Review

Affordances for Motor Skill Development in Home, School, and Sport Environments: A Narrative Review

Perceptual and Motor Skills
0(0) 1–23

DOI: 10.1177/0031512519829271
journals.sagepub.com/home/pms

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Abstract

Through development, a child's varied movement contexts provide different opportunities or affordances for action that are fundamental to promoting motor competence. Although home is the primary environment for infants, as children age, school and sport environments gain importance. Studies focusing on affordances for motor behavior in children have mainly addressed the home microsystem, providing an incomplete picture of affordances across different settings, particularly later in development. Here, we undertook a narrative literature review of various affordances for children's motor development. This review revealed that prior studies of school and sports contexts have not specifically focused on those environmental properties that promote or hinder motor learning opportunities, meaning that future research should assess these relationships through manipulations of environmental features in these different microsystems.

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Keywords
affordances, children, environment, motor behavior

Introduction

Children's development occurs in socioecological contexts ranging from proximal to distal, through an evolving process of reciprocal interactions between the child and multidimensional levels of the environment, such as physical, material, social, emotional, symbolic, and cultural (Bronfenbrenner & Ceci, 1993). According to Bronfenbrenner's (1995) bioecological theory, as children grow they are influenced by an ecological framework consisting of micro-, meso-, exo-, and macrosystems. The microsystem refers to the immediate context in which face-to-face interactions occur, such as the home, neighborhood, day care center, school, and so on. Mesosystems aggregate two or more microsystems, such as child-home, child-school, school-home, home-leisure center relations. The exosystem is comprised of the distal contexts that are not directly connected with the child's daily interactions in the immediate setting, but that can still influence them (i.e., events that occur at the parents' work place or in the community structure). The cultural institutions or the norms and symbols that serve as molar archetypes of day-to-day interactions characterize the last system, the macrosystem.

Bronfenbrenner and Ceci (1993) noted that the physical, social, or symbolic environmental characteristics invite, permit, or inhibit reciprocal tuning toward a progressively more complex interactional activity in and with the immediate environment. These interactional proximal processes of development are dependent on the mutual interaction between the subject and the environment. This person–environment transactional relationship is also the focus of Gibson's theory of affordances. According to J. J. Gibson (1979), affordances are properties of the environment with reference to an animal (or in our case, a person). They are opportunities for the person's action that are only perceived by the individual in order to establish a person–environment fit. Each environment has objects, places, surfaces, events, and other people that provide a child different action opportunities, depending on the child's action capabilities (J. J. Gibson, 1979). For example, a chair affords a sitting opportunity for a 6-year-old child who is able to sit but not for a 9-month-old infant who has just begun crawling. This concept emphasizes that the child immediately experiences the environment according to its functionality by detecting meaningful environmental properties of relevance to the perceiver (J. J. Gibson, 1979; Heft, 2012). Thus, perceiving relevant environmental functionality guides the child's actions and, reciprocally, action facilitates the further detection of environmental properties (affordances) with functional significance for the active whole-bodied individual (Heft, 2012). Affordances vary with

development (E. Gibson & Pick, 2000), but their availability also varies with culture and the family's social status (e.g., housing conditions vary around the world, according to socioeconomic status (SES), ranging from well accommodated large houses and even mansions to more primitive small houses and even slums, tents, or igloos).

The two theoretical models provided by Bronfenbrenner and Gibson, permit conceptualizing motor development as the result of proximal processes between the child and his or her immediate settings and analyzing it through the assessment of available affordances for motor skills in those same settings. The existence of a certain motor skill opportunity for a child in a given context does not mean that the child automatically perceives and acts upon it, but some environments provide richer affordance landscapes than others and thus have greater potential for fostering child development (Koller, 2004). Importantly, access to immediate settings in the home, school, and sports environments that represent an ecological fit best promotes the child's motor development. Scholars have also alluded to the invitational character of environmental affordances for movement and physical activities as some are more inviting than others for increasing physically active, nonsedentary, healthy behavior (Withagen & Caljouw, 2016).

