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Brief Report

Development of cultural strategies of attention in North American and Japanese children

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ABSTRACT

Recent studies suggest that North American adults exhibit a focused strategy of attention that emphasizes focal information about objects, whereas Japanese adults exhibit a divided strategy of attention that emphasizes contextual information about objects. The current study investigated whether 4- and 5-, 6- to 8-, and 9- to 13-year-old North American and Japanese children exhibit these divergent attention strategies. Two experiments suggest that those older than 6 years of age exhibit measurable cultural differences in attention, whereas 4- to 6-year-olds do not. We suggest that sociocognitive development and socialization experiences that occur around 5 to 7 years of age may foster the development of cultural strategies of attention.

Introduction

The past few decades have witnessed a growing body of research demonstrating robust cultural differences in basic psychological processes in adults (Gutchess, Welsh, Boduroglu, & Park, 2006; Ji, Peng, & Nisbett, 2000; Nisbett & Masuda, 2003; Nisbett & Masuda, 2006; Nisbett, Peng, Choi, & Norenzayan, 2001; Witkin & Berry, 1975). One intriguing explanation for many of these findings is that people in different cultures experience divergent socialization practices during childhood that shape the allocation of attention (Duffy & Kitayama, 2007; Kitayama & Duffy, 2004; Kitayama, Duffy, & Uchida, 2007). If this hypothesis is true, children may acquire these cultural attention strategies only over time with sociocognitive development and socialization experience. To test this hypothesis, the

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current study examined whether North American and Japanese children at different ages exhibit similar or divergent strategies of attention.

Kitayama and colleagues (Duffy & Kitayama, 2007; Kitayama & Duffy, 2004; Kitayama et al., 2007) suggested that East Asians are socialized to divide attention between objects and their surrounding contexts (called the *divided* attention strategy), whereas North Americans are socialized to focus attention on the focal features of objects (called the *focused* attention strategy). They argued that these attention strategies allow individuals to adapt to the particular perceptual, cognitive, and social affordances of their cultural environments. For instance, attention may be important for establishing and maintaining thought as analytic in North America and as holistic in East Asia (Nisbett et al., 2001). Focusing attention to an object's unique properties is crucial for categorizing, a primary characteristic of North American analytic reasoning. Dividing attention between objects is crucial for determining similarities, a primary characteristic of East Asian holistic reasoning (Ji et al., 2000; Nisbett, 2003). Attention also may influence social reasoning (Kitayama et al., 2007). Attending to the self or specific social others may be an important competence for engaging in predominantly independent cultures such as North America. Attending to social context or generalized social others may be crucial for individuals engaging in predominantly interdependent cultures such as Japan (Markus & Kitayama, 1991).

To provide empirical evidence for their hypothesis, Kitayama, Duffy, Kawamura, and Larsen (2003) developed a simple perceptual test measuring the degree to which individuals allocate attention to an object or its context. In the Framed Line Test, participants observe a square sheet of paper containing a line. After this stimulus is removed, participants view a second square that is larger than, smaller than, or the same size as the first square. Participants subsequently complete two tasks. In the absolute task, they draw a line in the second square so that it has the same length as the line in the initial square. Successful performance in this task requires ignoring the relation between the initial line and frame, and this should be easier for individuals with a focused attention strategy. In the relative task, participants draw a line in the second square so that it has the same proportion to the new square as the target line had within the original square. Successful performance in this task requires incorporating the relation between the target line and frame, and this should be easier for individuals with a divided attention strategy.

Kitayama and colleagues (2003) found that Japanese adults exhibited larger errors in the absolute task than in the relative task, whereas American adults exhibited larger errors in the relative task than in the absolute task. This cross-cultural difference has since been replicated (Hedden, Ketay, Aron, Markus, & Gabrieli, 2008; Kitayama, Park, Sevincer, & ~~Karasawa,~~ 2007). Although the Framed Line Test is similar to the Rod-in-Frame task (Witkin & Berry, 1975), the unique advantage of Kitayama and colleagues' (2003) test is that it permits a direct comparison of the ability to either include or exclude contextual information in two comparable nonsocial tasks.

