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Dynamics of canopy cover in a wet forest in Costa Rica

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Drawing as a Technique to Facilitate Childrens Memory

A thesis submitted in partial satisfaction of the

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Kendra Horstmyer Brennan

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To: Dean Arthur W. Herriott
College of Arts and Science

This thesis, written by Kendra Horstmyer Brennan, and entitled DRAWING AS A TECHNIQUE TO FACILITATE CHILDRENS MEMORY, having been approved in respect to style and intellectual content, is referred to you for judgement.

We have read this thesis and recommend that it be approved.

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Date of Defense: November 20, 1996

The thesis of Kendra Horstmyer Brennan is approved.

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ABSTRACT OF THE MASTER'S THESIS

DRAWING AS A TECHNIQUE TO FACILITATE CHILDRENS MEMORY

by

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Professor Ronald P. Fisher, Major Professor

This study examined a technique to assist children to recall more information about witnessed events. Thirty-eight fourth-grade children from a public grade school in Miami Florida participated in the experiment. The participants watched a Red Cross demonstration and were interviewed one week later about details of the demonstration. All of the children were interviewed using a police style interview. In addition, half of the children were instructed to draw during the interview. The current study supported previous findings that the instruction to draw increased the amount

of information recalled. The effect of drawing was greatest for high-visual events. In addition, the instruction to draw prompted an increase in non-verbal information, which had an unusually high accuracy rate.

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Drawing as a Technique to Facilitate Childrens Memory

The incidence of children who are called upon to serve as witnesses in the legal system has risen in recent years despite the fact that their ability and reliability as witnesses has often been challenged by both researchers and the legal system (Leippe, Romanczyk & Manion, 1991; Poole & White, 1991; Powell & Thomson, 1994). Although they have the potential for being just as reliable as adults, children do not generally make very effective witnesses for a variety of reasons. Lack of general knowledge often makes it difficult for children to articulate what they have experienced. Children frequently give rambling accounts of an incident and combine details from several occasions (Boat & Everson, 1988; Leippe et al., 1991). Children's recall can be inconsistent and often depends on the context in which the interview is conducted (McGough, 1994; Powell & Thomson, 1994; Farrar & Goodman, 1992). All of these factors make interviewing children particularly difficult (Dent, 1982).

Interviewers often use the same techniques with children as are standard for adults. This is problematic because a child's developmental level usually does not

mirror an adult's, for the reasons already cited. Techniques therefore need to be developed that will increase the quality and quantity of children's recall during the interview process. One such promising technique that was explored in the current study is to instruct children to draw during the interview.

In the past props other than drawing have been used, with varying degrees of success, to assist children to recall more information (Raskin & Yuille, 1989; Salmon, Bidrose, & Pipe, 1995). These props include dolls, toys, doll houses, and showing the actual items used during the event (Pipe & Wilson, 1994). The potential drawback of providing props for children is that the props can be construed as being suggestive (Salmon et al., 1995). There has also been a lack of consensus concerning the best way to use such explicit material (Raskin & Yuille, 1989). For instance, the procedure to incorporate props such as anatomical dolls during an interview has never been standardized. Props that are provided for the child witness may also inadvertently encourage the child to report activities associated with the props that are unrelated to

the event of interest (e.g., Pipe, Gee, & Wilson, 1993; Salmon et al., 1995). Drawing, on the other hand, is self generated and therefore should not be suggestive and bias the child's response.

Props vary in their utility according to the developmental age of the child (Pipe et al., 1993). Props such as dolls have been used successfully with younger children, especially those around the age of four or five (Salmon et al., 1995; Price & Goodman, 1990). Very young children have not developed effective communicating skills and often find it easier to show what has occurred rather than trying to verbalize the event. Children at this age also use drawing differently than do older children. Some researchers feel that young children's attraction to drawing is for the sake of moving crayon on paper and that they are not really interested in creating true representations (Golomb, 1974). Other researchers feel that young children's scribbling does have a representational purpose (Gardner, 1980). Very young children's drawings, whether intended to be representational or not, generally resemble tadpole-like figures (Gardner, 1980). But, from whatever the viewpoint

the consensus seems to be that very young children generate few specific details when drawing an event. Consistent with this Butler, Gross, and Hayne (1995) found that four to five year olds' recall of an event did not benefit from drawing during the interview. Therefore, older children may benefit more from using drawing as a mnemonic technique than younger children.

As children develop, their perception, imagination, motoric function and emotionality become increasingly differentiated (Mortenson, 1991). Until the age of eight or nine drawing continues to become more literal as children become increasingly interested with producing factual accounts of what they experience (Freeman, 1980). Researchers have shown that these children are able to use pictures as external aids to prompt memory for words (Kobasigawa, 1974). In general, by the time a child has reached the age of nine he or she is also able to represent details more accurately than younger children (Willats, 1992). By the age of nine, children are also quite adept at separating the purpose of drawing and writing, as opposed to younger children who confuse the two functions (Stetsenko,

1995).

