In other words, the collective actions of individuals together with the supportive environmental characters engender behaviour settings, and mutually, behaviour settings form the actions of the individuals participating in them (Heft 2001).

Within the field of landscape architecture and planning, the concept has been used in various studies and at various scales. In Grahn et al. (2010), an entire therapeutic garden of 2 ha is considered a behaviour setting, and likewise, in a study of teenage boys with behavioural problems, a 10 ha wood is considered a behaviour setting although a sub-setting, the camp fire, is mentioned within that setting (Roe & Aspinall 2011). In Moore and Cosco's studies of childcare outdoor settings and public playgrounds (Cosco 2006;Moore & Cosco 2007;Moore & Cosco 2010), behaviour settings are typically identified as sub-areas such as climbing settings, sand play settings, etc. They have also operated with functional use zones (Moore & Cosco 2007), a term which embraces a number of behaviour settings related to the overall use such as 'Young Children Zone' and 'Composite Structure Zones'. Using the concept within landscape design, behaviour settings provide a medium for identifying the potential affordances of different areas (*ibid.*).

Affordances

The concept of affordances refers to the functionally significant properties of the environment, and offers a psychologically relevant instrument to analyse human-environment relationships (Gibson 1979). For example, a

feature in the environment may afford seating if the feature has the right properties (Heft 1989). Thus, affordances are properties of the environment that are relational to each individual's physical characteristics (height, weight, and body proportions), but they are also highly dependent on the individual's capabilities, perception skills, previous experience and cultural meaning. An affordance is most often described as what is do-able, for example swing-on-able or jump-down-able (Heft 1988). An important aspect of affordances is the way that they are perceived. Perception is not merely about looking at an object or a setting, but also about interacting with it (Heft 2010).

It is feasible to identify the affordances of an environment which exist for an individual or a group of individuals relative to, e.g. body-scaling and motor skills (Heft 2001). This could be in play environments for children where many affordances can be anticipated (Heft 2010). Understanding the principles of affordances and how they relate to play activities in play environments can assist the designer in creating spaces for play (Moore & Cosco 2007). If there is compatibility between a child's desires and the recognised affordances of a place, the child interacts with the setting to actualise the affordance and perform the intended action (Chatterjee 2005). The child perceives or picks up information provided by the environment and then picks up self-information (own abilities, social context, previous experience) before responding to the information afforded by the environment (Tudge et al. 1997).

Applying the theoretical framework

The above mentioned examples of behaviour settings illustrate how they can consist of many different features and can appear at different scales depending on the research context. In Grahn et al.'s (2010) study, the therapy garden is a clearly defined behaviour setting where certain behaviour takes place different from its context; rural land and university campus. The same applies to Roe & Aspinall's (2011) forest setting where different behaviour is expected and observed than at the boys' everyday settings. According to, e.g. Moore and Cosco's (2007;2010) approach, both studies could have divided the garden or the forest into further behaviour settings if relevant. For example, the therapy garden's subspaces and their relation to specific therapeutic treatments and behaviour outcomes could be interesting to analyse. In Roe & Aspinall's case, further studies could concentrate on different types of wood and vegetation and how that affects behaviour and emotions.

In this study, I have worked with different scales of behaviour settings depending on whether I was designing them or analysing them. When analytically comparing, e.g. sand play settings, it does not serve a purpose to break the setting down into smaller entities as a comparison then stops making sense. It is quite important to know whether there is a slide in the sand

play setting or balance equipment to understand the actualised affordances observed in such settings (this approach was taken in papers II and III). However, when designing these settings, it can be valuable to work at different scales of sub-settings equivalent to Functional Use Zones as defined by Moore & Cosco (2007). Identifying these sub-settings helps define how the settings should be distinguishable and which overall potential affordances they should carry. The next step is to decide which further behaviour settings should constitute the sub-settings, how these should be inter-related and how they can provide additional affordances in this inter-relation (this approach was taken in the design process presented in paper IV).

As the above paragraph indicates, the affordance term also has different classifications. Kyttä (2004) uses the terms 'potential affordances' (relative to the individual and ready to be perceived), and 'actualised affordances' (revealed through action or self-reporting). She further differentiates between 'actively actualised affordances', meaning affordances which are derived from perception and action, and 'passively actualised affordances', meaning affordances which are derived from just perception. When analysing the use of behaviour settings, I have focused on 'actively actualised affordances' (paper II - IV), and when analysing self-reported information, I focused on 'passively actualised affordances' (paper I and IV, although the theoretical framework is not an explicit part of paper I). In the EBD design of the PlayLab Cph, potential affordances were anticipated (paper IV), and later it was investigated if these were actively or passively actualised. Further, I used the term 'non-actualised affordances' to refer to anticipated potential affordances which were not actualised. Also, the term 'additional affordances' was used (paper IV), which are actualised or perceived affordances which were derived from the evaluation, but which were not anticipated.

Methods and Materials used in the PhD thesis

The PhD thesis comprises two parts; 1) an evidence-based design approach to a playground design (PlayLab Cph), and 2) a multiple case study of selected playgrounds. I will present the study designs in chronological order although part one is related to research question 4 and paper IV.

1. PlayLab Cph

The PlayLab site was chosen among the city's playgrounds placed in an urban green space and due for renovation in 2009. According to Schipperijn (2010b), urban green space is 'publicly owned and publicly accessible open space with a high degree of cover by vegetation, e.g. parks, woodlands, na-

ture areas and other green space' (p. 26). Further, it can have a natural character, as well as a more designed or planned character (*ibid.*).

Due to diversity, it had to be a green space which did not already contain a Copla playground. Furthermore, it had to be of sufficient size and not just a single piece of equipment, and it had to be due for total renovation and not just the replacement of a few pieces of equipment. Based on all these criteria, the playground in Vigerslevparken's southern part was selected.

I.a PlayLab Cph - the relation to evidence-based design

In this part of the project, I was involved in an evidence-based design process as part of the design team. We triangulated existing research evidence on children's play and development, previous playground design research, the theoretical framework, knowledge on the specific site for the playground, and the requests and wishes of the municipality with our own best practice. As illustrated in figure 1, the process resulted in a research-based approach to the design of playgrounds and the PlayLab Cph, which was constructed in 2010.

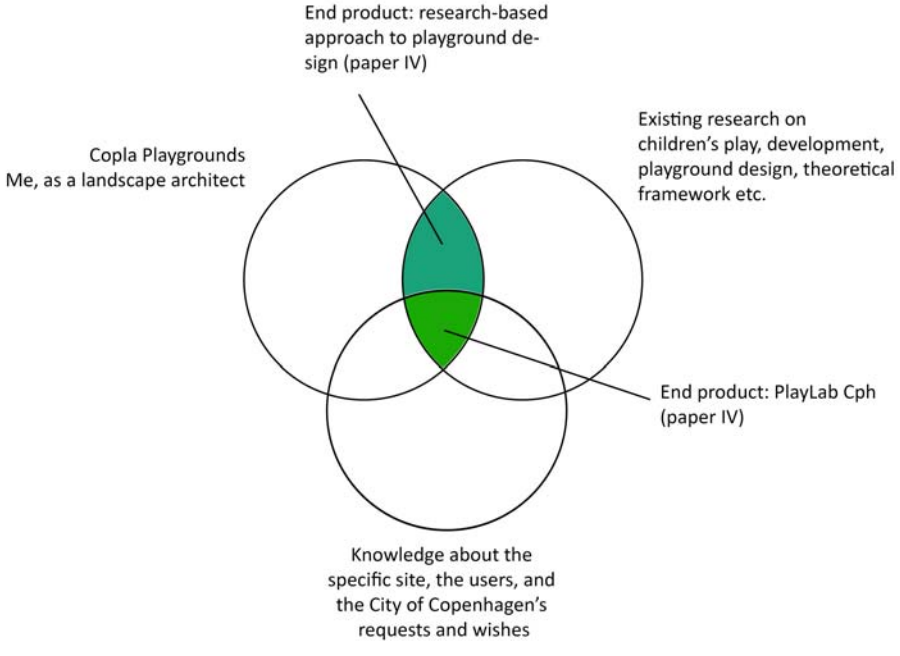


Figure 1. Illustration of the relation to evidence-based design in the project's first part

I.b The evidence-based design of the PlayLab Cph

The design of the PlayLab Cph offered the opportunity to investigate an evidence-based design process, and how to design for certain affordances. The process was iterative like most other landscape architecture design processes and consisted of four main tasks. 1) The identification of developmental characteristics of potential users by age and gender, and an identification of affordances which should be designed for based on these characteristics. 2) Designing behaviour setting types which previous play environment research has identified as providing these particular affordances. 3) Analysing and evaluating each proposal with questions such as 'does this comply with client wishes?', 'which senses are stimulated through this proposal?', 'is this realistic?', and 'which other affordances are provided by combining different behaviour settings?' 4) If the solution was not satisfactory, refinements were made, until the final behaviour settings had been identified and designed. The design of the behaviour settings also interplayed with evidence-based design intentions concerning the overall layout.

