
Article:
Bozkurt, M., Woolley, H.E. orcid.org/0000-0002-6238-4068 and Dempsey, N. (2019) Children's interactions with water in city centres: a case study from Sheffield, UK. Landscape Research, 44 (6). pp. 671-687. ISSN 0142-6397

https://doi.org/10.1080/01426397.2018.1518518

Children's Interactions with Water in City Centres: A Case Study from Sheffield, UK

Melih Bozkurt and Helen Woolley

Landscape Research: doi.org/10.1080/01426397.2018.1518518

Abstract

Children's experiences of outdoor environments have been studied now for more than forty years yet no research has specifically focussed on children's experiences of water play in constructed spaces of city centres. This paper discusses the development of an observational mapping tool, called TOWEC, to record the interaction of children with water. It then reports findings and analysis from 3,399 observations over a year long period of children interacting with water in the award winning public open space of the Peace Gardens in the centre of the City of Sheffield, UK. The findings show that children undertake both active and passive activities associated with the constructed water features and that these activities are influenced by gender, age and temperature, but not ethnicity. The water features were not designed for children to play in but the children realise the potential affordance that the water features provide.

Key words:

Children, water, play, spatial occupancy, city centre, open space, affordance, mapping tool

1. Introduction

1.1 Children Cities and Water

Approaching half of the world's children, about 2 billion in total, live in cities and this number is expected to increase in future years (UNICEF, 2012). Within cities different types of open spaces in the outdoor environment provide opportunities for active recreation, passive recreation, community and cultural focus, and for children this can contribute to their health, social, environmental and educational activities (Broadhead, 2006; Carmona et. al., 2008; NPFA, 2000)

Children's experiences of outdoor environments have been explored through the seminal work of key authors such as Ward (1977), Lynch (1977), Hart (1979), Moore (1986), and Chawla (2002) and each of these support the fact that children are attracted to play with water in some form or another. Other research has built on the knowledge and methods developed by these leaders and some has touched on the relationship of children with water in outdoor environments but none have made it the focus of their research.

Children's relationship with water in the outdoor environment is usually reported as being positive although a negative relationship with rivers resulted from children's fears and concerns generated from their perception that rivers were polluted, littered and dangerous (Tapsell, 1997; Tapsell et al., 2001; Tunstall et al., 2004). However, a positive relationship with rivers resulted from the experience of angling as an intervention for disaffected young people (Djohari et al., 2017). So, it may be that the type of intervention and quality of the river influences children's experience of rivers.

In cities children enjoy playing with water in the form of fountains in parks in Manresa and Sant Feliu de Llobregat in Spain where both boys and girls enhanced their water play with play

things such as water guns and water balloons (Ferre et al, 2006), while in Mexico City children consider a park to be a good one if it has fountains in which they can run and splash (Gulgonen and Corona, 2015). Designed water features and a pond adjacent to a children's library in Boulder provide seasonal experiences of water (Derr and Lance, 2012) while the existence of water in parks can increase the active recreation of girls (Hume et al., n.d). These positive experiences of water in cities are also supported by an iconic photo of children playing with small paper boats in little streams made of hard materials in the centre of the city of Freiburg in Germany (Lennard and Lennard, 1992).

Water is also attractive to children in smaller conurbations such as a Swedish village where walkabouts revealed children played with water, watched fish and animals by ponds and affirmed that water in different forms including fountains, ditches and ponds is an element that enhances children's experience of other elements in the landscape (Jansson et al., 2016). Preschool forest school settings in Denmark are characterised by landscape elements such as ditches, shallow lakes or running water which are valued features supporting activities such as pouring, mixing, splashing and floating (Lerstrup and Refshauge, 2016). In these settings ditches particularly provide many opportunities for challenge and growing competence in children through pouring and splashing in water, or playing with bridges over ditches (Lerstrup and Moller, 2016).

Water has also be been identified as one of five favourite elements of childhood play in outdoor environments (Brunelle, et al., 2016) and acknowledged by children as being an element of nature (Callado et al, 2016; Freeman et al., 2015; Giusti et al., 2014; Gulgonen and Corona, 2015; Donnell and Rinkoff, 2015). However access to play with water can be limited for children, apart for those from families of advantaged backgrounds (Kates and Katz, 1977; Zube et al., 1983; Stoneman et al., 1983).

So it is clear that water in different forms is an attraction for children of different ages in different types and sizes of conurbations and different cultures. This may not be the case everywhere in the world but the evidence strongly suggests that where water exists children will play with it and this happens whether the form of the water is specifically designed for children's play or not. Where children's play has not been anticipated by either the designers or the managers of water, children who play with and experience water are realising the potential affordance (Gibson, 1979; Kyttä, 2002) of the situation. It is this potential and realised affordance (Kyttä, 2002) of water play in the centre of the City of Sheffield that this paper will report on.

1.2 Existing Methods for behaviour mapping

Behaviour mapping is a method to understand human spatial relationships and has been increasingly used in landscape research. It was originally developed by environmental psychologists and was initially a quantitative mechanism for counting numbers of activities. The first published example was undertaken in Minnesota and recorded patterns of verbal behaviour between teachers and pupils in classroom settings every three seconds, using a 10 category coding system (Flanders, 1961). This early example was of behaviour recording, not behaviour mapping, and counted behaviour to create quantitative data. The term behaviour mapping was first used by Ittelson and Prohansky (1970) and was developed to record and count behaviour in the built environment. Over a period of 40 years, behaviour mapping has become a well-used non-participant observational method used by urban open space specialists (Golicnik & Thompson, 2010; Mckenzie, 2006; McKenzie, et. al., 2000; Moore & Cosco, 2010). Although initially such mapping was not used in open spaces, increasingly over the years the method has been used to observe human activities in public open spaces (Bahillo et. al., 2015; Malone & Tranter, 2003; Marušić, 2011).

An early example of research using behaviour mapping of children in urban open spaces sought to determine differences in children's relationships with the built environment before and after the redevelopment of a neighbourhood (Van Andel, 1984). Since then the amount of behaviour mapping and research specifically designed for children's activities has increased. For instance McKenzie et al. (2000) developed and successfully used SOPLAY, to explore types of play mainly in school grounds. Following this, SOPARC was developed to investigate types of physical activity with a focus on public parks with the aim of measuring fitness, sports, and active and sedentary play levels in open spaces (Mckenzie, 2006). Similarly, Malone and Tranter (2003) concentrated on social interaction and play behaviour in school grounds. One of the first behaviour mapping approaches using digital data to record behaviour mapping specifically of children used hand held PDAs, similar to today's smartphones (Cosco et. al., 2010). This research investigated and used several direct observation coding methods to create a protocol suitable for preschool environments.

