



Physical activity through place attachment: Understanding perceptions of children and adolescents on urban places by using photovoice and walking interviews

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ABSTRACT

Public urban places and their environmental characteristics impact youth's physical activity (PA) through perceptions. The objective of this study was to use a qualitative participatory approach with children and adolescents to understand how their attachment to urban places perceived as PA-friendly or unfriendly is related to their PA behaviour. Ninety-three participants aged six to 17 from six neighbourhoods with varying objective walkability engaged in photovoice and walking interviews. Data were analysed by using the tripartite framework of place attachment (PPP model), which was adapted for application to PA behaviour and supplemented by photographs. Themes were identified for each (sub-)dimension of the PPP model with person, place and process factors influencing attachment. Further subdimensions (PA and other behaviours) and categories (travel mode, trip length and frequency of visits) were added to the PPP model. Urban design recommendations were derived by age and gender to promote PA through place attachment.

1. Background

Physical activity (PA) is vital for children and adolescents' physical and mental health (Biddle et al., 2019; Janssen and Leblanc, 2010). Yet, less than a fifth meet the recommendation of the World Health Organization of at least 60 min PA per day (Guthold et al., 2020). Globally, strategies to promote PA in children and youth (CY) increasingly follow a socioecological perspective, addressing barriers and facilitators for PA in personal, social, policy and built environmental contexts (Sallis et al., 2006; Rutter et al., 2019). According to the German National Recommendations for Physical Activity and Physical Activity Promotion, the design of PA-friendly cities and living environments is an essential measure to promote PA for all age groups (Pfeifer and Rütten, 2017). Active transportation policies and policies targeting the built environment, e.g. the presence of sidewalks, safe neighbourhoods or access to safe play spaces including parks, playgrounds and recreational facilities have shown to promote PA in different target groups, although the evidence is ambiguous (Gelius et al., 2020).

This ambiguity becomes evident when looking at the example of parks, which are generally assumed to be beneficial for PA. Parks can

offer a PA-supportive environment by providing an infrastructure and opportunities for recreational activities in both organised and unorganised manner (Koohsari et al., 2015). However, studies indicate that adolescents' utilisation of parks and their engagement in PA within parks are limited (Joseph and Maddock, 2016; Marquet et al., 2019). In walking interviews with adolescents, Rivera et al. discovered that the likelihood of visiting PA-friendly places in parks depends on the specific characteristics of these places, which can either encourage or discourage engagement in PA (Rivera et al., 2021).

2. Physical activity and place attachment in urban neighbourhoods

The influence of the physical environment on behaviour is not only determined by the mere presence or absence of certain place characteristics from an objective perspective. Instead, behaviour is strongly shaped by subjective perceptions of environmental characteristics through individuals, e.g. the aspect of feeling safe in a neighbourhood (Gibson, 1982). When studying person-environment relationships, the concept of place attachment should be considered (Koohsari et al.,

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2023). Place attachment is the emotional bond between a person and a place. It describes how individuals perceive, interpret and emotionally connect with certain places they like to visit frequently (Dang and Weiss, 2021; Özkan and Yilmaz, 2019). Recent research has consistently shown that attachment to specific places within residential neighbourhoods positively influences the adoption and maintenance of PA routines in adults. For instance, positive associations were found between place attachment and outdoor leisure activities as well as revisiting renovated parks (Yuan and Wu, 2021; Nursyamsiah and Setiawan, 2023). These associations are mediated by subjective perceptions of the neighbourhood, e.g. measured by how individuals perceive the availability, accessibility and safety of physical activity opportunities in their neighbourhoods (Koohsari et al., 2023).

3. Understanding place attachment: the tripartite framework

The tripartite framework (PPP model of place attachment) describes place attachment in three dimensions: 1) person: the individuals involved (e.g. whether attachment is established personally or collectively), 2) process: the psychological mechanisms (the involvement of feelings, thoughts and actions in the attachment), and 3) place: the location itself (the specific characteristics of the place) (Scannell and Gifford, 2010). The model helps to understand place attachment by reviewing existing definitions of the concept and organising them into the person, process and place dimensions. It describes the components that contribute to place attachment, providing a framework for analysing and discussing the concept in different contexts, such as urban design or behavioural studies. In past research, the person dimension has been prioritised over process and place, leading to a neglect of some of the aspects through which place attachment is developed (Lewicka, 2011). Furthermore, there has been a stronger focus on quantifying the significance of places, leading to a greater emphasis on measuring “how much” attachment there is to a place rather than qualitatively exploring “how” place attachment is established (process) or to “what”, i.e. which specific place characteristics actually provoke place attachment (place) (Lewicka, 2011). The subjective intensity of attachment is mostly addressed by quantitative place attachment scales. Contrarily, qualitative measures aim to understand the characteristics (place dimension), the meanings for individuals or groups (person dimension) and the underlying psychological mechanisms (process dimension) that are associated with place attachment (Lewicka, 2011).

Thus, considering place attachment in qualitative studies can be beneficial as it allows for a holistic understanding of urban places that have potential to influence behaviour. In this study, CY were asked about their favourite PA-friendly places in their neighbourhood, as well as about places they perceive as PA-unfriendly, e.g. places they do not visit for PA even though they assume that they were originally designed for it. The primary aim of this study was to explore CY's perceptions about these places and to analyse their statements in the context of place attachment in order to find out how attachment to these places is related to their PA behaviour. Qualitative data was gained by using a combination of participatory methods. The PPP model of place attachment provided the framework for the systematic analysis of the data. The following research questions were posed to gain a comprehensive understanding of youth's place attachment regarding PA-friendly- and unfriendly places, taking into account the three dimensions of the PPP model and their interactions.

- Person – What are the individual or collective connections of CY to PA-friendly places in their neighbourhood?
- Place – Which PA-friendly- and unfriendly places are identified by CY and what are their characteristics?
- Process – Which psychological mechanisms are involved in the attachment of CY to PA-friendly places?

Place attachment in this study is entirely related to PA behaviour. By

applying the PPP model adapted for PA behaviour in the analysis, it can be examined how place attachment is related to CY's PA. Thus, the secondary aim of this study was to make recommendations on how PA can be promoted through place attachment in the city and how to design inclusive urban spaces for PA. These recommendations will be separately tailored to children and adolescents, and differentiated for both boys and girls.

4. Methods

4.1. Study design

This cross-sectional study used a participatory qualitative design, engaging participants in photovoice, walking interviews and mapping exercises to assess their attachment to PA-friendly places in terms of the three dimensions of the PPP model of place attachment. The qualitative methodological approach was pilot tested before the start of the main study. This article focuses on the analysis and results of the walking interviews, supplemented by photos from the photovoice exercise. The conduct and reporting of the study adhered to the guidelines outlined in the consolidated criteria for reporting qualitative research (COREQ) (Tong et al., 2007) (see Additional file 1). The study has been approved by the ethics committee of the Technical University of Munich (reference number 77/22 S).