Drawing itself is a complex process (van Sommers, 1995). Creating a likeness of an object calls for many different types of skill (Freeman, 1980). The ability to recall and draw an image is thought to be related to the memory capacity of the individual (van Sommers, 1995). Verbal skills and the ability to solve spatial problems in drawing also seems to be highly correlated (McCloskey, 1995). Possibly, those with greater verbal skills have increased access to more complex reasoning processes. Further study is required to determine how verbal and drawing skills interact. However, for the purposes of enhancing memory during an interview, the child should not have to draw the event for it to be remembered realistically. A simple icon representing the to-be-remembered item should be sufficient. Researchers have also proposed that children are generally able to use nonverbal methods of communication before verbal and that is also why art may lend itself to increased communication (Stronach-Buschel, 1990). Therefore, nonverbal methods should be a natural mode of communication for children.

Traditionally drawing has been used during the therapeutic process (Klingman, Keonigsfeld, & Markman, 1987; Kelley, 1984; Powell & Thomson, 1994). Drawing has been thought to lessen a child's anxiety about discussing events witnessed or experienced during a trauma. There are numerous accounts of children who have been unable to verbalize a traumatic incident until after they drew some aspect of the event (Kelley, 1984; Klingman et al., 1987). Drawing is also considered to be beneficial because children are naturally active and the physical aspect of drawing is thought to help them focus on the task of remembering. Drawing is also a natural activity for children to engage in and one to which they readily gravitate (Stetsenko, 1995).

Drawing may also assist the memory recall process in another way. Baddeley (1986a) postulated that retrieval is affected negatively by the limited amount of information that can be held in working memory during processing. Other researchers have proposed that the limited efficiency of children's processing can be moderated using external support (Wilkenson, 1988). These external aids often take the form of prompts (Boat & Everson, 1993). A classic study

by Leontiev (1931/1983) discovered that children aged 6-12 would spontaneously use pictures to aid in recall when memorizing words.

A drawing made of the event to be remembered should help to free up the mental resources required for retrieving information stored in memory. Once on paper the information would be available as an external cue and therefore would not continue to require internal storage in working memory. Having the information readily available (externally) would free up mental resources for decision-making tasks like sorting through memory to determine what is an accurate or relevant memory about the event to be remembered. Therefore, children's recall should be more extensive when they use drawing. Children can draw and then refer back to their picture, adding and correcting as the drawing takes shape (Stetsenko, 1995). The drawing will then act as a prompt to provide cues for retrieving more details about the event.

It is possible that drawing, being a visual medium, may facilitate only visual memory. Asking the child to draw what he or she has seen, and to use the drawing to enhance

recall, may influence the child to access primarily visual memories. If this is so, drawing may have a detrimental effect on the child's ability to report non-visual (for example auditory) information. For instance, the child may be less inclined to report a sound made during an event that he or she witnessed.

Only one study, to date, has examined whether drawing can improve the memory performance of young children during an interview. Butler et al. (1995) conducted two separate experiments to see if the amount of information recalled would increase when children were instructed to draw while being interviewed. The first experiment tapped the memories of a group of five-to-six-year-old children. For the second experiment both four year old and five to six year old children were interviewed. Both experiments showed that drawing increased the amount of information reported by the 5-6 year old group. The instruction to draw did not significantly increase the amount of information recalled by the four year old children. Although both experiments clearly indicated that drawing was beneficial to the memory performance of the older children, there are certain

methodological problems that limit the study's utility.

The first problem was that, prior to the interview, the interviewers spent two days at the children's school so that the children would feel comfortable being interviewed. Although it is generally accepted that children are able to recall more information when they are relaxed, for legal purposes this is not a realistic approach. When children are questioned, the interviewer is generally unknown to the child. Therefore the interviewer has only a short time before the actual interview within which to establish rapport and decrease the child's anxiety level about being interviewed.

After establishing rapport, the interviewers in Butler et al. (1995) asked a series of free and direct questions. Once the child had exhausted his or her memory during the free recall portion of the interview, the interviewer moved to more direct questions. The direct questions were a series of four simple questions: the child was asked where the event took place, how they got there, who was involved, and what they saw. The interviewer did not probe for details any more than was necessary to keep the conversation going. The

interviewer did not probe or ask the child to explain what he or she was drawing. This too, was unrepresentative of forensic interviews, which are typically conducted as a series of probing questions (Fisher et al., 1995; George & Clifford, 1992).

