

## Actual and perceived motor competence levels of Belgian and United States preschool children

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## **Abstract**

*Purpose:* The present study examined the motor competence of preschool children from Belgium and the United States (US), and the influence of perceived motor competence on actual motor competence. A secondary objective was to compare the levels of motor competence of Belgian and US children using the US norms of the Test of Gross Motor Development, Second Edition (TGMD-2).

*Methods:* All participants ( $N = 326$ ; ages 4-5) completed the TGMD-2 and the Pictorial Scale of Perceived Movement Skill Competence for Young Children.

*Results:* Belgian children performed significantly higher on actual object control and locomotor skills than US children. However, both Belgian and US children scored significantly worse on the TGMD-2 when compared to the US norm group from 1997-1998. Furthermore, perceived motor competence was significantly related to actual object control skills but not locomotor skills.

*Conclusion:* The present study showed cross-cultural differences in actual motor competence in young children. The findings also indicate a secular downward trend in childhood competence levels, possibly due to a decrease in physical activity and increase in sedentary behavior. Future research should consider conducting an in-depth exploration of physical activity contexts such as physical education to better understand cross-cultural differences in motor competence.

## **Introduction**

The importance of physical activity for one's overall health and well-being is well documented (World Health Organization, 2015). A substantial literature base also supports the association between children's motor competence and physical activity behaviors (Figueroa & An, 2016; Holfelder & Schott, 2014; Robinson et al., 2015). Motor competence refers to a child's ability to perform a wide range of motor skills in a proficient manner (Haga, 2008). In early childhood, motor competence is often operationalized as proficiency with performing fundamental motor skills (FMS; Stodden et al., 2008; Robinson et al., 2015). FMS are considered the building blocks to more advanced movement patterns (Seefeldt, 1980) and generally consist of locomotor skills and object control skills. Locomotor skills involve moving the body from one point in space to another (e.g., running, leaping, jumping, and galloping). Object control skills involve the reception and/or propulsion of an object with either the hand or foot (e.g. throwing, kicking, striking, and catching; Gallahue, Ozmun, & Goodway, 2012).

In light of the health benefits associated with motor competence (Robinson et al., 2015), it is important to appropriately evaluate and monitor children's motor competence, starting in the early years. Appropriate assessment helps to identify motor delay and provide appropriate support. Many assessments have been developed and validated to evaluate motor competence (Cools, De Martelaer, Samaey, & Andries, 2009). These motor competence tests include process-oriented and/or product-oriented measures. Process-oriented assessments focus on the quality of movement (e.g., contralateral step during throw) while product-oriented assessments focus on quantitative measures (e.g., ball speed during throw). Depending upon the geographical region, process-oriented or product-oriented measures may be more prevalent. For instance, process-oriented assessments such as the Test of Gross Motor Development, Second Edition (TGMD-2; Ulrich, 2000) are typically used in the United States (US) while product-

oriented assessments such as the Körperkoordinationstest für Kinder (KTK; Kiphard & Schilling, 2007) are generally adopted in Europe.

Comparative research on motor competence levels between children from distinct regions is scarce (Bardid, Rudd, Lenoir, Polman, & Barnett, 2015; Chow, Henderson, & Barnett, 2001), and generally involves one assessment since it is not recommended to use motor tests interchangeably due to low-to-moderate correlations between different tests (e.g., Bardid et al., 2016; Logan, Robinson, & Getchell, 2011; Rudd et al., 2016). The few cross-cultural studies available have mainly adopted a product-oriented assessment (Bardid et al., 2015; Chow et al., 2001). Nonetheless, cross-cultural comparisons using a process-oriented assessment could be of value in terms of contributing to a more comprehensive understanding of motor competence on a global level (Bardid et al., 2015; 2016). In turn, this will help identify cultural factors that influence motor competence. One assessment that would be appropriate for this purpose is the TGMD-2. While there may be a cultural bias of the test towards the US sports context (e.g., the two-hand strike commonly used in baseball), the TGMD-2 is one of few process-oriented standardized test batteries that has been used in different regions, including Asia, Europe and South America (Bardid et al., 2016; Kim, Han, & Park, 2014; Valentini, 2012).