Although a converging body of literature demonstrates cultural differences in adult attention strategies, few studies have explored these differences in children. Yet there are reasons to suspect that children's performance might differ from adults' performance. Although children engage in culturally mediated socialization practices starting at birth (Bornstein, Toda, Azuma, Tamis-LeMonda, & Ogino, 1990; Chavajay & Rogoff, 1999; Greenfield, Keller, & Fuligini, 2003; Rogoff, 2003), it is not clear whether infants and young children have the cognitive abilities or socialization experiences necessary to acquire their culture's attention strategy. Rather, children may exhibit cultural attention strategies only after considerable socialization experience and biological maturation. Before a certain point in development, active participation in socialization routines is controlled by caregivers and close social others, and this may mediate children's attention (e.g., Chavajay & Rogoff, 1999). However, with the gradual acquisition of cognitive skills and social experiences, children control their own attention independent of caregiver interactions.

To date, no study has tested children in the Framed Line Test. Thus, it is unclear at what point in development North American and Japanese children might show measurable differences in attention strategies. However, a recent study of North American 5-, 7-, and 9-year-olds provided a possible clue. Using a task similar to Kitayama and colleagues' (2003) Framed Line Test, Vasilyeva, Duffy, and Huttenlocher (in press) found that 5-year-olds produce larger errors reproducing absolute line lengths rather than relative ones, whereas the errors decrease significantly at 7 and 9 years of age. Although

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these findings are limited to North American children, they suggest that a transition in attention may occur around 5 to 7 years of age.

Vasilyeva and colleagues' (in press) results are particularly informative because many important cognitive and social changes occur during the period of development between 5 and 7 years of age (Sameroff & Haith, 1996). Around this time, children develop the ability to use complex syntax, giving them greater expressive ability regarding thoughts and intentions. (Byrnes, 1991; Vygotsky, 1978, ~~1932~~). Children also master a representational theory of mind, allowing them to understand that others can have feelings and thoughts that differ from their own (Wellman & Liu, 2004). Children also reveal greater depth in their own self-understanding, allowing them to better relate to social others (Harter, 1999). Apart from these cognitive developments, there are also important changes in socialization during this time. For instance, this is the time when children begin schooling in many cultures, providing new opportunities for autonomous socialization. These cognitive and social changes during this period of time may play an important role in shaping attention.

In the current study, we present two experiments exploring attention strategies in Japanese and U.S. children. Both experiments used a modified version of the Framed Line Test with simplified instructions for children. The first experiment tested 6- to 13-year-olds and used a paper version of Kitayama and colleagues' (2003) Framed Line Test. The second experiment tested kindergarteners in a computer version of the Framed Line Test. Because young children do not understand the terms *relative* or *absolute*, we used a simple training procedure in which we taught participants to encode and reproduce the absolute or relative length of a target line through the use of a matching procedure rather than verbal labels.

Experiment 1: The Framed Line Test in school-age children

In Experiment 1, we tested a group of 6- to 8- and 9- to 13-year-olds on a paper version of the Framed Line Test. We used these age groups because 8.5 years was the median age of the sample and because Vasilyeva and colleagues' (in press) study found that it was around 6 to 8 years of age that American children demonstrate an advantage in the Framed Line Test's absolute task. In the experiment, children observed a series of two squares that differed in size with lines inside them. In the absolute task, the lines have the same absolute length; in the relative task, the lines have the same proportional length with respect to the frames. We then showed a series of these squares to children and tested whether they learned the rule using a forced-choice discrimination task. We then conducted the actual test in which children reproduced lines in square frames.

Method

Participants

The sample consisted of 62 Japanese (38 female and 24 male) and 42 North American (22 female and 20 male) school-age children. The children were divided into two groups: 6- to 8-year-olds (24 North Americans and 26 Japanese) and 9- to 13-year-olds (18 North Americans and 36 Japanese). Children were recruited from schools in Shizuoka Prefecture in Japan and from schools in New Jersey in the United States. In both this experiment and Experiment 2, participants were recruited from schools serving middle-class communities, and all North American participants were from families of European or African descent.