In a forensic setting, the interviewer probes for as many details as possible (Dent, 1982). Children, especially, tend to offer only sketchy details which require direct follow-up questioning in order to elicit the requisite details when attempting to recreate a crime (List, 1986). Interviewers continue asking questions about the object or person to elicit as much detail as they can. For instance, if the child said that he or she saw a person the interviewer would ask follow-up probing questions to elicit as detailed a description as possible. The interviewer would typically ask what the clothes looked like, how big the person was, and other specific questions to extract as many details as possible. The interviewers in Butler et al. (1995) did not probe after the child gave a response, so the results are lacking in ecological validity for a legal setting.

If probing during an interview elicits more information it could also generate more inaccurate information. There was no such increase in errors in Butler et al., and the failure to find such an increase in error may be the result of the ceiling level performance (they reported .99 accuracy rate). In other words, the data were insensitive to notice changes in error rates. Increasing the number of probing questions to resemble actual forensic interviews should ameliorate the problem of ceiling effects. The interview format in the current study included more probing questions. Therefore, the results were more in keeping with the general findings in children's eyewitness literature.

Method

Participants

Forty children ranging in age from 108-120 months were asked to participate. The children attended the Coconut Grove Elementary School, in Coconut Grove. The sample included children from Black, White, and Hispanic ethnic groups. The children were English speaking and included many levels of socioeconomic status, from below the poverty line to more affluent families. The group included children in

both the regular program and those in the advanced program. To qualify for the advanced program, the child's parent had to request that the child be tested by the school, the child needed a minimum IQ score of 120 if Black, and 130 for all other ethnic groups, and the child also had to score well on a battery of other tests.

The range and mean scores for the Standard Achievement Test are provided as an indication of the cognitive levels of the two groups of children. The range of scores for the children in the regular program were: 04 to 84 for reading comprehension, 06 to 98 for math computation, and 05 to 96 for math application. The range of scores for the children in the advanced program were: 47 to 99 for reading comprehension, 05 to 99 for math computation, and 29 to 99 for math application. The mean scores for the children in the regular program were: $\underline{M}$ = 39.39 for reading comprehension, $\underline{M}$ = 61.28 for math computation, and $\underline{M}$ = 51.44 for math application. The mean scores for children in the advanced program were: $\underline{M}$ = 76.90 for reading comprehension, $\underline{M}$ = 86.79 for math computation, and $\underline{M}$ = 89.14 for math application.

All of the children were enrolled in one of two fourth grade classes (classrooms A and B). All of the children in the advanced program were in classroom A (n=15). The children in the regular program were distributed between the two classrooms (n=23). Two children in Classroom B were unable to view the demonstration due to illness and were dropped from the study.

Event

The event to be remembered was part of a Red Cross Basic Aid Training course created for fourth grade children. The instructor was certified by the Red Cross. The demonstration took approximately 20 minutes in each classroom. Each demonstration consisted of four sub-events: finding the carotid artery and helping someone who is unconscious, caring for venomous (but not necessarily lethal) bites, clearing an obstruction from the air passages, and caring for wounds.

There were two versions of each sub-event, one that conveyed the information in a high-visual manner, and one that conveyed the information in a low-visual manner. The sub-events were counterbalanced across participants, each of

whom witnessed two sub-events that were high-visual and two that were low-visual. In classroom A the first two sub-events of the demonstration were presented as low-visual, and the last two sub-events as high-visual. In classroom B the first two sub-events were high-visual, and the last two sub-events were low-visual.

The four sub-events are described as follows:

1. First sub-event: Unconscious and carotid pulse.

In both the low-visual and high-visual versions the demonstrator explained how to help someone who is unconscious. They were also told how to help an unconscious person breathe, and how to find the person's carotid artery. In the high-visual version only, the demonstrator also used a mannequin and a poster that contained a drawing of the human circulation system.

2. Second sub-event: Insect and other venomous bites.

In both the low-visual and high-visual versions the demonstrator explained how to treat a bee sting, a Portuguese-man-of-war sting, and fire ant bites. In the high-visual version only, the demonstrator also used a poster with a picture of a bee and Portuguese-man-of-war.

The demonstrator also used a credit card, a bar of soap, a compress, a T-shirt, a bottle of vinegar, and cortisone cream to demonstrate how to treat the various stings.

3. Third sub-event: Choking

In both the low-visual and high-visual versions the demonstrator explained how to help someone who is choking. The demonstrator explained that the person should be allowed to cough and if that did not work thrusts were needed to clear the person's airway. The demonstrator then explained how to give thrusts. The demonstrator also hit the desk with her hand to show an example of how to make noise to attract attention if the participant was choking.

