

Young children's eyewitness memory for a complex real-life event: Developmental change from 4- to 6-year-olds

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4歳児と6歳児における複雑な現実場面を目撃した際の記憶能力の発達的变化

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要約

本研究の目的は、複数の人物が登場する複雑なイベントを目撃した際の、4歳児と6歳児の記憶能力を検討することであった。実験参加者は、2名の主要人物と2名の周辺人物が登場するイベントを目撃した約1ヶ月後に、イベントの内容、周辺人物の存在、登場人物の顔再認、背の高さの見積もりに関する記憶テストを受けた。その結果、6歳児の方が4歳児よりもイベントの内容と人物の顔に関する記憶は優れていた。しかし、両者共に周辺人物の存在を思い出すことが困難であり、また背の高さの見積もりについては信頼性が低かった。これらの結果を注意能力の発達等の観点から考察した。

Key words

young children, facial identification, eyewitness memory

1. Introduction

When young children see a complex, real-life event in which a number of people appear, how accurately can they remember the event details and features of the persons involved in the event? Are there any developmental differences in these abilities between 4- and 6- year-olds? The present study addressed these questions.

A large number of developmental studies of eyewitness memory for real-life events have focused on the issue of suggestibility (e.g., Leichtman & Ceci, 1995; Principe, Tinguely, & Dobkowski, 2007; Sutherland & Hayne, 2001) and effective interview methods for children (e.g., Goodman, Sharma, Thomas, & Considine, 1995; Holliday & Albon, 2004; Walker, 1993). These studies investigated the vulnerability of young children's eyewitness memory to misleading information or inappropriate forms of questioning after seeing an event.

Although a number of other researchers have also addressed both the practical and theoretical issues of the effects of post-event information on young children's eyewitness memory, previous studies have not considered the influence of the complexity of an observed original event. Most research on children's eyewitness memory has adopted live events or video-taped events in which only one main person performed the target event (e.g., Goodman & Reed, 1986; Leichtman & Ceci, 1995). Although a few early eyewitness studies in which a medical procedure was used as the target event (Goodman, Aman, & Hirschman, 1987; Peters, 1987) examined facial-identification accuracy for two people (i.e., a doctor and an assistant), they did not provide any

error response data caused by the presence of others in the event, such as the misidentification of the doctor as the assistant. Thus, little is known about how accurately young children can memorize a complex live event in which a number of people appear in a sequence of incidents and what types of errors they make in remembering such an event.

Recently, Sugimura (2008) examined young children's and adult's eyewitness memory when watching a complex live event in which three persons appeared. In the experiment, 5- to 6-year-olds and adults watched a magic show in which three different female magicians each performed three different kinds of magic tricks. After approximately one month, the participants were asked to recognize what kind of magic tricks had been performed and to make facial identifications as to which person had performed the magic tricks. The results showed that the children were less accurate than adults in both trick recognition and facial identification tests, in contrast to the results of previous studies that had demonstrated that young children's recognition ability and facial identification accuracy are as strong as those of adults provided that children are not given misleading questions (e.g., Pozzulo & Lindsay, 1998). Sugimura (2008) explained that this contradiction was due to the higher task demands of the identification tasks used in Sugimura (2008), in which the participants needed to not only recognize faces but to bind a person's face and their performance.

Ross et al. (2006) also adopted a complex event in which a number of people appeared. They examined whether children from 5 to 12 years of age misidentified a bystander as a perpetrator in a line-up test after seeing a video-taped crimi-

nal event in which two or three people appeared. The results showed that the 11- to 12-year-olds were likely to select the bystander as the perpetrator; however, this tendency was not observed in 5- to 6-year-olds. In addition, the younger children identified the main performer in the event more accurately than they could the bystander.

These researches have revealed that the eyewitness memory of young children is not as strong as those of adults and older children when remembering a complex, real life event in which more than one person appeared. Sugimura (2008) showed that 5- to 6-year-olds had a disadvantage with respect to facial identification and in reporting the exact number of persons that were presented in a target event. Ross et al. (2006) demonstrated that 5- to 6-year-olds were less likely to notice bystanders who were not directly involved in the central aspect of an event.

