

# Development of Motor Coordination in Young Children

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## Abstract

Development of motor coordination in young children was investigated. Young children in nursery schools (N = 80) were asked to walk an obstacle course either alone, or with a partner; while keeping a piece of fabric balanced on their heads. Results indicated no differences in task performance between typically developing children and children requiring special care when they walked alone, whereas typically developing children performed better when walking with a partner. These results suggest that children requiring special care have difficulties in performing dual tasks requiring coordination of personal relationships.

**Key words:** motor coordination, young children, children requiring special care

## Purpose

Recently, children with difficulty for group adaptation in nursery schools, without any specific medical diagnosis, have increased (Hongo et al., 2003). These children require special care. Such children often have problems in motor and social development. Hongo et al. (2010) examined the developmental characteristic of children requiring special care using the Kinder Infant Development Scale (KIDS). Results indicated that motor development of these children was delayed compared to their cognitive and language development. Moreover, development of skills such as skipping and dribbling a ball three times, which are related to motor coordination was particularly delayed in children requiring special care.

In general, motor development has not been considered a central problem in children with developmental disorders. However, some researchers have reported that children with developmental disorders have problems in motor development. Hanai (2009), for example, found

that children with Asperger disorder have a deficiency in ball skills. Tillman et al. (2008) suggested a relationship between motor control and attention. Planinsec (2002) indicated an association between motor coordination and cognitive development, while Wassenberg et al. (2005) showed a relationship between motor development and attention. Moreover Hongo et al. (2006; 2009) reported that children requiring special care performed poorly in ball control tasks, such as throwing a ball up in the air, clapping the hands twice and catching the ball. However, it is not clear whether these deficits are directly or indirectly related to developmental disorders.

Although the above studies have suggested that children requiring special care have problems in motor coordination, there are only a few studies on the developmental process of motor coordination in typically developing children. Therefore, the mechanisms of motor coordination development are not well understood. This study was designed to clarify motor development and characteristics of motor coordination in typically developing children and children requiring special care.

## **Method**

### **1. Participants**

Participants were 80 nursery school children, including 69 typically developing children (34 four-year-olds, mean age 57.2 months and 35 five-year-olds, mean age 66.3 months) and 11 children requiring special care, because of difficulty in group adaptation in the nursery school, without any specific medical diagnosis (6 four-year-olds, mean age 56.3 months, and 5 five-year-olds, mean age 64.8 months).

### **2. Study Period**

Participants were observed twice in May (Period 1) and October (Period 2) of 2009.

### **3. Motor coordination relay task**

Children participated in a motor coordination relay. Participants were asked to walk a set obstacle course as fast as possible, without dropping a piece of fabric placed on their heads. The relay was conducted as a competition between teams of boys and girls. The obstacles in the middle of the course made the task difficult for small children (Figure 1). The relay consisted of two conditions: a "single condition," in which children kept the fabric on their heads and walked the course alone, and a "paired condition," in which they kept the fabric on their heads and walked the course holding hands with a partner. Children were instructed to pick up the fabric if it fell off. The time taken to reach the goal from the starting point (relay time), and the number of times children dropped the fabric (fall frequency of the fabric) were recorded.

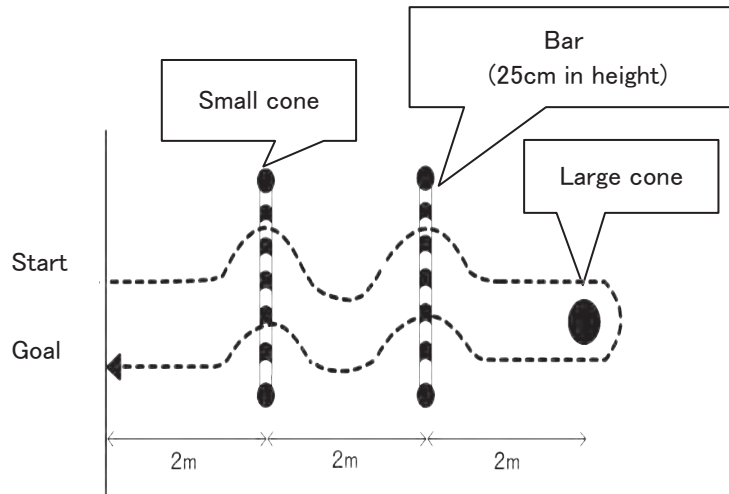


Figure 1 Relay course



Figure 2 Setting of the course

## Results

First, we used a t-test to compare differences in the mean relay time between different age groups, which indicated no significant difference in the mean time between the two age groups. Similarly, no significant difference was found between the two age groups in the mean fall frequency of the fabric. Therefore, we used the combined data of the two age groups in the analysis.

