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Differential Contributions of Language Skills to Children's Episodic Recall

J. Zoe Klemfuss

Florida International University

Theorists have identified language as a critical contributor to children's episodic memory development, yet studies linking language and memory have had mixed results. The present study aimed to clarify the mechanisms linking language and memory and to explain the previous mixed results. Sixty-four preschool children's receptive and productive language abilities were assessed as were their accuracy and completeness when answering an open-ended prompt, direct questions, and misleading questions about scripted laboratory tasks. Results indicated strong relations between language skills and recall even when controlling for initial encoding of the to-be-remembered events and memory for a separate event. Importantly, these relations varied by the type of language skill assessed and by the type of recall. Productive language skills were primarily associated with accurate free recall, whereas receptive language skills best predicted children's resistance to misleading questions. Implications are discussed for theory about language and memory development, and for practical applications.

To better understand episodic memory development and to help memory-related interventions in applied settings, researchers have begun to identify cognitive variables that explain individual differences in children's recall abilities (Nelson, 1993; Pipe & Salmon, 2002; Schneider & Bjorklund, 1997). Language skill is theorized to be an especially important predictor of variation in children's episodic recall and resistance to suggestion (Bruck & Melnyk, 2004). The present study was designed to test 2 important types of language skills—receptive and productive—to parse their individual contributions to recall. To help isolate the effects of language on children's delayed recall, children's recall of a separate event and their initial event reports were each controlled.

The language skills required to recall the past likely vary depending on the way recall is elicited. To freely recall, children must have sufficient memory to retain information and sufficient communicative skills to convey that information. To accurately respond to direct questions, children must be able to understand questions posed to them. Accurately responding to misleading questions requires additional skill given that the syntax associated with misleading questions is often developmentally inappropriate for young children (e.g., Davies & Seymour, 1998; Greenstock & Pipe, 1996). The present study tested the relations of language skills to accuracy and completeness in response to a free recall prompt and to direct and misleading questions.

Correspondence should be sent to J. Zoe Klemfuss, Department of Psychology, Florida International University, Modesto A. Maidique Campus DM 277, 11200 S.W. 8th Street, Miami, FL 33199, USA. E-mail: jessica.klemfuss@fiu.edu

Relations Between Language and Memory

Language is theorized to be a primary catalyst in autobiographical memory development (Nelson, 1993; Schneider & Bjorklund, 1997). In fact, verbal recall of early experiences is limited by language skills (Cleveland & Reese, 2008; Reese, 2009; Simcock & Hayne, 2002, 2003), and language skills may be particularly important for children's recall abilities during the preschool years (Cleveland & Reese, 2008; Jack, Simcock, & Hayne, 2012; Reese, 2009). Language skills may have a direct association with children's reporting by helping them to understand and respond appropriately to interviewer questions (Kulkofsky, 2010). Or perhaps children who are more cognitively advanced tend to have both advanced language skills and more accurate memories given that intelligence has been linked with children's memory accuracy (e.g., McFarlane, Powell, & Dudgeon, 2002; Roebers & Schneider, 2001). Finally, the association between language skills and memory accuracy may be indirect such that children with more advanced language skills are better able to organize and discuss past experiences. This discussion may in turn strengthen their memory and lead to more accurate reporting (Chae & Ceci, 2005; Kulkofsky, 2010; Kulkofsky & Klemfuss, 2008; Kulkofsky, Wang, & Ceci, 2008).

While some previous studies have shown that language skills related to preschoolers' memory accuracy (Burgwyn-Bailes, Baker-Ward, Gordon, & Ornstein, 2001 [1-year recall]; Cleveland & Reese, 2008; Kulkofsky, 2010; Kulkofsky & Klemfuss, 2008; Quas, Wallin, Papini, Lench, & Scullin, 2005; Roebers & Schneider, 2005), others have shown little or no relation (Burgwyn-Bailes et al., 2001 [1- and 6-week recall]; Chae & Ceci, 2005; Gordon et al., 1993; Greenhoot, Ornstein, Gordon, & Baker-Ward, 1999; Gross & Hayne, 1999; Reese & Brown, 2000). Some of the differences in findings may have resulted because the delay between the event and test and the language measures used varied across studies. Delays between event presentation and memory test have ranged from 1 day to 1 year. However, there are also differences in findings in studies with the same delay (e.g., Chae & Ceci, 2005; Greenhoot et al., 1999; Kulkofsky, 2010; Quas et al., 2005), and these differences may be explained by how language is assessed.