Design and procedure

We tested children in a quiet room at their schools by native-language experimenters. Each child participated in both the absolute and relative tasks. The order of the tasks was randomized between participants, and testing occurred on separate days. The delay between tests was no less than 7 days but no more than 9 days. The experiment occurred in three phases: training, criterion, and testing.

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Training phase. Children observed two squares of different sizes with two lines inside presented on a sheet of paper. For the absolute task, the two lines were identical in absolute length (i.e., the two lines were 3 inches long). In the relative task, the lines were equal in relative length with respect to the squares (i.e., the two lines were one third the length of their respective squares). The experimenter asked the child, "Do you see how the line in this square [pointing to one of the squares] is the same as the line in this square [pointing to the other square]?" The instructions were the same for the absolute and relative conditions; the only difference between conditions was whether the lines in the two squares had the same relative or absolute length. Children observed 8 trials during this phase, with stimuli presented on separate sheets.

Criterion phase. The experimenter showed the child two squares with lines in them. The experimenter asked the child, "Are these two lines the same?" If the child answered correctly on three consecutive trials, the criterion phase ended. All children reached criterion by the 16th trial, and the number of trials required to reach criterion did not differ by age or culture.

Testing phase. The experimenter showed the child a target line and square for approximately 7 s, at which point the experimenter covered the target square and showed the child an empty response square. The experimenter asked the child to "draw a line in this square that is the same as the line you just saw." There were a total of 8 trials of different line and frame combinations in both the absolute and relative tasks.

Results and discussion

We first calculated the mean absolute error for each trial (the absolute difference between the child's response and the correct response.) We culled data points more than 3 standard deviations from the average error. Culling eliminated less than 2% of the data. The remaining data were submitted to a 2 (Culture) × 2 (Age Group) × 2 (Gender) × 2 (Task Type) analysis of variance (ANOVA) with task type as the within-participant factor. The analysis yielded a significant main effect for age group, $F(1, 96) = 40.32$, $p < .01$, $\eta^2 = .30$, with younger children producing lines with larger errors than older children (*M*s = 10.73 and 6.94 and *SE*s = 0.59 and 0.37, respectively). There was also a significant interaction between task type and culture, $F(1, 96) = 6.95$, $p < .05$, $\eta^2 = .07$. Japanese exhibited larger errors in the absolute task than in the relative task, absolute task mean = 8.67, *SE* = 0.50, relative task mean = 7.86, *SE* = 0.38, whereas North Americans exhibited larger errors in the relative task than in

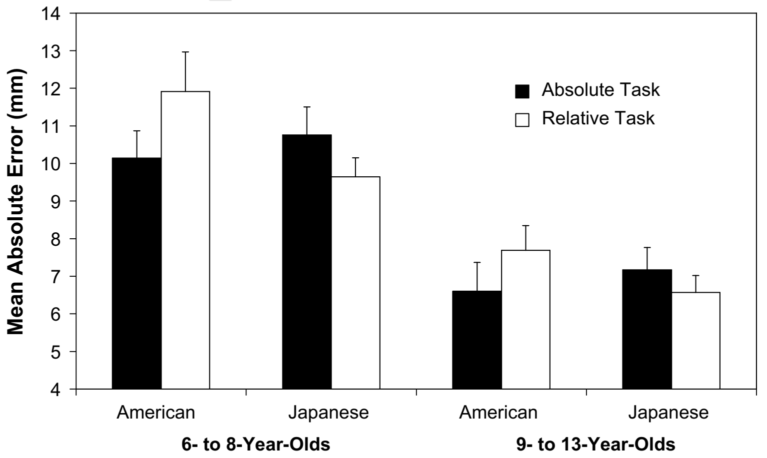

Fig. 1. Results of Experiment 1. Values are in millimeters.