In recent years, not only the number of behaviour mapping studies but also the number of GPS/GIS integrated behaviour mapping studies has increased, with the latter being used to create visual data showing the spatial occupancy of the spaces being examined. The development of GPS technology and the affordability of such devices has increased the number of GPS/GIS based studies (Neilson, 2005). However, in studies involving GPS devices, participants need to be recruited into the study in advance, in order to equip them with GPS devices and in such research only a limited number of participants can be studied. Moreover, participants' behaviours might be affected because they already know they are being tracked by researchers (Marusic & Marusic, 2012). Although it is mainly used for planning research, the frequency of use of GIS in behaviour mapping is increasing (Cosco et al., 2010; Golicnik & Thompson, 2010; Marusic & Marusic, 2012; Thwaites et. al., 2007; Thwaites & Simkins,

2007). The majority of the research merging GIS and behaviour mapping integrates human experience and spatial occupancy.

All of these options were considered for the research reported in this paper and none were deemed suitable. The use of SOPARC was rejected because it investigates physical activity not play. The use of both SOPLAY and Tranter and Malone's (2003) recording of play were both deemed inappropriate because they were developed for use in school grounds. Although school grounds might be deemed to be public open spaces in reality they are usually not because they are fenced in and managed very highly for the times and use. In reality such supposed public open spaces are in fact public closed spaces. In addition, the number of children using school grounds are fixed, known and limited to the children in the school and all the research about children in school grounds investigates only children attending a specific school and sometimes only a small number of these children. This is very different from seeking to observe children in public open spaces which are not fenced, where children can come and go at different times and for different reasons. This can result in unknown, often large, numbers of children to observe.

As a result of none of the known existing methods being suitable for use in public open spaces, as opposed to public closed spaces such as school grounds, and the desire to maximise the number of observations, a new method for recording and mapping children's interaction with water in public open spaces, was developed. The method developed was called 'Tool for Observing Water Experiences of Children' (TOWEC) and its development is explained in the following methods section.

The aim of the research was two-fold seeking to contribute to the gap in both *methodology* for the collection of data and *knowledge* about children's water play in public open spaces. The first aim was addressed through the development of TOWEC and this is described in section

2, methodology. The second aim was addressed in a large study that used TOWEC and other methods to collect data about children's water play from children, parents and professionals who designed and managed some of the public open spaces in the City of Sheffield. This paper only reports findings of the data from one of the three study sites of the larger study. In seeking to understand children's experiences of water play questions identified were: How do children interact with the water? How do different age groups interact with the water features? What is the diversity of children interacting with the water feature? How does the design of the urban open space influence children's interaction with water?

2 Methodology

The study took place in the City of Sheffield which is the third largest metropolitan area in England by population (Office for National Statistics, 2014). The city offers a variety of potential sites where children can interact with water and these include the city centre, where a series of water features have been developed since 2000, including the Peace Gardens, Millennium Square, Barker's Pool, and Sheaf Square. The one children interact with most and therefore the focus of this paper is the Peace Gardens (Figures 1 and 2).

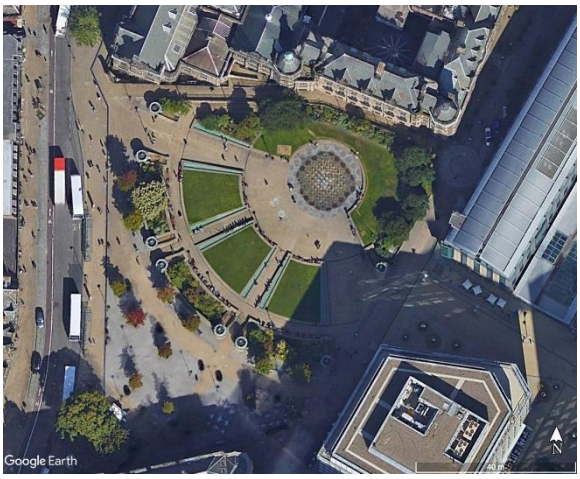


Figure 1 and 2: The Peace Gardens.

This was completed in 1998 and funded as part of a millennium regeneration project for the city centre. The design philosophy reflects the history of steel making in the city by the inclusion of water rills leading to the central area which contains 80 water jets which rise to heights of several metres. The space is managed by the city centre management team and City Centre Ambassadors who have a dual role of welcoming and enforcing bye-laws of no wheeled activities (Woolley et al.' 2011).

2.1 Development and piloting of TOWEC

TOWEC was developed to gather data about children's interaction with water in public open spaces taking account of activities, age, gender and ethnicity. It was designed for hand coding for two reasons. First, when this research was designed, mobile devices such as tablet PC's with integrated GIS software were not commonly available at a reasonable price. Second, hand coding with symbols is easier than coding on a mobile device in busy areas because of complicated dropdown menus in mobile device applications.

There is no previous research about children's interaction with water to inform a coding system and so a pilot study was undertaken with one aim of identifying the activities relating to water interaction that should be recorded. The Peace Gardens was observed for 5 days in April to identify what kind of activities children were undertaking in association with the water. An initial coding system was developed and was informed by pilot study. This allowed activities to be identified, listed and condensed into groups for coding. This set of new behaviour codes is shown in Table 1.

Some of these codes have resonance with the sedentary, active, sport and fitness codes in SOPARC (McKenzie, 2006) but the focus of this research was not the level of physical activity but the extent and type of interaction with water. Thus, in order to explore the spectrum of different interactions with water, the codes related to *active* and *passive* interaction with water.

Active interaction involved spending time and energy with water in activities such as running, walking or jumping in the water, chasing games, playing with water equipment and feeding animals in the water. Passive interaction involved no direct contact with water but included lying near the water, standing around the water, sitting on the grass, wall or bench and watching the water.

Physical Activity Base	Non-physical Activity Base	Non-water related Codes
Running/Walking in/under water	Lying around water	Passing through the space
Jumping in the water	Standing around water	
Chasing games	Sitting on a bench	
Playing water with equipment	Sitting on a wall	
Walking around water	Sitting on a grass	
Feeding animals in the water	Observing water features	

Age Codes	
Age Group 1 (0-9)	Age Group 2 (10-18)

Ethnicity Codes				
White	Asian	Black	Mixed	Chinese or Other

Gender Codes	
Male	Female

Table 1: Recording Protocol

The second characteristic addressed was age. Identifying a child's age by only looking at them can be problematic, but others have used age as an identifier of children in observations, so it

can be deemed to be an acceptable approach (McKenzie, 2006; Floyd et. al., 2011). These researchers used different age categorizations, however none of which were deemed suitable for this study. The wider study associated with this research involved children aged 8 to 11 participating in surveys in schools and from this data it was clear that about 10 was the age at which children's experiences with water changed from active to passive activities. The age of 10 has also been identified as when children's independent mobility increases (Brockman et al., 2011; Foster et al., 2014; Hillman et al., 1990; Hillman & Adams, 1992; Veitch et al., 2008) and when children are allowed to travel to town and city centres by themselves (Woolley, *et. al.*, 1999a; Woolley, *et. al.,* 1999b). Thus, age 10 was considered suitable as a breakpoint in age for observations in the context of this research (see Table 1).