The sketches in figure 2 are examples of the early sketching phase in which different behaviour setting types and their potential affordances, sensory stimulation, and spatial characteristics based on the studied literature were explored. Further into the process, the exploration was focused on the inter-relation between different behaviour settings.

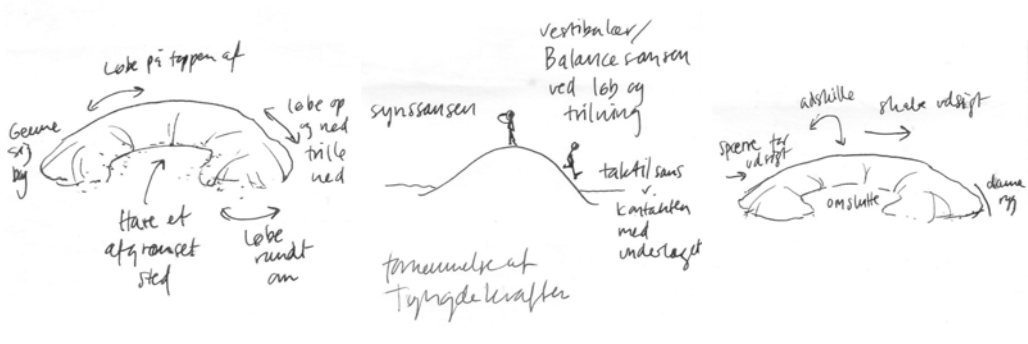


Figure 2. Examples of sketches from the early stage of the evidence-based design process – exploration of topography's potential affordances, sensory stimulation, and spatial characteristics

As previously stated, a large part of the literature comes from childcare research. Later in the project, I learned that play in a public environment is not always comparable to play in a childcare setting where all children know each other, use the space every day, and form certain social relations and

play situations in connection with the space, each other and the staff. However, childcare centres also visit public playgrounds and a 3-year-old child still has the same developmental needs, whether in a childcare setting or in a public setting. The biggest difference turned out to be children's mobility when at the playground, primary choice of play type, and peer-interaction (paper II).

I.c Post-occupancy-evaluation of the PlayLab Cph

The evaluation of the use of PlayLab Cph is based on a questionnaire survey and observation studies carried out as part of the multiple case study presented below. The name PlayLab Cph is not a publicly used name, but only used within the design team. When evaluating the use of the playground as part of the case study, the playground is thus referred to as Vigerslevparken South.

2. Multiple case study

The approach taken to answer research questions 1-3 was a multiple case study design, as case studies are useful for investigating complex, functioning, and contemporary units in their natural context with a variety of methods (Johansson 2005). According to Francis (2011), case studies within landscape architecture can build a body of criticism and critical theory. They are a way of expanding the research base, as they are useful for evaluating the successes and shortcomings of projects (*ibid.*). As human behaviour and feelings are partly determined by the context, it is important to study people in their context to understand this interaction (Gillham 2000). For this reason, I chose research methods which could be used on site.

2.a Multiple case study - the relation to evidence-based design

In this second phase of the PhD project, the PlayLab Cph had been constructed and I was no longer in the role of the designer. Instead, I conducted research which was particularly aimed at my own profession; landscape architecture. In this phase, I investigated the use and design of selected public playgrounds in urban green spaces. This resulted in new knowledge on user characteristics (presented in papers I and II), and on design (presented in paper III), as illustrated in figure 3. This knowledge can be included as part of an evidence-base in future EBD projects.

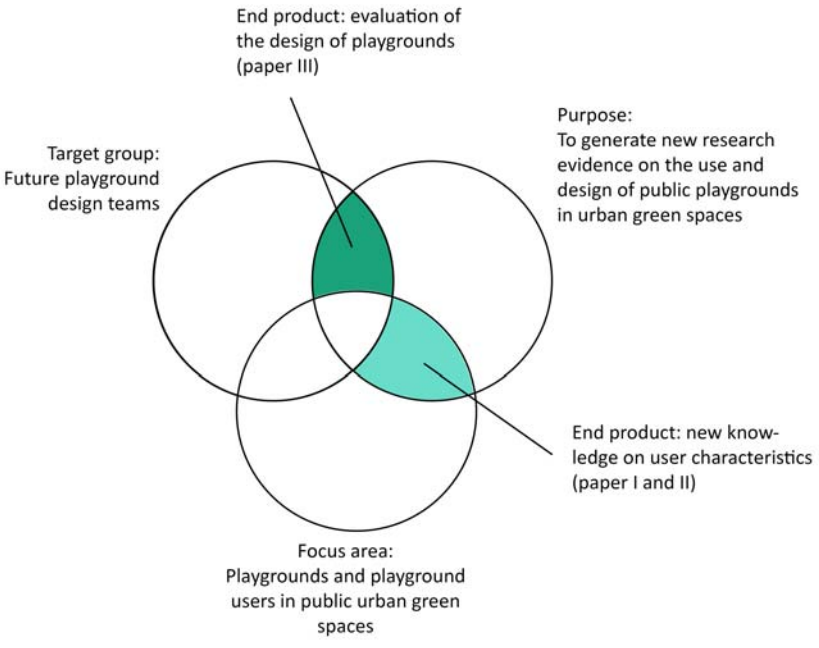


Figure 3. Illustration of the relation to evidence-based design in the project's second part

2.b Case selection

In order to obtain a broader perspective and to increase the likelihood of collecting valuable evidence, I chose a multiple case study design (Yin 2009) to answer research questions 1-3. The PlayLab Cph was naturally included as a continuous case in all studies to eventually be able to evaluate the design in relation to the intentions. Based on information-oriented selection, three additional Copenhagen cases were chosen from the city's other 62 public playgrounds in green spaces (Flyvbjerg 2004). Of these, 29 were eliminated as cases as they were due for renovation during the time of the field studies or in the immediate future due to their very poor condition. Other playgrounds were excluded if they only consisted of one play element (3), or if they had employed play leaders (11). This gave a total of 19 playgrounds to choose from, all of which were high quality in the sense that they were either fairly new or had been recently renovated. The next selection criterion was to find playgrounds with vegetation and topography to be able to answer research question 3. Three playgrounds, which are located in parks in

outer Copenhagen in areas with quite similar socio-economic status as the area of the PlayLab, were finally chosen: Rødkildeparken, Vigerslevparken North, and Ørestad City Park.

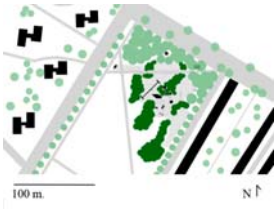
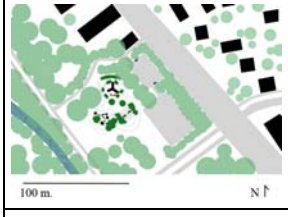
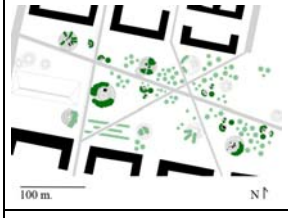
For research question 1, Cary, North Carolina, USA was chosen as a second case area. In the USA, there is great concern about the negative changes in children's lifestyles and children's lack of contact with nature (Louv 2008). In Denmark, there is a tendency for children to slowly follow the same pattern as the USA. Hence, I chose to compare the factors which influence the use of park playgrounds in the USA and Denmark in order to learn how the planning of these could be improved to support a positive development in each of the areas.