These studies did not examine developmental differences with respect to preschool age; however, it is well known that the ability to process complex real-life information remarkably improves from 3-4 to 5-6 year olds. For example, a number of eyewitness studies demonstrated that 5-6 year olds are more tolerant to suggestible questions or repeated interviews than are 3-4 year olds (e.g., Leichtman & Ceci, 1995; Quas, et al., 2007; Thierry, Spence, & Memon; 2000). Neuropsychological studies have also demonstrated that the development of executive function (EF), which plays an important role in information processing, relates to eyewitness memory performance (Alexander, et al., 2002; Scullin & Bonner, 2006; Robert & Powell, 2005). Furthermore, performance on EF tasks including working memory and inhibitory control is improving during the preschool age (Carlson, 2005; Welsh, Pennington, & Groisser, 1991; Luciana & Nelson, 1998). For example, Luciana & Nelson (1998) demonstrated that there are significant differences between 4 year olds and 5-6 year olds in the performance of a variety of working memory tasks. Accordingly, in this study we focused on the developmental differences between 4 and 6 year olds in respect to their eyewitness memory when seeing a complex live event in which a number of people appeared.

The chief aim of this study was to examine the differences between 4- and 6-year-olds in the ability to recognize bystanders who were not main part of an event and to make facial identifications. In the experiment, the participants first watched a magic show event in which two main performers and two bystanders appeared, and then they were given a performance-recall/recognition test (i.e., being asked what the magic show was like), a bystander-recognition test and a facial identification test. Qin, Quas, Redlich, & Goodman (1997) suggested that age differences might diminish or disappear when an event was particularly salient or personally meaningful to children, such as genital-contact situations involving the children themselves and someone else (e.g., a child and a man). However, under conditions of a neutral, complex event, 6-year olds were expected to perform better than 4-

year olds on the abovementioned tests. Consistent with a large number of studies (e.g., Goodman & Reed, 1986), therefore, we predicted that memory and facial-identification accuracy would improve, while false reports would decrease, with age.

The second issue examined in this study was how accurately young children can estimate the height of people who appeared in an event. A number of archival studies have examined the content of person descriptions reported by adult eyewitnesses in real cases (Kuehn, 1974; Yuille & Cutshall, 1986; van Koppen & Lochun, 1997). These studies demonstrated that almost all person descriptions contain references to aspects of the body including perceived height and weight of the perpetrator. It is apparent that estimates of height are an important part of person descriptions in real eyewitness; however, previous studies do not sufficiently clarify the issue of a child's ability to estimate height. It is generally accepted that children report fewer person descriptions than do adults (Marin, Holmes, Guth, & Kovac, 1979; Pozzulo & Warren, 2003) and that younger children are less accurate in reporting perceived heights, weights, and ages of target persons (Davies, 1996). Nevertheless, a number of researchers (e.g., Dent, 1982; Davies, Stevenson-Robb, & Flin, 1988) have suggested that estimation accuracy can be improved by inviting children to make judgments relative to a known anchor, such as the investigator or a familiar teacher. Accordingly, in this study participants were asked to compare the target persons with their class teacher and principal using three-alternative questions such as "Was the woman taller or shorter than your class teacher, or are they almost the same height?" The 6-year-olds were expected to show higher performance in this height-estimation test than the 4-year-olds, similar to studies revealing developmental improvement with age.

The goal of this study was to examine the developmental differences between 4- and 6-year-olds in the abilities to remember a complex live event based on three types of tests: bystander recognition, facial identification, and height estimation. As the target event, a magic show at a kindergarten, an event that generally appeals to young children and has also been used in previous studies (Bruck, Melnyk, & Ceci, 2000; Sugimura, 2008), was adopted.

2. Method

2.1 Participants

Twenty 4-year-olds (ages 4:0-4:11, M=4:6) and 25 6-year-olds (ages 6:0-6:9, M=6:4) participated in the experiment.

2.2 Materials

The three target persons (i.e., Performer A, Performer B, and Helper) were 20-year-old Japanese female undergraduate students with black eyes, black hair, and heights ranging from 5 feet 5 inches to 5'6" tall. They all wore jeans and a plain sweater. The announcer was also a 20-year-old Japanese female with black eyes and brown hair who was 5'6" tall and wore a pantsuit. The two class teachers and the principal, whose heights were used as a

baseline when estimating the heights of the three target persons, were 4'11", 5'0" and 5'6", respectively.

For the performance recognition test, eight 8cm × 6cm picture cards, on which were drawn the scenes of eight acts of amusement, were used: two of the eight depicted acts that were actually performed in the show (i.e., making balloon animals and making huge soap bubbles), while the other six were distractors, including paper folding and a card trick.