White	**Black**	**Asian**	**Mixed**	**Chinese or other ethnic**
White British	Black Caribbean	Indian	White and Black African	Chinese
White Irish	African	Pakistani	White and Black Caribbean	All other Ethnic backgrounds
Other White	Other Black	Bangladesh	White and Asian	
		Other Asian	Other Mixed	

Table 2: Details of ethnicity codes derived from ONS

The third characteristic to code was ethnicity, because Sheffield is a multi-cultural city with 80.85% of its 570,000-population identifying as white British, and 19.15% as other ethnicities (Office for National Statistics, 2011). In addition, other research has identified differences between users from different ethnic backgrounds (Moore & Cosco, 2010; Cosco *et al.*, 2010).

This research used codes from the United Kingdom 2001 census ethnicity guideline, being the most up to date published national information at the time this research commenced (Office for National Statistics, 2001).

However, the national census ethnicity codes are detailed and it can be difficult to determine detailed ethnicity of children by observation in a multicultural city. Therefore, the Office for National Statistics (ONS) codes were condensed into 5 main headings used by ONS: White, Asian, Black, Mixed and Chinese or other (Table 2), in order to simplify the collection process.

According to the ONS the category Asian refers to people of Indian, Pakistani and Bangladeshi origin, whereas Chinese and others refers to people of Chinese and other Far East Asian origins. This was appropriate for Sheffield where the majority ethnic group is of Pakistani origin, who can usually be readily observed as different from people of Chinese origin. Although ethnicity codes were simplified, the reliability of the ethnic data collected might still be questioned.

Behaviour mapping rounds of less than 10 minutes are rare even for moderately used urban parks and shorter round intervals are likely to result in some double counting (Moore & Cosco, 2010). Larger or highly used spaces require longer round intervals and durations. The behaviour mapping for this research was undertaken in 15 minute rounds because the site was busy on warm days, with larger numbers of children than in more controlled settings such as schools or preschool outdoor spaces.

As well as codes for age, gender, and ethnicity the tool also included the round starting time, temperature, weather condition such as sunny, part cloudy, cloudy, light rain and heavy rain. Figure 3 shows the final behaviour-mapping tool that was developed and used in the research.

The sheet for recording observations was organized with the map on the left-hand side and coding for observations on the right-hand site.

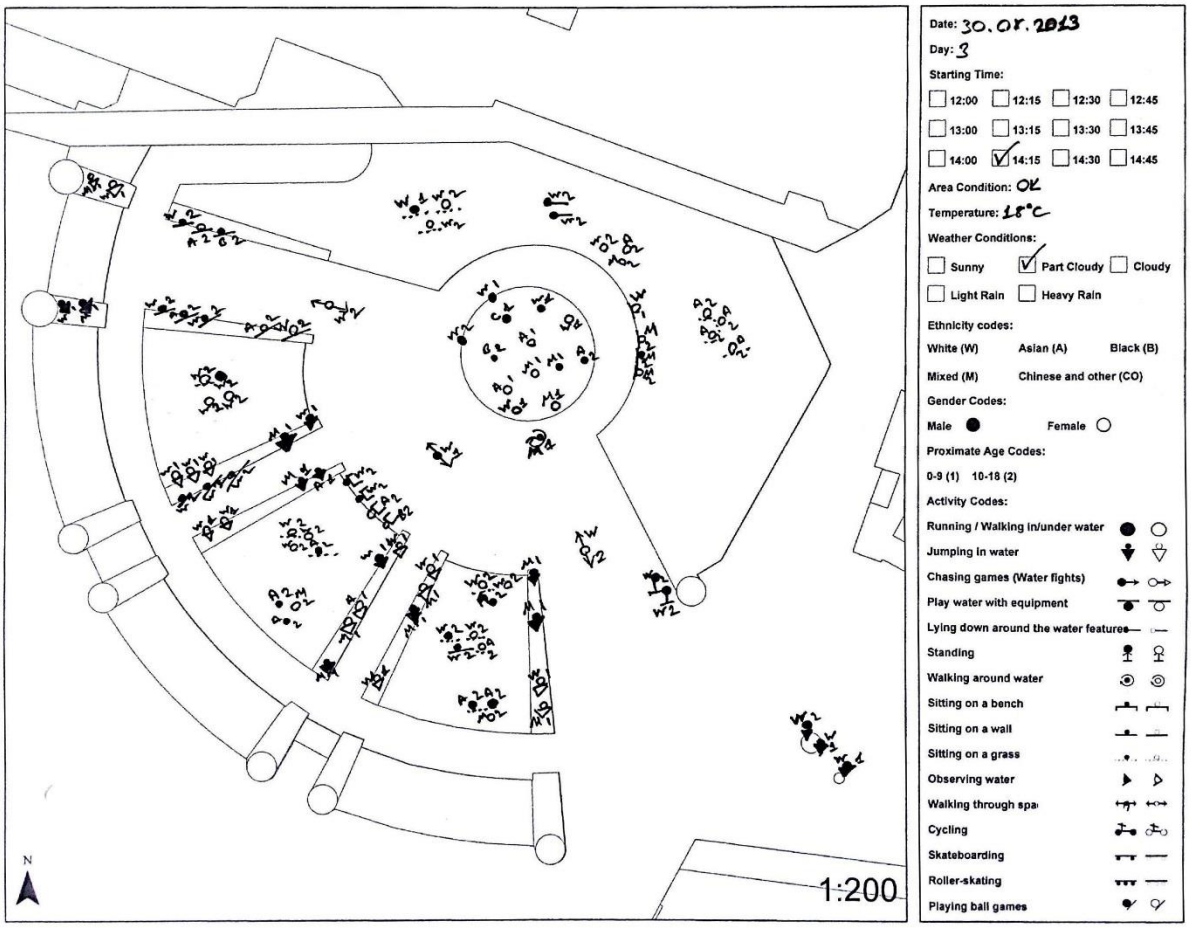


Figure 3: Final behaviour mapping tool

2.2 Ethics, Data Collection and Analysis

An ethics application was undertaken and approved as required by the university. It may be of interest to readers that one aspect of taking an ethical approach was the need to ask and gain permission from the managers of the city centre to undertake this research in the Peace Gardens, which is a highly managed civic open space at the heart of the City of Sheffield (Woolley et al., 2011).