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the absolute task, absolute task mean = 8.62, $SE = 0.58$, relative task mean = 10.10, $SE = 0.72$. However, there was no three-way interaction among age group, culture, and task type, $F(1, 96) < 1.00$, suggesting that the pattern of results is consistent between the two age groups in each culture. The means for each task by age appear in Fig. 1.

Experiment 1 suggests that 6- to 13-year-olds in both North America and Japan exhibit the pattern of performance in the Framed Line Test observed in adults by Kitayama and colleagues (2003). Children in both cultures showed improvement in performance over the course of childhood, but the basic Japanese relative task advantage and North American absolute task advantage remained consistent over the school-age years.

Recall that many important cognitive and social abilities emerge around 5 to 7 years of age (e.g., Sameroff & Haith, 1996). Recall also that Vasilyeva and colleagues (in press) found that North American 4-year-olds, like Japanese older children, exhibited larger errors in the absolute task than in the relative task. It is possible that 4-year-olds in Japan and North America might exhibit more similar attention strategies than do older children because the younger children are less likely to have acquired the sociocognitive skills and socialization experiences that older children have acquired and experienced. Experiment 2 tested this hypothesis by sampling kindergarteners in Japan and the United States.

Experiment 2: The Framed Line Test in kindergarteners

Pilot testing using the paper version of the Framed Line Test used in Experiment 1 demonstrated that younger children have trouble with the paper task and that many simply began drawing pictures on the stimulus sheets. Thus, in Experiment 2, we designed a computer-administered version of the task. In addition, pilot testing showed that children often refused to participate in a second session. For these reasons, we conducted this study using a between-participant design.

Method

Participants

The samples consisted of 60 Japanese (27 female and 33 male) and 82 North American (38 female and 44 male) kindergarteners. We recruited Japanese participants from schools in Kyoto, Japan, and recruited North American students from schools in Ann Arbor, Michigan.

Materials

In both countries, stimuli were presented on a Macintosh G4 computer with a 15-inch diagonal screen with 30 pixels = 1 cm.

Procedure

Children were tested in three phases: training, criterion, and testing.

Training phase. Children viewed two squares on the computer screen, with each square containing a line. As in Experiment 1, in the absolute task, the lines had the same length; in the relative task, the lines had the same proportions to their respective frames. The experimenter told the child that one of the boxes was the child's box and the other one was the experimenter's box. The experimenter then asked, "Do you see the line in your box? Do you see how it is just like the line in my box? So, do you see how these lines are the same?" Children then saw 8 line and frame examples.

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Criterion phase. As in Experiment 1, children completed a forced-choice discrimination task to determine whether they learned the absolute or relative rule. The computer presented the experimenter's square at the top of the computer screen. The bottom of the screen presented two squares, with one square containing a line that had the same absolute length as the line in the top square (the correct absolute task response) and the other square containing a line that had the same proportion as the line and square at the top of the screen (the correct relative task response). The experimenter asked the child to decide which of the two squares was his or her square based on what the child had seen during the first part of the experiment. Once the child reached a criterion of 3 correct discriminations in a row, he or she moved on to the testing phase.

Testing phase. A practice square appeared with a 10-pixel line in it. The experimenter demonstrated how she could make the line grow and shrink. Next, the child reproduced 8 test trials in random order. The child saw a line in a square for 7 s. The line and square disappeared for 1 s, and then a reproduction frame appeared containing a 10-pixel line. The experimenter told the child that he or she needed to indicate to the experimenter when to stop the line when the child's square looked like the experimenter's square. During the adjustment procedure, the experimenter sat behind the computer and did not view the computer screen at any point.