Along with actual motor competence, perceived motor competence has rarely been evaluated across cultures (e.g., Barnett, Robinson, Webster, & Ridgers, 2015). Perceived motor competence refers to a child's thoughts or perceptions about his/her ability to perform motor skills (Stodden et al., 2008). Understanding perceived motor competence from a global perspective is important as emergent evidence supports perceived motor competence as a mediating construct between actual motor competence and physical activity (Barnett et al., 2008; 2011; Robinson et al., 2015). Children with higher levels of perceived motor competence are often more willing to participate in physical activity including sports and games (Stodden et al., 2008). Moreover, children with higher levels of perceived motor competence are more

likely to persist with tasks that can be perceived as challenging (Harter, 1978). Participating in developmentally appropriate tasks and persisting when tasks become challenging is critical to the development of motor competence. As such, perceived motor competence may be an important predictor of levels of physical activity (Babic et al., 2014) given that when children do not believe they are skilled at a task they will most likely opt out (Stodden et al., 2008). It should be noted that few studies, which examined actual and perceived motor competence, have adopted an instrument that assesses the perceptions of the same skills included in the motor test (e.g., Barnett, Ridgers, & Salmon, 2015; Liong, Ridgers, & Barnett, 2015).

Given the importance of perceived and actual motor competence in children's health, it is important to compare actual motor competence across cultures adopting the same assessment and to examine how perceived motor competence is related to actual motor competence. The primary objective of the present study was to examine the actual motor competence of 4- and 5-year old children from Belgium and the US using the TGMD-2 and to investigate the influence of perceived motor competence on actual motor competence. In their study, Bardid et al. (2016) found that Belgian children aged 3-5 years demonstrated similar TGMD-2 scores on locomotor skills but lower scores on object control skills when compared to the US reference group. Based on these findings, we hypothesized that Belgian children will demonstrate similar levels of locomotor skills and lower levels of object control skills compared to the US children. The secondary objective of the present study was to compare the distribution of Belgian and US children across the TGMD-2 performance categories to each other and against the TGMD-2 reference group of 1997-1998 (Ulrich, 2000). Previous studies have reported a decrease in motor competence levels in Western countries (e.g., Bardid et al., 2015; Kambas et al., 2012; Tester et al., 2014). We therefore hypothesized that both sample distributions will have moved towards the lower end of the competence spectrum (for both locomotor and object control skills) in comparison to the TGMD-2 reference group.

## **Material and methods**

### **Participants**

Four schools in the Flemish region of Belgium and six schools in the Midwestern region of the United States (US) were recruited for this research. A convenience sample of 326 preschoolers (170 Belgian and 156 US children) aged 4-5 years participated in the study. Data-collection took place between September and December 2013. Parents or legal guardians provided written informed consent for each participant. The University Ethics Committees in both countries approved the study.

### **Site Information**

*Belgian preschool environment.* The preschools in Belgium provided two physical education classes of approximately 60 min per week. During recess (2 x ~15 min per day) and lunch break, children participated in free play on the playground and had access to typical equipment such as playground balls, scooters and tricycles.

*US preschool environment.* The preschools in the US did not provide physical education but featured well-equipped free play as their means to engage children in motor skill activities. This free play environment is unstructured and child facilitated. All free play occurred either outdoors on a playground or indoors in a gross motor space for up to 60 minutes per day. During free play, children had access to playground equipment including swing sets, sandboxes, playground balls, scooters and tricycles.

### **Procedure**

First, we assessed children's actual motor competence using the Test of Gross Motor Development, 2<sup>nd</sup> Edition (TGMD-2; Ulrich, 2000). In Belgium, members of the research team assessed all participants on site and coded all trials live. In the US, the research team was able to record children's TGMD-2 performance on video for later assessment. Four weeks after the

conclusion of the TGMD-2 assessment, children's perceived motor competence was assessed with the Pictorial Scale of Perceived Movement Skill Competence for Young Children (Barnett, Ridgers, Zask, & Salmon, 2014). Examiners had a physical education background and received training on the administration of the TGMD-2, which included scoring directions and practice. All tests were conducted indoors.

## **Measurement**

*Actual motor competence.* Children's actual motor competence was measured using the TGMD-2 (Ulrich, 2000). The TGMD-2 includes 12 FMS (which is comprised of six locomotor and six object control skills) and takes approximately 20 min to administer. The locomotor subtest consists of running, galloping, hopping, leap, horizontal jump and sliding. The object control subtest contains striking a stationary ball, stationary dribble, catching, kicking, overhand throwing and underhand rolling. Following a visual demonstration, the child was asked to perform the skill twice. The TGMD-2 is a qualitative measure where each skill was scored against performance criteria prescribed in the manual (3-5 criteria per skill); the criteria were scored 1 (present) or 0 (absent). Scores for locomotor and object control skills were summed to compute scores for locomotor and object control skills (each score ranging from 0 to 48). Using the TGMD-2 reference data (based on the performance of a US sample in 1997-1998), these scores were transformed into standard scores in order to classify children's locomotor and object control skill performance, from very poor to very superior (Ulrich, 2000). The psychometric properties of the TGMD-2 have been evaluated. The manual reports excellent test-retest reliability and inter-rater reliability (all  $r$  values  $> 0.85$ ) as well as a good internal consistency (Cronbach's  $\alpha$  is 0.85 and 0.88 for locomotor and object control subtests respectively). Construct, content and concurrent validity have also been determined for children aged 3 to 10 years (Kim, Han, & Park, 2014; Simons et al., 2007; Ulrich, 2000; Valentini, 2012; Wong & Cheung, 2010).