In order to observe urban open spaces in different seasons and weather conditions an observation schedule was developed to cover the whole year. It was anticipated that observations in different times and seasons of the year would reveal differences about the

spatial distribution of children experiencing water. School holidays were chosen as observation intervals, due to the fact that most of the children involved in the surveys in the larger study mentioned that they most frequently used urban open spaces with water features in school holidays. Table 3 summarises the schedule of observations that took place in the Peace Gardens.

Autumn Mid-term Holiday (1 week)	1 day
Christmas Holiday (2 Weeks)	1 day
Spring Mid-term Holiday(1 week)	1 day
Easter Holiday (2 Weeks)	1 day
Summer Mid-term Holiday(1 week)	1 day
Summer Holiday (6 Weeks)	7 days

Table 3: Schedules of Observations in the Study Site

As table 3 shows observations took place 6 times in different seasons. One day of observations was conducted in each short school holiday and weeklong observations were conducted in the longer school summer holiday. Visits were made systematically at set times and at least one day in each site in each different holiday in different seasons, in order to increase the reliability of the data (Table 4).

As previously mentioned, a pilot study was undertaken and another of its purposes was to determine the optimum times and durations for observations. These observations took the form of counting the number of children in the area at different times of the day and different days

of the week. Data gathered in this pilot was used to determine the systematic observation times across seasons and times of day for the main study which are shown in Table 4.

	Sunset at latest	Times no more activity observed	Times of Observations
Autumn (November)	15:52	15:00	12:00 – 15:00
Winter (January)	15:57	15:00	
Spring (April)	19:42	16:00	
Summer (June)	21:38	17:30	14:00 - 17:00

Source of sunset times: (The Weather Channel, 2010, HM Nautical Almanac Office, 2011, Timeanddatecom, 2013)

Table 4: Summary of initial informal observations for determining observation times

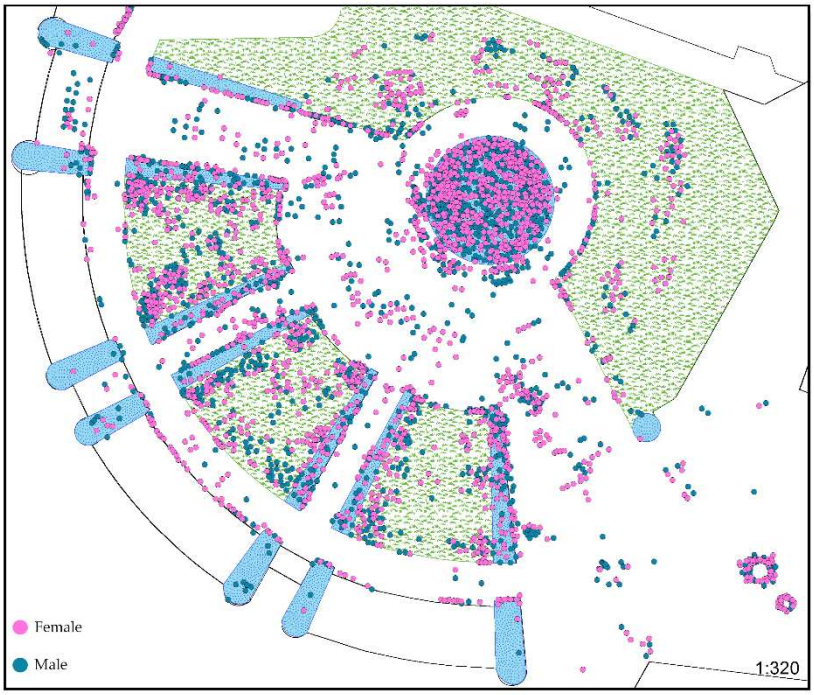
During observations, special attention was paid to avoid the classical behaviour mapping issue of double counting, which might affect any behaviour mapping study's validity (Moore & Cosco, 2010). Children staying in the area longer than a round (15 minutes) were specifically observed and not recorded in the following rounds unless the original behaviour had radically changed. This applied to only a small number of children during the observations, although there might still be a limited number of double counted observations, this is not likely to affect the overall reliability of the results.

Behaviours were hand recorded on the map and later digitized to make it suitable to use on a computer. Data was transferred to Arc GIS software from ESRI® for analyses. Children's behaviours and spatial distribution at different times of the day, year and in different weather conditions were compared and analysed. In this way, a series of behaviour maps were created with individual dots representing each child by age, gender, ethnicity and activity (Figure 1).

3. Results

A total of 3,399 observations of children were recorded in the Peace Gardens and these observations are shown on composite maps showing patterns of activity by gender, age groups, different times of the day and year, weather conditions, and temperature. Ethnicity was not an influencing factor and so this is not shown on maps or discussed in the text but this lack of influence is interesting in itself because this is different from some previous studies about open spaces (Moore & Cosco, 2010; Cosco *et al.*, 2010). Some examples in the written text of this paper refer to behaviours occurring on a particular day in order to explain specific observations.

According to the composite map of gender, it was clear that a greater percentage of female (56.7%) than male (43.3%) children were observed in the Peace Gardens and the majority of them were attracted to water features (Map 1).

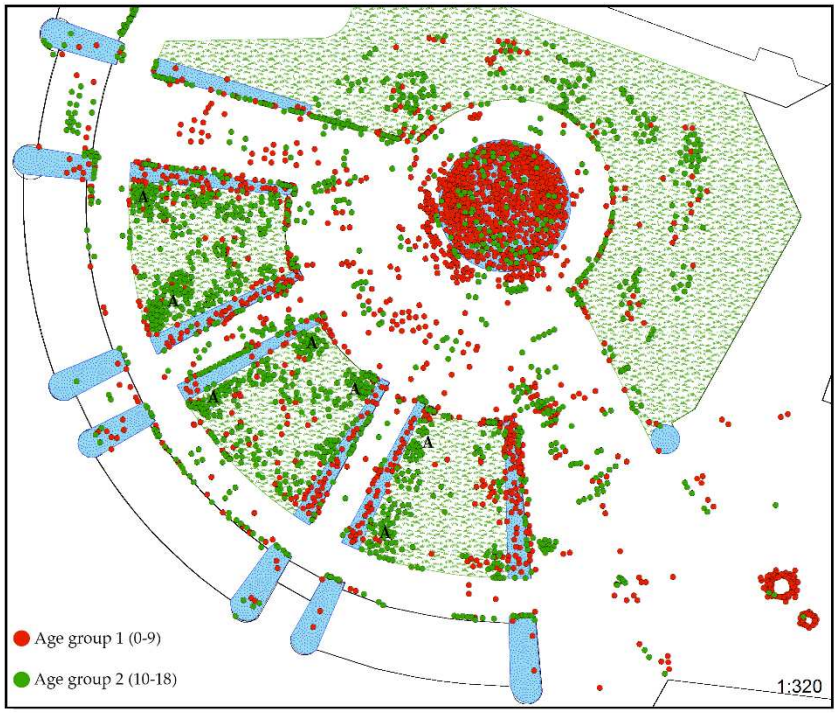


Map 1: Male and females

There was no real difference between males and females with respect to how they interacted

with water. This is especially the case for the younger age groups, who played with water in many different ways. More girls than boys were present in the Peace Gardens and most of them were interacting with the water taking part in many of the activities coded. They sat on the edge of the water elements, walked and ran under the spraying water features, and walked through the water canals, played chasing games and many others.