Language is composed of both receptive and productive systems (Newcomer & Hammill, 2008a), with different sets of skills underlying these systems. Studies that have used global language measures that tap into both receptive and productive language skills often have shown no relation between language and memory (Chae & Ceci, 2005, correlation results; Gordon et al, 1993; Greenhoot et al., 1999; but see Chae & Ceci, 2005, regression results). Other studies, however, have found that receptive language skills are sometimes related to correct details in free recall (Kulkofsky, 2010; Quas et al., 2005; but see Gross & Hayne, 1999; Reese & Brown, 2000) and are related to accurate responding to misleading questions (Kulkofsky, 2010; Kulkofsky & Klemfuss, 2008; Quas et al., 2005).

Researchers have not yet examined the contributions of receptive and productive language skills to episodic recall within the same sample. However, it is possible that different sets of skills are associated with different types of recall, especially given the pattern of findings in extant research. Free recall is likely to rely more on productive rather than on receptive language skills given that free recall prompts tend to be brief and simple and elicit lengthier responses from children. On the other hand, direct and misleading questions require children to accept or reject information provided by an interviewer, and therefore, they likely rely more on receptive language skills.

Finally, although studies have identified links between language skills and children's episodic memory reports, these studies have not controlled for children's memory for other events. It is

possible that the consistency of children's memory performance across events may overshadow the contributions of language skills to reporting or that children who are more cognitively advanced overall may be more successful at language and memory tasks. Controlling for children's memory for a different event enables examination of language skills separate from general cognitive skill and from individual differences in recall ability. Additionally, to examine the contributions of language skill to children's delayed recall separate from encoding and reporting skills alone, children's initial event reports were included as a control variable.

Present Study

The goals of the present study were to identify specific relations between children's language skills and episodic recall performance and to explain mixed findings in the field regarding these relations. To do this, the relations between productive and receptive language skills and children's episodic recall in response to free recall, direct, and misleading prompts were examined. Critically, both initial reporting of a staged laboratory event and memory for a separate event were controlled to examine the specific contribution of language to delayed recall.

It was hypothesized that language skills would predict children's delayed recall performance beyond the contributions of age, initial reporting, and memory for a separate event and that the associations between language and recall would vary by recall prompt. The specific hypotheses were: a) Productive language skills would best predict children's free recall performance, and b) receptive language would predict children's accuracy to direct questions and especially their resistance to misleading questions.

METHOD

Participants

Sixty-four preschool-aged children aged 2;7 to 5;7 ($M_{age} = 4;4$, $SD = 6$ months; 48% female) were recruited from one private preschool classroom and several preschool classrooms within a larger public school in the upstate New York area. Children were included in the study if they were native English speakers, if they agreed to participate, and if their parents consented and agreed that the interviews could be audio-recorded.

Materials

Memory Measure

To control for children's episodic memory abilities across events, children completed the Video Suggestibility Scale for Children (VSSC; Scullin & Ceci, 2001). The VSSC is composed of two phases separated by at least 1 day. During the first phase, children watch a brief video of a child's birthday party. In the second phase, children are interviewed about the content of the video. Only children's responses to the nonsuggestive open-ended prompts are included as part of the present study.

Language Measures

Children's receptive language skill was assessed with the Syntactic Understanding component of the Test of Language Development-Primary-Fourth Edition (Newcomer & Hammill, 2008b). Children's productive language skill was assessed via the Vocabulary subtest of the Wechsler Preschool and Primary Scale of Intelligence-Third Edition (Wechsler, 2002).

Procedure

Overview

Children were interviewed in their schools as part of a larger study on children's memory (Klemfuss, 2011). Only relevant measures and results are discussed here. Interviews took place during four separate visits. The length and organization of each visit were piloted on a separate sample of 10 preschool-aged children and were adjusted accordingly for the final sample. The first two interviews were spaced an average of 3.09 ($SD = 2.37$) days apart so that there was a delay between the target event and the memory test. The third and fourth interviews were spaced an average of 4.97 ($SD = 4.43$) days apart to accommodate the VSSC procedures. For the vast majority of children, the delay between the first and second interviews and third and fourth interviews were each within 2 to 5 days. Due to absences and school closings, some children had longer delays between interviews. All interviews were conducted in quiet rooms at children's schools with breaks offered between tasks as needed.