For the person-identification test, nine 9cm × 6cm color facial photographs of Japanese females taken from the shoulders up were used. All photographs were front views with neutral expressions, and each person wore identical gray clothes. Three of these nine females were the target persons (i.e., Performer A, Performer B, and Helper) who actually appeared in the show, three were distractors whose facial features were similar to those of the target persons, and three had facial features that were dissimilar to the target persons. The six distractors were selected from 31 female photographs given similarity ratings by 35 undergraduate students. The students were asked to rate the similarity of facial features between a target female and the 31 females in the photographs using a 5-point scale of similarity-dissimilarity: 1-completely dissimilar, 2-dissimilar, 3-neutral, 4-similar, and 5-very similar. The same procedure was repeated for the other two targets. The order of rating these three females was randomized for each participant. On the basis of the mean ratings, six distractors, i.e., the three females rated most similar to Performer A (mean=2.66, SD=1.16), Performer B (mean=2.83, SD=1.04), and the Helper (mean=2.51, SD=1.09), respectively; and the three females rated most dissimilar to Performer A (mean=1.20, SD=0.47), Performer B (mean=1.14, SD=0.35), and Helper (mean=1.26, SD=0.50), respectively, were selected.

2.3 Watching an event

The children participants watched an amusement event in the playroom of their kindergarten as part of their school entertainment curriculum. The announcer greeted the children and introduced them to the first performer, i.e., Performer A. "Hello everyone! We are the 'Dandelion Theatrical Troupe!' From now, we are going to show you a wonderful amusement show by some of the great members of our troupe. The first performer is going to make balloon animals. Here comes the first performer!" Performer A then came into the room and made balloon animals for 1.5 minutes, during which time the announcer made comments about the balloon animals (e.g., "What a lovely giraffe, isn't it?") Then, 45 seconds after Performer A entered the room, the Helper entered the room and assisted Performer A in holding the balloon animals while standing close to Performer A. The announcer did not mention anything about the Helper. Forty-five seconds after the Helper appeared, Performer A finished the performance, and both Performer A and the Helper exited the room together. Immediately following their exit, the announcer introduced the second performer

(i.e., Performer B). "The next performer is going to make soap bubbles. Here comes the next performer!" Performer B and the Helper, who carried the materials to be used in Performer B's performance, came into the room together. Performer B made soap bubbles for 1.5 minutes while the Helper handed all the necessary materials to Performer B. Then, 45 seconds after Performer B and the Helper had appeared, the Helper exited the room. Forty-five seconds later, Performer B finished the performance and exited the room. Thus, the exposure times were all the same (i.e., 1.5 minutes) for the three target persons (i.e., Performer A, Performer B, and the Helper). The exposure time of the announcer was five minutes throughout the entire show. At the end of the performances, the announcer said a few brief comments and good-bye to the children, and then exited the room.

2.4 Performance-recall and recognition test

After approximately one month, the participants were asked to recall and/or recognize what the entertainment show they had seen was like. A female experimenter, sitting across a table from each participant, first built up a rapport and then asked the following. "Can you remember the entertainment show that took place at your school just before the last winter holiday? You enjoyed the wonderful show performed by the 'Dandelion Theatrical Troupe,' didn't you? Please try to remember what the show was like. Can you tell me what the performances were like?" (recall-test). The participants who could recall the two kinds of performances (i.e., balloon animals and soap bubbles) were then given the person identification test. As for the children who failed to recall the performances, the recognition test was given with the following instructions. "Now I'm going to show you some pictures depicting a variety of performances." The experimenter then put the eight picture cards on the table, one by one, while describing each picture (e.g., "This shows a person making balloon animals"). After arranging the eight cards into a 4 × 2 array, the experimenter instructed, "Please choose all the cards depicting a performance that you saw in the show."

2.5 Performer-identification and height-estimation test

The participants who gave correct responses in the performance-recall or recognition test were told the following. "Now, I'd like you to remember what the two performers looked like. Please try to remember carefully what the face of the balloon animals performer looked like." The experimenter arranged the nine facial photographs into a 3 × 3 array and gave the following instructions. "Now, here we have 9 photos of women on the table. Can you tell me who made the balloon animals?" In the identification test, the participants were not given any information regarding the absence or presence of a target. Furthermore, they were not forewarned that the target persons in the array of photos wore different clothes from what they had worn in the show. After obtaining the participant's response, the experimenter then gave the height

estimation test. "Now, I'd like you to try to remember the height of the woman who made the balloon animals. Was the woman taller or shorter than your teacher, or were they almost the same height?" (comparison with the class teacher). After obtaining the participant's response, the experimenter gave another height estimation question in the same format using the principal as the anchor person. This procedure was then repeated for the soap bubbles performer. The order of asking about the two performers, the two anchor persons, and the arrangement of the nine photos were randomized for each participant.