Results and discussion

We first calculated the mean absolute error for each trial as in Experiment 1. We culled data points that were more than 3 standard deviations from the average error for that trial, eliminating less than 5% of the data. To determine whether there were any effects of age, we divided the children into two groups based on a median split of the group's ages (62 months). Although this cutoff point is relatively arbitrary from a developmental perspective, it permits a general comparison between the performance of younger and older children within the sample. This resulted in a group of 65 younger kindergarteners (mean age = 55 months, range = 47–61) and a group of 77 older kindergarteners (mean age = 68 months, range = 62–74). We then submitted these data to a 2 (Culture) × 2 (Age Group) × 2 (Task Type) ANOVA. This analysis yielded a significant main effect of culture, $F(1, 134) = 7.89$, $p < .01$, $\eta^2 = .06$, with North American children exhibiting smaller errors ($M = 31.69$, $SE = 1.04$) than Japanese children ($M = 35.00$, $SE = 1.74$). This effect may have arisen from small differences in testing conditions. Second, there was a significant main effect of age

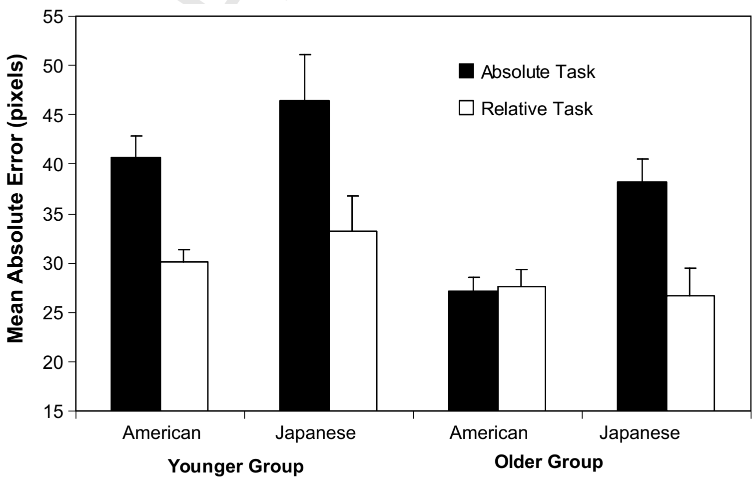

Fig. 2. Results of Experiment 2. Values are in pixels.

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group, $F(1, 134) = 21.04$, $p < .01$, $\eta^2 = .136$, with younger kindergarteners producing larger errors ($M = 36.75$, $SE = 1.43$) than older kindergarteners ($M = 30.00$, $SE = 1.18$). Third, there was a main effect of task type, $F(1, 134) = 27.10$, $p < .01$, $\eta^2 = .17$, with larger errors overall in the absolute task ($M = 37.35$, $SE = 1.39$) than in the relative task ($M = 28.95$, $SE = 1.15$). Unlike in Experiment 1, both North Americans and Japanese exhibited higher accuracy in the relative task than in the absolute task.

Next, we consider interaction effects. First, there was a significant interaction between country and task type, $F(1, 134) = 4.72$, $p < .05$, $\eta^2 = .034$. There was a smaller difference in performance between the absolute and relative tasks for North American children (*M*s = 34.63 and 28.89, *SE*s = 1.06 and 1.08, respectively) than for Japanese children (*M*s = 40.98 and 29.03, *SE*s = 2.23 and 2.22, respectively). There was a marginal interaction between age group and task type, $F(1, 134) = 3.57$, $p < .07$, $\eta^2 = .03$, with larger differences between the absolute and relative task performance for younger kindergarteners than for older kindergarteners (*M*s = 42.54 and 31.13, *SE*s = 2.05 and 1.44, respectively).

As depicted in Fig. 2, younger children in Japan and the United States exhibit similar performance patterns, with larger errors in the absolute task than in the relative task. Planned contrasts reveal significant differences between the absolute and relative tasks for both groups in the same direction of larger absolute errors than relative errors: United States, $t(42) = 4.38$, $p < .001$; Japan: $t(19) = 2.28$, $p < .05$. However, this pattern changed in the older group. The difference in performance between the absolute and relative tasks was not significant for the North American older children, $t(36) = 0.17$, *ns,* but the difference for the Japanese older children was significant, with larger errors in the absolute task, $t(37) = 3.26$, $p < .005$, consistent with the Japanese adults.