Visit 1

After a brief warm-up conversation, the primary interviewer excused herself and left the child alone in the interview room. A confederate then entered, introduced herself, and engaged the child in a staged event that involved reading a book, playing ''Simon Says,'' and interacting with toys (see Appendix A). When these tasks were complete, the confederate left the room and the interviewer returned for an immediate memory interview, which was audio-recorded and later transcribed. The interview consisted of a free recall prompt followed by 20 direct and 5 misleading questions, intermixed (see Appendix B). Children then completed the receptive language measure.

Visit 2

Children were interviewed about the staged event again by the same interviewer with the same battery of free recall and misleading and direct questions. Next, children completed the productive language measure.

Visit 3

The third visit occurred within 3 weeks of the earlier interviews. Children watched the 5-min video from the VSSC.

Visit 4

Children completed the VSSC interview and were thoroughly debriefed. The interviewer explained that she learned she had made some mistakes when interviewing the child. She then listed all of the misleading items from the staged event interviews and provided the correct responses.

Coding

Two independent coders coded approximately 20% of the transcripts for the immediate and delayed event recall and the episodic recall section from the VSSC. Disagreements were discussed until the coders agreed on final codes. One of the coders assigned to each task then completed the remaining coding.

Event recall. Children's on-topic free recall responses were coded for the number of correct and incorrect references to persons, objects, or actions (Poole & Lindsay, 1995; Quas, Bauer, & Boyce, 2004). Similar to Quas et al. (2004), there were few incorrect responses in free recall so only correct responses were included in the analyses. For example, the sentence, ''[I] [tossed] [the ball]'' was coded as including three correct details. Children's responses to the direct and misleading questions were also coded for correct responses. Because there were 20 direct questions and 5 misleading questions, children could receive a total score of 0 to 20 for the direct questions and 0 to 5 for the misleading questions. Cohen's Kappa for free recall was .98 ($p < .001$), and for the misleading and direct questions, it ranged from .85 to .96 (all $ps < .001$).

VSSC. The coding scheme for the free recall portion of the VSSC in the present study was similar to that used by Memon, Walk, Bull, and Koeknken (1997; Karpinski, 2006). Children received 1 point for each item correctly recalled from a list of all relevant people, actions, objects, and surroundings. These points were summed to create each child's narrative recall score. The coders achieved perfect agreement.

RESULTS

Preliminary Analyses

Preliminary analyses revealed no relations between child gender, interviewer, delay between the staged event and memory test, or delay between the VSSC video and VSSC memory interview, or any of the variables of interest. These variables are not considered further. Descriptive analyses of the language measures showed that children performed similarly to the general population. Scaled scores for both the productive and receptive language measures have an average of 10 and a standard deviation of 3 in the population. In the present sample, the average scaled scores were 10.20 and 9.92 and the standard deviations were 3.34 and 3.59 for productive and receptive language, respectively.

In the following analyses, the relations among age, receptive and productive language skills, memory for the video, and initial reporting and later memory for the laboratory events were

assessed. Because age was included as a variable in all analyses, children's raw language scores were used rather than their age-adjusted scores.

Individual Differences and Event Recall

First, to test the relations between individual difference variables and children's recall performance as well as intercorrelations between individual difference variables, Pearson correlations were conducted across all measures (Table 1). Age, language, and memory measures were associated with children's correct responses. As predicted, the associations varied slightly depending on the type of recall prompt. Age, productive language, and memory for the video were associated with free recall. Age, receptive language, and productive language were associated with correct responses to misleading questions. Finally, all language and memory measures were associated with correct responses to direct questions.