*Perceived motor competence.* Children's perceived motor competence was assessed via The Pictorial Scale of Perceived Movement Skill Competence for Young Children (Barnett et al., 2014) for the same locomotor and object control skills as the TGMD-2. The perceived motor competence assessment took approximately 10 min to administer. For each skill, children were shown two picture illustrations of a competent and less competent child performing the skill. Children were asked which child they identified themselves with the most; each question had the same standard structure: "This child is pretty good at [...], this child is not that good at [...]: Which child is most like you?" Once children selected a picture, they were then asked to further indicate their perceived motor competence as more or less identifying with the selected picture. For the picture of the most competent child, the follow-up question was: "Are you pretty good or really good at [...]?" For the picture of the less competent child, the accompanying question was: "Are you sort of good or not that good at [...]?" Each item was scored 1 (not that good), 2 (sort of good), 3 (pretty good) or 4 (really good). Scores for locomotor and object control skills were summed to compute scores for locomotor and object control skills (each score ranging from 6 to 24). The Pictorial Scale of Perceived Movement Skill Competence for Young Children was shown to have acceptable face validity as well good test-retest reliability ( $r > 0.78$ ) and internal consistency (Cronbach's  $\alpha = 0.60-0.81$ ; Barnett et al., 2015). Construct validity has also been established in children aged 4 to 10 years (Barnett et al., 2016; Lopes et al., 2016; Valentini et al., 2017).

### **Data analysis**

We computed descriptive statistics for the actual and perceived competence in locomotor and object control skills, using SPSS 23 for Windows (IBM Corp., Armonk, NY, USA). Due to the nested design of the study (i.e. children within schools), we then conducted hierarchical linear modeling in HLM 7 Student for Windows (SSI Inc., Skokie, IL, USA) to examine the effects of country and perceived competence on actual competence in locomotor and object



control skills. Potential effects of confounding factors such as sex and age were controlled for at level 1 (child level). Full maximum-likelihood estimation was used for the 2-level model and the significance level was set at  $p < .05$ .

We ran separate hierarchical linear models for locomotor skills (model 1) and object control skills (model 2). First, two-level null models (child – school) including only the outcome were estimated for locomotor skills (null model 1) and object control skills (null model 2). Next, level 1 variables (sex, age and perceived competences) were inserted to the model for locomotor skills (model 1a) and object control skills (model 2a) to examine child characteristics. Sex was entered as a dichotomous variable (0 = boy; 1 = girl); age and perceived motor competence were entered as continuous variables. Random effects were inserted but were only kept in further analysis when significant. Finally, country was included as a level 2 variable (0 = US; 1 = Belgium) in the model for locomotor skills (model 1b) and object control skills (model 2b), to investigate the effect of country on actual motor competence. Variables with no meaningful zero value (i.e., age and perceived motor competence) were grand mean centered.

Finally, chi-square analyses were completed to compare the distribution of Belgian and US children across the TGMD-2 categories for both locomotor and object control skills. Prior to these analyses, the TGMD-2 categories “very poor”, “poor” and “below average” were collapsed into one level (i.e., “below average”) due to small numbers of children in these categories. Similarly, the categories “very superior”, “superior” and “above average” were merged into one category (i.e., “above average”). As such, only three performance categories were included in the chi square analyses: “below average”, “average” and “above average”. Additional chi-square tests were conducted to compare the distribution of each group with the expected distribution, based on the TGMD-2 reference group (Ulrich, 2000).

## Results

The means and standard deviations for the actual and perceived motor competence are reported in Table 1. Our sample was not normally distributed with regard to perceived motor competence. Mann-Whitney U tests revealed no significant differences in perceived motor competence between Belgian and US children for both locomotor skills ( $U = 12663$ ;  $p = .476$ ) and object control skills ( $U = 11912$ ;  $p = .107$ ).