In the high-visual version only, the demonstrator also used a diagram of the diaphragm with pictures to show how to help someone who is choking. A mannequin was used to demonstrate the thrusts. A 'pop gun' effect was also demonstrated. The demonstrator squeezed a plastic milk bottle to force the cap off to simulate a foreign object being cleared from the airways.

4. Fourth sub-event: Types of wounds.

In both the low-visual and high-visual versions the

demonstrator explained in detail how to treat a scrape, cut, puncture, and bruise. In the high-visual version only, the demonstrator also used an apple to demonstrate what a scrape, cut, puncture, and bruise looked like. The demonstrator used a mannequin to show how to apply pressure to stop bleeding. The demonstrator also used a bar of soap, a Band-Aid, a dressing, a bandage, and a compress to demonstrate how to treat wounds.

Interview

The interview consisted of a standard interview format developed by the Children's Center of the Dade County State Attorney's Office, and used by McCauley and Fisher (1995). The format was adapted for this particular study (see appendix) and was used for both the no-draw and draw groups. The interview for the draw group included instructing each child to draw what he or she remembered about the event while he or she was being interviewed. As the child responded to questions, the interviewer asked the child also to draw what he or she saw.

One person conducted all the interviews. The interviewer was the author of the study.

Materials

Plain white 8 inch x 11 inch paper and a box of 24 Crayola colored pencils were used to make drawings during the interview portion of the study. A video camera was used during the demonstrations and a tape recorder was used in order to accurately record the children's responses.

Design

The design of the experiment was a 2 (Visuality: high, low) x 2 (Interview Instruction: draw, no-draw) x 2 (Program: regular, advanced) mixed factorial design. Visuality was the within-subjects factor; Interview Instruction and Program were the between-subjects factors.

The results were scored in terms of the number correct statements, and proportion of statements that were incorrect.

Procedure

The participants were told by their teacher that they would be watching a first aid demonstration. The events were conducted separately in each of the two classrooms. The two classrooms (A and B) were chosen randomly for the order in which the sub-events were given. The children were sitting

at their desks in their usual classroom. The classroom teacher did not refer to the demonstration after the instructor finished in order to minimize rehearsal.

Each child was assigned randomly to either the no-draw (n=18) or draw (n=20) group. In each classroom half the children were assigned to the draw and half to the no-draw groups. The children were assigned numbers to assure anonymity. The numbers were recorded at the beginning of each taped interview, and the responses were referred to only by number during the coding process. The treatment of the subjects followed the guidelines outlined in the ethical standards of the APA.

Seven days later the interview process began at the school. Only children whose parents returned permission slips were interviewed. Before the interview began each child was informed that he or she could ask to stop the experiment at any time with no negative consequences. The interviewer alternated classes and whether the participant was in a draw or no-draw group in order to ensure that an equal number from each group was interviewed each day. Each child was interviewed separately during the course of the

school week.

The interview began with the interviewer developing rapport with the child by talking about his or her favorite activities. The interviewer showed each participant a drawing made by the interviewer of a sailboat in order to further develop rapport. The interviewer also asked each child to draw his or her favorite activity.

The fact-finding portion of the interview consisted of open-ended, closed and probing questions relating to the first aid demonstration. An example of an open-ended question was, "Can you tell me from start to finish what she showed you that day?" An example of a closed question was, "Did she tell you anything more about that?" Two examples of probing questions were, "What did she do with the fake person?" and "So she showed you about choking too. Can you remember how you go from behind?" Children in the draw group were asked to draw what they remembered about the demonstration at the same time as they were asked questions. The interview was terminated when the child answered "no" to the question, "Can you remember anything else?"

The participants were thanked for their participation

and escorted back to class. The participants were not told the real purpose of the experiment until all of the children had been interviewed. All of the participants were then debriefed.

Scoring

The verbal responses were transcribed verbatim by the author. Non-verbal responses were noted in either of two ways: either the transcriber noted them in parentheses, or the interviewer repeated the gestured response verbally during the interview (e.g., "she showed you to put your fingers to your neck to find the pulse). The author then checked the responses for accuracy by comparing the responses to the videotape. A catalogue of all the possible responses was made for each sub-event. An independent rater also scored the responses. The author and independent rater discussed any discrepancies and corrected the scores if necessary. Interrater reliability was measured as a simple agreement between raters. There was approximately 95% interrater reliability. The final judgment was made by the author. Non-verbal responses were scored separately. Subjective statements (e.g., "she looked happy") were not

scored.

Results

There were three independent variables of interest: Interview Instruction (no-draw, draw), Program (regular, advanced), and Visuality (low-visual, high-visual). Interview instruction and Program were between-groups measures, and Visuality was a within-group measure. Three, parallel, mixed 2 x 2 x 2 analyses were performed on three dependent variables. The dependent variables were: number of correct responses, proportion of responses that were incorrect, and number of gestures. An alpha of .05 was used except where indicated otherwise.