To address the primary hypothesis about the specific relations between language skills and episodic recall, it was important to examine the relations between receptive and productive language skills while controlling for child age, initial report, and memory for a different event (the birthday party video). Hierarchical regressions were conducted with age and the number of correct responses at the initial memory interview (for free recall, misleading questions, and direct questions, respectively) entered on the first step and language (receptive or productive) and video recall entered on the second step predicting children's correct responses about the staged event. Because the receptive and productive language measures were moderately correlated with each other ($r = .51$, Table 1), each of these language measures was considered in a separate set of regression equations. Separate regression analyses were also conducted for each recall format.

Free Recall

The regression predicting children's free recall responses from age, free recall at Time 1, receptive language, and video recall was significant at the final step, $F(4, 61) = 7.95$, $p < .001$. However, the addition of receptive language and the video memory measure did not

TABLE 1
Pearson Correlation Coefficients Comparing Individual Difference Scores and Memory

Recall Phase	*2*	*3*	*4*	*5*	*6*	*7*
1. Free recall	.16	.25*	.27*	.19	.45***	.31*
2. Misleading	—	.26*	.40**	.55**	.43**	.08
3. Direct	—	—	.30*	.43***	.38**	.27*
Individual Difference Variable						
4. Age	—	—	—	.42**	.31*	.22
5. Receptive language	—	—	—	—	.51***	.31*
6. Productive language	—	—	—	—	—	.25*
7. Video recall	—	—	—	—	—	—

Note. *$p < .05$. **$p < .01$. ***$p < .001$.

significantly improve the model, $\Delta R^2 = .01$, $F(2, 57) = 1.00$, *ns*. Only free recall at Time 1 predicted free recall at the delay (Table 2). Children who were able to report more about the staged event immediately after it happened were also more likely to remember and report more details after the delay. When productive language skills replaced receptive language skills in the regression model, the equation was again significant during the final step, $F(4, 61) = 9.94$, $p < .001$. The addition of productive language and video memory significantly improved the model, $\Delta R^2 = .08$, $F(2, 57) = 3.66$, $p = .032$. Children's initial reporting and their productive language were both associated with increased correct free recall at the delay (Table 3).

Misleading Questions

The model predicting children's correct responses to misleading questions from age, initial event report, receptive language, and video recall was significant during the second step, $F(4, 61) = 31.44$, $p < .001$. The fit was significantly improved by the addition of receptive language and video recall, $\Delta R^2 = .04$, $F(2, 57) = 4.16$, $p = .025$. Correct responses to misleading questions at immediate recall and children's receptive language skills were positively related to correct responses to misleading questions at delayed recall (Table 2). In the model with productive language skills, the second step was significant, $F(4, 61) = 28.67$, $p < .001$. However, the addition of productive language and video recall did not significantly improve the model, $\Delta R^2 = .02$, $F(2, 57) = 1.96$, *ns*. Correct responses to misleading questions at immediate recall predicted correct responses at the delay, and productive language was a marginal predictor (Table 3).

Direct Questions

The model predicting children's correct responses to direct questions with receptive language skill as the language measure was significant at the second step, $F(4, 61) = 21.41$, $p < .001$.

TABLE 2
Hierarchical Regressions With Age and Correct Responses at Time 1 (Free Recall, Misleading Questions, and Direct Questions, Respectively), Receptive Language, and Video Recall Predicting Correct Responses at Time 2

	Free Recall			*Misleading*			*Direct*		
Variable	β	*t*	R^2	β	*t*	R^2	β	*t*	R^2
Model 1			.34***			.65***			.59***
Age	.08	0.79		.03	1.55		.03	0.82	
Time 1 correct	.42	5.00***		.81	9.20***		.74	8.72***	
Model 2			.36***			.69***			.60***
Age	.09	0.84		.02	1.11		.02	0.51	
Time 1 correct	.41	4.52***		.72	7.92***		.71	7.62***	
Receptive language	–.09	–0.89		.05	2.70**		.01	0.27	
Video recall	.13	1.23		–.02	–1.38		.04	1.09	

Note. $^{**}p < .01$. $^{***}p < .001$.