Experiment 2 suggests that 4- and 5-year-olds in Japan and the United States exhibit similar performance in the Framed Line Test. However, 5- and 6-year-olds in Japan and the United States reveal what may be the beginning of a divergence in performance. There was a larger improvement in accuracy in the absolute task than in the relative task among older 4- and 5-year-old in North America. Their Japanese counterparts revealed the opposite pattern, with a larger improvement in the relative task than in the absolute task.

General discussion

More than 40 years ago, Piaget (1966) noted, “Psychology elaborated in our environment, which is characterized by a certain culture and a certain language, remains essentially conjectural as long as the necessary cross-cultural material has not been gathered as a control” (p. 13). The current study highlights the importance of Piaget’s observation. In Experiment 1, we observed that North American and Japanese 6- to 13-year-olds tested on the Framed Line Test exhibited the pattern of performance observed in adults of their respective cultures (Kitayama et al., 2003). Japanese 6- to 13-year-olds revealed a relative task advantage characteristic of divided attention, and North American 6- to 13-year-olds revealed an absolute task advantage characteristic of focused attention. However, 4- and 5-year-olds in both cultures exhibited similar performance in the Framed Line Test, with their performance suggesting the beginning of a cultural divergence for both Japanese and North American children. These results provide tentative evidence that cultural divergences in attention may be measurable by around 6 years of age. Moreover, the data are consistent with the hypothesis that cultural strategies of attention may emerge only after considerable socialization experience and the development of various sociocognitive skills.

The finding that 4-year-olds exhibit a divided attention strategy in both cultures is consistent with prior studies examining how infants and young children encode relative information. For instance, Duffy, Huttenlocher, and Levine (2005) found that North American infants and young children were more accurate at remembering the relative size than the absolute size of an object until around 5 years of age. This suggests that young children may start life with relatively divided attention. Importantly, however, this attention is not strategic in that children use divided attention in tasks requiring a more focused strategy, leading to characteristic errors such as incorrectly estimating an object’s size (e.g., see DeLoache, Uttal, & Rosengren, 2004; Huttenlocher, Duffy, & Levine, 2002). However, with different amounts of experience at engaging in social and cognitive tasks that require focused or divided attention, children in North America may improve more at focusing attention than at dividing attention, whereas children in Japan may improve more at dividing attention than at focusing attention. Although more data are necessary to understand longitudinal patterns of attention development across different cultural contexts, these results are consistent with the notion that children in both cultures begin life with similar modes of attention that become modified through cultural experience.

These findings suggest that cognitive developments and cultural practices that occur around the 5th or 6th year of life may play important roles in shaping attention. Of the psychological developments that occur during this time, theory of mind may be particularly crucial because knowing that other people have mental processes and divergent perspectives is fundamental for active engagement in a culture. Of the social developments that occur during this time, schooling may be particularly crucial because this significantly increases exposure to many new members of the culture, including teachers and peers. One direction for future research may be to test the association between the emergence of a representational theory of mind (Wellman & Liu, 2004), as well as the start of schooling, and the development of attention strategies with the ability to focus or divide attention.

There are broader implications and possible future directions for research. An often-cited paradox is how cultures may undergo tremendous social changes yet remain relatively stable at some deeper level over time (Kitayama & Duffy, 2004). One possible answer is that socialized attention may serve as a "carrier" of culture. Once acquired, it is likely that attention strategies remain relatively stable over an individual's life. Thus, attention strategies may be impervious to the external forces that cause cultural change. If so, one generation, socialized to attend with either the focused or divided strategy, will subsequently socialize the next generation to have a similar attention strategy. This intergenerational transmission of attention strategies might explain, in part, why cultures are so resistant to change. Future work exploring intergenerational correlations in attention strategies may shed light on this intriguing possibility.

In conclusion, this article has suggested that cultural experiences that occur during childhood may shape how individuals allocate attention between focal and contextual information. In addition, the methodology used in this study may provide a useful new tool for exploring the development of children's capacity to focus or divide their attention between objects and their contexts. Future work has much to gain by further elaborating on how culture enters and shapes the mind during childhood.

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