Two preliminary analyses were performed using either strict or lenient criteria for what was considered a correct response. The basic unit of analysis was a statement (e.g., "she dropped the apple to show us a bruise"). With the strict criterion a response was evaluated only if the subject made the complete statement; otherwise it was considered to be a non-response. With the lenient criterion a response was evaluated even if the subject only made a partial statement (e.g., "she dropped the apple"). Both

analyses produced similar patterns of results, and only the results of the lenient analysis are presented here. In either case, an incorrect response (e.g., "she showed us a poisonous flower") was scored as incorrect.

Number of correct responses

The first dependent variable tested was the number of correct responses (see Table 1). There was a main effect for Program, F (1,36) = 16.84, MSE = 53.95, ETA squared = .33, power = .978. The participants in the advanced program made significantly more correct responses than the participants in the regular program. There was a marginally significant effect of Interview Instruction, with the draw group making more correct responses than the no-draw group ($.05 < p < .10$), F (1,36) = 3.13, MSE = 53.95, ETA squared = .08, power = .41. A significant main effect for Visuality was found, F (1,36) = 51.31, MSE = 56.89, ETA squared = .60, power = 1.00. More high-visual events were recalled than low-visual events.

An Interview Instruction x Visuality interaction was found, F (1,36) = 4.15, MSE = 56.89, ETA squared = .11, power = .51. A test of simple main effects showed that for

high-visual events, the draw group recalled more correct information than the no-draw group (F (1,36) = 5.09, MSE = 70.52. For the low-visual events, however, the draw group was not different than the no-draw group F (1,36) < 1.00, MSE = 70.52.

There was no significant Program x Interview Instruction interaction, F (1,36) = 1.42, MSE = 53.95, ETA squared = .04, power = .21, no significant Program x Visuality interaction, F (1,36) < 1.00, MSE = 56.89, ETA squared = .03, power = .17, and no Program x Interview Instruction x Visuality interaction, F (1.36) < 1.00, MSE = 56.89, ETA squared = .01, power = .06.

Proportion of responses that were incorrect

In order to measure accuracy, the proportion of responses that were incorrect were scored (see Table 2). The procedure for scoring was to divide the number of incorrect responses by the total number of responses.

The proportions of responses that were incorrect were not affected by any of the variables in isolation or in combination. There were no significant main effects for Program, F (1,36) = 1.33, MSE = .09, ETA squared = .038,

power = .20, Interview Instruction, F (1,36) < 1.00, MSE = .09, ETA squared = .014, power = .10, and Visuality, F (1,36) = 1.66, MSE = .07, ETA squared = .05, power = .24. There were no significant interactions between Program x Interview Instruction, F (1,36) < 1.00, MSE = .09, ETA squared = .01, power = .06, Program x Visuality interaction, F (1,36) = 2.39, MSE = .07, ETA squared = .07, power = .32, Interview Instruction x Visuality, F (1,36) < 1.00, MSE = .07, ETA squared = .01, power = .07, and Program x Interview Instruction x Visuality, F (1,36) = 1.14, MSE = .07, ETA squared = .03, power = .18.

Number of gestures

A gesture was defined as any non-verbal communication meant to convey information. Gestures included pointing to other people, pointing to the drawing, pointing to the participant's body, imitating sounds, and demonstrating what the participant saw on his or her own body. Credit was not given to the participant for any gesture made at the direct request of the interviewer (e.g., "show me where she told you to find the pulse").

There was a main effect for Interview Instruction, F

(1,36) = 5.83, MSE = 5.66, ETA squared = .15, power = .65 (see Table 3). The participants in the draw group made significantly more gestures than the no-draw group. More gestures were also made for high-visual than for low-visual events, F (1,36) = 10.17, MSE = 2.88, ETA squared = .23, power = .87. No significant difference was found between the regular and advanced groups, F (1,36) < 1.00, MSE = 5.66, ETA squared = .009, power = .05.

There was a significant Interview Instruction x Visuality interaction, F (1,36) = 4.34, MSE = 2.88, ETA squared = .113, power = .52. More gestures were made to high-visual than low-visual events, and this trend was even more pronounced for the draw than the no-draw group.

There were no significant interactions between Program x Interview Instruction, F (1,36) = 2.74, MSE = 5.66, ETA squared = .08, power = .36, Program x Visuality interaction, F (1,36) = 2.48, MSE = 2.88, ETA squared = .07, power = .33, and Program x Interview Instruction x Visuality, F (1,36) = 2.59, MSE = 2.88, ETA squared = .07, power = .35.

Of the total of 136 gestures, only one was incorrect, therefore no analyses were performed on proportion of

incorrect gestures.