For the participants who failed to recognize both performances in the performance recognition test (i.e., 4 children), the experimenter told them the correct answer ("The correct answers were making balloon animals and soap bubbles."). The subsequent instructions were the same as those given to the participants who achieved a perfect score.

2.6 Bystander-recognition/recall test and Helper identification test

Following the performer identification and height estimation tests, the experimenter told the children, "You watched two members of the Dandelion Troupe make balloon animals and soap bubbles in the show. Well, do you remember if there were other members of the troupe in the show?" (i.e., recognition question). To the children who responded "yes" to this question, they were asked as follows. "Can you tell me about them? What were they doing?" (i.e., recall question). If the children answered that they recalled only one bystander (e.g., the announcer), then the experimenter asked a further question. "You saw an announcer, didn't you? Well, were there any other members of the Dandelion Troupe in the show?" If he/she responded "yes" to this question, then the experimenter asked, "Okay, so what was the person doing?" If the participants succeeded in recalling the Helper, then the experimenter conducted the helper identification test by saying "You said that there was a helper in the show, didn't you? Now, I'd like you to try to remember what the helper looked like. Please think carefully about what the face of the helper looked like." The subsequent instructions were basically the same as those used in the performer identification test.

Regarding the children who responded "no" to the question about the presence of bystanders or those who failed to recall the Helper, the experimenter explained as follows. "Actually, there was an announcer and a helper in the show besides the two performers. Now, I'd like you to remember what the helper looked like." The subsequent instructions were the same as those described above.

3. Results

3.1 Performance recall/recognition

The recall/recognition score was defined as follows: the participants who succeeded in recalling both performances were given 4 points, those who could recall one performance and recognize the other were given 3, those who failed to recall but succeeded in recognizing both performances were given 2, those who succeeded in recognizing only one performance were given 1, and those who failed to recognize both performances were given 0 points. Table 1 shows the numbers and percentages of participants who achieved each score as a function of age. The participants were divided into two categories according to their performance on the recall test: participants who succeeded in recalling both performances (i.e., score of 4) and the others (i.e., score from 0 to 3). A χ^2 test showed that the 6-year-olds tended to perfectly recall more than the 4-year-olds, $\chi^2 = 3.375$, $df = 1$, $p < .066$.

3.2 Bystander recall/recognition

Table 2 shows the numbers and percentages of all types of responses for the bystander-recognition/recall questions. The results demonstrate that approximately 45% of the children responded "No" or "I don't know" to the recognition question. A χ^2 test showed that there was no difference in the proportion of participants who failed to answer "yes" to the recognition question between the 4- and 6-year-olds. In addition, those who responded "yes" were divided into four categories according to their responses to the recall questions: recalled both (i.e., the announcer and the helper), recalled only the announcer, recalled only the helper, and failed to recall both. The results show that none of them were able to recall both and that only a few 4-year-olds could recall the announcer.

Table 1: Number and proportion of participants who made each score for performance-recall/recognition test as a function of age

Age Group	Score					Total
	0:none recognition	1:one recognition	2:both recognition	3:one recall	4:both recall	
4-year-olds						
<u>N</u>	4	0	6	5	5	20
<u>%</u>	20.0	0.0	30.0	25.0	25.0	100.0
6-year-olds						
<u>N</u>	0	0	7	5	13	25
<u>%</u>	0.0	0.0	28.0	20.0	52.0	100.0

Table 2: Number and proportion of all types of responses for bystander recall/recognition test as a function of age

Recognition question	Response						Subtotal	Total
	No	I don't know	Yes					
			Fail to recall	Recall only Announcer	Recall only Helper	Recall both		
4-year-olds								
<u>N(%)</u>	7 (35.0)	2 (10.0)					9 (45.0)	20 (100.0)
<u>N(%)</u>			7 (35.0)	4 (20.0)	0 (0.0)	0 (0.0)	11 (55.0)	
6-year-olds								
<u>N(%)</u>	6 (24.0)	5 (20.0)					11 (44.0)	25 (100.0)
<u>N(%)</u>			5 (20.0)	7 (28.0)	2 (8.0)	0 (0.0)	14 (56.0)	

3.3 Person identification

Table 3 shows the number and percentage of participants who correctly identified each target as a function of age. Almost every 4-year-old failed to identify all three persons. The participants were divided into two categories: those who failed to identify all three persons, and those who identified either 1, 2, or 3 persons. The number and proportion of participants for each of these categories were, respectively, 19 (95.0%) and 1 (5.0%) for the 4-year-olds and 15 (60.0%) and 10 (40.0%) for the 6-year-olds. A Fisher's exact test confirmed that the number of the first category (failure to identify) for the 4-year-olds was significantly larger than that for the 6-year-olds ($p < .012$).