Table 2 shows the results of the hierarchical linear models for locomotor skills (model 1) and object control skills (model 2). The null model for locomotor skills (null model 1) demonstrated a significant variance at school level [ $\chi^2(9) = 225.82$ ;  $p < .001$ ]. The intraclass correlation coefficient (ICC) showed that 43% of the variance in locomotor skills was situated at school level and 57% at child level. Of the included level 1 variables (model 1a), age was significantly related to children's actual competence in locomotor skills. As age increased, the locomotor skill score increased [ $\beta = 4.03$ ; S.E. = .99;  $t(9) = 4.05$ ;  $p = .003$ ; ES = 0.42]. Sex and perceived competence in locomotor skills were not significantly related to children's actual competence in locomotor skills ( $p = .805$  and  $.425$  respectively). Results from the model that included country (model 1b) showed that, after controlling for sex, age and perceived competence in locomotor skills, Belgian children performed significantly higher on actual locomotor skills than US children [ $\beta = 10.56$ ; S.E. = 1.87;  $t(8) = 5.65$ ;  $p < .001$ ; ES = 1.09].

The null model for object control skills (null model 2) revealed a significant variance at school level [ $\chi^2(9) = 84.60$ ;  $p < .001$ ]. The ICC showed that 21% of the variance in object control skills was located at school level and 79% at child level. With regard to the included level 1 variables (model 2a), sex, age and perceived competence in object control skills were significantly related to children's actual competence in object control skills. Girls scored significantly lower in object control skills than boys [ $\beta = -3.36$ ; S.E. = .85;  $t(9) = -3.95$ ;  $p = .003$ ; ES = 0.44]. As age increased, the object control skill score increased [ $\beta = 4.20$ ; S.E. = .91;

$t(9) = 4.60; p = .001; ES = 0.55$ ]. Similarly, as the perceived object control skill score increased, the actual object control skill score increased [ $\beta = .31; S.E. = .12; t(9) = 2.51; p = .033; ES = 0.04$ ]. The final model that included country (model 2b) showed that, after controlling for sex, age and perceived competence in object control skills, children from Belgium performed higher on actual object control skills than children from the United States [ $\beta = 4.57; S.E. = 1.35; t(8) = 3.39; p < .001; ES = 0.60$ ].

Figure 1 shows the distribution of Belgian and US children across the TGMD-2 performance levels. The chi-square tests revealed a significant difference in distribution between the two groups for both locomotor skills ( $\chi^2 = 63.88; p < .001; \phi_c = .443$ ) and object control skills ( $\chi^2 = 20.17; p < .001; \phi_c = .249$ ). The percentage of US children scoring below average for locomotor skills was higher compared to Belgian children (52% vs. 17% respectively). Similarly, a larger proportion of US children scored below average on object control skills when compared to their Belgian peers (57.1% vs. 32.4% respectively). Moreover, more Belgian children scored above average in comparison with US children (locomotor skills: 16.5% vs. 2.6%; object control skills: 3.5% vs. 1.9%). Additional chi-square analyses further reveal that the observed distribution of both Belgian and US children across the TGMD-2 categories were significantly different from the expected distribution for both locomotor skills (Belgium:  $\chi^2 = 26.98; p < .001; \phi_c = .140$ ; US:  $\chi^2 = 66.57; p < .001; \phi_c = .221$ ) and object control skills (Belgium:  $\chi^2 = 40.23; p < .001; \phi_c = .171$ ; US:  $\chi^2 = 83.70; p < .001; \phi_c = .248$ ). Both groups had a higher percentage of children scoring below average than the expected 25.25%. In contrast, the proportion of Belgian and US children scoring above average was lower than the expected percentage of 25.25.

## Discussion

This study sought to compare actual motor competence levels of 4- to 5-year-old children from Belgium and the US and to examine whether perceived motor competence was associated

with actual motor competence in both groups. The findings showed cross-cultural differences in actual motor competence. Belgian children scored higher on both locomotor and object control skills compared to US children. There is limited research investigating cross-cultural differences and similarities in motor competence in early childhood. One recent study compared the motor competence of Belgian and Australian children aged 6-8 years using the KTK (a non-sport-specific assessment commonly used in Europe; Bardid et al., 2015). The study also found that the Belgian children had higher motor competence levels (Bardid et al., 2015). It should be noted that the KTK and the TGMD-2 assess different aspects of motor competence (Bardid et al., 2015). The KTK focuses on gross motor coordination (e.g., intentional actions derived from various body movements that consider direction and force; Gallahue et al., 2012) whereas the TGMD-2 measures FMS (e.g. precursor patterns that are foundational movements leading to more specialized non-specific and sport specific movements; Gallahue et al., 2012). Nonetheless, the present study similarly showed that Belgian children demonstrated significantly higher levels of motor competence than US children as indicated by the large ( $ES = 1.07$ ) and medium ( $ES = 0.58$ ) effect sizes for locomotor and object control skills respectively.