4.2. Study area and participants

Purposive convenience sampling was used to enroll 93 children and adolescents aged six to 17 years (mean age 11.2 years) from six different neighbourhoods in central and lateral urban districts of Munich, Germany. Overall, there was a near-even gender distribution among the participants, with 47 males (mean age 10.9 years) and 46 females (mean age 11.4 years). The districts were selected based on varying objectively-measured walkability indices covering the whole spectrum from “very low” (red) to “very high” (green) objective walkability (see Fig. 1) measured based on land-use-mix, street connectivity and population density (ranging from 1,688 to 13,880 inhabitants/km²) (Landeshauptstadt München, 2023a). Low, middle and high socioeconomic status neighbourhoods were included based on unemployment rates and other factors like social work, social benefits and basic security. These factors are represented by the so-called social challenges indicator (SCI) provided by the Social Department of the Munich city government, which ranges between one (very low) and five (very high) with neighbourhoods of all five categories included in this study (Landeshauptstadt München, 2023b). Participants were recruited from neighbourhoods of the districts: Neuaußing (n = 17) with very low walkability and SCI 3–4; Bogenhausen (n = 10) with low walkability and SCI 1–2; Berg am Laim (n = 21) and Riem (n = 6) both with low walkability and SCI 4–5; Giesing (n = 11) with moderate walkability and SCI 3–4 and Westend (n = 28) with very high walkability and SCI 2–3.

Participants were recruited through schools, youth centers, clubs and local institutions, with a particular focus on educational facilities for families from diverse socioeconomic backgrounds. Teachers and social workers served as facilitators for recruitment. All participants completed the entire participatory process comprising three appointments (Fig. 2). Prior to participation, children and their parents were informed about privacy policies regarding audio recordings and photographs. Written informed consent was obtained from both a parent/legal guardian and the participant. More information on the recruitment process and the methodology is presented in the study protocol of the WALKI-MUC project, which this article is part of (Scheller and Bachner, 2024).

4.3. Data collection and measures

In each neighbourhood, participants were divided into age-differentiated groups (six to ten and eleven to 17 years) with a

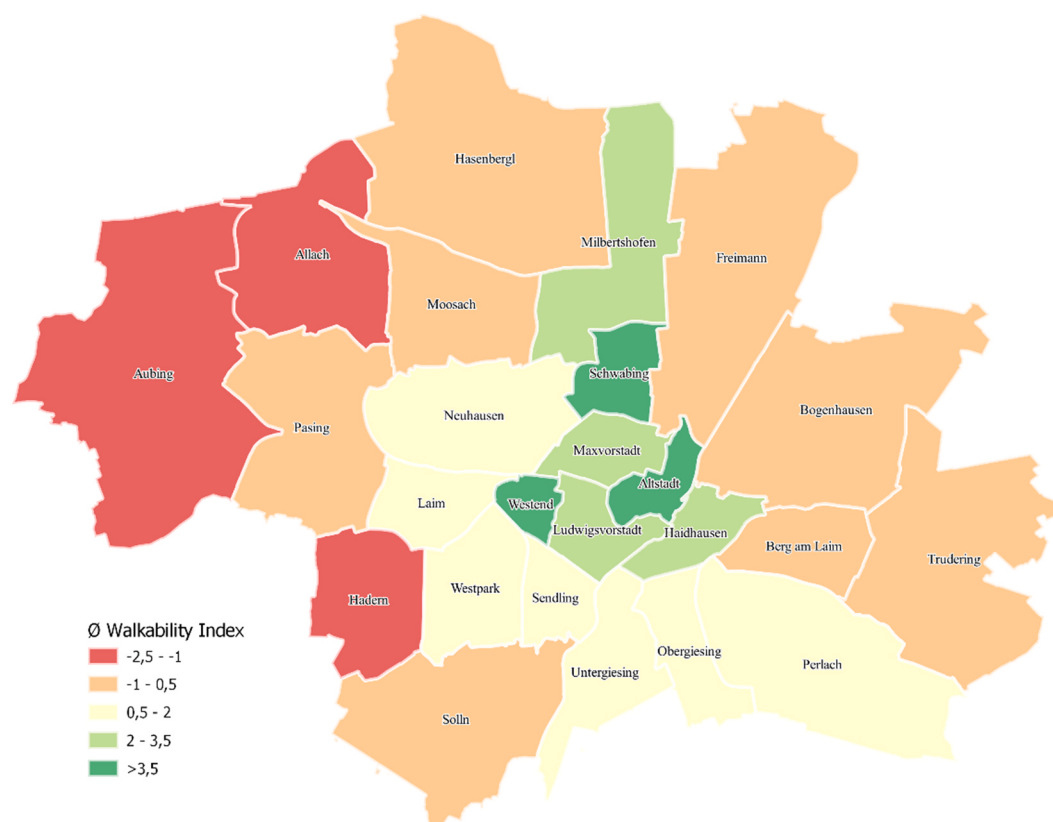


Fig. 1. Objective walkability categories for Munich districts.

minimum of five and a maximum of 15 participants per group to be able to better respond to the individual needs of the participants. In total, 12 groups were formed (two per neighbourhood) that all went through the same procedure. The participatory procedure began with an introductory workshop conducted by two researchers (DAS and KS), in which the participants were introduced to the research topic and their “photo mission”. In the photo mission, each participant was asked to take pictures with a Polaroid camera of at least two places within walking distance from their home that he/she considered to be relevant for PA. This included places that pertain to at least one of three specific categories: 1) their favourite place for physical activity, called “good place”; 2) their least preferred place for PA, which, although typically designed for PA, is avoided by them, called “bad place”; 3) any other place that they find PA-(un)friendly but is not their “good” or “bad place” for PA. Within six days after the first workshop, participants completed the photo mission during a walking interview, in which the individual significance of the places was shared in a one-on-one setting with an interviewer. The interviews were conducted by university students who were enrolled in sports or health science programs at the Technical University of Munich or tourism programs at the Munich University of Applied Sciences who collaborated during data collection. The university students were trained by the lead researcher (DAS), a male PhD student and sport scientist, who had prior experience in working with youth and conducting qualitative interviews. He put interviewers and interviewees in pairs, aiming for pairs of the same gender and also carried out interviews himself. In total, 32 interviewers took part in the data collection. Participants had no established relationship with the interviewers. Each interviewer followed a checklist to standardise the procedure. During the walking interview, a semi-structured interview protocol was used, which was based on the “SHOWeD” questions of a typical photovoice study by Wang and Burris (1997). The original SHOWeD questions, which were used for development of the interview protocol, prompts to describe a place and the derived questions that were asked in the

walking interviews can be found in Table 1. The interviews were recorded by dictaphones. During the walking interviews, which took place on weekdays, participants covered distances from 300 m to nearly 7 km, with interview durations ranging from 11 min to an hour and 44 min. In some cases more than one interviewer or interviewee were present, e.g. if non-German participants were involved who needed translation. None of the interviews was repeated. Data collection was managed by three researchers and the aforementioned university students between March and July 2022. DAS and KS conducted the workshops and some walking interviews. AH supervised the university students.