As for the 6-year-olds, to analyze the differences in accuracy of identification of the three persons, a Cochran's Q test was performed. The results showed that there were no differences in the identification accuracy for the three persons.

Table 3: Number and proportion of participants who achieved correct identifications for each person as a function of age

Age Group	Target Person		
	Performer A	Performer B	Bystander
4-year-olds (N = 20)			
<u>N</u>	1	0	0
<u>%</u>	5.0	0.0	0.0
6-year-olds (N = 25)			
<u>N</u>	8	2	4
<u>%</u>	32.0	8.0	16.0

3.4 Height estimation

As for the height estimation of the three target persons compared with the participants' class teachers, one point was given for a correct response (i.e., 'taller than my class teacher') and 0 points were given for any other response. The height estimation score was defined as the sum of the scores for the three target persons (maximum = 3). Regarding the height estimation compared with

the principal, the same scoring method of the previous comparison with the class teachers was used, with the exception of slightly changing the definition of a correct response (i.e., 'almost the same as our principal').

Table 4 shows the mean high-estimation score as a function of age group and type of comparison. A two-way (age $2 \times$ type of comparison 2) ANOVA was conducted. Age was a between-participants and type of comparison was a repeated measure. The main effect of type of comparison was significant, $F(1, 43) = 27.693$, $\eta p^2 = .392$, $p < .000$, indicating that the comparison with the class teacher was more accurate than the comparison with the principal. The main effect of age and the interaction of age and score type were not significant. Further, chance level tests were performed on the mean scores, which showed that the 6-year-olds' mean score for their class teacher was above chance ($t = 3.166$, $df = 25$, $p < .004$), the 4-year-olds' mean score for their class teacher was at chance level, and both the 4- and 6-year-olds' mean score for the principal was below chance ($t = 3.901$, $df = 19$, $p < .001$, $t = 4.925$, $df = 25$, $p < .000$, respectively). An error analysis of responses for the comparisons with the principal showed that most of the children overestimated the height of the principal (i.e., 85.7%, 72.2%, and 85.3% for each person).

Table 4: Mean scores as a function of age and type of comparison

Age Group	Comparison	
	Class Teacher	Principal
4-year-olds (N = 20)		
<u>M</u>	1.10	0.35**
<u>SD</u>	1.16	0.74
6-year-olds (N = 25)		
<u>M</u>	1.72*	0.32**
<u>SD</u>	1.13	0.69

Note: *above chance-level, **below chance-level (chance-level = 1.00)

4. Discussion

The results of performance-recall/recognition test demonstrated that the 6-year-olds could more accurately recall what had been performed in the event than the 4-year-olds. This result corresponds with previous research revealing that the descriptions of an event by younger children are likely to provide less information than those given by older children (e.g., Leippe, Romanczyk, & Manion, 1991; Marin, Holmes, Guth, & Kovac, 1979). Regarding the accuracy of recognition, although previous research has shown that there is not much difference in the recognition accuracy of an event among preschool age children, 20% of the 4-year-olds in our study were not able to recognize both performances.

This result suggests that the younger children might have had difficulty in extracting relevant information from the performance recognition test. It is possible that the recognition test procedure, in which the participants were asked to select the actual performances that they had seen out of 8 alternatives including misleading distractors, prevented the younger children from responding correctly. As is well known in the suggestibility studies (e.g., Leichtman & Ceci, 1995), the younger children are especially vulnerable to misleading information when retrieving an event they had seen.

As for facial identification accuracy, the results showed that the 6-year-olds performed more accurately than the 4-year-olds in facial identification as well as in memory for the performances. That is, 40% of the 6-year-olds were able to identify at least one person out of three, whereas almost every 4-year-old failed to identify all three persons. In particular, the performance of the 4-year-olds was consistently lower than any of the proportions described in the meta-analyzed experiments of Pozzulo and Lindsay (1989), which were performed under conditions similar to those of the current study (i.e., 4-year-old participants, a real life event, and a target-present line-up). This differing result can likely be explained by the higher task demands of our study, in which the participants were asked to bind performances and performers' faces in a complex event in which four people appeared. The younger children were not likely able to demonstrate abilities that they would have been able to show in more conventional tasks, such as making a facial identification for only one target.