Two additional playgrounds were thus selected in Cary, NC, and were studied during a stay as a visiting scholar at NC State University. Again, all playgrounds share overall characteristics as they are located in urban green spaces in areas with similar socio-economic status, and all playgorunds are from the same decade. The playgrounds instead vary in terms of layout, play equipment design, immediate context and size (1500-5000m^2). Their individual design characteristics are briefly presented in table 1. For a more thorough presentation see the appendix in paper I. In the different papers, I often refer to the playgrounds as park playgrounds. Unlike those presented previously, this is not a playground type. Instead the term reflects the location of the sites, as all of the selected playgrounds are placed in parks.

2.c Questionnaire survey

On-site self-reporting semi-structured questionnaires were chosen as the data-collection method to obtain the adult perspective on the playgrounds in order to answer research question 1. The questionnaires were handed out at the playground and completed by the accompanying adults on-site. A proportional stratified approach was chosen to sample respondents to reflect, as closely as possible, the actual constellation of users (Agresti & Finlay 1997). Most questions were pre-coded with multiple choice options, but there were also several opportunities to give individual comments. The questionnaire was structured according to five overall themes: 1) The trip to the playground, 2) Choice of playground, 3) Time spent at the playground, 4) General questions about priorities when visiting playgrounds, and 5) Demographics. The number of completed questionnaires at each playground varied from 38-49 (N 261). The survey is described in paper I and the questionnaire is included as an appendix.

Table 1. Brief presentation of all cases

Context of playground	Photo of playground	Information about playgrounds
		Rødkildeparken DK Construction year: 2000 Size: 2000 m² Character: Dense vegetation and topography connected with play equipment.
		Vigerslevparken North, DK Construction year: 2007 Size: 1500 m² Character: Hilly terrain and vegetation create structure in the playground.
		Vigerslevparken South, DK Construction year: 2010 Size: 1700 m² Character: Vegetation and hills connected to play equipment.
		Ørestad City Park, DK Construction year: 2008 Size: 4000 m² Character: Spread 'islands', some of which contain play equipment, some are hilly and some vegetated.
		Kids Together Park, U.S. Construction year: 2000 Size: 5000 m² Character: Fenced playground with different zones. Varied topography and vegetation species.
		Walnut Street Park, U.S. Construction year: 2009 Size: 2000 m² Character: Even rubber surface. Surrounded by gentle slopes which are planted.

2.d Observation studies

Behaviour mapping was chosen as a means to gather information on the users' play and behaviour. Behaviour mapping as a tool for observing people's interaction with the environment was originally developed by Ittelson et al. (1970). The method has since been developed further (Cooper Marcus & Francis 1998) and has been used to collect evidence on the use of space in various fields (Golicnik & Ward Thompson 2010;Moore & Cosco 2007;Moore & Cosco 2010). A detailed description of the method and the approach of this project can be found in papers II and III. The behaviour mapping variables are attached as an appendix. In total 755 persons were observed in the mapping.

During my stay in North Carolina, I carried out a pilot study at the two playgrounds, Kids Together Park and Walnut Street Park, investigated in the questionnaire survey.

Figure 4. Behaviour mapping in action – picture taken during the pilot study at Kids Together Park, Cary, North Carolina, USA (photo: Peter Nordskov Hansen).

However, as behaviour mapping is a purely quantitative method, I selected semi-structured observations as a supplementary, qualitative method, with the purpose of explaining in detail either a specific situation observed in the mapping, a specific play taking place, how groups of children behaved compared to individual children, or in general what was going on at the playground. The term 'semi-structured' is chosen as, during the pilot study, I be-

came aware of the above mentioned subjects, which were important to cover. This way of observing is thus inspired by semi-structured interviewing where the interviewer seeks to cover certain overall topics (Bryman 2008). Hence, this provided the opportunity to more deeply understand the courses of a play, the interaction between the observed persons, and the interaction with the environment.

Figure 5 summarises the different methods used in the PhD project and how they relate to the different cases, research questions and thus papers.

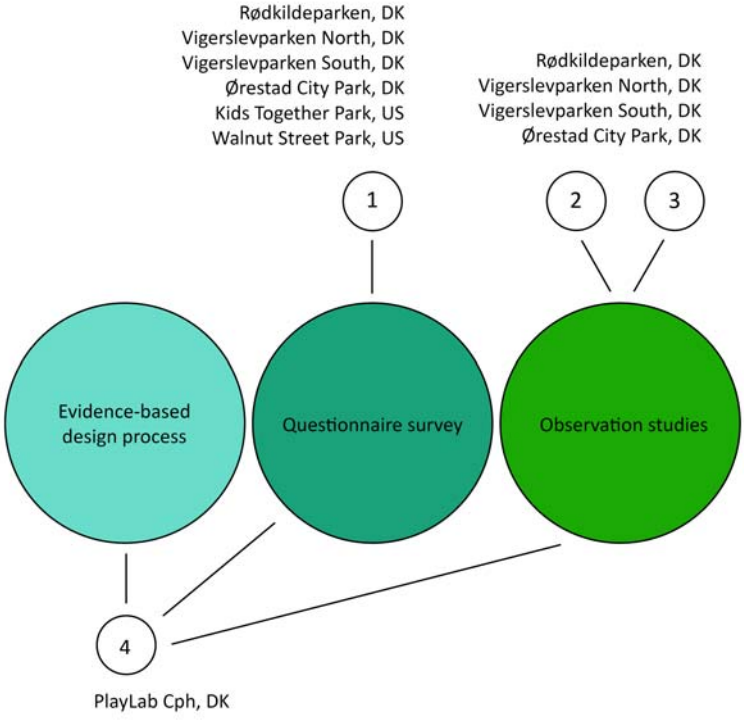


Figure 5. Overview of chosen methods. The numbers refer to both the related research question and to the related paper. Vigerslevparken South and PlayLab Cph is the same playground, but PlayLab Cph is only used in paper IV due to the focus on the design process.

2.e Processing and analysing data

The behaviour mapping data was selected in HanDbase Desktop Version 4.1.6., and on paper maps, and later carefully digitalised in GIS (paper II, III and IV).

Both the questionnaire and behaviour mapping data were processed and analysed in SPSS (version 19). Analyses performed in SPSS were descriptive analyses, factor analyses, and binary logistic regression analyses with a significance level of 0.05.

Written responses from the questionnaires were transcribed and coded in relation to common identified terms (paper I and IV).

Summary of results

The connecting thread of the four papers is that paper I focuses on more overall aspects such as the location and layout of park playgrounds. Like paper II, it also has a focus on user characteristics, but with a cultural perspective (USA and DK). Paper II elaborates further on the Danish users of the studied playgrounds and what influences their behaviour. In paper III, the playgrounds' designs are analysed in detail. Paper IV presents the entire process of working evidence-based and evaluates both the process and the use of the constructed site.

Paper I: Adults' Motivation for Bringing Their Children to Playgrounds in Parks

The aim of the first paper of the PhD thesis was to uncover more knowledge about the use and preferences of public playgrounds in urban green spaces. This could enable an understanding of possible motivational factors among accompanying adults for visiting park playgrounds with their children. Further, it provided an opportunity to compare respondents in the USA and Denmark.

The typical accompanying adult user in both the USA and Denmark is female, 31-45 years old, in a relationship, well-educated and the parent of the child she is accompanying. She brings 1-2 children to the playground and the average age of the child is 4.4 years old in Denmark and 4.3 years old in the USA. While sharing the above demographic variations, there are bigger differences when it comes to the home environment. Almost equal amounts of the Danish respondents live in apartment buildings with a playground in the courtyard, as in a private house with a garden; whereas most of the American respondents live in private houses with gardens.

The results show that the respondents have different motivations for going to a park playground. The Danish respondents find it most important to be together with their children, while the American respondents find it most important that their children are physically active whilst being there.

Other results show that different factors can influence both the frequency of visits and the length of stay. To Danish respondents, location is very important. The location in an urban green space seemed, for example, more

important than to the American respondents as Danes appreciated the green surroundings more than the Americans. Although most of the Danish respondents have outdoor environments at their home, the ones who have a courtyard with a playground seem to seek out the park playgrounds due to their location in a nature environment, amongst other reasons. Pleasing green surroundings and a nearby location also tend to result in more frequent visits among the Danes.

Not only is the playgrounds' location in a green space important, but also how they connect with the surrounding city, especially to the Danes who mostly come by bike or on foot. Rødkildeparken's location near a school and childcare facilities resulted in many users visiting on their way home.

Distance was not an issue among the American respondents who, in the majority of cases, visited the playgrounds by car, although both playgrounds connect with greenway systems and low trafficked housing estates.