The second emerging result relates to the spatial use by different age groups. The percentage of young children aged 0-9 (51.4%) and older children, aged 10 and over (48.6%) visiting the Peace Gardens was not very different from each other. However, spatial occupancy by different age groups was different as can be seen in Map 2.

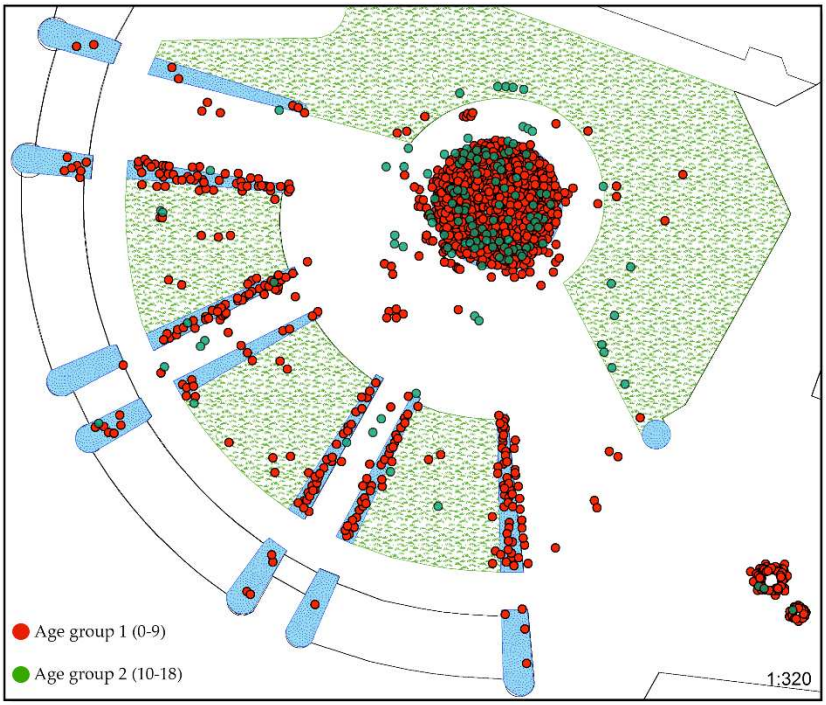


Map 2: Spatial occupancy by age

In the warm, sunny afternoon in spring or summer the younger age group visited the space with their parents to enjoy the water features and play with the water. The majority of children in the 0-9 age group were recorded in or around the water features. However, the older age group

seemed to visit the space and sit on a grass near the water features (A in Map 2). On a hot summer day if the space was crowded, then the older children started to move inwards on the grass areas while trying to keep themselves as close as possible to the water. In every situation, the older children tried to be close to the water features, even though they were not directly interacting with the water.

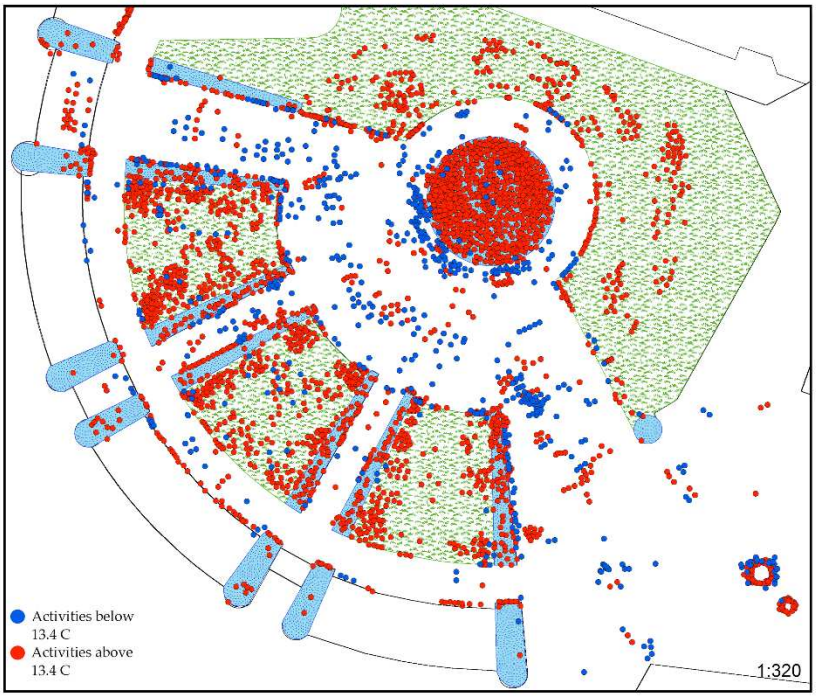
From analysing the data, it was apparent that there were two main types of water interaction: active and passive, as indicated in table 1. As mentioned earlier the former involves activities that expend energy and involve physical contact with water. This included throwing things into the water, running and walking in it.



Map 3: Interaction with water by age

On the other hand, passive interaction, involved activities with no physical interaction with the water but included watching, listening and sitting nearby the water features. Those displaying passive interaction with water read a book, met their friends, ate their food, chatted or listened

to music while being close to the water. From composite maps it is apparent that 33.8% of the activities recorded in the Peace Gardens were active interactions, 53.9% were passive interactions and the rest of the recorded children were just passing through the space. Active and passive interaction was directly related with the spatial occupancy of different ages. Young children occupied the places where they could interact directly with water directly. The majority of children actively interacting with water were young children (88.9%) with a limited number of older children (11.1%) actively interacting with the water (Map 3). They ran and played in and around the water, played chasing games, including water fights, and played with water with found equipment such as bottles and branches from trees. A small number of older children were observed actively interacting with the water but this was only observed on hot summer days and those who did were at the younger end of the older age range.