Duration of interview segments

The interview was divided into two segments: rapport building and fact-finding. Two one-way ANOVAs were performed on the length (in minutes) of the rapport building and fact-finding segments. For the rapport building segment there was no difference between the no-draw and draw groups, F (1,36) = .74, MSE = 19.49, ETA squared = .02, power = .147 (m = 10.67, and m = 11.91, respectively). For the fact-finding portion of the interview, however, the no-draw group took significantly less time than the draw group, F (1,36) = 8.51, MSE = 18.35, ETA squared = .19, power = .79 (m = 14.89, and m = 18.95, respectively).

Discussion

The goal of this study was to develop an ecologically valid technique to elicit more correct facts from children during interviews. It was also of interest to expand and clarify previous research (see Butler et al., 1995). The results of the current experiment showed that children in the draw group recalled 20% more correct statements than the children in the no-draw group. These results clearly show a

beneficial effect of instruction to draw.

Effect of Drawing Manipulation

Butler et al. found a much larger effect of the drawing manipulation than the current study. They found that 59% more facts were elicited from the draw group than the no-draw group. The question arose as to why Butler et al.'s effect was stronger than that found in the current study.

The results from the current study approximated Butler et al.'s effects only when high-visual events were recalled. The draw group remembered almost 50% more high-visual items than the no-draw group. In the current study the demonstrator used visual aids and demonstrations for the high-visual events. The demonstrator used only verbal descriptions for the low-visual events. The strength of the results of the draw manipulation were dependent upon the information emanating from the high-visual events. The event in Butler et al. (a tour of a fire station) was a high-visual event. If all of the events had been high-visual in the current study the results may have more closely echoed Butler et al. for the effect of the draw instruction.

Cognitive Implications of the Instruction to Draw

The instruction to draw may have improved the recall of high-visual events because of the way visual events are encoded and retrieved. Baddeley (1986b) postulated that separate memory codes are created for visual and verbal events. The visual code created during the high-visual demonstrations may have provided an additional source of information to draw upon beyond that contained in the verbal code. Young children often do not generate efficient retrieval strategies (Pressley, & Levin, 1980). They have been shown to improve recall after being provided with a strategy. The instruction to draw may have prompted them to access the visual code, because of the visual nature of the drawing task. Accessing this additional visual memory code may account for the improved recall.

Cost of Drawing Instruction

Perhaps the increase in correct facts recalled when given the instruction to draw came at a cost of accuracy. One of the limitations of the Butler et al. study was that this issue could not be assessed because they found ceiling effects (proportion accurate was reported at .99). This is considerably higher than reported by other researchers when

interviewing children (McCauley & Fisher, 1995); Pipe & Wilson, 1994; Poole & White, 1994). Accuracy rates of around .85 are considered the norm.

In the current study there were no ceiling effects (mean proportion accurate of .78), thereby allowing a proper test of a quantity-accuracy tradeoff. In fact, the accuracy rate did not differ between the draw and no-draw groups. Therefore, it appears that an increase in recall for the draw group did not come at a cost to accuracy.

A second possible cost of the draw instruction is that it may have affected the child's ability to report auditory information. Only one child recalled the auditory event of the sound of the demonstrator's hand hitting the desk. It is unclear why the auditory information was not recalled in any of the conditions. Nevertheless, because floor effects were found for recalling auditory information the present study does not permit us to examine whether the instruction to draw affects the recall of auditory information.

Another type of auditory event was presented as a high-visual event in the form of a 'pop gun' effect. No floor effect for the high-visual/auditory 'pop gun' effect was

found. Eight children out of twenty recalled the 'pop gun' effect; four in the draw group and four in the no-draw group. Although the instruction to draw does not seem to have had an effect, a conclusion cannot be drawn at this time because of the small sample size.

Ecological Validity

Two major procedural differences between Butler et al. and the current study were analyzed for ecological validity. They were the rapport building process and the inclusion of probing questions. The rapport building process in Butler et al. was unrealistic for forensic interviews. The interviewers spent two days prior to the interviews in the children's classrooms as observers. The purpose was to enable the children to become familiar with the interviewers so they would be more comfortable with the interview process. This is not an ecologically valid procedure. Police interviewers are typically strangers to the witness and are able to spend only a minimal amount of time developing rapport.

The other aspect of the rapport building process in Butler et al. that may have affected the validity of the

results was the effect of the lengthy rapport building process on the subsequent fact-finding portion of the interview. If the interviewer played with the child until he or she was totally comfortable with the interviewer the fact-finding portion of the interview may have been affected. Children recall more information when they are comfortable (Saywitz & Geiselman, 1995; Steward, Bussey, Goodman, & Saywitz, 1993). Therefore, it is possible that Butler et al. unwittingly created an unrealistic environment for the interview process and artificially strengthened their results.