Schools are often cited as prime venues to promote actual motor competence as well as physical activity (Institute of Medicine, 2013) due to children spending on average 6-7 hours per day in schools (DeSilver, 2014). However, the approach to promoting physical activity and developing motor skills within schools is highly variable depending on policy within different countries (Haerens et al., 2014; WHO, 2010). Variability among schools is supported by the variance explained at the school level within both HLM models (e.g., 43% for locomotor skills and 21% for object control skills). For example, in Belgium, 98-99% children aged three to five years are enrolled in preschools (Organization for Economic Cooperation and Development [OECD], 2014), where physical education is offered as part of the school curriculum (Haerens et al., 2014). In the US, however, the enrollment rates at age three, four and five in early

childhood education is 38%, 66% and 93% respectively (OECD, 2014). Moreover, US preschools generally feature free play/recess as their vehicle to develop motor skills (Brian, Goodway, Logan, & Sutherland, 2016; in revision).

Similar to present findings, Bardid et al. (2015) concluded with the explanation that the preschool physical education program in Belgium is a key factor, which could have enhanced school-aged children's motor competence in comparison to Australian children. Three out of ten Australian children do not attend preschool and there is no mandated physical education preschool program (Bardid et al., 2015), whereas almost all Belgian children attend preschool and physical education starts at age three (Haerens et al., 2014). As the children in the current study are preschool aged this suggests that this preschool program is making a difference to the motor competence of the Belgian children even at the very early ages. The US sample could be seen as similar to the Australian sample, in that four out of ten children do not attend preschool (OECD, 2014), and there is also no mandated program in any state for physical education at preschool. There is substantial evidence that a preschool program with appropriate movement programs for children can improve motor competence (Brian et al., 2016; in revision). These improvements can be maintained years into the future (Lai et al., 2014).

We reiterate that a main difference across cultures is the policy surrounding physical education in the early years. Interestingly, Belgian children scored higher in object control skills despite the cultural bias inherent within the TGMD-2 in favor of US children, especially for object control skills. In the US, children are familiar with and often learn skills such as striking, throwing, and catching in baseball, which is more relevant within the US sports culture compared to the Belgian sports culture. As such, the present findings seem to be in contrast with the study of Bardid et al. (2016) who found lower object control scores in Belgian children aged 3-8 years when compared to the US children of the TGMD-2 reference group. However, the authors argued that the findings of their study may be due to a secular downward trend in

motor competence levels as there was a time difference of ~ 15 years between the data-collection in the US reference group (1997-1998) and the Belgian group (2012; Bardid et al., 2016), implying that today's US children would similarly demonstrate declined levels of motor competence in comparison with the US reference group.

We also examined the influence of Belgian and US children's perceived competence on their actual competence in locomotor and object control skills. Perceived competence was significantly related to actual competence in object control skills, but not in locomotor skills. These findings are supported by previous studies (Barnett et al., 2015; Liong, Ridgers, & Barnett, 2015). For instance, the study of Liong et al. (2015) in Australian children aged 5-8 years found a significant relationship between actual and perceived competence in object control skills, but not in locomotor skills.

It is unclear why the relationship between actual and perceived motor competence differed for locomotor and object control skills. A possible explanation is that object control skills tend to be more ontogenetic than locomotor skills (Hayward & Getchell, 2014). Children may learn and develop object control skills in more specific game contexts that generally include motor instruction, which might influence the relationship between actual and perceived motor competence. Nonetheless, young children generally overestimate their motor competence, as they do not yet possess the cognitive capabilities to accurately perceive their actual motor competence (Harter, 1978; Robinson et al., 2015). This is supported by the high levels of perceived motor competence in both samples (means greater than 20 for all items; see Table 1) contrasted with lower levels of actual motor competence. There were also no cross-cultural differences in perceived competence for either locomotor or object control skills. This suggests that the perceived motor competence of children in both countries is not accurate enough to reflect the differences in actual motor competence between the groups.

A secondary objective within our study was to compare the distribution of both groups with the TGMD-2 reference group and to examine the hypothesis that there is a decline in levels of motor competence in Western countries. Although Belgian children performed better than the US children, both groups scored below what might be expected of them at this age, especially for object control skills. 32.4% of the Belgian sample and 57% of the US sample scored below average for object control skills compared to 25.33% of the TGMD-2 reference group (Ulrich, 2000). It should be noted that the TGMD-2 norms were published in 2000, and a third version of the instrument (i.e., TGMD-3), along with new norms, are being developed. In the recent study comparing the motor competence levels of Belgian and Australian children using the KTK, a similar concerning trend was identified (Bardid et al., 2015). The observed percentages for both Australian and Belgian children differed significantly from the expected percentages, with 39% of Australian children and 21% of Belgian children scoring below average compared to the expected figure of 16% in the German reference group of 1974 (Kiphard & Schilling, 1974). As such, the current study reinforces these previous findings, in that the children of today are not the same as children of the past in terms of their motor competence levels.