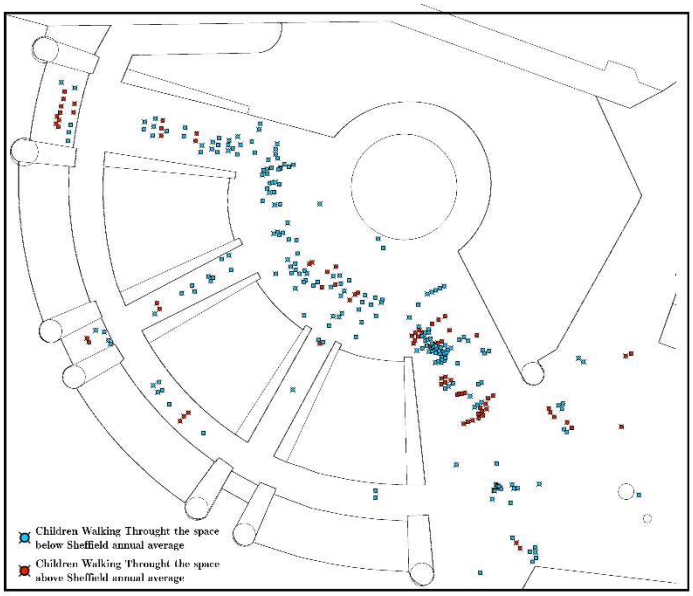


Map 4: Interaction with water by temperature

Sheffield's ambient temperature can be considered to be neutral, a thermal condition where people usually feel neither cold nor warm (Humphreys, 1975) and identified by research across

seven European cities as being 10.8 Celsius (Nikolopoulou and Lykoudis, 2006). People are likely to feel comfortable around this temperature and start undertaking outdoor activities in open spaces. This temperature (10.8° C) was used as a break point for analysis of the behavior mapping. The mapping revealed that in colder weather conditions, below about 10.8° C, both active and passive interactions with water rapidly decreased. In particular, active interaction that involved direct contact with water was almost non-existent (Map 4). Nonetheless, passive interaction in the Peace Gardens continued throughout the year.

Throughout the autumn or winter seasons, when the temperature was lower, only one or two children ran through the water while a small number interacted with the water, but only by touching it with their hands. In this colder weather, a limited number of younger children interacted with the water as they played around, rather than inside, the water features. Older children changed their behaviours to sit on benches rather than on the grass next to the water. Moreover, children sitting on the walls and passively interacting with water in colder temperatures, preferred the walls near to the western entrance of the space. The amount of time children spent in the space also reduced dramatically.



Map 5: Walking through the Peace gardens by temperature

The number of children passing through the space without stopping increased on cold winter days (Map 5) and on such days even passive interaction with water decreased. However, on warm spring days or summer afternoons even children walking through interacted with water features and older children passing by, broke their journey and sat on the grass if just for a few minutes. Warmer weather conditions affected both active and passive interaction and spatial occupancy in the space.

Another criteria that can affect the spatial occupancy of open spaces is their design. In the combination maps, it can be seen that the long raised walls, which are approximately 50cm high, with water channels were used for sitting on by children. This was particularly the case on hot summer days, when all of the walls were occupied (Map 6).

Map 6: Design influencing spatial occupancy

However, children mostly sat on the walls at the western entrance, around the big water feature and next to the water channels. Children did not seem to prefer to sit on the walls or grass areas at the eastern entrance of the space. Indeed, a large number of children were recorded standing at this point as if they were not staying in that part of the gardens. They talked with friends either sitting or standing for a short period of time before moving further into the Peace Gardens or leaving. This part of the site appears to have a function of temporary occupancy. Furthermore, children in the 10-18 age group seemed to like sitting on the raised grass areas and repeatedly avoided places on both sides of the entrance at the eastern end of the space (B in Map 6), which is close to the high-rise buildings and used by many people just passing through the space (Map 5). The density of children sitting on grass areas decreases towards the eastern end of the space.

A majority of the children sitting on a bench were recorded either on the benches directly facing the large water feature in the middle of the Peace Gardens or on the benches at the south-west of the site, which is away from the main attraction and exits. This may be a more relaxed and cosy place to sit in on a warm sunny afternoon, when the space is full of people.

This variety of sitting opportunities: raised walls, raised grassed areas, and benches, as well as well planted areas on the western side of the space, provide different options for children (and adults) to choose from and in sunny and hot weather all these seating opportunities were completely occupied.

4. Discussion and Conclusions

In summary the results confirm what much of the population of Sheffield knows, that the water features in the Peace Gardens are a great attraction for children. This is despite the fact that this public open space and the water features it includes were not designed for children to play in.

Despite this, as soon as the regenerated space was opened in 1998 many children immediately identified and realised the potential affordance (Kyttä, 2002) of the water and started to play in the fountains. This has continued for 20 years and no doubt will continue well into the future. It was this use, unanticipated by the designers, which made the Peace Gardens in Sheffield an eminently suitable site to study children's interaction with water in a city.

The research has shown that children's interaction with the water in the Peace Gardens is complex and influenced by a variety of issues including age, weather and to a lesser extent gender. A total of 3,399 observations were made and revealed that interaction with the water was either active or passive (Table 1). These interactions were spatially determined and dominated by the presence of the fountains where active involvement took place. On the other hand the water features acted as a stage for the passive activities.

The different types of interaction with water were influenced by three issues: gender, age and temperature, but not by ethnicity. More girls than boys were observed in the Peace Gardens and this may reflect the assertion that water features can contribute to adolescent girls' physical activity as suggested by Hume et al., (nd). Age was a good indicator of whether children's interaction with the water was active or passive. Younger children were more likely to interact actively with the fountains at the heart of the Peace Gardens confirming water as one of the favourite elements of children in the outdoor environment (Brunelle et al., 2016). Sometimes the active interaction included found equipment such as water bottles, tree branches similar to the use of water guns and water balloons identified by Ferre et al. (2006).

Temperature also influenced the use of the fountains in the Peace Gardens. The comfortable temperature of around 10/11 degrees C related to the amount of active interaction with the main water fountains agreeing with the work of Nikolopoulou and Lykoudis (2006). Above this temperature there was a lot of active interaction while below this temperature there was only

occasional interactions with the fountains**.** However, use of the overall space also changed with temperature, particularly for older children who would sit on benches rather than grass when the weather was colder. In addition some seasonal changes were identified, as Derr and Lance (2012) suggest might happen. Active interaction reduced in the cooler months but some level of passive interaction continued even in the cooler months, sometimes just in the form of walking through the space. Length of time spent in the Peace gardens also seemed to be seasonal with longer stays taking place in the warmer months and shorter stays being undertaken when it was cooler.

Beyond the water features the spatial use of the Peace Gardens varied with all elements of gender, age and temperature and specific design elements such as seating opportunities influenced this. More girls than boys interacted with the space as a whole as well as with the water features; younger children's activities were focused in the centre of the space where the fountains are positioned; older children's activities focussed on the raised grass areas, especially at the western end, away from the more commercial end with cafes and offices. Also the older age group appeared to like places where they could experience the feeling of open space but with aspects of enclosure at the same time, which were provided by the design elements of the high walls of the Peace Gardens, trees and herbaceous planting (A in Map 6). Although this vegetation does not provide any shade to the grass area it creates an environment which appears to be liked by the older children.