The current study created more ecologically valid conditions for the interview process. The interviewer did not interact with the child until the rapport building process of the interview began. Other than asking the child to draw a picture of his or her favorite activity the verbal interaction was typical of rapport building before fact-finding (McCauley & Fisher, 1995).

The second major procedural difference was the use of probing questions. The interviewers in Butler et al. did not ask any follow-up probing questions subsequent to their open

ended questions. This was not ecologically valid for several reasons. The first is that police interviewers make liberal use of probing questions (George & Clifford, 1992). In fact, police often ask more probing than open-ended questions.

In the Butler et al. study the lack of probing questions also reduced the number of questions the interviewers asked, which resulted in less time spent in the interview. An interview that is much shorter than the standard may not provide the opportunity to obtain the requisite information from the witness. A standard police interview takes 15-32 minutes (George, 1991; Geiselman, Fisher, MacKinnon, & Holland, 1985). Butler et al. reported a mean interview duration of 3.00 minutes for the no-draw group and 9.75 for the draw group. It is difficult to interpret the drawing effects that Butler et al. found because the no-draw group interview was so unrealistically short.

The current study used open and follow-up probing questions. This format more closely followed police interviews and so was more ecologically valid. Probing questions allowed the interviewer to elicit more detail

about statements made by the child. This line of questioning also created interview times that are representative of standard interviews (14.89 for the no-draw group, and 18.95 for the draw group). Therefore, the effect of the drawing manipulation could be realistically assessed in the current experiment.

The current study also showed that the instruction to draw did not appreciably lengthen interview time beyond what is considered standard. Police are often pressed for time (Fisher & Geiselman, 1992) and might find it difficult to use a technique that increased the amount of time spent in the interview. Asking a child to draw what he or she remembers does not seem to require a longer interview time than is typically used for recalling witnessed events.

Gesturing

An unexpected finding was that the interview instruction to draw produced more gesturing than in the no-draw group. In addition, gesturing was greater for children who were instructed to draw and had witnessed high-visual events as opposed to low-visual events.

The function of gesturing may be clarified by observing

the conditions in which gesturing was most likely to occur. Specifically, the children appeared to gesture under two conditions: when they could not remember the proper word (e.g., carotid artery), and to convey complex information (e.g., how to do thrusts on someone who is choking). Gesturing was used as a substitute for verbal information, or to supplement verbal information. Gesturing under these conditions was primarily seen in the children who were given the instruction to draw.

It is possible that the instruction to draw may have influenced gesturing in two ways. First, it encouraged the children to access visual-spatial memory, by priming the children to access visual images. The visual images were then more readily available than the verbal-abstract memories. If separate verbal and visual representations exist in memory (Bartlett, Till, & Levy, 1980), then it could follow that one representation is more accessible than the other. It is also reasonable to postulate that the children would access the more available memory. Because the visual image was readily available there was no reason to translate already accessible information into a verbal

response. Gesturing, being a visual-spatial response, was a natural vehicle to convey information held in visual-spatial memory. Second, when the information was difficult or complex the children recalled the information in a non-verbal manner because the pictorial image was more accessible than the verbal memory. When they could not remember a word or action the verbal code may have been difficult to retrieve or possibly did not exist. Gesturing then became the best way to articulate the information held in memory.

Out of 136 gestures in the entire experiment, 135 were correct. The proportion of gestured responses were much more accurate than the proportion of verbal responses (.75 proportion correct for verbal responses). Researchers have found that it is more difficult to verbally describe a visual memory than a verbal memory (Fisher & Geiselman, 1992). When the child gestured he or she was describing a visual image. Because the image held in memory was in the same form in which it was encoded the information was conveyed more accurately. Not having to translate the visual image to a verbal description maintained the accuracy of the

memory. Therefore, the child was able to maintain a high-level of accuracy when gesturing.

Individual Differences

Butler et al.'s participants were drawn from a predominantly middle class sample. They reported that the population consisted of New Zealanders of European descent. Without using a diverse sample it is difficult to generalize that the technique of asking a child to draw during an interview would be beneficial for all children.

The current experiment used a more representative cross-section of children. They were from a diverse socio-economic background (ranging from poverty level to affluent). The children also varied in cognitive abilities. Both the regular and advanced groups recalled more items when instructed to draw than when not instructed to draw. Therefore the technique of drawing during an interview appears to be useful for a wide range of children.

Conclusion

Clearly the technique of instructing a child to draw during an interview facilitated recall of witnessed events and is a promising technique for forensic interviews.