It is unclear why significant differences exist with regard to levels of motor competence in today's children when compared to standardized norms of children from the past. However, as noted by Bardid et al. (2015), it is possible that increased rates of sedentary behavior along with decreased levels of physical activity have contributed to lower levels of motor competence. It seems that the lifestyle patterns of children may be important factors. For a preschool child, it appears that the trend of decreased motor competence levels reinforces the notion that large amounts of time are now spent in sedentary behavior (e.g. screen based behaviors), and less time is spent playing outside (Tandon et al., 2012). In order to be physically active, young children need the opportunity to engage in such play with appropriate parental support (Campbell et al., 2001; Trost et al., 2003) and the necessary physical environment (e.g. large

backyard or close by park that is perceived as safe; Hinkley, Salmon, Okely, Hesketh, & Crawford, 2012; Tandon et al., 2012). Future research should consider examining levels of motor competence, physical activity, and constraints in the environment across generations.

### **Strengths and Limitations**

The main strength of the study is that we assessed motor competence across cultures using the same process-oriented instrument and that our assessment tool for perceived motor competence directly aligned with the skills tested to capture FMS. In addition, we conducted multi-level analyses to analyze the hierarchical data and account for differences in school environment. However, some limitations need to be considered within the context of this study. First, the present study evaluated the locomotor and object control subtests of the TGMD-2. However, future research should examine the individual skills of the test to further explore cross-cultural differences in motor competence. Second, this study did not include physical activity and physical fitness measures, which could provide more insights into the cross-cultural differences in motor competence. Third, there was a difference in coding procedures for the TGMD-2; while the US children were assessed using video recording it was not possible to video record Belgian children's performance for later assessment due to logistical constraints. For this reason, it was also not possible to report inter-rater reliability in the present study. Nonetheless, all examiners had a physical education background and received training on TGMD-2 assessment.

### **Conclusion**

In conclusion, this study has provided evidence of cross-cultural differences in motor competence in early childhood. Belgian children displayed higher scores on locomotor and object control skills than US children, which may be explained by differences in physical activity contexts such as physical education. In Belgium, preschool children have the



opportunity to develop their motor skills through physical education, which is provided starting at the age of three and is generally taught by a physical education specialist. In the US, preschool children receive free play as their medium to develop their motor skills. Present results also showed that perceived competence is associated with actual competence in object control skills but not in locomotor skills. However, there were no differences in perceived motor competence between Belgian and US children for both locomotor and object control skill. Future research should consider conducting an in-depth exploration of extraneous variables (e.g., access to equipment, physical education specialist, and time spent in structured and unstructured physical activity) in the educational and built environments to further explore cross-cultural differences in motor competence.

**Table 1**

Means (M) and standard deviations (SD) of children's actual and perceived motor competence

Variable	Belgium ( <i>N</i> = 170)			United States ( <i>N</i> = 156)			
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	
Actual motor competence							
Locomotor skills	Boys	97	32.1	7.4	66	21.9	7.9
	Girls	73	32.0	6.6	90	21.7	9.0
	All	170	32.0	7.1	156	21.8	8.5
Object control skills	Boys	97	25.5	7.2	66	20.2	7.4
	Girls	73	21.4	5.8	90	17.2	6.3
	All	170	23.7	6.9	156	18.5	6.9
Perceived motor competence							
Locomotor skills	Boys	97	20.6	3.3	66	21.3	2.5
	Girls	73	21.1	2.8	90	21.0	3.0
	All	170	20.8	3.1	156	21.1	2.8
Object control skills	Boys	97	20.6	3.4	66	21.6	2.5
	Girls	73	20.5	3.4	90	21.1	2.7
	All	170	20.6	3.4	156	21.3	2.6

**Table 2:** Relationship between sex, age, perceived competence, country and actual motor competence.

Locomotor skills (Model 1)													
Fixed effect	Null model 1				Model 1a				Model 1b				
	$\beta$	S.E.	$t$		$\beta$	S.E.	$t$		$\beta$	S.E.	$t$		
Intercept	25.69	2.05	12.54	***	25.99	1.72	15.10	***	21.63	1.29	16.74	***	
Country									10.56	1.87	5.65	***	
Sex					-0.25	0.97	-0.26	<i>n.s.</i>	-0.08	0.80	-0.11	<i>n.s.</i>	
Age ‡					4.03	0.99	4.05	**	3.90	0.92	4.24	***	
Perceived competence ‡					0.12	0.15	0.84	<i>n.s.</i>	0.22	0.14	1.64	<i>n.s.</i>	
Random effects	$\sigma^2$	S.D.	$\chi^2$		$\sigma^2$	S.D.	$\chi^2$		$\sigma^2$	S.D.	$\chi^2$		
Intercept	39.68	6.30	225.82	***	25.90	5.09	70.08	***	6.30	2.51	55.60	***	
level-1 residual	53.33	7.30			48.93	6.99			49.87	7.06			
Sex					2.90	1.70	10.45	<i>n.s.</i>					
Age					1.34	1.16	7.35	<i>n.s.</i>					
Perceived competence					0.03	0.16	6.75	<i>n.s.</i>					