The findings and conclusions are of course limited because of the use of only one methods of data collection and this on one site. However the number of observations was large and included systematic observations over a year long period of time. One way to build on these limitations would be to undertake research about children's interaction with water in other locations. This could include settings in other parts of the world where culture, climate, seasons

and daily experience of water is different. It could also explore the influence of parents, friends and seasonal interventions in public open spaces while providing a deeper understanding of any differences by age, gender and ethnicity in different settings.

Despite the limitations the evidence from the research reported in this paper clearly indicates that even when water features are not designed for children's play many children will perceive the affordance for play. This means that designers and managers of similar civic spaces with water could benefit from considering the feature from a child's point of view, realise that children will seek to exert their agency through play in water and take this into consideration as they finalise their design and management plans.

Acknowledgements

Tool for Observing Water Experiences of Children (TOWEC) was developed as a part of PhD thesis undertaken at the Landscape Department in the University of Sheffield to understand children's experiences of water in urban open spaces. Both authors would like to than Sheffield City Council for allowing this research to take place in the city centre.

The first author would like to acknowledge Turkish Ministry of National Education's financial support for his PhD and Sheffield City Council's collaboration for authorizing permissions to conduct site studies.

References

Bahillo, A., Marusic, G. B., & Perallos, A. (2015, December 1-4, 2015). *A Mobile Application as an Unobtrusive Tool for Behavioural Mapping in Public Spaces.* Paper presented at the Ubiquitous Computing and Ambient Intelligence. Sensing, Processing, and Using Environmental Information, 9th International Conference, UCAmI 2015, Puerto Varas, Chile.

Broadhead, P. (2006). Developing an understanding of young children's learning through play: the place of observation, interaction and reflection. *British Educational Research Journal, 32*(2), 191-207.

Brockman, R., Fox, K. R., & Jago, R. (2011). What is the meaning and nature of active play for today's children in the UK? *International Journal of Behavioral Nutrition and Physical Activity, 8*(15). doi:doi: 10.1186/1479-5868-8-15.

Brunelle, S., Herrington, S., Coghlan, R. & Brussoni, M. (2016) *Play Worth Remembering: Are Playgrounds Too Safe?* Children, Youth and Environments, 26(1), 17-36.

Carmona, M., de Magalhåes, C., & Hammond, L. (2008). *Public Space: The Management Dimension*: Oxon, Routledge.

Chawla, L. (2002) *Growing Up in an Urbanising World*. London: UNESCO/Earthscan.

Collado, S., Íñiguez-Rueda, L & José A. Corraliza (2016) Experiencing nature and children's conceptualizations of the natural world, *Children's Geographies*, 14(6), 716-730. DOI:10.1080/14733285.2016.1190812

Cosco, N., Moore, R., & Islam, M. (2010). Behavior Mapping : A Method for Linking Preschool Physical Activity and Outdoor Design. *Medicine & Science in Sports & Exercise, 43*(3), 513-519. doi:doi: 10.1249/MSS.0b013e3181cea27a.

Derr, V. & Lance, K. (2012) Biophilic Boulder: Children's Environments That Foster Connections to Nature. *Children, Youth and Environments*, 22(2), 112-143

Djohari, N., Brown, A. & Stolk, P (2017) The comfort of the river: understanding the affective geographies of angling waterscapes in young people's coping practices, *Children's Geographies,* DOI: 10.1080/14733285.2017.1341971

Donnell, A. & Rinkoff, R. (2015) The Influence of Culture on Children's Relationships with Nature. *Children, Youth and Environments*, 25(3), 62-89.

Ferré, M. B., Guitart, A. O. & Ferret, M. P. (2006) Children and playgrounds in Mediterranean cities, *Children's Geographies*, 4(2),173-183, DOI: 10.1080/14733280600806999

Flanders, N. A. (1961) Analyzing Teaching Behaviour. *Educational Leadership*, 19(3), 173-200.

Floyd, M. F., Bocarro, J. N., Smith, W. R., Baran, P. K., Moore, R. C., Cosco, N. G., … Fang, K. (2011). Park-Based Physical Activity Among Children and Adolescents. American Journal of Preventive Medicine, 41(3), 258–265. https://doi.org/doi: 10.1016/j.amepre.2011.04.013.

Freeman, C., van Heezik, Y., Hand, K. & Aviva Stein, A. (2015) Making Cities More Child- and Nature-Friendly: A Child-Focused Study of Nature Connectedness in New Zealand Cities. *Children, Youth and Environments*, 25(2), 176-207.

Foster, S., Villanueva, K., Wood, L., Christian, H., & Giles-Corti, B. (2014). The impact of parents' fear of strangers and perceptions of informal social control on children's independent mobility. Health & Place, 26, 60–68.

Gibson, J. J. (1979/1986) *The Ecological Approach to Visual Perception*. Hillsdale, New Jersey: Lawrence Erlbaum Associates, Inc.

Giusti, M., Barthel, S. & Marcus, L. (2014) Nature Routines and Affinity with the Biosphere: A Case Study of Preschool Children in Stockholm. *Children, Youth and Environments*, 24(3), 16-42.

Golicnik, B., & Thompson, C. W. (2010). Emerging relationships between design and use of urban park spaces. *Landscape and Urban Planning, 94*(1), 38–53.

Gülgönen, T. & Corona, Y. (2015) Children's Perspectives on Their Urban Environment and Their Appropriation of Public Spaces in Mexico City. Children, Youth and Environments, 25(2), 208-228.

Hart, R. (1979). *Children's experience of Place*. New York: Irvington.

Hillman, M., & Adams, J. (1992). Children's Freedom and Safety. *Children's Environments, 9*(2), 12-33.

Hillman, M., Adam, J., & Whitelegg, J. (1990). *One False Move...: A Study of Children's Independent Mobility*: Policy Studies Instutue Publishing.

Hume, C., Timperio, A., Ball, K., Salmon, J., Andrianopoulos, N., & Crawford, D. (n.d.). *Public open spaces – what features encourage children to be active?* https://www.deakin.edu.au/__data/assets/pdf_file/0018/307017/book-12.pdf [Accessed 6.2.18]

Ittelson, W. H., G., R. L., & Prohansky, H. M. (1970). The use of behaviour maps in environmental psychology. In H. M. Prohansky, W. H. Ittelson, & L. G. Rivlin (Eds.), *Environmental Psychology: Man and his Physical Setting*. Cambridge: Cambridge University Press.