4.4. Data analysis

All walking interviews were transcribed verbatim. Transcripts and field notes were not returned to participants for comment and were assigned a code to ensure participant anonymity. A deductive coding approach using the PPP model was used for the analysis of all 93 walking interviews. Coding was performed with MAXQDA 2022 (VERBI Software, 2021) by using a self-developed codebook based on the PPP model (Additional file 2). Codebook development and deductive analysis was guided by the guidelines of the framework method (Gale et al., 2013) and was characterised by coding data into the dimensions “person”, “place” and “process” including their respective subdimensions and categories as indicated in the PPP model (see Table 2). As an example, the category “Built” is situated under the subdimension “Physical” within the overarching dimension of “Place”.

Two independent coders (DAS and JTB) conducted the data analysis. In the test coding phase, intercoder reliability (ICR) in form of Krippendorff's α was used as measure of the agreement between the coders, following practical guidelines for evaluating coding frames in qualitative research (O'Connor and Joffe, 2020). The test coding process included one joint coding session, followed by multiple independent

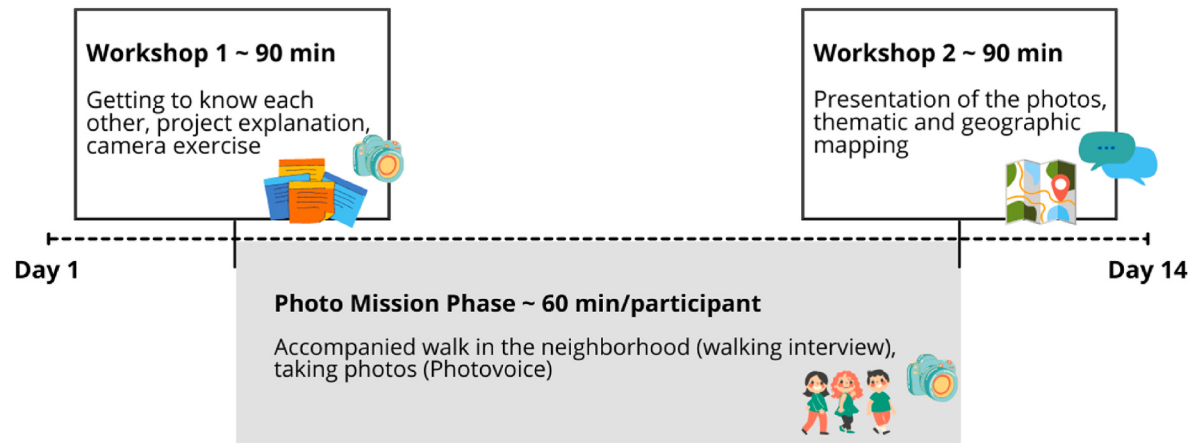


Fig. 2. Qualitative procedure to assess children and youth’s attachment to PA-friendly places through a combination of participatory methods.

Table 1
Semi-structured interview protocol based on the SHOWed questions for a photovoice study by Wang and Burris (1997)

SHOWed questions and prompts for place descriptions	Walking interview questions asked to participants
1. What do you See here? → Describe the place	- What do you see here? - Which PA-friendly elements can you see? - What do you think this place is made for?
2. What is really Happening? → Describe activities at the place	- What do you usually do there? - Why do you come specifically to this place if you want to play, exercise or do sports? - Do the other people there do the same as you, or other activities? What activities do others mainly do here?
3. How does this relate to Our lives? → Describe relevance of the place	- How often do you go to this place? How do you feel when you are in this place? - How do you feel when you think about this place? - Which memories do you have of this place?
4. Why does this problem, concern, or strength Exist? → Describe weaknesses and strengths of the place	- Is there an activity/or any activities that you only can do in this place? - What exactly do you like about this place? What are its strengths? - What exactly do you dislike? What are weaknesses?
5. What can we Do about it? → Describe potential improvements of the place	- Would you like to change something about this place? If so, what? - Which improvements would you suggest to make the place more PA-friendly?

double-codings with discussions after each round to resolve disagreements. DAS and JTB double-coded a total of twelve interviews, representing 13% of the entire dataset. All statements that did not align with the predefined (sub-)dimensions of the PPP model were systematically collected. This provided the opportunity to generate new codes and refine the coding framework before the final coding phase. Five new codes “Physical activity”, “Other behaviours”, “Travel mode”, “Trip length”, and “Frequency of visits” were generated in addition to the PPP model to ensure comprehensive coverage of the data. The double-coding resulted in an average inter-coder reliability of $\alpha = .89$, which indicates very good agreement. After inter-coder reliability was established, the coders initiated the single-coding process based on the final set of codes for all 93 interviews by dividing the sample into 51 interviews for JTB and 42 interviews for DAS to code (including the twelve interviews that had already been coded in the test coding phase). The comprehensive coding guidelines as well as the entire code system can be found in the Codebook (Additional file 2).

5. Results

The participants discussed all dimensions and subdimensions of the PPP model. The overall distribution of mentions is visually represented in Fig. 3, with varying segment sizes indicating the frequency of references to each (sub-)dimension and category by the participants. The boxes showcase the themes discussed by participants within each (sub-)dimension and category, reflecting the various facets of place attachment. In the following, “younger girls and boys” refers to children aged

six to ten years, while “adolescent girls and boys” refers to those aged eleven to seventeen years.

5.1. Person – what are the individual or collective connections of children and adolescents to PA-friendly places in their neighbourhood?

5.1.1. Individual

The person dimension includes statements that go beyond describing the places themselves and rather focusses on “experiences-in-place” that create meaning for a person or group. The individual subdimension captures memories, experiences and milestones that shape a participant’s independent perception of a place and thus emphasises an individual’s autonomy in the relationship with a place. In the present study, these events ranged from unique memories in the past that contributed to a participant’s self-image to milestones in personal growth such as acquiring special skills or abilities related to sport and PA.