In the child's early years, home is the primary environment, leading researchers to have made various efforts to characterize the home environment in its relationship to different aspects of child development. For example, researchers created the Home Observation for Measurement of the Environment (HOME) inventory (Caldwell & Bradley, 1984) to examine the effects of the child's home environment on cognitive and social development. One of the most striking and consistent HOME findings has been the discovery that the strong relationship between available stimulating play materials and motor skill development exceeds that of the relationship between motor skills and other "global measures of environmental quality such as SES (socioeconomic status)" (Bradley et al., 1989). Similarly, Rodrigues, Saraiva, and Gabbard (2005) developed the Affordances in the Home Environment for Motor Development instrument, and this tool was followed by the Affordances in the Home Environment for Motor Development–Infant Scale in 2011 (Caçola, Gabbard, Santos, & Batistela, 2011).

As the child matures, other environments become central in the child's life and objects, toys, materials, events, and other people change in number, type, and complexity. Together, these additional environments have a further fundamental role in promoting motor competence (MC). For primary schoolchildren, most time is spent in three different (but connected) environments: home, school, and leisure places (e.g., sports facilities, study centers, music academies). All of these environments may have multiple influences, and their affordances for motor stimulation should be studied as well. A recent systematic review and meta-analysis of prior research (Barnett et al., 2016)

found that most studies demonstrated correlates between gross MC in children and adolescents and biological and demographic factors. Some studies found correlates of more specific motor skills to be physical activity and participation in sports, and only three studies reported correlations between MC development and physical environment (Barnett, Hinkley, Okely, & Salmon, 2013; Chow & Chan, 2011; Parvez et al., 2011). Thus, there is a need for further studies regarding the influence of the sociophysical environment on the development of MC.

As far as we know, only a few studies specifically examined these variables, and there has been no published review of studies focusing on the environmental affordances for motor behavior in school-age children (Chowdhury, Wrotniak, & Ghosh, 2010; Coley, Leventhal, Lynch, & Kull, 2013; Fjørtoft, 2004; Venetsanou & Kambas, 2010). To more fully characterize information gathered to date, in this article, we aimed to carry out a narrative review of the published studies regarding motor affordances for children in home, school, and leisure environments.

Method

Search Strategy

The online search expression we used to locate published studies for this review was "Affordances AND Environment AND Motor Behavior (OR Motor Development) AND Child." We used five online databases: (a) Science Direct, (b) PubMed, (c) Web of Science, (d) Sport Discus, and (e) Education Resources Information Center. We did not delimitate any specific year for the search. In addition, we conducted a further general Internet search (i.e., Google Scholar) using these search expressions and a snowballing literature search method, by additionally identifying relevant references within the reference lists of previously selected studies (Green, Johnson, & Adams, 2001).

Inclusion criteria. Inclusion criteria for articles in this literature search were as follows: (a) from peer-reviewed journals, (b) written in English and Portuguese languages, (c) investigations of the effect of environments children regularly encounter (e.g., home, school, and leisure places) on their motor skill development, and (d) involved studies with children aged 0-18 years.

Exclusion criteria. The following types of studies were excluded from our review: (a) those not involving children or involving children with disabilities; (b) those surveying such environments as high-performance sports, digital interface, and robotics; and (c) those only addressing psychometric properties of measurement tools.