**Table 1 Mean relay time for age groups**

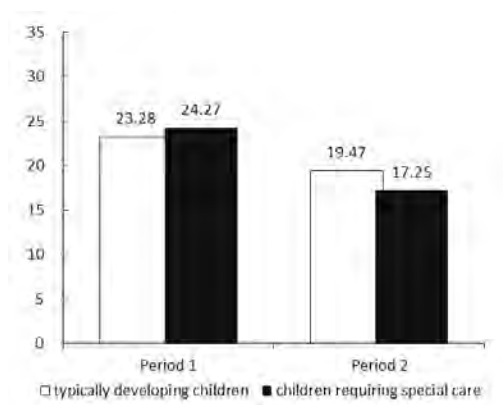
Condition	Period	Single		Paired	
		Period 1	Period 2	Period 1	Period 2
4-year-olds	M	23.62	18.88	29.89	25.63
	SD	12.04	8.91	11.68	10.98
5-year-olds	M	23.21	19.46	31.85	24.27
	SD	9.91	9.08	13.49	11.25

**Table 2 Mean fall frequency for age groups**

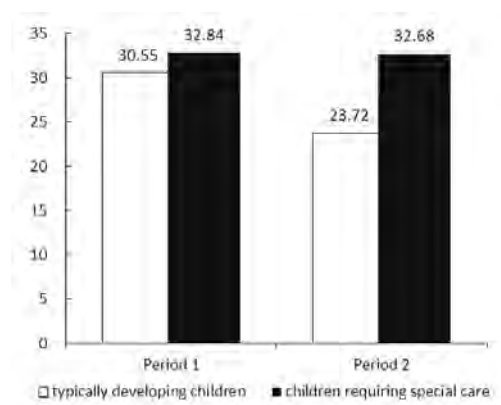
Condition	Period	Single		Paired	
		Period 1	Period 2	Period 1	Period 2
4-year-olds	M	23.62	18.88	29.89	25.63
	SD	12.04	8.91	11.68	10.98
5-year-olds	M	23.21	19.46	31.85	24.27
	SD	9.91	9.08	13.49	11.25

### 1. Relay Time

In the single condition, the mean relay time was examined using a two-way analysis of variance (ANOVA) with type of children (2) and period (2) as factors, which indicated that the main effect of period was significant ( $F(1,78) = 6.21, p < .05$ ). As shown in Figure 3, children walked faster during Period 2 than in Period 1 in the single condition. Similarly, we examined relay time in the paired condition, and found that the main effect of types of children was marginally significant ( $F(1, 78) = 3.52, p < .10$ ). As shown in Figure 4, typically developing children walked faster than children requiring special care.



**Figure 3 Mean relay time  
in the single condition**



**Figure 4 Mean relay time  
in the paired condition**

## 2. Fall Frequency

The fall frequency in the single condition was examined using a two-way ANOVA with type of children (2) and period (2) as factors; the main effects and the interactions were not significant (Figure 5). Similarly, we examined the fall frequency in the paired condition, which indicated that a marginally significant main effect of type of children ( $F(1, 78) = 3.54, p < .10$ ). As shown in Figure 6, children requiring special care dropped the fabric more frequently than typically developing children.