Note: ‡ grand mean centered

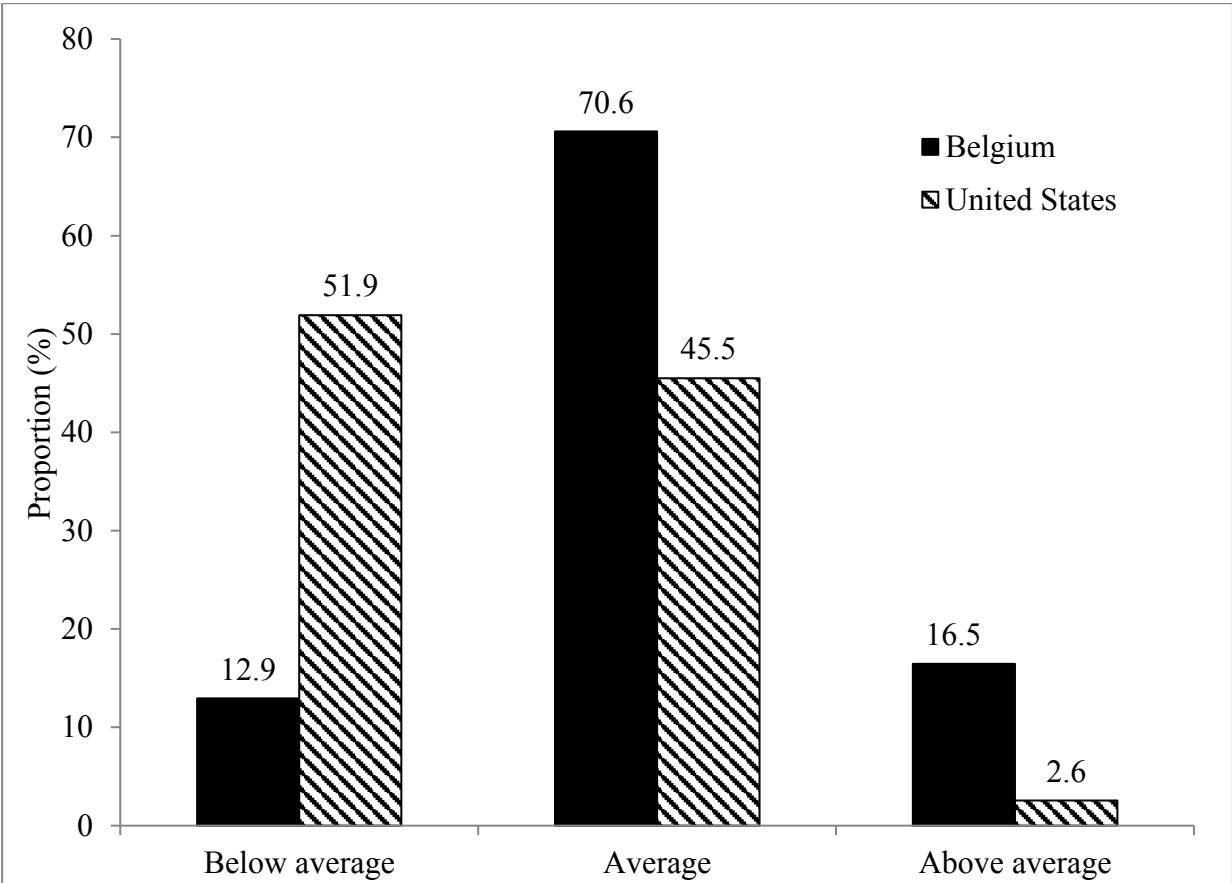
Note: \*  $p \leq 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ ; *n.s.* = not significant