Results

Home Environment Affordances

Household conditions. As previously emphasized, home is the dominant setting during early childhood. The home contains opportunities for the child's interaction and forms specific demands for his or her motor behavior so as to boost different aspects of motor development (Venetsanou & Kambas, 2010). Environmental stimulation has a critical role in this process. High levels of development and MC occur in rich contexts that are full of support and opportunities (Fischer & Rose, 1998; Gallahue, Ozmun, & Goodway, 2013). Several different studies have provided converging evidence that less favorable motor development was associated with more limited availability of stimulating home affordances (Abbott & Bartlett, 1999; Coley et al., 2013; Saccani, Valentini, Pereira, Müller, & Gabbard, 2013). Mori, Nakamoto, Mizuochi, Ikudome, and Gabbard (2013) found that children with physically active parents presented higher scores on measures of fine and gross motor skills than did children whose parents were not physically active. Leitschuh and Dunn (2001) studied the influence on gross motor development of the foster family for children who were exposed prenatally to drug abuse and parent separations. Their results indicated that characteristics of the primary care provider and the amount of early intervention guidance from them reduced the risk of the children showing delays in gross motor development. These researchers assumed that these improved environmental conditions were a consequence of both new living arrangements with a caring provider and longtime utilization of early intervention services.

Most research relating MC to affordances in the home analyzed very young children's motor development when motor ability was limited to reflexive movement (Abbott, Bartlett, Fanning, & Kramer, 2000; Miquelote, Santos, Caçola, Montebelo, & Gabbard, 2012) or rudimentary movement (Fuligni, Han, & Brooks-Gunn, 2004; Haydari, Askari, & Nezhad, 2009; Soares et al., 2015). Generally, these studies showed that more supportive and stimulating home environments were associated with higher infant motor development scores. Studies assessing the effect of home affordances on fundamental or specialized movement skills are difficult to find. Saraiva, Rodrigues, Cordovil, and Barreiros (2013) asserted that age reflects both the child's biological and neurological maturity and the accumulated effects of environmental stimulation and influence.

Coley et al. (2013) noted that, regardless of age, poor quality housing was associated with children and adolescents' more limited emotional and behavioral functioning and their lower cognitive skills. Other environmental influences, such as toxic exposure (e.g., lead, arsenic), have been linked to lower motor functioning scores (Davis & Svendsgaard, 1987; Parvez et al., 2011). Venetsanou and Kambas (2010) affirmed that rearing conditions significantly influence motor development during childhood. In addition, every context

provides different demands that can affect children's development, learning, MC, and physical activities. Generally, even though the home's physical structure is a restricted environment, the home contains opportunities for positive motor stimulation for children living within it, and optimal home environments with a variety of play materials and adequate physical space can improve children's motor capabilities at various ages. Thus, a home assessment for motor skill affordances can inform those interested in providing necessary MC development opportunities for children at risk (Leitschuh & Dunn, 2001; Saccani et al., 2013).

Family SES. Studying family SES has presented researchers with a challenge, given that there are many different situations and family conditions. Although there is no broad research consensus in this realm, the influence of SES in children's well-being and behavior has been previously studied by various researchers who have reached separate conclusions (Bradley & Corwyn, 2002; Chowdhury et al., 2010; Lizana, González, Lera, & Leyton, 2017). Freitas, Gabbard, Caçola, Montebelo, and Santos (2013) found that SES can influence the general provision of affordances for motor development in the home. Terrisse, Roberts, Palacio-Quintin, and MacDonald (1998) pointed out that children from higher SES had more stimulating environments and received higher scores in motor, social, language, and cognitive developmental domains compared with children in lower SES homes. These researchers emphasized that fathers most influenced children's motor and social development, while mothers most influenced their language and cognitive development. Chowdhury et al. (2010) showed that children from lower SES home environments had lower motor proficiency compared with children from comparatively higher SES backgrounds. Bobbio, Morcillo, Filho, and Gonçalves (2007) found that Brazilian schoolchildren attending public schools had a higher risk of inadequate fine motor skills compared with children attending private schools; they also suggested that SES may be associated with differential fine motor skill development.

Guryan, Hurst, and Kearney (2008) examined how parents invest their resources and time into raising children. They found that parents with a low level of education spent less time taking care of their children; poorly educated mothers (i.e., less than a high school degree) dedicated only 12.1 hours per week to their children, while mothers with higher educational levels (i.e., college-educated mothers) spent an average of 16.5 hours taking care of their children. Thus, maternal education levels influence the quantity and quality of home affordances for motor development. Likewise, the study identified that mothers with higher levels of education are those with higher SES. According to Bradley and Corwyn (2002), the most widely used SES measure is the family's financial capital, and this can be an accurate measure of access to motor development opportunities. In summary, research regarding the family's socioeconomic level

indicates that better financial conditions can influence the quantity and quality of materials, objects, and toys, among other factors, providing helpful motor skill affordances to developing children. Also, SES has been associated with good health, and with cognitive and socioemotional outcomes in children (Sigmund et al., 2018).