In contrast to the results of the performance-recall/recognition and facial identification tests, there was no difference in bystander-recognition accuracy between the 4- and 6-year-olds, and both the 4- and 6-year-olds had difficulty in recognizing the presence of bystanders in the target event, in which a number of people appeared. A large number of eyewitness studies have demonstrated the high recognition ability of young children (e.g., Goodman & Reed, 1986; Leichtman & Ceci, 1995). In particular, 6-year-olds demonstrated performance as high as that obtained from adults provided they were not given suggestive questions or misleading information (Goodman & Reed, 1986). However, the results of

the present study, using a complex target event in which both the main persons and bystanders appeared, did not show improvement in recognition accuracy with age.

There might be a plausible explanation as to why no difference in bystander-recognition accuracy between the 4- and 6-year-olds was observed. It is possible that both the 4- and 6-year-olds had not been able to encode the bystanders because they had been attending to the central aspects of the event. A number of studies (Burke, Heuer, & Reisberg, 1992; Christianson, Loftus, Hoffman, & Loftus, 1991; Christianson, 1992) have demonstrated that arousal and stressful events can cause a narrowing of attention and impoverish the encoding of the peripheral aspects of an event. We can conclude that the children's attention was likely focused on the main performances of the event, which should have been very appealing to both the 4- and 6-year-olds and aroused them (e.g., making balloons). When adequately attending to the bystanders in an event, 6-year-olds are likely to show better performance than 4-year-olds because of older children generally have stronger memory traces.

The results of the bystander recall test showed that even the 6-year-olds had difficulty in recalling the actions of a bystander who had been visible for more than three times as long as the main performers; conversely, 72 % of the 6-year-olds could recall the actions of one or both of the main performers. This result suggests that the ability of young children to remember someone's actions may be attributable to whether that person was involved in the central aspect of the event, but not to the person's duration of visibility. Although previous studies (e.g., Goodman, et al., 1987) have observed high ability for memorizing actions, the results of this study showed that this is true only in conditions in which the actions are involved in the main part an event sequence.

Regarding the results of the height estimation test, although the 6-year-olds performed above chance level in estimation compared with their class teacher, the 4-year-old's performance was at chance level. The 4-year-olds might have found it difficult to compare the image of the targets with that of their class teacher in their minds. These results suggest that the younger children's estimation of height had no credibility even when they were asked to make judgments relative to a known anchor person.

As for the estimation of height compared with the school principal, most of the 4- and 6-year-olds were not able to respond correctly, overestimating the height of the male principal. Although the target persons were all the same height as the principal, the children tended to judge the target persons as shorter than the principal. This tendency can be explained by the perceptual distortion of height as a function of increasing prestige. Wilson (1968) has demonstrated that estimations of the same target varied as a function of increasing prestige: the shortest estimates were given to a supposed undergraduate student (i.e., 177.4 cm), while the highest estimates were given to a supposed professor (i.e., 183.6 cm). The children's overestimation of the principal's height

might therefore be attributable to their perception of the principal as an authoritative teacher. Another possible explanation is based on the development of gender schema, such as "men are taller than women". As is well known, the memory of young children for gender-related information is affected by their gender-stereotype knowledge (e.g., Welch-Ross & Schmidt, 1996). Such knowledge might prevent children from making correct responses (i.e., the female's height is the same as the male principal's), which is inconsistent with the typical relationship between females and males.

The present study demonstrated that 6-year-olds performed more accurately than 4-year-olds in recalling the main acts of, and identifying the faces in, a complex event, while both 4- and 6-year-olds failed to recognize the presence of bystanders who were not involved in the central aspect of the event. In addition, young children had low height estimation credibility, especially when the height to be estimated was compared with that of an authoritative person. However, further studies will need to elucidate the following issues. First, the reason why there is no developmental difference in memory performance with respect to the peripheral aspects of an event between 4- and 6-year olds needs to be investigated. Second, it need to be revealed whether or not children fail to originally encode information by means of including the factor of time interval of memory tests. Finally, more appropriate forms of objective questioning for asking about the peripheral aspects of events and height estimation need to be developed to elicit more accurate information from young children.

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