“I learned to swim, and then, when I was on holiday I was able to swim.” (Boy, 13 years old; Fig. 4a)

Particularly noteworthy are events related to overcoming fears, e.g. with regard to risky play equipment. The type of memories (positive or negative) did not necessarily influence whether the place was perceived as “good” or “bad”, as some participants recalled injuries related to PA and risky play at their favourite places.

Table 2
Code system based on the PPP model of place attachment by Scannell and Gifford (2010)

Hierarchy of codes	Codes							
Dimension	Person		Place		Process			Other
Subdimension	Individual	Cultural/ Group	Social	Physical	Affect	Cognition	Behaviour	Travel mode, Trip length, Frequency of visits
Category				Built, Natural, Mobile			Physical Activity, Other Behaviour	

The table presents the code system derived from the PPP model of place attachment (Scannell and Gifford, 2010) featuring additional codes that were integrated into the original model (written in *italics*).

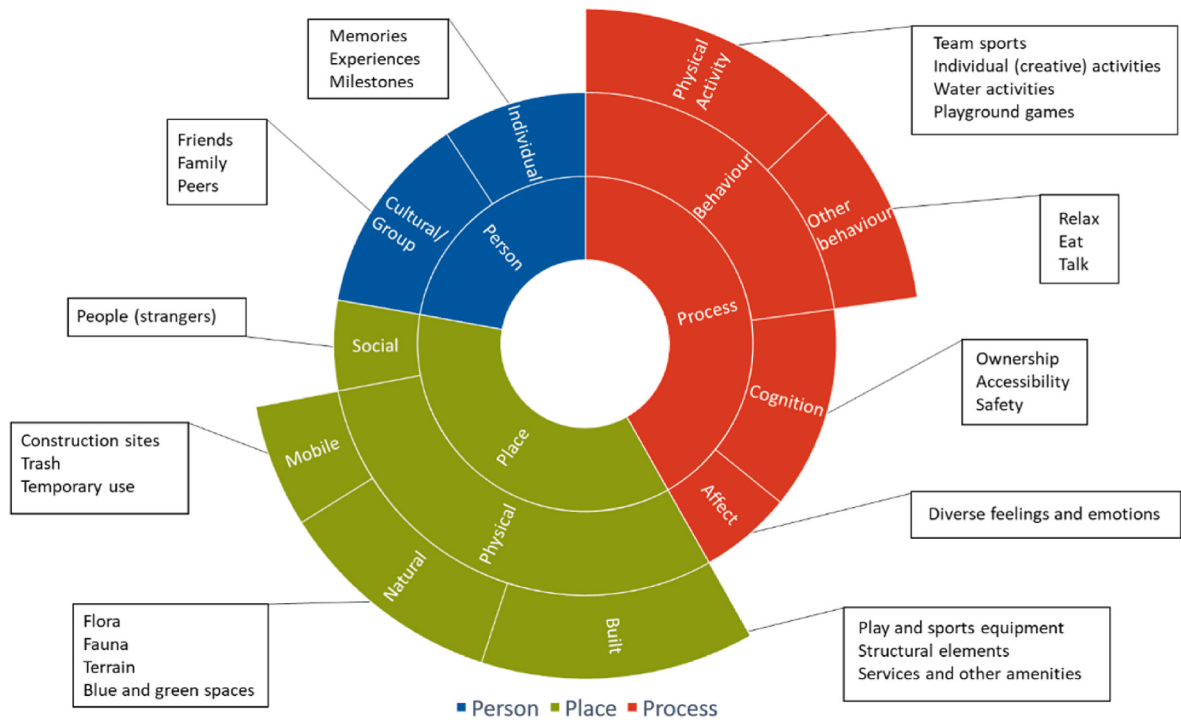


Fig. 3. Overview of the distribution of coded content across the dimensions of person, place, and process, including their respective sub-dimensions and categories.

5.1.2. Cultural/group

This subdimension covers statements that demonstrate how a family or a group of the same culture, gender, religion or akin ascribe the same symbolic meanings to a place, or simply when people from the same group visit a place regularly for PA.

“I feel comfortable here because many Spanish-speaking families come here at the weekend for barbecues. And then we can play soccer on the large meadow.” (Boy, 12 years old; Fig. 4b)

Generally, friends were the most frequently discussed factor. Family members, especially siblings, were described more often by adolescents than by children. Several times, adolescents associated PA-friendly places with the opportunity to be active themselves while looking after their younger siblings. Unlike the cultural/group subdimension of the person dimension, incidental interactions at a place with strangers are captured by the subdimension “social” in the place dimension.

5.2. Place – which PA-friendly places are identified by children and adolescents and what are their characteristics?

5.2.1. Social

Within the place dimension, social attachment is oriented towards people rather than to the inherent characteristics of the place itself. The most discussed topic was participants’ preferences regarding the

number of people, particularly strangers, at a place. Younger girls expressed more favorability towards many people at their favourite place compared to boys in the same age group. In adolescents, females highlighted a higher risk of spreading diseases, less space and being observed by others, avoiding places with numerous people, especially in cases of so-called “social arenas”, where physical activities play a subordinate role.

“We always watch the boys play soccer here or something, or we talk here. So, for us, it’s not really for sport, because it’s embarrassing to do sport here. Everyone is watching you.” (Girl, 14 years old)

Crowded places seemed to be less of an issue for male teenagers as they more often reported of potential play or exercise companions that are associated with them.

5.2.2. Physical – natural

The physical subdimension comprises participants’ perceptions of natural or built place characteristics that contribute to place attachment. These characteristics can also be part of partially constructed places that have been built upon natural settings, such as designed playgrounds incorporating natural elements like wood to provide a nature experience (Fig. 4c). Trees were mentioned most frequently because of the multiple opportunities they offer, such as climbing, hiding or providing shade.



Fig. 4. The figure shows diverse PA-friendly places identified in the natural and built environment. (a) Blue spaces, such as lakes, serve for activities like swimming in the summer and ice skating in the winter. (b) Parks were appreciated for their greenery and large meadows for various sports, mainly soccer. (c) Playgrounds commonly provide equipment made of wood and metal without one material reported to be superior to the other. Sources of shade, such as trees, emerged as a significant theme, showing their importance for participants' recovery during physical activities in outdoor spaces. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

"I could climb up [...] this hill. These trees would also make great climbing trees. You would also have a lot of shade in summer." (Boy, 8 years old)

Plants, specifically flowers and fruits, were often mentioned as an aesthetic characteristic. Green areas, landscapes and hills were an important theme as well as blue spaces associated with water (Fig. 4a and b). The floor composition (e.g. gravel or sand) played a huge role with the evenness of the ground being a crucial factor for play. Stony ground was mainly noted as a negative attribute, together with the topics of bare and uncared-for landscapes (e.g. high grass) that inhibit PA-related activities.