Neighborhood and outdoor play. Home settings with different degrees of urbanization, especially the neighborhood, can differentially influence children's independent mobility and motor behavior. Several different studies tried to evaluate the importance and characteristics of this type of home context for child development (Clark & Uzzell, 2002; Holupka & Newman, 2011; Monsur, Mansur, & Islam, 2017). Kyttä (2002) studied varied affordances for children's motor development within the cities, small towns, suburbs, and rural villages. She found a more significant number of perceived affordances in rural villages compared with cities. Opportunities for unsupervised neighborhood exploration tend to be scarcer for children in big cities, compromising children's well-being in these urban environments (Carroll, Witten, Kearns, & Donovan, 2015). Roemmich et al. (2006) showed that neighborhoods with decreased housing density and increased park density were associated with greater levels of physical activity in 4-year-old children. The time spent outdoors is an essential determinant of children's physical activity and independent mobility (Schaefer et al., 2014; Wen, Kite, Merom, & Rissel, 2009). According to the World Health Organization (2010), children aged between 5-17 years should engage in at least 60 minutes of daily physical activity, the decreased time children spend outdoors is a growing concern (Gray, 2011; Islam, Moore, & Cosco, 2014; Olds et al., 2009). Associated with this problem, children's free play with other children seems to have declined sharply, while their feelings of anxiety and depression have generally increased (Gray, 2011).

A small number of studies analyzed the relationship between the availability and type of neighborhood streets and children's outdoor activities (Falb, Kanny, Powell, & Giarrusso, 2007; Islam et al., 2014). According to Monsur et al. (2017), some streets near the child's home can be considered as an extension of the home garden or yard, providing larger spaces in which the child may actively move. The time children spend outdoors is associated with street type in that children who live on dead-end streets seem to be more active, spending more minutes outdoors than children who live on through streets (Islam et al., 2014; Monsur et al., 2017). The neighborhood is an important setting for children, as they spend a great of time within their immediate neighborhood. Chambers et al. (2017) found that children, aged between 11-13 years, spent over half of their leisure time within 500 m of their homes. These authors also found that children leave their neighborhood for three specific reasons: (a) to visit the school for some leisure purpose; (b) to visit close friends, and (c) to go to food stores. A very worrying finding from Chambers' research is that children spent more

time at food stores than at sports and outdoor recreational locations combined. Lopes, Cordovil, and Neto (2018) reported that going to shops with adults was one of the most prevalent children's weekend activities. Thus, free play in outdoor neighborhood spaces functions as the primary means by which children can engage in multiple forms of peer interaction; different kinds of movements; and explore different surfaces, objects, and places.

School Environment Affordances

As noted earlier, school plays a critical role in children's physical development as they age and can access various objects, materials, toys, and other people. Of course, school ages are a critical childhood time period for developing and learning fine and gross motor skills, and the acquisition of a varied motor repertoire during this period helps determine the later acquisition of still more advanced motor skills (Lubans, Morgan, Cliff, Barnett, & Okely, 2010; Saraiva et al., 2013) and of MC (Luz, Almeida, Rodrigues, & Cordovil, 2017). Luz et al. (2017) explain that MC development is influenced by a combination of environmental factors, opportunities, encouragement, and instruction, making school experiences and the school environment especially meaningful. Different studies have shown that schoolchildren spend their school time in three different contexts: traditional classes, physical education (PE) classes, and free schoolyard play (recess). Clark and Uzzell (2002) considered school a vital component of the daily environments of adolescents, but these authors found that modern schools may provide significantly fewer interaction sites than town centers, creating a new concern and challenge, especially given the considerable amount of time children stay at school. The school contains a broad range of opportunities to develop and increase children's personal capabilities, though, for a large proportion of children, affordances provided by PE classes in school are the children's only school opportunity to engage in sports, games, gymnastics, and dance.