Jansson, M., Sundevall, E. & Wales, M. (2016) The role of green spaces and their management in a child-friendly urban village. *Urban Forestry & Urban Greening* 18, 228–236.

Karsten, L. (2005). It All Used to be Better? Different Generations on Continuity and Change in Urban Children's Daily Use of Space. *Children's Geographies, 3*(3), 275-290.

Kates, R. W., & Katz, C. R. (1977). The Hydrologic Cycle and The Wisdom of The Child. *Geographical Review*, *67*(1), 51–62.

Kyttä. M. (2002) Affordances of Children's Environments in the context of cities, small towns, suburbs and rural villages in Finland and Belarus. *Journal of Environmental Psychology* 22, 109-123 doi:10.1006/jevp.2001.0249

Lennard, H.L. & Lennard, S. H. C. (1992) Children in Public Places: Some Lessons from European Cities. *Children's Environments*, 9(2), 37-47.

Lerstrup, I. & Møller, M. S. (2016) Affordances of Ditches for Preschool Children. *Children, Youth and Environments*, 26(2), 43-60.

Lerstrup, I. & Refshauge, A. D. (2016) Characteristics of forest sites used by a Danish forest preschool. *Urban Forestry & Urban Greening* 20, 387–396

Lynch, K. (1977). *Growing up in Cities*. Cambridge: MIT Press.

Malone, K., & Tranter, P. (2003). Children's environmental learning and the use, design and management of school grounds. *Children youth and environments, 13*(2).

Marušić, B. G. (2011). Analysis of patterns of spatial occupancy in urban open space using behaviour maps and GIS. *Urban Design International, 16*(1), 36-50. doi:doi:10.1057/udi.2010.20

Marusic, G. B., & Marusic, D. (2012). Behavioural Maps and GIS in Place Evaluation and Design. In B. M. Alam (Ed.), *Application of Geographic Information Systems*: InTech.

Mckenzie, T. L. (2006). SOPARC: System for Observing Play and Recreation in Communities. Retrieved from http://activelivingresearch.org/node/10654

McKenzie, T. L., Marshall, S. J., Sallis, J. F., & Conway, T. L. (2000). Leisure-Time Physical Activity in School Environments: An Observational Study Using SOPLAY. *Preventive Medicine, 30*(1), 70-77. doi:http://dx.doi.org/10.1006/pmed.1999.0591

Moore, R. C. (1986). *Childhood Domain: Play and Place in Child Development*. London: Croom Helm.

Moore, R., & Cosco, N. (2010). Using behaviour mapping to investigate healty outdoor environments for children and families: conceptual framework, procedures and applications. In C. Tompson, P. Aspinal, & S. Bell (Eds.), (pp. 33-72): Oxon, Routledge.

Nikolopoulou, M., & Lykoudis, S. (2006). Thermal comfort in outdoor urban spaces: Analysis across different European countries. *Building and Environment*, *41*, 1455–1470.

Neilson, T. S. (2005, May 30-June 4). *The potential for the exploration fo activity patterns in the urban landscape with GPS-positioning and electronic activity diaries.* Paper presented at the Life in Urban Landscape - Interntional Conference for Intergrating Urban Knowledge and Practice, Gotenburg, Sweden.

NPFA. (2000). *Best Play: What play provision should do for children*. Retrieved from London: http://www.playengland.org.uk/resources/best-play.aspx

Office for National Statistics. (2001). Census: Aggregate data (England and Wales) (Online, [computer file]). Retrieved 1 October 2010, from UK Data Service Census Support http://infuse.mimas.ac.uk/

Office for National Statistics. (2011). Census: Aggregate data (England and Wales) (Online, [computer file]). Retrieved 1 October 2014, from UK Data Service Census Support http://infuse.mimas.ac.uk/

Office for National Statistics. (2014). Population Estimates for UK, England and Wales, Scotland and Northern Ireland, Mid-2014 (Online). Retrieved 24.08.2015, from UK Data Service Census Support.

Stoneman, Z., Cantrell, M. L., & Hoover-Dempsey, K. (1983). The Association Between Play Materials and Social Behavior in a Mainstreamed Preschool: A Naturalistic Investigation. *Journal of Applied Developmental Psychology*, *4*, 163–174.

Tapsell, S. M. (1997). Rivers and river restoration: a child's-eye view. *Landscape Research*, *22*(1), 45–65.

Tapsell, S. M., Tunstall, S., House, M., Whomsley, J., & Macnaghten, P. (2001). Growing up with rivers? Rivers in London Children's Worlds. *Area*, *33*(2), 177–189.

Thwaites, K., & Simkins, I. (2007). *Experiential Landscape: An Approach to People, Place and Space*: Routledge.

Thwaites, K., Porta, S., Romice, O., & Greaves, M. (2007). *Urban Sustainability through Environmental Design: Approaches to time-people-place responsive urban spaces*: Taylor & Francis.

Tunstall, S., Tapsell, S., & House, M. (2004). Children's perceptions of river landscapes and play: what children's photographs reveal. *Landscape Research*, *29*(2), 181–204.

UNICEF. (2012). *State of The World's Children 2012: Children in an Urban World*. Retrieved from New York:

Van Andel, J. (1984). Effects on children's behavior of physical changes in a Leiden neighborhood. *Children Environments Quarterly, 1*(4, Neighbourhoods as childhood habitats (Winter 1984 / 1985)), 46-54.

Veitch, J., Salmon, J., & Ball, K. (2008). Children's active free play in local neighborhoods: a behavioral mapping study. *Health education research, 23*(5), 870-879. doi: 10.1093/her/cym074

Ward, C. (1977). *The Child in the City*. London: Architectural Press.

Woolley, H., Dunn, J., Spencer, C., Short, T., & Rowley, G. (1999a). Children describe their experiences of the city centre: a qualitative study of the fears and concerns which may limit their full participation. *Landscape Research, 24*(3), 287-301.

Woolley, H., Spencer, C., Dunn, J., & Rowley, G. (1999b). The Child as citizen: Experiences of British Town and City Centre. *Journal of Urban Design, 4*(3), 255-282.

Woolley, H., & Johns, R. (2001). Skateboarding: The City as a Playground. *Journal of Urban Design, 6*(2), 211-230.

Woolley, H., Hazelwood, T. & Ian Simkins, I. (2011): Don't Skate Here: Exclusion of Skateboarders from Urban Civic Spaces in Three Northern Cities in England, Journal of Urban Design, 16:4, 471-487. Doi.org/10.1080/13574809.2011.585867

Zube, E. H., Pitt, D. G., & Evans, G. W. (1983). A Lifespan Developmental Study of Landscape Assesment. *Journal of Environmental Psychology*, *3*, 115–128.