**Table 2** (continued)

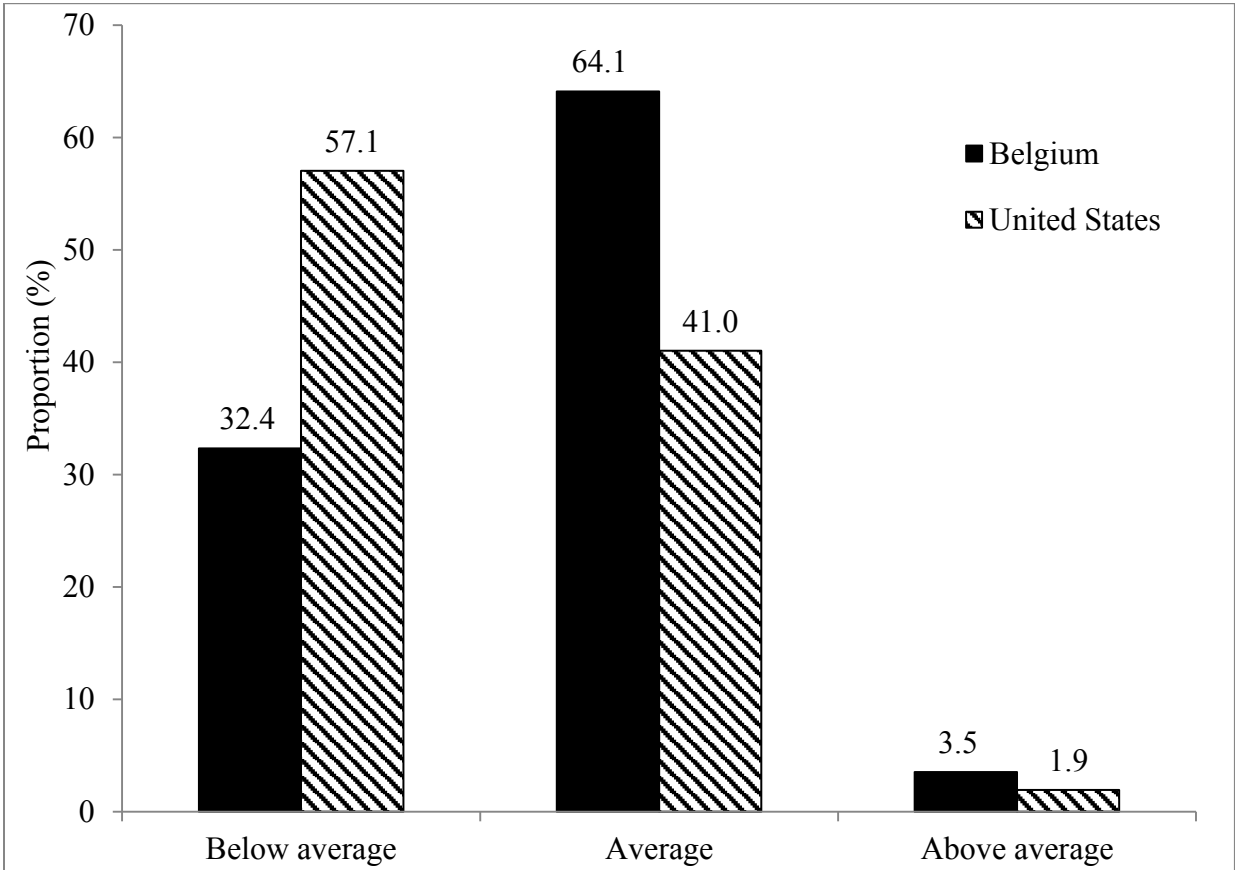
Object control skills (Model 2)													
		Null model 2				Model 2a				Model 2b			
Fixed effect		$\beta$	S.E.	$t$		$\beta$	S.E.	$t$		$\beta$	S.E.	$t$	
Intercept		20.32	1.18	17.26	***	22.25	1.21	18.44	***	20.53	0.97	21.22	***
	Country									4.57	1.35	3.39	*
Sex						-3.36	0.85	-3.95	**	-3.54	0.70	-5.09	***
Age ‡						4.20	0.91	4.59	**	3.97	0.80	5.00	***
Perceived competence ‡						0.31	0.12	2.51	*	0.33	0.11	2.92	***
Random effects		$\sigma^2$	S.D.	$\chi^2$		$\sigma^2$	S.D.	$\chi^2$		$\sigma^2$	S.D.	$\chi^2$	
Intercept		11.96	3.46	84.60	***	11.37	3.37	49.96	***	2.83	1.68	34.33	***
	level-1 residual	45.24	6.73			37.02	6.08			37.92	6.16		
Sex						2.10	1.45	10.22	n.s.				
Age						1.80	1.34	12.10	n.s.				
Perceived competence						0.02	0.14	10.04	n.s.				

Note: ‡ grand mean centered

Note: \*  $p \leq 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ ; n.s. = not significant



**Figure 1a:** Proportion of Belgian and US children across the TGMD-2 performance categories for the locomotor subtest.



**Figure 1b:** Proportion of Belgian and US children across the TGMD-2 performance categories for the object control subtest.

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