PE classes. Many studies have tried to analyze different aspects of PE classes, including physical activity, motivational climates, and active time (Dias et al., 2017; Hills, Dengel, & Lubans, 2015; McIver, Brown, Pfeiffer, Dowda, & Pate, 2016). Compelling evidence supports a beneficial association between PE classes and children's physical activity (Nettlefold et al., 2011). Research generally shows that physical activity provided through PE decreases adiposity in overweight children, decreases blood pressure, and enhances cardiovascular health (Costa, 2018; Nader, 2003; Nettlefold et al., 2011). In addition, PE classes can influence children's development in five separate domains: physical, lifestyle, affective, social, and cognitive (Bailey, 2006).

Despite the potential benefits of PE for children, time allocated for it in the school curriculum is declining (Marshall & Hardman, 2000; Snyder, Lee,

Bjornsen, & Dinkel, 2017). Nettlefold et al. (2011) found that less than 5% of children in Canada met recommendations for physical activity during school PE classes (U.S. Department of Heath and Human Services, 2000). Nettlefold et al. attributed these failures to a lack of PE teachers (specialists). Many PE classes are taught by regular teachers from other disciplines (generalists), though Sallis et al. (1997) showed that a school-based PE program taught by specialist teachers was more effective at increasing time students spent in moderate-to-vigorous physical activity (MVPA) compared with the same program taught by generalist teachers.

Since MVPA during PE classes is lower than recommended (Nader, 2003; Nettlefold et al., 2011; Trost et al., 2002), PE classes (provided by a specialist) should ofter health-promoting physical activity to children, especially as children spend approximately 30 hours a week in school. Although it is difficult to analyze all the motor development affordances provided by PE classes, some studies have analyzed specific factors such as class size and play materials used (Barroso, McCullum-Gomez, Hoelscher, Kelder, & Murray, 2005; Reynolds, 2013; Starc & Strel, 2012; Taras, 2005). The full and specific effects of class size on educational outcomes in PE is still an unresolved educational issue (Reynolds, 2013). Moreover, although the literature has not reached a consensus regarding an exact number of recommended students in PE classes, evidence suggests that children in smaller classes have more skill practice time, more activity time, more on-task activity time, and fewer management issues (Bevans, Fitzpatrick, Sanchez, Riley, & Forrest, 2010; Reynolds, 2013). Reynolds (2013) showed that a small number of students in PE classes helped personalize the teacher–student relationship, meaning that the teachers' efforts were less diluted and had a greater teaching effect. Also, PE teachers in smaller classes had more opportunity to interact with all the students in the class, significantly enhancing the class learning atmosphere. However, there remains no agreed upon ideal number of students per class, nor are there agreed upon ideal types of play materials; these topics remain to be more fully researched.

Recess, schoolyards, and playgrounds. Ramstetter, Murray, and Garner (2010) emphasized that recess should be understood as a complement to PE classes, never as a substitution for them. Moreover, other researchers found that recess can help children to develop social skills that are not acquired in the more structured classroom environment (Pellegrini & Bohn, 2005; Pellegrini, Kato, Blatchford, & Baines, 2002; Ramstetter et al., 2010). Previous research reported that children spend 30 to 105 minutes in recess per day (Mota et al., 2005; Verstraete, Cardon, De Clercq, & De Bourdeaudhuij, 2006).

Fjørtoft, Kristoffersen, and Sageie (2009) evaluated how schoolchildren used their schoolyard during recess time and how this context invited physical activity. They analyzed the different affordances provided by different schoolyards.