5.2.3. Physical – built

Built environmental characteristics refer to exclusively human-made features and structures at a place. This topic was raised the most frequently by participants, with play and sports equipment being addressed by the majority.¹ For younger girls, the trampoline emerged as the preferred sports equipment, while adolescent girls showed a preference for parkour facilities (Fig. 5a). Among boys, climbing walls were the top choice for the younger age group (Fig. 5b), whereas soccer pitches were most frequently reported by older boys.

Overall, swings were the favourite play equipment. Teenagers as well as children preferred slides, followed by climbing frames and sandpits (Fig. 5c). There was a clear preference for places that offered both play and sports equipment in one place:

"That you have so many options here. That if something is occupied, then you can do something else. [...] Because you can also play football there, you can have a picnic on the meadow, you can play volleyball ... and if I

have to take my little sister with me, she can go to the playground next to the sports field where I play or something." (Girl, 13 years old)

Additionally, participants highlighted nearby amenities that contributed to the overall appeal of PA-friendly places. Youth centers and courtyards provided private spaces for organised sports or recreational activities. Access to benches, toilets and the proximity to food and drink options (e.g. supermarkets) ensured convenience, energy intake and hydration for recovery during extended periods of PA.

5.2.4. Physical – mobile

In addition to permanently installed elements, this category represents the dynamic aspect of the built environment, focusing on movable objects or events at places that are only present at some times of the day, week, month or year. Construction sites were perceived both negatively and positively, as they occupied space but also provided opportunities for activities like parkour. Trash was a primary concern, especially broken glass bottles and cigarettes on the ground. A few participants mentioned the availability of freely accessible equipment for recreational activities that is provided in mobile boxes at a place. Additionally, topics in this category included sport events, mobile game trailers and other pop-up equipment. It became clear that the same place could be perceived as a "bad place" at certain times of the year, namely when it is not being used for specific purposes and as a "good place" when it is being used temporarily for events or provides objects useable for PA.

"It's very beautiful on one side [...] like a theme park and on the other side it's almost like ... if people keep throwing trash on the ground, the landscape will only look bare like this. And the funny thing is, if you look over here now when it's empty, it's not that far, but when all the attractions are set up, it's really huge if you walk right through it. That also fascinates me a little." (Boy, 10 years old; Fig. 6)

¹ Sports equipment refers to objects specifically designed and used for organised or competitive sports activities, such as soccer, basketball or table tennis. Play equipment refers to objects used for recreational or informal leisure activities often found in playgrounds, such as swings, slides or climbing structures.

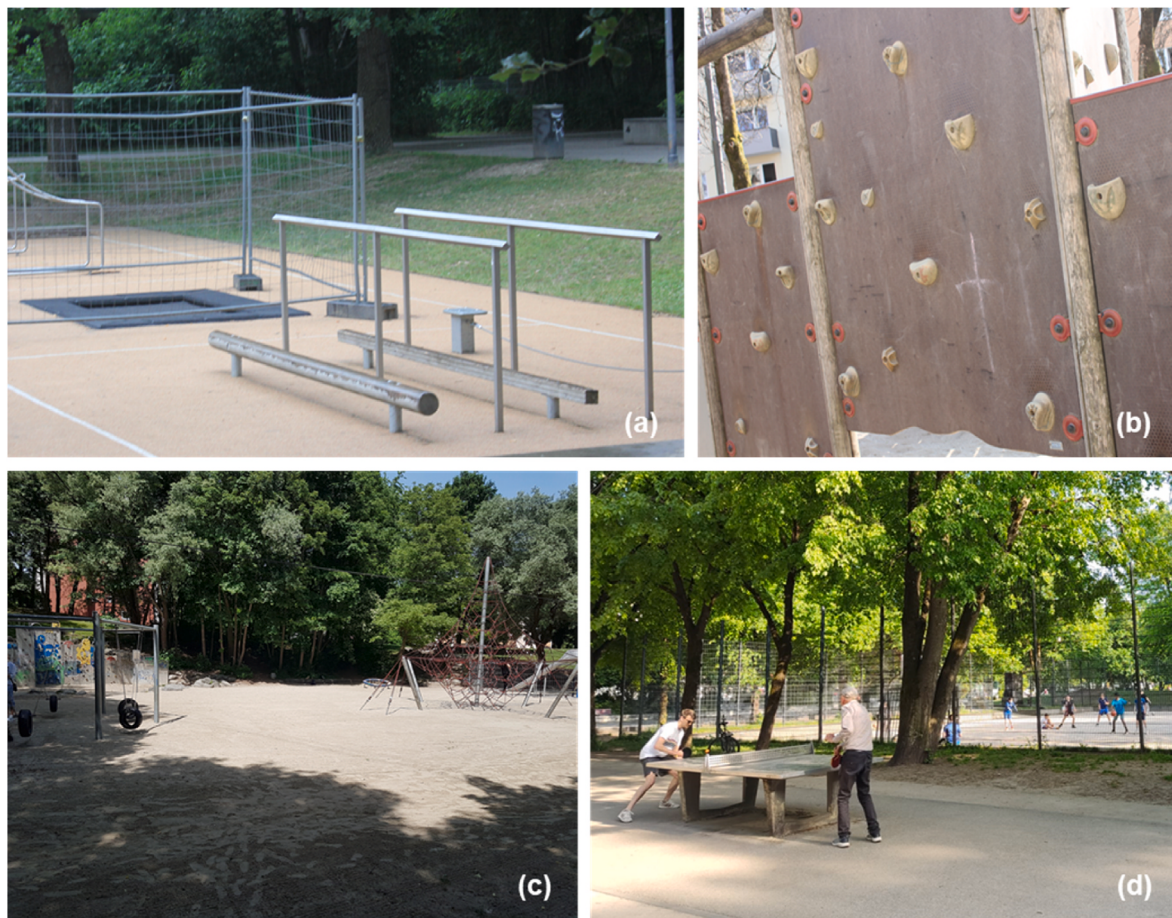


Fig. 5. The figure displays different play and sports equipment preferences: (a) Ground trampoline and parkour bars, preferred by girls; (b) Climbing wall, popular among young boys; (c) Tire swing and pyramid climbing frame in a sandpit; participants highlighted the appeal of unique equipment like tire or nest swings. (d) Multifunctional area with a table tennis table in the fore- and a combined soccer and basketball pitch in the background. Participants favored bright, renovated spaces and expressed safety concerns about concrete flooring and dark objects that can become excessively hot in the summer.