Drawing has already been shown to be of benefit during therapy (Kelley, 1985). The current study supported Butler et al.'s (1995) general finding that the instruction to draw improved amount of information recalled. The current experiment also took Butler et al's study one step further and established that the technique works with older children. The present experiment also defined some parameters under which drawing is most useful, in particular, for high-visual events. The technique is also useful for children at different cognitive levels. In addition, the instruction to draw prompts an increase in non-verbal information that has an unusually high accuracy rate.

TABLE 1

Number of correct responses.

	Visuality			
	Low-visual		High-visual	
	Interview Instruction			
Program	No-draw	Draw	No-draw	Draw
Regular	8.79	13.23	13.96	21.86
Advanced	11.50	15.94	18.50	26.39
Mean	10.15	14.59	16.23	24.13

TABLE 2

Proportions of responses that were incorrect.

	Visuality			
	Low-visual		High-visual	
	Interview Instruction			
Program	No-draw	Draw	No-draw	Draw
Regular	.36	.32	.22	.21
Advanced	.27	.22	.22	.22
Mean	.32	.27	.22	.22

TABLE 3

Number of gestures.

	Visuality			
	Low-visual		High-visual	
	Interview Instruction			
Program	No-draw	Draw	No-draw	Draw
Regular	1.12	1.35	1.68	2.61
Advanced	0.96	1.20	2.20	3.13
Mean	1.04	1.28	1.94	2.87

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Appendix A

Standard Interview Format

1. (INTERVIEWER INTRODUCES HERSELF AND TELLS THE CHILD WHAT SHE IS ABOUT TO DO). Hi, my name is _____. I'm here to ask you a few questions. Your mom and dad said it was O.K. for you to talk with me. Is it okay if I ask you a few questions? Good. You can stop any time by telling me that you don't want to answer any more questions.

2. (RAPPORT BUILDING: ASK THE CHILD ABOUT THEIR FAVORITE ACTIVITIES, ETC.). This is a drawing of my favorite activity. What do you like to do? Can you draw me a picture of your favorite activity?

3. (CHILD'S NAME) when I ask you the questions I want you to try to remember the best you can. If you don't know what something means just tell me to say it in new or different words.. Okay?

(IF DRAW GROUP: Please use the pencils and paper to draw what you remember of the demonstration, draw as much as you want using the colored pencils and paper)

4. Do you remember when someone came into your classroom to give a demonstration? (WAIT FOR RESPONSE).

5. Can you tell me more about that? (ALLOW CHILD TO GIVE NARRATIVE RESPONSE).

6. WHO:

a. Do you know the person's name?

b. Have you ever seen that person before? (USE THE NAME IF THE CHILD PROVIDED IT).

c. Can you tell me what the person looked like?

7. WHAT:

a. Can you start telling me from the very beginning to the end everything you saw during the demonstration? (ALLOW THE CHILD TO GIVE A NARRATIVE RESPONSE).

b. Is there anything else you remember about the demonstration?

c. Have you ever seen the demonstration before?

d. Is there anything else you remember about the demonstration?

8. WHEN:

a. When did you see the demonstration?

b. What time of day was it?

c. What day of the week was it?

d. What month was it?

9. CONCLUSION:

a. Is there anything else you can tell me? (KEEP ASKING THIS UNTIL THE CHILD SAYS NO).

b. Okay CHILD'S NAME, thank you for helping me today. (WALK THE CHILD BACK TO CLASS).

Appendix B

I freely and voluntarily consent that my child may be a participant in the research project entitled "Memory For Events", which will be conducted at the elementary school where my child is enrolled. I have been told that the experiment will take place during February of 1996, with Kendra Brennan as Principal Investigator. I have been told that this experiment will last approximately 35 minutes. I understand that my child will be one of 40 participants in this study.

I understand that the purpose of this research is to study the effect of drawing on the quantity and quality of children's' memory.

I understand that the research procedures will be as follows: The children will be given a Red Cross first aid demonstration, by a certified Red Cross instructor, in their classroom that will last approximately 20 minutes. The following week each child will be interviewed for approximately 20 minutes to determine how much of the demonstration they remembered. Some of the children will be asked to also make a drawing of what they saw during the demonstration.

I understand that there are no known risks in my child's participation in this experiment. I have been told that my child's responses will be kept strictly confidential. All scores will be identified only by a code number, and each individual performance will be anonymous.

I understand that I, or my child, may withdraw my, or my child's, consent and discontinue participation in this research project at any time with no negative consequences.

I understand that if I desire further information about this research, I should contact Dr. Ronald P. Fisher (940-5853) of the Department of Psychology at Florida International University. I have been offered a copy of this informed consent form.

I have read and I understand the above.

_____ _____

Parent's signature Date

I have explained and defined in detail the research procedure in which the participant has agreed to participate, and have offered him/her a copy of this informed consent form.

_____ _____

Principal Investigator's signature Date