Fjørtoft and et al. found that asphalt areas, in city schools, invited running and playing soccer (promoting physical activity in boys and girls), but these authors emphasized that there were few appropriate landscape structures that afforded wider activity in the flat asphalt schoolyard, leading the movement pattern to become naturally more traditional. On the other hand, the rural schoolyard had more diverse surroundings and afforded play in a forest, which was more attractive to girls than boys, so that there was similar physical activity for children of both genders in the two schoolyards. Regardless of the school area, the recess period offers an excellent opportunity to promote children's physical activity.

Blatchford, Baines, and Pellegrini (2003) examined the context of school playground games. Specifically, they studied the activities at recess and the peer relations of boys and girls aged 7-8 years. In this context, social activities were far more prevalent than when children were engaged in either solitary or parallel activities. Children spent recess in three main types of activity: (a) conversation, (b) free play (vigorous, sedentary, and fantasy play), and (c) games (chasing, catching, seeking; racing, ball games, jump skipping, and games with materials). The play and game categories each represented one third of the physical activities in which children were engaged during recess time. Laaksoharju, Rappe, and Kaivola (2012) analyzed the physical qualities and types of behavior induced among 7-12 year-old children in a garden environment inside a free-time camp context. According to the authors, after-school children's play is more diverse and long lasting in natural green environments. The garden fostered social interactions by offering plentiful materials in a varied space.

Haug, Torsheim, Sallis, and Samdal (2008) examined the association between physical environmental characteristics and participation in daily physical activity during school recess. They found that schools with more outdoor facilities had a higher probability of promoting children's movement compared with schools with fewer facilities. Consequently, improving the outdoor environment should be considered essential in promoting school physical activity programs. Regarding the size of the play area, Chow and Chan (2011) assessed gross motor skills of preschool children and concluded that children from preschools with larger play area performed better in locomotor skills and worse in object control skills than those from preschools with a smaller play area. In the same context, but analyzing older children (aged 14 years), Fjørtoft, Löfman, and Thorén (2010) observed that environmental settings can influence the activity patterns of children in schoolyards. When analyzing children's leisure-time physical activity at school and how it is associated with contextual variables, McKenzie, Crespo, Baquero, and Elder (2010) found that boys had more MVPA and more vigorous physical activity than girls. This finding is in accordance with other studies (Dowda et al., 2016; Fjørtoft et al., 2009; Skrede et al., 2017). In this context, boys perceived the available space at recess as an opportunity to play, while girls viewed this context as an opportunity to socialize.

In addition, McKenzie et al. (2010) found that MVPA was greater during lunch and break time than before school.

There is a debate in the literature regarding the benefits of unstructured versus structured recess contexts (Frago-Calvo, Pardo, García-Gonzalez, Solana, & Casterad, 2017). Ramstetter et al. (2010) asserted that unstructured recess presents an opportunity for children to be physically active, contributing positively to the child's development. These authors considered recess as a period when children can be more physically active, regardless of the type of activity. Pate, Baranowski, Dowda, and Trost (1996) commented that it is more likely for children to participate in an MVPA within unstructured recess than within more structured contexts. However, some studies found that children, especially girls, were sedentary during the recess period (Frago-Calvo et al., 2017; Ridgers, Stratton, & Fairclough, 2006; Verstraete et al., 2006). Therefore, the effects of the structure of recess on children's behavior still need further investigation.