Fig. 6. The figure captures the varying use of a public space that is dedicated for interim use in Munich, depicting its transformation across different times of the year. On the left, the space is used for a theme park during traditional festivals, featuring attractions like bumper cars and carousels. In the middle, the space remains unused, representing a bare landscape that can only be used for running. On the right, the space hosts a large pop-up bouldering wall, providing a temporary opportunity for climbing activities that contributes to its dynamic character.

5.3. Process – which psychological mechanisms are involved in the attachment of children and adolescents to PA-friendly places?

5.3.1. Affect

The process dimension serves as a crucial link in the exploration of person-place relationships as it describes the underlying psychological mechanisms, such as emotions and cognitions that are tied to memories, experiences and milestones described in the person dimension. This subdimension refers to positive emotions regarding participants' favourite places and negative emotions regarding their least favourite places.

“I was sad once and it was raining that day [...] I lay down there, right in the middle, I just looked up, I felt so ... really free. It felt like a hug. Regardless of this place being meaningful to me for playing [...] when I walk past or just stand here and talk about it, I feel at home.” (Girl, 16 years old)

Feelings of fear were frequently associated with empty or unfamiliar buildings and certain individuals, e.g. homeless people. The expressed feelings are rooted in the knowledge and beliefs that individuals attribute to a place, which are described in the cognition subdimension.

5.3.2. Cognition

The cognition subdimension involves mental responses of an individual when being at a place or thinking about it. These cognitive schemas are interpretations (in contrast to visible physical characteristics) regarding the qualities that are attributed to a place based on, for example, size, age-appropriateness (e.g. child-friendliness), perceived risk associated with playing and the variety of possibilities for PA.

"The most boring playground I have ever seen. I hate the playground. [...] It's childish. They only build childish things that babies want to do, like this mini-bridge or these mini-houses. Me and my friend would hit our heads there." (Girl, 11 years old)

These interpretations can culminate in a feeling of ownership of places, referring to the sense of belonging or control that individuals feel over a particular place or space, accompanied by repeated visits and care behaviour (e.g. cleaning).

"Look, that's our place. And look, they just leave their bottles here, and cigarettes [...] and sometimes we collect their trash." (Girl, 9 years old)

Often, when a place was perceived as belonging to no one, particularly when its purpose remained unknown, it was deemed unnecessary. Accessibility emerged as a significant theme, with participants reporting about places that were not open for PA every day of the week or during all times of the day (Fig. 7). Aesthetics as well as traffic and crime safety were also discussed as important cognitive aspects that play a role when engaging in PA.

5.4. Themes added to the PPP model

5.4.1. Physical activity and other behaviours

The categories of physical activity and other behaviours were added to the PPP model to enhance the behaviour subdimension by highlighting how different activities may contribute to place attachment of CY. Team sports like soccer, basketball and volleyball offered competitive opportunities, while dance, gymnastics and acrobatics allowed for creative expression. Racket games such as (table) tennis and badminton, water activities like swimming and stand-up paddling and winter sports like sledging were popular. Participants also enjoyed biking, scootering, skateboarding, climbing and parkour. Playground games without further equipment and activities on foot, such as walking and jogging, were common, along with non-physical activities like picnics and relaxing in nature, providing a balance to physical exertion.

5.4.2. Travel mode, trip length and frequency of visits

The themes travel mode, trip length and frequency of visits were introduced during the coding process to cover aspects regarding participants' place attachment that deviate from the preexisting (sub-)

dimensions of the PPP model. Besides walking, bicycles and scooters were commonly used for moving around in the neighbourhood, occasionally in connection with public transport, showing the importance of accessibility and active transportation. Short trip lengths to PA-friendly places ensured convenience and ease of access from home or school, facilitating engagement in PA without significant time constraints or barriers. In terms of frequency, most participants established routines of visiting their places one to three times a week for PA, with especially boys indicating more frequent visits, some even daily. However, frequent visits are not seen as an initial factor for place attachment. Instead, it seems they act as a reinforcing factor once place attachment is already established.

6. Discussion

Through the lens of the PPP model of place attachment, this study explored children and adolescents' perceptions on PA-friendly and PA-unfriendly places in their urban environment by using a qualitative participatory design including photovoice and walking interviews. Specifically, participants were asked about their favourite PA-friendly places in their neighbourhood, as well as about locations perceived as PA-unfriendly or designed for PA but not used for certain reasons. Content regarding all dimensions, subdimensions and categories of the PPP model and their interactions were identified. Additionally, themes outside the model and their potential relation to place attachment were elaborated. Perceptions are discussed within the dimensions of the PPP model (person, place and process) adapted for PA. The discussions are further framed from a socio-ecological perspective, which considers factors at the individual, social, physical (built and natural) and policy environment that either support or hinder CY's engagement in PA behaviour (Sallis et al., 2006). By integrating these frameworks, it can be better understood how emotional bonds to specific environments (place attachment) interact with broader socio-ecological factors that may be related to PA behaviour. The results are put into the context of current research to understand how PA can be promoted through place attachment among children and adolescents in order to derive age- and gender-specific recommendations for urban design.

6.1. Children and youth's attachment to urban physical activity-friendly places

The personal dimension indicates that individual memories and milestones are often tied to overcoming challenges in the past which seemed to strengthen current place attachment. These past events were frequently linked to risky play opportunities on playgrounds or suffered injuries that resulted from them. Risky outdoor play has declined over time due to growing concerns about child safety and a focus on injury

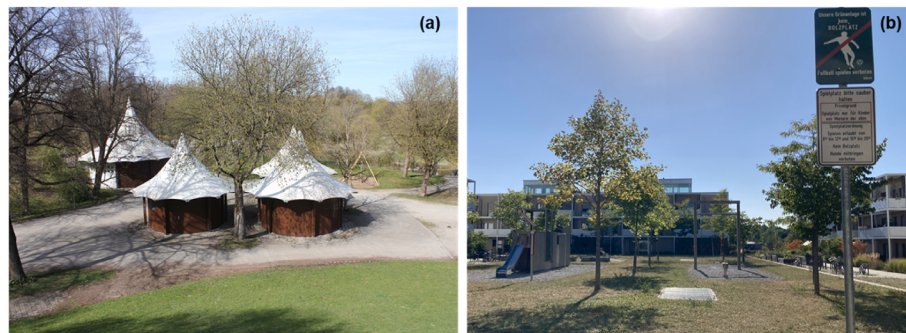


Fig. 7. (a) Buildings that stood empty or whose official use was unknown to participants were often portrayed as “useless” or “unnecessary” and were sometimes associated with feelings of fear; (b) Bans or prohibitions, e.g. a sign explicitly restricting certain types of PA and dictating closed hours for a playground, were a frequent theme in PA-unfriendly places. Such restrictions were common, whether officially imposed on locations like schoolyards or sport clubs, or verbally pronounced by people such as neighbours or parents.

prevention, e.g. leading to changed playground safety standards (Brussoni et al., 2015). However, risky play has demonstrated positive effects on various health indicators and behaviours, including PA and social health, which is why it should not be neglected in the neighbourhood environment (Brussoni et al., 2015). Friends and family were the most cited personal factors for place attachment, with older siblings often acting as play companions and supervisors, highlighting the importance of social interaction in physical activities.