All respondents, both American and Danish, stay longer and visit more often if they like the social atmosphere of the playground. However, male respondents of both nationalities, who are more active with their children than female respondents, have shorter stays if they dislike the variety of play equipment.

Paper II: Play and Behavior Characteristics in Relation to the Design of Four Danish Public Park Playgrounds

The aim of this part of the PhD study was to obtain a better understanding of certain user characteristics and behaviour in public park playgrounds in a Danish context. It explored which type of play and behaviour is characteristic of the Danish playgrounds included in the study, and how this is related to the design of the environments.

The paper reveals results that are partly already known from previous research, especially from childcare research. At the same time, it presents novel characteristics of play at public park playgrounds. As seen in childcare research, boys are more frequent users than girls, and the two groups also seem to seek different affordances. The constructive and sensory explorative world of water and sand had high appeal amongst boys, whereas different types of balance equipment seemed to attract girls. However, the swings at Vigerslevparken South, with their atypical and challenging design, also appealed strongly to boys. Girls at this playground, on the other hand, entered the world of sand play, which seemed to be due to the combination of wooden structures and sand, which offered various affordances and spaces. Rødkildeparken is the only playground which has an almost equal share of visiting boys and girls.

The types of play that take place at the playgrounds are related to the physical settings and hence the design of the playground, but also to the amount of peer-interaction in relation to age. Since a relationship between

individual play and functional play was found in this study amongst the largest user group (children aged 0-5), and since many visitors were individuals, the most dominant play type at the studied playgrounds was functional play. In connection with this, water play seems to initiate peer interaction and collaboration, regardless of whether the children know each other or not. However, it was also clear that two of the playgrounds lacked physical features which promote dramatic play. Another finding was the significant involvement in play, especially dramatic play, among male adults. This again calls for special attention to certain physical features in the playground design which support this involvement. Also, when groups (such as preschools, school classes, but also groups of friends visiting in their free-time) visited the playgrounds, it became clear that they used the playgrounds in other ways than otherwise observed. This was especially evident when looking at the use of the landscape. Compared to 'individual' visitors, groups were especially involved in dramatic play, which included play equipment, but also hills and vegetation. The opportunity to use many different physical features, including manufactured play equipment, vegetation, and topography thus seems to be important to both groups of children and to adult involvement in play. Female adults are mostly attracted to places that afford the opportunity to socialise.

Finally, the playgrounds have the potential to support physical activity, especially when physical features are linked together, such as play equipment and topography.

Paper III: Combining Behaviour Settings – How Design Affects Play and Affordances at Public Playgrounds

The aim of the third paper was to explore whether there are certain relations and combinations between behaviour settings previously identified as giving high quality playgrounds, which should be aimed at in a design situation.

Almost all of the most frequently used settings can be categorised in one of two groups; 1) the setting connects several behaviour settings, such as a water play setting at Rødkildeparken, a balance setting at Vigerslevparken North, settings in connection with a sand play setting at Vigerslevparken South and settings around slides at Ørestad City Park, or 2) the setting can be categorised as an attraction with a special character such as two climbers at Vigerslevparken North and Ørestad City Park. Twelve out of eighteen belong to the former category, while four belong to the latter. The least used settings are either located away from the centre of the playground, such as a climbing rock and a path at Rødkildeparken, or they lack connections with other settings and thereby attractions such as the vegetation settings at Ørestad City Park, pure topographic settings at Rødkildeparken and Vigerslevparken North and the back of a slide island at Ørestad City Park.

Also, the coding of the settings seems important to consider as a mix of defined and ambiguous settings within a sub-setting seems to provide more potential affordances. Thus, merely assuming that the presence of settings such as topography, play equipment, sand, water, and vegetation and an overall mix of ambiguous and defined settings is enough to guarantee high quality at public playgrounds is inaccurate. Careful consideration should instead be given to how settings interact with each other in order to gain the full benefit of the suggested settings. Attention should be paid to the potential affordances and sensory stimulation which can emerge in the close interrelations between settings.

Paper IV: Evidence-based Playground Design – Lessons Learned from Theory to Practice

The aim of last paper was to explore and evaluate the evidence-based design process along with the use of the constructed site of PlayLab Cph. This enabled an investigation of how well the design intentions comply with the actual use and perception of the site.

The paper presents an overview of children's developmental stages and identifies affordances which are important to design for. The design of the PlayLab is presented by behaviour settings and is anchored in research-evidence to support the various affordances.

The post-occupancy-evaluation of the constructed site shows that many of the anticipated affordances were passively or actively actualised. The design, however, also failed to some extent in regards to the youngest age groups and girls. Some accompanying adults expressed a wish for more opportunities for the youngest. Also at the PlayLab, the girls were equally represented as boys in the questionnaire survey, but in the behaviour mapping, they were outnumbered. So, girls do not seem to seek out playgrounds as a favourite place for play, if they can choose for themselves.

In regards to the EBD approach, it seems valuable to apply it to playground design as it concerns a certain user group with special developmental characteristics which changes within age and gender. As this part of the study shows, affordances can be a theoretical frame for interpreting these characteristics and for identifying behaviour settings which can support the actualisation of these affordances.

Discussion

Instead of feeding into the discussion on prevalent playground types in 2012 this thesis makes a suggestion for a new design approach to playgrounds placed in urban green spaces. Many of the results can, at the same time, be valuable for playground design in general, such as the affordance and behaviour setting approach. It is, however, clear that vegetation, which may be easier to implement in a green space setting compared to a very urban setting, provides sensory stimulation which other features lack. As such, the approach may be broadly applicable, but the constructed playgrounds will obviously differ depending on the context and on the designer.

Evidence-based playground design

As I did not perform a pre-intervention study of the old playground in Vigerslevparken, or an evalu

ation of a second non-EBD based Copla playground, there is no key by which to judge whether the PlayLab Cph is better than any of the above, or if this is due to the EBD approach. However, most of the anticipated and research-based affordances were actualised, together with additional affordances. And although some affordances were not actualised, the approach seems valuable. However, it still needs further development in terms of identifying additional affordances which should be designed for. If we, for example, had been able to include the results derived from all the investigations carried out in the PhD project, the design would most likely have been slightly different.

It is thus important that the results and experiences gained from this project are communicated to practitioners both within landscape architecture and play equipment design (see 'Recommendations for practice').

It has been argued that evidence-based practice should not be blindly embraced, as much knowledge is derived from lab-like settings and is not directly transferable to, for example, educational practice (Biesta 2010). Evidence from lab-like settings misses the active interaction between subject and object (Heft 2010). However, the evidence used in this EBD process has been produced in real world settings. This does not mean that all evidence works, as exemplified in paper IV by the research of Fjørtoft (2004). Results from a Norwegian wood did not seem directly transferable to an urban park playground in Copenhagen. The vegetation at the PlayLab was new at the time of the study and did not provide clear enclosures, which may explain why it did not afford, e.g. dramatic play. However, of the other studied playgrounds, only Rødkildeparken's vegetation afforded some dramatic play, even though scattered vegetation was present at all playgrounds.

Much of the evidence available in the field of outdoor play is drawn from childcare settings with focus on preschool-aged children. There is thus a need for further evidence on the characteristics of play in the public realm, due to the possible differences from institutional settings as presented in paper II.

Behaviour settings and affordances – useful in a design situation?

By taking the affordance and behaviour setting concepts into the evidence-based design process, the design embraces the relations between environment and behaviour. This is important as adults, in contrast to children, tend to perceive environments in terms of shapes instead of functions (Heft 1988). Landscape architects are, to a large extent, trained to work spatially with the environment, which is an essential skill that should not be undervalued. Nevertheless, by adding behaviour settings and affordances to the design process focus on what these spatial formations offer in terms of affordances and how they affect the behaviour at the designed space may increase. As stressed in paper III the inter-relation between behaviour settings and the additional affordances arising in this relation are in fact important to identify during the design process.

The challenge is, thus, not to design as easily comprehensible behaviour settings as possible by, for example, selecting well known play equipment from a catalogue and predicting whether the child will slide or not. The challenge is to create landscapes in which different types of behaviour settings in conjunction and with reference to the specific user group, offer opportunities for many potential affordances and sensory stimulation. Indisputably, it is not possible to predict every single human action no matter how carefully or well researched the design. The critical voices of playgrounds might claim that evidence-based design takes away the unexpected and children's initiative. It could on the other hand also be argued that it is the designer's job to set the best possible stage for public meeting places intended for play, socialisation and exploration. And here the EBD approach can prove to be valuable.