The association between recess, schoolyards, playgrounds, and opportunities for children to move has been debated for quite some time (Cardon, Labarque, Smits, & de Bourdeaudhuij, 2009; Gubbels, Van Kann, & Jansen, 2012; Mott et al., 1997). Despite this, little emphasis has been placed on understanding the affordances made available by play materials or equipment. Using the Environment and Policy Assessment and Observation Instrument, Gubbels et al. (2012) found that the variability of play equipment was quite limited in childcare centers. The most common materials were balls, indoor floor play equipment, push and pull toys, and balancing surfaces. In contrast, materials such as indoor structured track, merry-go-round, tunnels, and sandboxes and swinging equipment have almost never been found in these settings. Hannon and Brown (2008) also showed that adding portable play equipment (hurdles, hoops, bean bags, and balls) significantly decreased sedentary behavior and increased PA during recess time in 3-5 year-old children. Despite some positive results, a study by Cardon, Van Cauwenberghe, Labarque, Haerens, and De Bourdeaudhuij (2008) showed that access to play materials, such as toys, was not a significant physical activity predictor. The same results were found by Cardon et al. (2009), supporting Cardon et al.'s (2008) conclusion that providing play equipment during recess is not sufficient to increase time spent in PA or to decrease time spent in sedentary activity during preschool recess. In summary, children's levels of physical activity (vigorous or not) will only increase if their environmental contexts (in this case, recess period, schoolyards, and playgrounds) provide opportunities for movement and access to a wide variety of materials.

Affordances in Sport Environments

Different studies have addressed the effects of sports practice and after-school programs on multiple aspects of children's lives (Herrick, Thompson, Kinder, &

Madsen, 2012; Kelder et al., 2005; Kordi, Nourian, Ghayour, Kordi, & Younesian, 2012; Wickel & Eisenmann, 2007). A large number of studies report that a substantial number of children fail to engage in any kind of physical activity after school (Atkin, Gorely, Biddle, Marshall, & Cameron, 2008; Barnett et al., 2013; Frago-Calvo et al., 2017; Laguna Nieto, Lara Hernández, & Aznar Laín, 2011). Since children generally make rapid gains in learning and are capable of increasingly refined motor functioning (Gallahue, 1996), sport environments are important learning contexts (ecological settings), critical to children's acquisition of movement skills.

In the last two decades, many studies have shown that children who practice sports during childhood are more likely than children who do not practice sports to be physically active during adulthood (Kjønniksen, Anderssen, & Wold, 2009; Tammelin, Näyhä, Hills, & Järvelin, 2003; Zimmermann-Sloutskis, Wanner, Zimmermann, & Martin, 2010). Ribeiro-Silva, Marinho, Brito, Costa, and Benda (2018) analyzed the motor performance in fundamental movement skills of 8-10 year-old children, participants and nonparticipants in guided sports practice outside school. These results showed that children who participated in guided sports practice had higher levels of fundamental motor skills than the control group, in both locomotor and object control skills. Kjønniksen et al. (2009), in a 10-year longitudinal study, examined whether participating in sports during childhood predicted the frequency of leisure-time physical activity during adulthood. Having participated in organized youth sports was positively related with the frequency of leisure-time physical activity at 23 years of age. Children who were involved in organized youth sports at an early age (6–10 years) and continued through adolescence were more likely to become active adults.

The after-school period is a potentially important moment for increasing physical activity for youth. According to Kelder et al. (2005), it is important to reach children who are enrolled in after-school programs in order to increase their nonacademic activities and promote their health. To accomplish this, a large number of after-school programs have been developed (Herrick et al., 2012; Mahoney, Larson, & Eccles, 2005; Shann, 2001). For example, CATCH (Coordinated Approach to Child Health) was designed for the early prevention of cardiovascular disease and improvement of physical activity of third- to fifth-grade children. Using CATCH in the after-school period was associated with a decrease in children's self-reported fat consumption and increased physical activity (Sharpe, Forrester, & Mandigo, 2011). Other studies have found similar CATCH program results (Hoelscher et al., 2010; Nader et al., 1999; Parcel et al., 2003; Sharpe et al., 2011).

The Sports, Play, and Active Recreation for Kids program was another after-school program used to increase children's physical activity. However, in a 5-month study, Herrick et al. (2012) found no differences in MVPA between children enrolled in SPARK (Sports, Play, and Active Recreation for Kids)

versus a control group of children who were not enrolled. Vizcaíno et al. (2008) used the MOVI program, found that this after-school program of recreational physical activity was able to reduce all children's adiposity and girl's body fat percentage and led to increased diastolic blood pressure in boys. Despite the aforementioned studies on the influence of sports programs (events) on children's motor skills, investigations that address the impact of sporting physical features (e.g., materials and spaces) on motor skill development are difficult to find. New approaches are needed to understand the role of affordances in sports contexts in which children are engaged.