In the place dimension, attachment was focused on individuals being present at a place rather than to aspects of the place itself, which is considered to be a socially based place bond (Scannell and Gifford, 2010). In this context, the findings on younger girls preferring crowded environments are consistent with previous research, indicating that their PA levels are predominantly influenced by social factors, such as the presence of other active children, while boys in the younger age group were more likely than girls to report that the presence of too many people would discourage their visitation (Veitch et al., 2021; Bocarro et al., 2015). This study found positive reactions to individuals of the opposite gender at PA sites, contrary to some literature suggesting gender-based inhibition (Azzarito and Hill, 2013; Pawlowski et al., 2019). However, some adolescent girls showed a preference for places offering privacy to avoid being observed, which can possibly be related to the fear of being evaluated for their athletic abilities (Cowley et al., 2021).

In the physical environment, surrounding nature, particularly blue and green spaces, facilitated recovery from PA by offering opportunities for relaxation in nature for the participants in this study. Especially when equipped with benches and shade from trees or artificial structures, outdoor spaces are enhanced for CY, ensuring comfort and aesthetics that foster attachment. Finally, these place qualities matter for how PA affordances emerge in a neighbourhood (Coen et al., 2019; Burke, 2005). Parks, playgrounds and sports fields were commonly preferred as PA-friendly places. Research has highlighted that these public open spaces are CY's favourite destinations for PA regardless of age and gender (van Hecke et al., 2018; Egli et al., 2020).

Participants emphasised the significance of leveraging spaces designated for "temporary use" or "interim use", as they provide areas for community-driven initiatives and activities. The term "interim use" is used for bare landscapes (e.g. conversion sites) and vacant buildings, which, after their original use has been abandoned, can be temporarily used for other purposes until a new (planned) use is realised (Christmann, 2019). Interim uses can provide opportunities for PA like it has been shown in this study with pop-up PA equipment or seasonal festivities.

Schoolyards and sports facilities were oftentimes not accessible to CY, which is why they were frequently accessed without authorisation by participants due to a lack of PA-friendly places or equipment in a neighbourhood. Children and adolescents often rely on these familiar facilities for their recreational activities, which are commonly located nearby, close to their homes. Especially in low-income urban neighbourhoods, schoolyards may promote positive development among youth, by providing safe spaces for PA and prosocial behaviour (Bates et al., 2018). However, less than half of schools provide such access outside school hours, as shown by recent studies in the US, a trend observed in other countries as well (Guerra et al., 2024).

Perceptions in the process dimension about poorly maintained areas or vacant buildings contributed to feelings of insecurity and prevented individuals from visiting nearby PA-unfriendly spaces. Interpretations of PA-friendly places were based mainly on factors like size, age-appropriateness, perceived risk and the availability of PA options. This highlights the complexity of creating ideal PA-friendly places as perceptions of the environment depend on age, gender and other individual factors (Brownson et al., 2009).

6.2. Policy and practical implications: how to design a physical activity-friendly place that fits all needs?

The question of how a "perfect" PA-friendly place that fits everyone's needs regardless of age or gender looks like cannot be answered by the results of this study, as the needs of individuals differed from one another. Nonetheless, trends in preferences were identified in this study, from which practical implications can be derived.

Based on the analysis of statements in the place dimension, which consists of the physical (e.g. built environment) and social (empty vs. crowded places) environment, the following preferred place characteristics can be described in four cohorts based on age and gender: 1) Younger girls favor trampoline sports equipment and wide open spaces with many people being present, while 2) boys in the same age group prefer climbing facilities and less crowded areas; 3) adolescent girls are drawn to parkour equipment and private, less visible, areas, whereas 4) adolescent boys prefer vast meadows, such as soccer pitches, and crowded areas. Hence, in densely populated neighbourhoods, where urban places are inevitably crowded, attention should be given to younger boys and adolescent girls who try to avoid crowds and seek privacy. Parkour and climbing facilities, which are favored by these two cohorts, could be intentionally designed to provide private areas where individuals can practice their activities away from the public eye (e.g. by using visual protection elements).

In terms of play equipment, swings were universally liked by all cohorts and can be installed anywhere. Consistent with literature, adolescents often perceived that public open spaces are designed for younger children (van Hecke et al., 2018). Risky play equipment can provide exciting alternatives for elder ones. When combined with natural flooring for injury prevention, risky play can promote personal growth and mitigate concerns about injuries (Brussoni et al., 2015). Incorporating diverse *play and sports equipment* at the same location benefits all cohorts and encourages families or other groups to visit PA places together. Cleanliness, maintenance and nearby amenities such as shopping and eating options, though not directly related to PA, enhance overall attractiveness and positive perceptions like it has been shown in similarly designed studies (van Hecke et al., 2016; Loebach and Gilliland, 2010).

Cities should implement temporary use policies to repurpose vacant or unused spaces and buildings for recreational activities, facilitating PA initiatives. In a similar vein, providing pop-up facilities and mobile play equipment can optimise urban spaces for health-promoting activities. Additionally, schoolyards should be planned and designed according to current research in order to serve as publicly accessible spaces for PA within neighbourhoods, also outside of school hours. A recent study on urban schoolyard play zone diversity and nature-based design features recommended similar design elements to those identified for PA-friendliness in this study, such as shade from trees and/or balance and climbing obstacles (Raney et al., 2023).

6.3. Place attachment and perceived neighbourhood walkability

The themes outside of the PPP model that were introduced during the coding process provide additional insights into the dynamics of place attachment among CY and highlight the importance of neighbourhood characteristics that offer a deeper understanding of the physical environment's impact on PA. The availability of different travel modes besides walking, including biking, scooters and public transport, as well as a safe infrastructure in terms of well-maintained sidewalks and bike lanes are important criteria for youth's active travel in their neighbourhood (Panter et al., 2008). Proximity of PA-friendly places to participants' homes or schools encourages PA routines, typically one to three times a week and more frequently for boys. These behavioural routines might further strengthen place attachment, but the initial attachment likely stems from other factors related to the person or place dimension. Many of the identified neighbourhood characteristics in this

study, such as accessibility, walking infrastructure as well as traffic and crime safety, are included in tools to measure youths' perceptions of their neighbourhoods like the Neighbourhood Environment Walkability Scale for Youth (NEWS-Y) (Rosenberg et al., 2009). The NEWS-Y will be adjusted for the German context based on the identified PA-supporting neighbourhood characteristics in the walking interviews in order to be able to further quantify the perceived PA-friendliness in the studied area (Scheller and Bachner, 2024).