This is why the preliminary work of linking together children's developmental needs and characteristics with potential affordances and the design characteristics of behaviour settings, initiated in paper IV, is important to develop further. This should preferably be in close collaboration with child development specialists. In such future projects, it could be useful to also include how children are affected emotionally (Roe & Aspinall 2011), and attention-wise (Mårtensson 2004), when actualising or being constrained in actualising affordances. Also, a deeper understanding of how to design for similar affordances but for different age groups could strengthen the evidence-base.

User characteristics

While there are more female than male adults at the playgrounds, the gender distribution is more varied among children. There could be several explanations for why girls seem to fade out of the public playground realm. First of all, it has been reported that girls do not gain independent mobility as early as boys (e.g. Prezza et al. 2001). Further, it has also been suggested that girls do not go outside to play as often as boys (Harper & Sanders 1975). And finally, especially older girls have expressed dissatisfaction with the play opportunities found at playgrounds (Jespersen 2007). That Rødkildeparken had the most equal share of visiting boys and girls may be because it is able to offer potential affordances which are valued by both genders although not being the same, as described in paper II. A valuable focus for future research would be to try to determine whether something in the design of a playground can entice girls to visit more often, or whether it is just in their nature to gradually stop visiting earlier than boys.

Play and behaviour characteristics

In this project, new knowledge about play types emerged as it was not only related to age, but also to peer interaction and hence the nature of play in the public realm. Functional play has historically been criticised because of the relation to traditional playgrounds, at which this play type seems to dominate (Frost & Klein 1983). In this project, which did not include playgrounds falling under the traditional playground category, functional play was dominant even so. At some of the playgrounds this was due to the lack of settings which carried potential affordances for, e.g. dramatic play. This was not the entire explanation though, because there also seemed to be a relation between peer-interaction and play types. It thus seems to be a characteristic of play in the public realm that when children visit the playgrounds as individuals and not as part of a group, their play is solitary and primarily functional. Another characteristic of play observed at these public park playgrounds was related to peer-interaction and the use of the environment. Groups of children were much more mobile and had a higher use of a broader variation of settings – especially in the immediate surroundings compared to visitors who played alone.

Playgrounds in urban green spaces

Playgrounds in urban green spaces are not only used by city dwellers that do not have access to outdoor home environments such as gardens or courtyards with or without playgrounds. As seen in previous studies on urban green space use, having a garden increases the chances of being a frequent user of such spaces (Schipperijn et al. 2010b;Stigsdotter 2005). This may be because the garden is a catalyst for a more frequent use of nature environ-

ments (*ibid.*). However, the nature aspect was most important to respondents in Denmark as opposed to those in the U.S.

Proximity to the home and everyday facilities is another important aspect to consider when planning for playgrounds in green spaces, as also observed in Jansson & Persson's (2009) study of two Swedish towns. Again, this issue only proved to be important for the Danish respondents. Instead, promoting the greenway systems and their connections to the studied American playgrounds may raise their proportion of soft road users, although more research on the reason for this low use is needed.

Not only is the location in a green space important, but also the immediate green surroundings. Although they are not used all the time, they seem to have significant value to the children who visit in groups of various sizes. The same tendencies have been observed in previous studies (Jansson 2008;Moore 1986).

Design of public park playgrounds

For all visitors of public park playgrounds to gain as many of the benefits of nature elements as possible it is, however, important that nature settings are incorporated into the playground design and not just into the surroundings. As this study has shown, solitary child visitors rarely seek out the opportunities that pure surrounding vegetation and topography provide on their own. Thus, actively integrating such settings into the public playground design is important. Still, as also revealed, just adding the settings is not sufficient to ensure high quality. It is how they are added that seems to make the difference.

As already mentioned, the inter-relations between behaviour settings is an important design aspect to consider. Inter-relation is an aspect which has also been observed as important in play equipment design, as it can make children play for longer and promote more social play (Bruya 1985). Hilly topography could be inter-related with other settings, and at the same time, could increase the likelihood for higher levels of physical activity, which was confirmed in this project as well as in previous studies (Boldemann et al. 2006;Boldemann et al. 2011).

As also discussed in paper III, each setting's coding as either ambiguous/soft functionalistic or defined/hard functionalistic (Kirkeby 2006;Moore & Cohen 1978) is an aspect which can improve the quality of the design if combined in the proper way. Whether a setting is defined or ambiguous is based on the designer's individual assessment. Pure ambiguous settings seem to be too difficult for some children to perceive and thereby to actualise potential affordances. This is especially the case for children who are not part of a group, at least in the public playground realm. Settings which are too defined can, on the other hand, cause dissatisfaction and frustration as exemplified in papers I and III. So, when inter-relating the behaviour set-

tings, it is thus valuable to consider a mix of ambiguous and defined settings in this inter-relation. This is important to consider at the sub-setting level and not just at the playground level.

The role of the adults

This project revealed some interesting aspects of the role of accompanying adults. As previous studies have shown, there are factors which influence the use of public playgrounds and parents' choice of playgrounds (Berglund & Jergeby 1989;Jansson 2010;Sallis et al. 1997;Veitch et al. 2006). In this project, there was a clear relation to use and several of the respondents' preferences and criticisms of the playgrounds in question, both in terms of the frequency of visits and length of stays. A relation which has not been pointed out in any of the above studies is the one between fathers, involvement in play, and dissatisfaction with play equipment design and variation. As reported in the questionnaire survey and as observed in the site observations, male adults were significantly more involved in playing with the children than female adults. That the level of involvement is influenced by the play equipment found at the playgrounds, calls for attention to equipment which promotes the preferred play type, dramatic play. This could also explain why male adults in a North American observational study of a public park playground preferred a setting with a giant dragon (Moore & Cosco 2007). In the same study female adults preferred gathering settings much more (*ibid.*), which correlates with the findings in this thesis. Most female adults thus seem to use the playground visit as a time for relaxation and socialising and for spending time with the child by simply being present and available.

Critical voices have questioned the value of adult involvement in play (Sutton-Smith 1974), but research is limited and mostly concerns infant/mother play, or teacher/preschool child play (Johnson et al. 1999). The children observed in play involving adults in this PhD project did not seem suppressed or overruled by the fathers in any way, and one may argue that they also benefit from the involvement after long hours of separation from their parents during everyday life. Thus, there is no key to this question and it needs further research.

Recommendations for practice

The following is a suggestion for how to transform the research evidence gained through this PhD study into applicable design and planning guidelines for practitioners. The guidelines concern location and overall design, as well as more detailed design aspects and they can supplement existing knowledge on playground design. Further, the appendices in paper IV provide compilations of research evidence related to affordances and to integrating nature settings into the design.

Table 2. Design guidelines based on the research results

Location and overall layout
o Proximity to every day facilities o Easily accessible o Immediate surroundings should include vegetative settings for groups to explore o The playground layout should not be too spread-out o Nature settings should be integrated into the playground layout to benefit the solitary visitors o The playground setting can be seen as a refuge in interplay with surrounding open space settings o Consider safety aspects such as proximity to traffic or water features. Water features could, if possible, be located in connection with the access routes
Evidence-based design approach
o Identify the potential affordances which should be designed for based on client requests and wishes, and on the characteristics of the potential user group o Identify the potential sensory experiences which should be designed for o Find evidence in research and own best practice to support the design of behaviour settings which carry potential for the identified affordances and sensory stimulation to be actualised
Behaviour setting inter-relations
o Pay careful attention to any additional potential affordances and sensory experiences which emerge when inter-relating different settings o Inter-relation can both be beneficial between various play equipment and between equipment, vegetation and topography
Defined and ambiguous settings
o Consider carefully the mix of defined and ambiguous settings o The mix should be provided on sub-setting level and not just on playground level o This means that within the sub-setting there should be settings which are easy to decode together with settings which leave room for different interpretations
Adult user considerations
o Integrate gathering settings closely with play settings to especially accommodate female adults o Create opportunities for dramatic play to engage the male adults

Theoretical and methodological discussion and limitations

The dual researcher role

During this research project, I was involved in a design process with external collaborators and afterwards I had the task of evaluating the result myself. It was therefore important to be aware of the possible bias in having this role, although it has been done before. For example, in the 1990s, Herrington & Studtmann (1998) led a research project with the aim of testing whether landscape interventions in an existing childcare setting encouraged various kinds of play and development. The researchers placed both temporary and permanent interventions in the setting, and carried out pre- and post-intervention studies (*ibid*). Similarly, Moore (Moore & Cosco 2007) has been involved in both designing and evaluating the use of the Kids Together Park, one of the cases in this thesis. As opposed to these two examples, I did not have a research team with me to collect and validate the data. Instead I had co-authors collaborating with me on each paper, validating the analyses. I also attempted impartiality when presenting the results which I hope shines through the papers. By including additional cases, the derived data further comes from several sources and not just 'my own' case. It can, on the other hand, also be an advantage to know a case well, as it enables more thorough analyses like the one on EBD presented in paper IV.