TABLE 3
Hierarchical Regressions With Age and Correct Responses at Time 1 (Free Recall, Misleading Questions, and Direct Questions, Respectively), Productive Language, and Video Recall Predicting Correct Responses at Time 2

	Free Recall			*Misleading*			*Direct*		
Variable	β	*t*	R^2	β	*t*	R^2	β	*t*	R^2
Model 1			.34***			.65***			.59***
Age	.08	0.79		.03	1.55		.03	0.82	
Time 1 correct	.42	5.00***		.81	9.20***		.74	8.72***	
Model 2			.41***			.67***			.60***
Age	.01	0.09		.02	1.31		.02	0.44	
Time 1 correct	.35	4.00***		.77	8.41***		.70	7.69***	
Productive language	.24	2.43*		.03	1.84+		.03	0.67	
Video recall	.08	0.84		–.02	–1.38		.04	1.06	

Note. $^{+}p > .10$. $^{*}p < .05$. $^{***}p < .001$.

However, the model was not improved by the addition of receptive language or video recall, $\Delta R^2 = .01$, $F(2, 57) = 0.72$, *ns*. Similarly, the model was significant at the second step when productive language replaced receptive language in the model, $F(4, 61) = 21.63$, $p < .001$, but there was no model improvement after the addition of productive language and video recall, $\Delta R^2 = .01$, $F(2, 57) = 0.90$, *ns*. Only immediate recall remained significant in both models (Tables 2 and 3).

DISCUSSION

This study was the first to examine the relations between separate facets of language skill—receptive and productive abilities—on different types of episodic recall. It was also the first to account for children's initial reports of the events as well as episodic recall for a separate event to pinpoint language's specific influence on delayed recall. As expected, language skill predicted delayed memory performance beyond the contributions of age, initial reporting, or memory for a separate event. Critically, the relation varied depending on the way recall was assessed (free recall vs. responses to misleading and direct questions), suggesting that responses to these question formats draw on different skill sets.

Together, the present findings address several important questions about the relations between language and episodic recall. First, the findings support the theoretical view that language skills are uniquely linked to children's recall abilities. Language predicted children's recall performance above the contributions of age and memory for a separate event suggesting that this relation is not just an artifact of overall higher intelligence or cognitive ability (e.g., McFarlane et al., 2002; Roebers & Schneider, 2001). Second, the findings suggest that language skills were critical to the immediate recall context. This was evident in the finding that language skill did not have a consistent relation with memory ability but instead varied by the linguistic demands of the prompt used to elicit recall.

Language skills also likely contribute to children's memories over time given that in the present study, language was associated with delayed recall even when controlling for initial

reporting. Thus, language skills predicted delayed recall beyond the effect of the amount of information originally encoded and reported. This finding lends support to the idea that language creates structure and content with which children can later report and rehearse their experiences (Chae & Ceci, 2005; Kulkofsky, 2010; Kulkofsky & Klemfuss, 2008; Kulkofsky et al., 2008). These mechanisms—namely, the independent contribution of language skills and the indirect path whereby language skills contribute to the ability to rehearse experiences with others—should be further explored in future research.

It is also of note that there was a relatively short delay between the event and the memory test in the present study (∼3 days). The relations between language and memory may vary across the delay interval with potential sleeper effects during more extended delays. The existing literature is unclear on this point with findings varying within similar delay intervals. For example, Kulkofsky (2010) and Kulkofsky and Klemfuss (2008) found positive relations with receptive language skills and memory in preschoolers after a 1-week delay, but Greenhoot et al. (1999) did not, and Roebers and Schneider (2005) found mixed results for the relations between global language and memory during the same delay interval. The picture is even less clear after delays of several weeks or years (Burgwyn-Bailes et al., 2001; Cleveland & Reese, 2008; Gordon et al., 1993; Greenhoot et al., 1999; Gross & Hayne, 1999; Reese & Brown, 2000; Roebers & Schneider, 2005). Future research is needed to examine the effects of different language skills after more extended retention periods.

These findings do, however, help clarify mixed results in the literature regarding the links between language skills and recall. The present results demonstrate that previous mixed findings may have been the product of variations in language skill assessment. Overall measures of language have likely been less predictive of children's recall performance because they do not take into account the different linguistic demands posed by different types of memory prompts. The present study suggests that free recall relies primarily on productive language skills, whereas correctly resisting misleading questions relies more on receptive language skills. Researchers should keep these specific relations in mind to select appropriate linguistic control variables when studying children's memory.