6.4. Strengths and limitations of the study

The combination of photovoice and walking interviews in this study empowered participants to identify PA-friendly and PA-unfriendly places themselves, facilitating guided discussions and reflective analyses. The results of this study are highly consistent with findings from other studies with CY that explored their neighbourhood environments by using participatory approaches including photography, drawings or narratives (van Hecke et al., 2016; Loebach and Gilliland, 2010). Another study that employed child-led tours with a similar protocol conducted walking interviews in pairs with two accompanying adults (Loebach and Gilliland, 2010). The authors noted the drawback that participants may not have had the chance to discuss the personal significance of their photographs thoroughly or to walk the route they wanted. In the present study design, both aspects were made possible. Despite or perhaps because of the sensitive nature of the walking interviews of this study in a one-on-one setting, the approach yielded direct, subjective insights of high ecological validity, fostering a personal atmosphere where children and adolescents felt comfortable expressing their own opinions. Notably, even more introvert participants opened up during the walking interviews and photovoice discussions, highlighting the effectiveness of these methods in reaching typically harder-to-reach groups (Kolb et al., 2021). Photovoice has proven its applicability in studying health-related issues across disadvantaged groups such as the elderly, students, CY and people with disabilities from high-, middle- and low-income contexts (Catalani and Minkler, 2010; Musoke et al., 2022). Similarly, its combination with walking interviews like in the present study has potential to be applied in various target groups and contexts in order to capture the perspectives of more introverted or marginalised populations. Another advantage of this study was the use of the framework method with the PPP model of place attachment in the analysis (Scannell and Gifford, 2010; Gale et al., 2013), which facilitated the deductive coding of a substantial number of interviews compared to similar studies.

Some limitations regarding the study design should be considered. This study exclusively focused on urban places. Six neighbourhoods were integrated to cover both central and peripheral urban areas, characterised by a diverse level of objectively-measured walkability. Future research needs to encompass both urban and rural settings for a more comprehensive understanding. Moreover, interviews were conducted mostly in fair weather conditions in summer, potentially overlooking the influence of adverse weather conditions. The involvement of multiple interviewers with varying levels of experience could be a limitation due to the potential inconsistency in interview quality. The length as well as the depth of detail between the transcripts varied to some extent. Asking participants to identify and describe their "least favourite" or "bad places" in the photo mission sometimes resulted in participants being reluctant to label a place as bad, leading them to claim they were unaware of any negative places in their neighbourhood. As a result, more favourite places were identified. Participants were divided into two age groups of 6 to 10 years and 11 to 17 years. Based on the classification of a German nationwide study on the health of children and adolescents, the primary school age (6–10), puberty age (11–13) and adolescent age (14–17) represent different cognitive, social and emotional development stages that have to be considered (Lange et al., 2007). However, previous photovoice studies have shown that during the years of puberty and adolescence, there is a shift from

family-oriented activities to peer-oriented and self-directed activities on the taken pictures, suggesting that they should be considered as a unified group (e.g. in group discussions) when exploring their perceptions regarding the environment and their preferences (Marent and Marent, 2013). Still, the age-based division during data collection and analysis may not have accurately reflected individual developmental stages. Some participants might have been placed in an age group that did not fully suit their actual maturity, potentially affecting the validity of the study's conclusions and recommendations. Another limitation to consider when interpreting the results is the lack of objective or self-reported data on the participant's PA levels. The frequently reported visits to PA-friendly places suggest a rather active sample, which may limit the generalisability of the recommendation to the broader (inactive) population in the studied age groups.

6.5. Participatory approaches and place attachment – it is worth walking the extra mile

By encouraging active engagement with their surroundings, the participatory approach may have functioned almost as an intervention itself, conveying a sense of importance and contribution among participants. The reported ownership of places in the process dimension with participants referring to "their places" in the interviews may have further strengthened their place attachment. Place attachment can impact perceptions and engagements within neighbourhoods and vice versa. The association of place attachment with engaging in PA outdoors may be used as a lever for a long-term increase in PA in CY, although this relationship has so far been studied mainly in adults (Yuan and Wu, 2021; Nursyamsiah and Setiawan, 2023; Lee and Shen, 2013; Tsaur et al., 2014).

7. Conclusions

This study emphasises the potential of place attachment when promoting physical activity among CY within urban environments. To foster place attachment and thus potentially increase PA, urban PA-friendly places should ideally be located within walkable neighbourhoods, surrounded by green space and provide risky play and sports equipment for different age groups to create a social meeting point. Optimally, these places are well maintained and aesthetically appealing. Further, cities should implement policies for temporary use initiatives and facilitate accessibility to potential areas, e.g. closed schoolyards, in order to harness the full potential of urban neighbourhoods. In future studies, it should be longitudinally examined how PA can be promoted via promotion of place attachment and which role neighbourhood perceptions play in this regard. The combination of photovoice and walking interviews provided a deeper understanding of CY's perceptions on urban PA-friendly places. Beyond that, this participatory approach could be used to actively engage CY in their living environment and promote PA through place attachment.

Ethics approval and consent to participate

The study has been approved by the ethics committee of the Technical University of Munich (reference number 77/22 S). For participation, one parent/legal guardian and the participant had to sign a declaration of consent. Written consent was obtained and documented from all participants for their inclusion in the study.

Consent for publication

Written consent for publication was obtained and documented from all participants and their parents/legal guardians.

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

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CRediT authorship contribution statement

Daniel A. Scheller: Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Katharina Sterr:** Writing – review & editing, Project administration, Methodology, Investigation, Data curation. **Andreas Humpe:** Writing – review & editing, Supervision, Resources, Project administration, Funding acquisition. **Filip Mess:** Writing – review & editing, Supervision, Resources, Project administration, Funding acquisition. **Joachim Bachner:** Writing – review & editing, Validation, Supervision, Project administration, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no competing interests.

Data availability

Data will be made available on request.

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List of abbreviations

PA	Physical Activity
CY	Children and Youth
PPP Model	Person-Process-Place Model
SCI	Social Challenges Indicator

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.healthplace.2024.103361>.

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