Data collection

Due to the inclusion of the PlayLab Cph project, this thesis has not taken the classic research design approach. This means that I had to exclude having a large amount of cases, and also to prioritise the data collection methods.

My intention was, for instance, to conduct interviews with a number of adult informants, but this was not compatible with reality. The interviews were meant to take place with selected adults immediately after they had returned the completed questionnaire. However, as they had already spent 20-30 minutes on filling out the questionnaire while keeping an eye on the children, these interviews became rather stressful and I decided to abandon them. The interviews could have provided more in-depth and qualitative knowledge on the responses from the questionnaire. Some of the intended questions were 'Do you think this playground offers something for you as an adult that you cannot find at other playgrounds you use?' and 'Is this playground a place that you mostly visit to satisfy your children or is it a place you enjoy as well?'

I had similar intentions with the children. Though the adults were able to give valuable information about their children's perceptions of the selected playgrounds, it would have been even more valuable to have used the children as informants themselves. The intension was from the beginning to conduct walk and talk interviews (e.g. Kylin 2003) with children at the playgrounds, but due to time limitations, I had to leave out this method. In retro-

spect I could have tried to prioritise interviews at the PlayLab in order to obtain deeper insight into this playground instead of not having any interviews at all.

When it comes to the observations studies, observing human behaviour in a real world context as a researcher means being part of, in this case, the playground realm. Although I tried to move around as unnoticed as possible, sometimes the children became aware of my presence and perhaps acted differently than usual (Graue & Walsh 1998). I never obstructed a play, however, and my observation positions in the behaviour mapping were carefully selected so that observations could be made at a distance, whilst still enabling all the details to be recorded. When conducting the semi-structured observations, the act of observing was not as visible as with the mapping with large paper maps and a clipboard. Instead I resembled more an accompanying adult although I wore a name tag.

The time aspect is not covered by behaviour mapping and here it could have been valuable to supplement with behaviour tracking (Moore & Cosco 2007). This method would have enabled an analysis of the behaviour settings' ability to maintain the children's interest. In the ideal world the study would also have been a longitudinal study in order to explore seasonal changes, and the change of the landscape.

In order to get the most valid and reliable data it would have been beneficial to have a team of observers for the behaviour mapping (Moore & Cosco 2010). This could also have given twice as much data to strengthen the analyses. However, resources in a PhD project seldom allow for taking such an approach and I have merely my word to give for guaranteeing the validity of the data. This is, on the other hand, also the conditions that many qualitative researchers work under if not using e.g. video recording as data collection tool.

In the PlayLab project, I did not carry out a pre-intervention study of the former playground in Vigerslevparken. The park manager reported a low share of users due to its worn down state, but also users' unease about loitering teenagers. Further, such a study would have been rather time consuming. Instead I prioritised studying the other selected playgrounds. Generating knowledge about different approaches for combining behaviour settings, especially topography, vegetation and play equipment was to me more interesting than comparing a worn down playground with a new one.

Data analysis

In papers II and III, the division of behaviour settings is rather broad when it comes to vegetation settings. There was not sufficient data to subdivide these settings further. For future studies, it would be interesting to learn about the design and management of such settings and how different kinds of vegetative combinations afford different opportunities for play. Such a

study would be a further development of the work conducted by Fjørtoft (Fjørtoft 2001;Fjørtoft & Sageie 2000). It could provide evidence for why for instance some vegetative settings are better at affording some play types compared to others. Due to the usually long winters in e.g. Denmark, in such a study, seasonal changes would be very important to explore. This would, for example, generate knowledge on whether certain vegetation types carry more potential affordances than others when defoliated.

Case selection

As differences in socioeconomic status can influence children's play and behaviour (Rubin et al. 1976), I only chose cases placed in non-deprived neighbourhoods in rather equal socioeconomic status areas in an attempt to eliminate factors which could have influenced the results and thereby placed design as a secondary factor in the discussion.

In a future study with adequate resources, it would be interesting to include a larger number of cases, as this would enable analyses which could also be statistically validated (e.g. Mårtensson et al. 2009) instead of being mainly descriptive, as in this study. Playgrounds in more different contexts could then be included.

Chosen theory

Piaget's (1962) theories on play have been criticised, not as much for his definitions, but more for his view of children's different stages. He saw them as being more incompetent than they really are, which is probably due to his laboratory and not real-world context based research (Graue & Walsh 1998). Further, in the beginning of his research, Piaget viewed children as egocentric non-social beings which he, however, later refuted (*ibid.*). He has also been criticised for having a far too narrow view on what play really is (e.g. Sutton-Smith 1997). Sutton-Smith, for example, listed more than one hundred examples of what play can be, also among adults (*ibid.*).

As the focus in my study has been on playground play, there is little point in embracing all the different versions of play suggested by Sutton-Smith (1997), e.g. gambling, sports, and festivals. Four play categories may be the minimum for analysing play, and obviously they are also chosen as they suited the method of behaviour mapping well as they are easily recognisable and concise. On the other hand, I have tried to make the semi-structured play observation descriptions in the papers as precise and transparent as possible to give the reader an idea of my interpretations. These descriptions, furthermore, provide details which the mapping results are not able to give.

Strengths and weaknesses of the study

One of the strengths of the study is the fact that it provides an in-depth analysis of public playgrounds placed in parks. And as the study has been carried out on-site, instead of in a lab-like setting, the results should re-

flect, as closely as possible, the nature of public playground use. It is of course always essential to ask, whether the results derived in social science can be generalised. According to Gillham (2000), the results are usable and generalisable for understanding how other similar settings work through the analyses and theorisation of the generated data, even though they are specific to the particular settings. And although the studied playgrounds are located outside the city centre in less dense areas, it is feasible to argue that if the results are valid for these areas, they will also be valid for the dense city areas (Flyvbjerg 2004). This argument would have been more difficult the other way around, e.g. in relation to the significance that the green space has.

I also see the fact that the thesis presents applied research as being a strong point. This makes the results more useful for professions such as landscape architects and playground designers. Further, the cross-cultural part of the study gives it an interesting international perspective.

The study could have been strengthened with a larger amount of data and additional data sources. And although it manages to go in-depth on some aspects, others are only touched on superficially. A great weakness is also the total lack of universal design (UD) in both the PlayLab design and in the case study. The City of Copenhagen does not have any specific regulations on this in relation to public playgrounds, besides that it should be possible to enter the playground area in a wheelchair. Instead, there are a few fully accessible playgrounds in the city. This does not mean that I agree with this strategy, but it is a main reason why this has not been in focus in the thesis. On the other hand, there is no hindrance to applying the suggested EBD approach to a UD project. This would make UD part of the conditions for the project and valuable evidence can then be found in the previously mentioned work by Moore et al. (1992) and Moore & Cosco (2007).

Concluding remarks and future directions

This thesis has provided valuable knowledge on public park playground user aspects which affects the way that such playgrounds should be designed and located, both in terms of children and accompanying adults. If the design fails to incorporate these different aspects, it may affect the use of and satisfaction with the playgrounds. The evidence generated can be included in an evidence-based design approach as the one suggested in this study. The approach seems beneficial as, by integrating child development and play characteristics with affordances and behaviour settings, it takes many different and important aspects into consideration. As also revealed, it is important to carefully integrate different settings when designing the playgrounds.

As reflected upon in the discussion, there are a number of aspects which could bear further research. For future studies, it would thus be interesting to

go deeper into the role of the adult users. This could generate knowledge on further design aspects to consider. It would also enable a discussion of the affect that adult involvement/non-involvement has on children's play, for good or for worse.