Discussion

In the present article, we summarized current research literature regarding relationships between different environmental microsystems and motor learning affordances for children. We adopted Bronfenbrenner's bioecological systems theory with Gibson's ecological perceptual theory to focus particularly on different types of microsystems, such as home, school, and sport settings in order to analyze within them various opportunities for motor skill development.

In the home microsystem, we concluded that the optimal home context (i.e., variety of play materials, adequate physical spaces to use, etc.) can improve children's motor capabilities at various ages. Better financial conditions can positively influence the quantity and quality of materials, objects, toys, and so on and the availability of parents to provide more appropriate MC affordances for developing children. In addition, SES, including maternal education level, was associated with children's good health and cognitive and socioemotional outcomes. The neighborhood setting had rich potential for motor affordances essential to children's explorations through outdoor free play; multiple forms of interaction; different kinds of movements; and different surfaces, objects, and places.

In the school microsystem, no studies determined an ideal number of students per PE class or an ideal type of play materials, suggesting a need for more research in these areas. Generally, researchers have called for increased physical activity levels within PE classes for more students and greater numbers of specialists versus generalists in PE education. After-school activities on school premises may represent further MC development opportunities, though these too have been generally under studied.

Considering the sports microsystem, we found no studies that addressed the motor learning affordances from sports engagement in school-aged children. Leisure activities, such as going to a sports center, are sometimes embedded in children's daily routines with clear health advantages. Sport environments influence children's development in multiple ways that extend beyond the development of sports abilities per se. These are also important contexts for social interaction and a place to meet friends, thus providing a key developmental role

for the emergence of motor and social learning affordances. Future studies should focus on assessing the material and social features of these microsystems and their relation with the motor affordances along different stages of the lifespan.

Some research gaps were identified in our narrative review. This narrative review did not address motor affordances for children with disabilities, a niche topic that merits its own review. Also, most studies reviewed here focused only separate specific microsystems, failing to aggregate two or more microsystems into a mesosystemic view of motor development. Bronfenbrenner's theory reinforces the advantage of various different perspectives, including analyses of human development influences of both proximal and more distal processes involving the relation between micro-, meso-, exo-, and macrosystems. Thus, comparing the affordances for motor skill development in multiple microsystems across different cultures, and along the lifespan, would be a valuable next contribution to this field. Some research efforts have used web-map surveys to study children and youths' meaningful places across different cultures (Kytta et al., 2018), and others have primarily focused on mapping places with social opportunities (Lopes, Cordovil, & Neto, 2018). Extending this methodology to identify motor affordances through development and across different cultures is an important future research direction.

Conclusion

Our literature review findings support Bronfenbrenner's ecological systems theory and Gibson's affordances theory. Both authors addressed human development from within a person–environment transactional relation and not as individual units of analysis. Physical, social, symbolic, and cultural characteristics of an environment may invite, permit, or inhibit a reciprocal transaction between the immediate environment and the active child's engagement in diversified motor behaviors (walking to school, performing a motor task, practicing a sports activity, etc.). These child–environment interactions result from the emergence of diversified types of affordances, such as those in the motor category. Maturation stems from the occurrence of proximal processes established via the emergence of affordances in the immediate setting as affected by more distal ones. We have focused on home, school, and sports environments, each microsystem with its own objects, places, surfaces, events, and people to stimulate and offer children different opportunities for motoric interaction. This narrative review revealed that studies of affordances for motor development in the home environment setting have been focused mainly in early developmental stages, while studies in school and sports contexts promoting or hindering motor opportunities are scarce. An ecological approach to studying motor development holds promise for learning how to better enhance motor skill acquisition by manipulating environmental constraints.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Luis P. Rodrigues work is supported by national funding through the Portuguese Foundation for Science and Technology, I.P., under project UID/DTP/04045/2019.

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