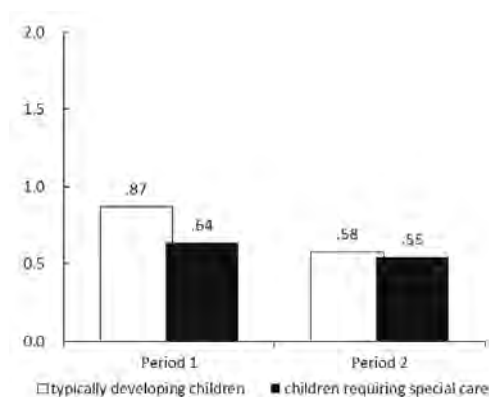


Figure 5 Mean fall frequency  
in the single condition

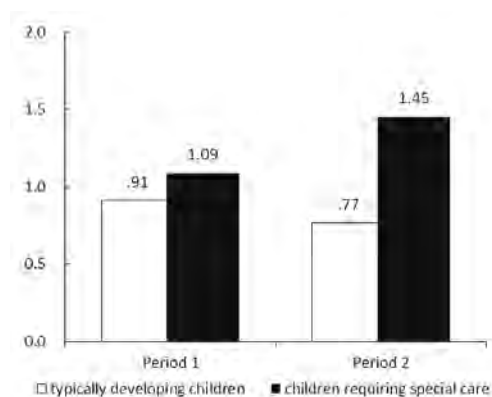


Figure 6 Mean fall frequency  
in the paired condition

## Discussion

These results suggest that children requiring special care had more difficulty in the paired condition than in the single condition. In the paired condition, it was necessary for children to coordinate their movements in addition to the relationship with their partner, which made the task a dual task. Therefore, it is possible that children requiring special care tended to have difficulties in performing a dual task. However, another possible interpretation of this finding is that such children face challenges when coordinating personal relationships.

Getchell and Whittall (2003) reported that children have a similar pattern of coordination with adults for relatively simple tasks, whereas they have a different pattern of coordination with adults for complex tasks. The results of this study indicated that the pattern of motor coordination varies according to age and the complexity of the task. Furthermore, Laufer et al. (2008) suggested that children with developmental coordination disorder (DCD) were not affected by the task condition, whereas non-DCD children's performance varied depending on whether a task was a simple, or a dual task. This unexpected result can be explained because children with DCD might have similar difficulties with both tasks, resulting in no difference in performances on

the two tasks.

The dual task could be more challenging for typically developing children than the simple task, whereas these two tasks might be equally difficult for children with DCD (Hongo, 2014). The results of this study suggest that the development of motor coordination in children requiring special care resembles that of typically developing children more closely than that in children with DCD. However, children requiring special care might also have additional difficulties related to other aspects of the dual task used in this study, such as the need to coordinate personal relationships.

## References

- Getchell, N., & Whittall, J. (2003). How do children coordinate simultaneous upper and lower extremity tasks? : The development of dual motor task coordination. *Journal of Experimental Child Psychology*, 85, 120-140.
- Hanai, T., (2009). Consideration of Developmental Coordination Disorder of Asperger Syndrome Children. *Bulletin of College of Contemporary Education, Chubu University*, 1, 81-90.
- Hongo, K. (2014). The Development of Motor Coordination Embedded in Sociability. In Sawae, Y., Kawata, M., & Suzuki, T. (eds.) *Universal Design of the Development Support about <Body>*. Chapter 11, 147-158, Kaneko Shobo.
- Hongo, K., Sawae, Y., Suzuki, T., Koizumi, Y., & Iijima, N. (2003). Research on the Behavioral Characteristics of "Difficult Children" and Teacher's Intervention in Nursery Schools. *Japanese Journal on Developmental Disabilities*, 25(1), 50-61.
- Hongo, K., Iijima, N., Sugimura, R., Ohta, K., Hirakawa, M., Saito, J., Usui, S., & Usui, Y. (2006). Effect of Miyagi Kids Program for Soccer on Young Children in a Nursery School. *Annual Report of Graduate School of Education, Tohoku University*, 55(1), 263-282.
- Hongo, K., Hirakawa, K., Iijima, N., Usui, S., & Usui, Y. (2009). Effect of Miyagi Kids Program for Football Young Children in a Nursery School 2 -The Relation between the Motor Development and the Social Development-. *The Tohoku Journal of Psychology in Education*, 11, 11-20.
- Hongo, K., Iijima, N., & Hirakawa, K. (2010). Delay and Deviation of Development of Children with Special Care Needs. *Annual Report of Graduate School of Education, Tohoku University*, 58(2), 121-133.
- Laufer, Y., Ashkenazi, T., & Josman, N. (2008). The effects of a concurrent cognitive task on the postural control of young children with and without developmental coordination disorder. *Gait and Posture*, 27, 347-351.
- Planinsec, J. (2002). Relations between the motor and cognitive dimensions of preschool girls and boys. *Perceptual and Motor Skills*, 94, 415-423.
- Tillman, C., Thorell, L., Brocki, K., & Bohlin, G. (2008). Motor response inhibition and execution in the stop-signal task : Development and relation to ADHD behaviors. *Child Neuropsychology*, 14, 42-59.
- Wassenberg, R., Feron, F., Kessels, A., Hendriksen, J., Kalf, A., Kroes, M., Hurks, P., Beeren, M., Jolles, J., & Vles, J. (2005). Relation between cognitive and motor performance in 5- to 6-year-old children: Results from a large-scale-cross-sectional study. *Child Development*, 76(5), 1092-1103.