The absence of especially school girls at playgrounds could also be meaningful for further studies. Is there something in the design which could change this, or is it just an inevitable part of their development? And is there a relation to how accompanying female adults behave when at playgrounds?

In relation to the urban green space context, it would be valuable to obtain more knowledge on the affordances of different types of vegetation in a Danish context. For instance, what is the relation between different types and combinations on one side, and play types and social relations on the other? How should park managers plan and maintain the immediate vegetative surroundings of park playgrounds?

Finally, there are several things to develop further in the suggested EBD approach such as a refinement of the identified affordances, especially in relation to age and gender characteristics, but also to emotional affordances. Such further development would require collaboration with child development experts.

Acknowledgements

Becoming a PhD is a learning process and an education. When I graduated as a landscape architect in 2006, research did not play a very big or visible part in the education and in many ways I had to start from scratch. I started out by wanting to save the whole world and ended up filling a few small research gaps. During my time as a PhD student, I realised along the way what I was and was not capable of, and the amount of resources it actually requires to fill out larger gaps. The approach to this PhD study has been rather broad and there are many gaps yet to be filled as not all ends could be tied up by this project. However, this is also one of the important tasks as a researcher – to be able to make suggestions for future research directions.

The project has now come to an end and I feel that I have gained a thorough understanding of the use and design of public park playgrounds and on combining research and practice. There are a number of people and institutions that I would like to thank for helping me get this far.

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List of papers

The thesis is based on the work contained in the following four papers, referred to by their Roman numerals in the text.

I: Refshauge, Anne D., Stigsdotter, Ulrika K., & Cosco, Nilda G. *In 2. review.* Adults' Motivation for Bringing Their Children to Park Playgrounds, (submitted for publication in *Urban Forestry & Urban Greening*).

II: Refshauge, Anne D., Petersen, Lise S., & Stigsdotter, Ulrika K. *In review.* Play and Behavior Characteristics in Relation to the Design of Four Danish Public Park Playgrounds, (submitted for publication in *Children, Youth and Environment*).

III: Refshauge, Anne D., Stigsdotter, Ulrika K., & Petersen, Lise S. Combining Behaviour Settings – how Design Affects Play and Affordances at Public Playgrounds, (Manuscript, to be submitted to Landscape & Urban Planning).

IV: Refshauge, Anne D., Lamm, Bettina, Thorleifsdottir, Kristin, & Stigsdotter, Ulrika K. *In review.* Evidence-Based Playground Design – Lessons Learned from Theory to Practice (submitted for publication in *Landscape Research*).

The four papers are not included in this version of the thesis due to copyright.

Questionnaire

Case Id nr.: Weather:
Date: Time:

Questionnaire about the role and behavior of accompanying adults at public playgrounds

This questionnaire is part of a survey about the role of adult users accompanying children to public playgrounds in green areas. The survey is conducted by Centre for Forest, Landscape & Planning, University of Copenhagen, Denmark, and by The Natural Learning Initiative, North Carolina State University, US. It is funded by the City of Copenhagen and Copenhagen University. Principal investigator is PhD student and visiting scholar Anne Dahl Refshauge from Denmark. The results will be part of a PhD project about the design and use of public playgrounds in green areas.
There will be a similar study in Copenhagen, Denmark in July and August 2010. All participants will be accompanying adults at a number of public playgrounds in the area of Raleigh and Copenhagen.

It will take 10-15 minutes to fill in the questionnaire. Your answers will be treated completely anonymously, and all data will be aggregated and kept in a private database. Your participation is voluntary and you may discontinue participation at any time without consequence.

In the questionnaire we will both be asking questions about this specific playground and about playgrounds in general (this excludes playgrounds at daycares or schools unless they are open to the public). There are no right or wrong answers so please feel free to give your oppinion. ☐
Please mark your answers with an X (how many will be indicated under each question), and please write clearly when you are asked to write an answer.

☐ ☐
Would you like to participate in the survey? Yes No

Thank you very much - we appreciate your contribution.

Contact number (principal investigator): 919-345-6969
Contact number (the IRB): 919-515-7515

1

The first questions will be about your trip to this playground

1. How did you get to the playground?
Please choose several if relevant):

- ☐ I walked with the child in a stroller
- ☐ I walked while the child biked next to me
- ☐ We both/all walked here
- ☐ I biked and had the child in a child seat or hanger
- ☐ We both/all biked here
- ☐ I drove by car
- ☐ I used public transportation
- ☐ Other If other - please write which: _____

2. Where did the trip to the playground start?

- ☐ At the child(ren)'s home
- ☐ At the day care/school etc.
- ☐ Elsewhere If elsewhere - please write where: _____

_____

3. How far did you travel to get to this playground from where the trip started?
Please mark with one X:

☐ 0 - 0.2 miles	☐ 0.3 - 0.6 miles	☐ More than 1.2 miles
☐ 0.2 - 0.3 miles	☐ 0.6 - 1.2 miles	☐ Do not know

4. Which other playgrounds do you visit regularly?
Please write name and/or location and rank them (you visit number 1 more often than number 2 and so forth)

1. _____
2. _____
3. _____

Now we would like to ask you questions regarding your choice of playground

5. Who made the decision to go to this playground? Please mark with one X:

- ☐ You (or another adult)
- ☐ The child(ren)
- ☐ A combination

6. What do you and the child(ren) like about this playground?

I like it because... (choose several if relevant):

- ☐ It is the nearest one
- ☐ We pass it on our way
- ☐ I like the green surroundings
- ☐ I like the design of the play equipment
- ☐ I like the variety of play equipment
- ☐ I like the way the whole playground is designed
- ☐ There are good facilities (nearby toilets, café)
- ☐ There is good seating (benches etc.)
- ☐ The environment feels safe
- ☐ It is easy to socialise with other adults
- ☐ It is not too crowded
- ☐ There are always other people here
- ☐ Other reasons (please write):

_____

_____

Please describe what you think your child(ren) like about it:

_____

_____

_____

_____

_____

_____

_____

7. What - if anything - do you and the child(ren) dislike about this playground?

What I do not like about it is that...
(choose several if relevant):

- ☐ It is too far away
- ☐ It is too difficult to get here (e.g. due to traffic conditions)
- ☐ I do not think the green surroundings are very interesting
- ☐ I do not like the design of the play equipment
- ☐ There is not enough variety in the play equipment
- ☐ I do not like the way the whole playground is designed
- ☐ There should be more natural elements
- ☐ There are no good facilities (toilets, café)
- ☐ There is no good seating (benches etc.)
- ☐ The environment does not feel safe
- ☐ It is not easy to socialise with other adults
- ☐ It is often too crowded
- ☐ There are not many people here
- ☐ I like it the way it is
- ☐ Other reasons (please write):

_____

_____

Please describe what you think your child(ren) do not like about it:

_____

_____

_____

_____

_____

_____

_____

8. Why did you choose to visit this particular playground today rather than any of the others you visit regularly?

Please write: _____

_____

_____

Now we would like to know how much time you spend at this and other playgrounds and what you do at this playground

9. How often do you usually visit this playground and playgrounds in general during the summer? Please mark the one that applies in both categories:

This playground:	Playgrounds in general:
☐ Every day	☐ Every day
☐ Several times a week	☐ Several times a week
☐ Once a week	☐ Once a week
☐ 1 – 3 times a month	☐ 1 – 3 times a month
☐ Infrequently	☐ Infrequently

10. How much time do you usually spend at <u>this playground</u>?
Please mark the one that applies in both categories:

During weekdays:	During weekends and holidays:
☐ 15-30 minutes	☐ 15-30 minutes
☐ 31-60 minutes	☐ 31-60 minutes
☐ 1-2 hours	☐ 1-2 hours
☐ More than 2 hours	☐ More than 2 hours

11. How much time do you generally spend at playgrounds?
Please mark the one that applies in both categories:

During weekdays:	During weekends and holidays:
☐ 15-30 minutes	☐ 15-30 minutes
☐ 31-60 minutes	☐ 31-60 minutes
☐ 1-2 hours	☐ 1-2 hours
☐ More than 2 hours	☐ More than 2 hours

12. Would you bring the child(ren) to this green space as often if it did not contain a playground? Please mark with one X and write:

☐ Yes - please write why: _____

_____

☐ No - please write why not: _____

_____

13. Please rate these five examples of activities that you as an adult might involve yourself in at or around this particular playground.