These findings highlight the importance of approaching language as a multifaceted construct. Although receptive language and productive language are two meaningful types of language skills, this study was by no means exhaustive. Future research should continue to explore the unique contributions of different linguistic dimensions, including importantly, children's narrative abilities (Nelson & Fivush, 2004; see, e.g., Kulkofsky & Klemfuss, 2008). The findings also have important real-world applications. For example, educators, clinicians, and forensic interviewers alike should be aware of the links between language and memory and should take great care to tailor their questions to the productive and receptive language abilities of the child. The findings are also important for legal settings where an individual child's competence to serve as a witness about an experienced event is of considerable interest (Klemfuss & Ceci, 2012).

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APPENDIX A

Staged Event Script

''Hi [child name]! I'm [confederate name]. I'm here to play some games with you while we're waiting for [interviewer].''
''I brought this book for us to read together. Let's do that first.''
[read the book]

''Okay, how about a game of 'Simon Says'? Do you know how to play that game? I tell you to do silly things, but you only do them if I say 'Simon Says' first. Like, if I said '[child's name] touch your nose,' would you do it? [That's right! You wouldn't!] or [Actually, you wouldn't because I didn't say 'Simon Says.'] What if I said 'Simon says jump up and down'? [That's right! You'd jump up and down since I said 'Simon Says'] or [Actually, you would jump up and down because I said 'Simon Says']. Great, let's try it!''
''Simon Says put on this T-shirt.''
''Touch your cheeks.''
''Simon says throw me the ball.''
''Stomp your feet.''
''Simon says take off the T-shirt.''
''Clap your hands.''
''Simon says do a silly pose for the camera.'' [Confederate pretends to take child's photo with a play camera.]
''Good job!''

''Let's look at some of the toys in here.''
''This one looks like a fire truck. Neat, you can drive it around and pretend to fight fires!''
Action: Roll the truck around and make fire truck noises.
''And this one is a doll. Look at this, you can take her dress on and off and play dress up.''
Action: Lift the doll's dress up and down.
''Wow, look at this one. It looks like you can push this button and it will do something.''
Action: Push button.
''Hmm, I guess it's broken. I better take it. Don't tell anybody, OK?
Wait for child to agree (or disagree). If the child does not agree say, ''Please?''
If the child still doesn't agree, skip ahead.
''I had a great time playing with you. Bye [child's name]!''

APPENDIX B

Memory Interview Prompts

Open-Ended

Time 1: ''Hi again [child's name]. So, what happened while I was out of the room just now?''
Time 2: ''Remember, last time you played with [confederate's name] while I was out of the room. Please tell me all about that again.''
*Follow up with long pauses and, if needed, open-ended prompts such as, ''What else?''; ''What else can you tell me?''; ''Please tell me one more thing''; ''How about one more thing?''

Closed-Ended

''[Confederate name] told me about some of the things she did with you, so next I'm going to ask you some questions about that.''
Storybook task:

1. What was the name of the little bear in the book?
2. What was the name of the big bear in the book?
3. What was wrong with the little bear's porridge?
4. Did the little bear have a bath?
5. Did the big bear help the little bear brush his teeth?
6. Did little bear give big bear a kiss?
7. What did the little bear do when he got lost? (Leading: He didn't get lost.)
8. Did the little bear talk to his friend Bill? (Leading: There was no character named Bill.)

''Simon Says'' task:

9. What kind of clothing did you put on during Simon Says?
10. What did you do with the ball?
11. What did you do with your feet?
12. Did you touch your cheeks?

13. Did someone ask you to stomp your feet?
14. Did someone ask you to take off some clothes and pose for a picture?
15. What color was the hat [confederate] asked you to put on? (Leading: Child was not asked to put on a hat.)
16. Did [confederate] ask you to touch your toes?

Toy interaction task:

17. What was the first toy you played with?
18. What was the doll wearing?
19. What happened when you pushed the button on the last toy?
20. Did someone make fire truck noises?
21. Did someone lift up the doll's clothes?
22. What did you do with the toy monkey that was in the room? (Leading: There was no monkey.)
23. Did [confederate] show you the jump rope? (Leading: There was no jump rope.)

Secret-keeping component:

24. Did someone ask you to keep a secret?
25. Do you know what happened to the toy that was right here?