Mark with X a number between 1 and 5 - 1 applies the least to what you do and 5 applies the most to what you do:

	Least 1	2	3	4	5 Most
At this playground I am often passively involved (standing/sitting next to the climber/swing/sandbox) watching the child playing or guiding the child.	☐	☐	☐	☐	☐
At this playground I am often actively involved in the play (e.g. playing together with the child in the sandbox/at the swings/on the climber etc.).	☐	☐	☐	☐	☐
At this playground I am often exploring the natural elements at or around the playground together with the child (studying flowers, playing hide-and-go-seek behind trees, bushes etc.)	☐	☐	☐	☐	☐
At this playground I am often recreating (at e.g. a bench, on a blanket in the grass) reading, working, picnicking etc. while keeping an eye on the child.	☐	☐	☐	☐	☐
At this playground I am often running, walking or doing other kinds of exercise myself in the nearby surroundings while the child is at the playground.	☐	☐	☐	☐	☐

14. Now please rate the five examples again but this time trying to indicate what you think the child(ren) would prefer that you do.

Mark with X a number between 1 and 5 - 1 applies to what you think the child(ren) would the least prefer that you do and 5 what you think they would the most prefer that you do:

	Least 1	2	3	4	5 Most
At this playground they would prefer me to be passively involved (standing/sitting next to the climber/swing/sandbox) watching them playing or guiding them.	☐	☐	☐	☐	☐
At this playground they would prefer me to be actively involved in the play (e.g. playing together with them in the sandbox/at the swings/on the climber etc.).	☐	☐	☐	☐	☐
At this playground they would prefer me to be exploring the natural elements at or around the playground together with them (studying flowers, playing hide-and-go-seek behind trees, bushes etc.)	☐	☐	☐	☐	☐
At this playground they would prefer me to be recreating (at e.g. a bench, on a blanket in the grass) reading, working, picnicking etc. while keeping an eye on them.	☐	☐	☐	☐	☐
At this playground they would prefer me to be running, walking or doing other kinds of exercise myself in the nearby surroundings while they are at the playground.	☐	☐	☐	☐	☐

In the next questions we would like to know what you find important in terms of visiting playgrounds in general

15. How important are the following factors in general for you as an adult when going to a playground? Please mark with one X in each row:

	Very important	Important	Neither/nor	Unimportant	Very unimportant
Being together with the child(ren)	☐	☐	☐	☐	☐
Recreating outdoors	☐	☐	☐	☐	☐
Being physically active myself	☐	☐	☐	☐	☐
The child(ren) being physically active	☐	☐	☐	☐	☐
Experiencing nature	☐	☐	☐	☐	☐
The children experiencing nature	☐	☐	☐	☐	☐
Socialising with adults you know (spouse, friend etc.)	☐	☐	☐	☐	☐
Socialising with other adults	☐	☐	☐	☐	☐
The ability to have gatherings (birthday parties, picnics etc.)	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐

If other, please write: _____

_____

16. How do you think the following design features should be prioritized in playground design?
Mark with X a number between 1 and 5 - 1 means that you think it should have low priority and 5 means that you think it should have high priority:

	Low 1	2	3	4	5 High
Play equipment suitable for both adults and children	☐	☐	☐	☐	☐
Trees and shrubs as part of the playground design	☐	☐	☐	☐	☐
Hilly topography as part of the playground design	☐	☐	☐	☐	☐

Finally we would like know a little bit about yourself and the child(ren) you are accompanying to this playground.

17. Please indicate your gender and age

☐ Female
☐ Male

☐ 18-20 ☐ 26-30 ☐ 36-40 ☐ 46-50 ☐ 56-60
☐ 21-25 ☐ 31-35 ☐ 41-45 ☐ 51-55 ☐ More than 60

18. What is the highest level of education you have completed?
Please mark with one X:

☐ Elementary/middle school
☐ High school/ GED
☐ Vocational training
☐ 2-Year College Degree (Associates)
☐ 4-Year College Degree (BA,BS)
☐ Master's degree
☐ Doctoral Degree
☐ Professional Degree (MD,JD)
☐ Other

19. What is your current civil status?

☐ Single/ not living with a partner
☐ Living in a permanent relationship

20. Please indicate the age and gender of the child(ren) you are accompanying to this playground:

1. Age ⌊__,__⌋ Girl ☐ Boy ☐
2. Age ⌊__,__⌋ Girl ☐ Boy ☐
3. Age ⌊__,__⌋ Girl ☐ Boy ☐
4. Age ⌊__,__⌋ Girl ☐ Boy ☐

21. What is your relation to the child(ren) you are accompanying?
Please mark with X (more than one if relevant):

- ☐ Parent
- ☐ Grand parent
- ☐ Other relative
- ☐ Care giver
- ☐ Neighbor
- ☐ Friend
- ☐ Other, please write: _____

22. Please indicate which type of physical environment can be found at the home of the child(ren) (if the children are not living at the same address, please answer on behalf of the oldest child). Please mark with one X:

- ☐ Apartment house, **closed** court yard **without** playground
- ☐ Apartment house, **open** court yard **without** playground
- ☐ Apartment house, **closed** court yard **with** playground
- ☐ Apartment house, **open** court yard **with** playground
- ☐ Private house, **small** yard
- ☐ Private house, **big** yard
- ☐ Do not know
- ☐ Other, please write: _____

23. How far away from the playground do the child(ren) live? (if the children are not living at the same address, please answer on behalf of the oldest child). Please mark with one X:

☐ 0 - 0.2 miles	☐ 0.3 - 0.6 miles	☐ More than 1.2 miles
☐ 0.2 - 0.3 miles	☐ 0.6 - 1.2 miles	☐ Do not know

24. These were the last questions. Is there anything you would like to add?

Please write: _____

_____

_____

Thank you very much!

Behaviour mapping variables

1. Gender

Gender	Male / Female / N/A

2. Age

Early childhood	0-5 years
School age	6-12 years
Teenagers	13-17 years
Adults	18+

3. Physical activity level

0	No PA (empty obs.)
1	Stationary, no movement
2	Stationary, with movement, limb motion
3	Translocation, low movement: walking speed
4	Translocation, moderate movement: Jogging and vigorous movement
5	Translocation, high movement: Full run, very vigorous/strenuous movement

4. Play types

Functional	Player engages in repetitive or active physical activity
Constructive	Player creates or constructs something
Dramatic	Player performs fantasy actions and/or vocalises fantasy
Games	Player engages in activity with clear purpose and parameters
None	Observation subject is engaged in interactive or non-interactive behaviours, not defined by the above categories (routine care giving w/out verbal, non-verbal expression; sleeping, eating, crying, etc.)

5. Contact

Contact natural loose	Natural loose elements, player plays with twigs, leaves, flowers, small rocks, sand, dirt, water, etc.
Contact natural fixed	Player interacts with fixed to ground natural elements such as trees, shrubs, stumps, rocks, flowers, plants, etc.
Contact manufactured loose	Player plays with toys or other small objects
Contact manufactured fixed	Player plays with fixed elements such as play equipment, fence, brick wall, etc.
No contact	No contact

6. Peer interaction

One other positive	Positive interaction with one other
One other negative	Negative interaction with one other
Group positive	Positive interaction with a group
Group negative	Negative interaction with a group
No interaction	No interaction
Not present	Peer not present

7. Adult-child interaction

Not present (no value)	Adult not present
No interaction	Adult is present but does not interact with the target child
Positive	Adult encourages target child overtly, indicating agreement and support
Custodial	Adult looks after target child (does shoe laces, helps child to blow nose, offers water, collects clothing, etc.)
Negative	Adult stops target child's actions in an authoritative manner, rejects child's behaviour

8. Shade

Shade	Yes/no

9. Behaviour

Which applies the best?	1 Bending 2 Climbing 3 Constructing 4 Crawling 5 Digging 6 Hanging 7 Hiding 8 Jumping 9 Kicking 10 Kneeling 11 Lying 12 Moving 13 Other 14 Picking 15 Pouring 16 Pulling 17 Pushing 18 Running 19 Run-pull 20 Run-push

	21 Sitting 22 Sliding 23 Spinning 24 Splashing 25 Standing 26 Still 27 Swinging 28 Walking 29 Walk-pull 30 Walk-push 31 Pedalling

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