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The Influence of Disclosure History and Body Diagrams on Children's Reports of Inappropriate Touching: Evidence From a New Analog Paradigm

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We tested a new paradigm for child eyewitness research that incorporates children's disclosure histories into analog study designs. Mr. Science—Germ Detective creates meaningful touching experiences and varied patterns of preinterview disclosures by convincing children that touching in the laboratory is potentially contaminating (germy). Children (N = 287, 4 to 8 years) heard that Mr. Science could no longer touch children's skin and then participated in an educational program involving 2 attempted touches. A week later, their disclosure histories were determined by a phone call that occurred a day before a forensic-style interview in the laboratory. This interview was delivered in 1 of 2 conditions: with early open-ended and more focused prompts delivered without a diagram (conventional-first condition) or with an initial diagram-assisted phase (diagram-first condition). Results confirmed that the new paradigm produces salient touches and performance patterns across open-ended and more focused questions that mirror well-known findings in eyewitness studies. A diagram made it easier for research assistants to elicit detailed reports of touching, but only among children 5 years and older who had not previously disclosed. Accuracy rates were comparable across interview conditions for early substantive phases but declined among older children when interviewers used diagrams to elicit additional reports late in interviews. These findings demonstrate that disclosure history is an important variable to include in analog study designs and confirm that Germ Detective is a promising paradigm for initial tests of new interviewing strategies.

Keywords: analog research, children, eyewitness research, body diagrams

The mainstay of child eyewitness research is the analog study, a type of study in which researchers ask children about documented (often staged) events. Analog studies have identified numerous interviewing practices that improve children's testimony, including a supportive (but not suggestive) demeanor, verbal encouragement to continue talking, narrative practice, ground rules instruction, and the use of open-ended prompts (for reviews, see Lamb, La Rooy, Malloy, & Katz, 2011; Poole, Brubacher, & Dickinson, 2015). The international effort to incorporate findings from these studies into protocols for investigating abuse allegations represents a broader social movement for evidence-based practice in medicine, mental health, education, and business.

Yet despite the widespread influence of analog research, critics have long argued that results from these studies have little relevance for the type of case that motivated this research: sexual abuse investigations. The majority of complaints center around two issues. First, analog paradigms mimic the dynamics of day care cases in which investigators interviewed numerous children who had not previously reported abuse (Wood, Nathan, Nezworski, & Uhl, 2009). In contrast, sexual abuse investigations include a sizable percentage of children who have already disclosed (Lamb, Hershkowitz, Orbach, & Esplin, 2008), and this group may be less suggestible in the face of questions about unfounded allegations. If this is true, then interviewing techniques that prompt an alarming number of false reports in laboratory studies may not have similar effects in the field, where many children are not reporting events for the first time. The second criticism is the most frequently vented: because the innocuous touches in analog studies are not emotionally salient or memorable, results from these studies cannot inform us about the pros and cons of the interview methods tested (Lyon, 2012; Maples, 2012).

To ameliorate these concerns, an analog paradigm would need to produce a variety of disclosure histories for inappropriate, memorable touching. Here we report preliminary findings from a candidate paradigm that accomplishes these goals: Mr. Science—Germ Detective (hereafter just Germ Detective). After explaining the conceptual bases for the paradigm, we describe a study that documented children's reactions to the paradigm, explored whether performance differences across conventional and diagram-assisted questioning were comparable for children who had and had not previously disclosed, and

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provided new findings on the benefits and risks of using body diagrams to elicit touch reports.

Conceptual Foundation for Germ Detective

A well-known phenomenon in the adult memory literature is the *testing effect*, which is the positive influence of memory retrieval on subsequent memory performance. Previously retrieved information is more accessible than nonretrieved information (Roediger & Karpicke, 2006) and more memorable than information that was merely studied another time (Karpicke & Roediger, 2008). Moreover, the benefits of previous retrieval extend to test environments that are contextually different from those of the initial memory tests (Rohrer, Taylor, & Sholar, 2010).

The testing effect has important implications for eyewitness testimony. Events that children have already described, either spontaneously or in response to inquiries (e.g., "Where did you get that bruise?"), should differ from other autobiographical memories in three ways: (a) any emotional barriers to reporting have already been overcome once, (b) previously retrieved events should have an increased probability of subsequent recall, and (c) these stronger memories should be more resistant to suggestion (Holliday, Douglas, & Hayes, 1999). As a result, children who previously disclosed may be more likely than nondisclosing children to simply repeat the gist of their earlier reports regardless of which interview methods are used. To explore the possibility that performance differences between protocols are attenuated among children who previously disclosed, Germ Detective incorporates a phone call to parents and their children that assigns children to disclosure and nondisclosure groups prior to the final interview.

Our new paradigm produces memorable touches by taking advantage of a well-known developmental phenomenon: children's reactions to contamination. Children grasp contamination at a young age, have a precocious understanding of contagion (the realization that contact with germs can cause illness), and develop a corresponding sense of disgust for contaminated objects. For example, 2- and 3-year-olds usually fail appearance-reality tests but do well when the hidden attribute is moldy bread (Siegal & Share, 1990), and 2.5-year-olds frequently refuse to touch contaminated objects (Stevenson, Oaten, Case, Repacholi, & Wagland, 2010). From an evolutionary perspective, the early emergence of strong emotions and behavioral reactions to contamination increases survival by protecting children from disease (Curtis & Biran, 2001). The impetus for Germ Detective was the realization that researchers could convert innocuous touches into memorable, inappropriate touches simply by convincing children that due to the numerous families strolling through our laboratories, touching from research assistants is potentially contaminating (i.e., germy).

Overview of the Germ Detective Paradigm

Germ Detective begins with a staged event about germ transmission and contagion prevention. At the beginning of Session 1, an assistant discusses the potentially contaminating effects of touching and explains that to avoid spreading germs, Mr. Science has been instructed not to touch children's skin in any way (including shaking hands at the end of sessions). Furthermore, because Mr. Science might forget this new rule, the child should remind him if he lapses into old habits. During subsequent germ education activities, Mr. Science attempts to touch the child twice. Children in a pilot study were highly engaged by these instructions, with many blocking at least one touch from Mr. Science and some spontaneously disclosing Mr. Science's transgression to a parent.

Session 2 is a phone call to the child's home that assigns the child to a disclosure or nondisclosure condition. During this call, an assistant first questions the parent to learn whether the child made any initial or additional disclosures since the laboratory visit. A child who disclosed in the laboratory or later to a parent is put on the phone, asked about the touching, and assigned to the disclosure condition (regardless of answers). A child with no known disclosures is put on the phone for questioning either to encourage disclosures (in which case the child's answers determine the disclosure condition) or to confirm the upcoming laboratory visit (in which case the child is assigned to the nondisclosure condition). For children with no known disclosures, assignment to the questioning versus nonquestioning phone call is made to better balance the number of children across disclosure and nondisclosure conditions. At the beginning of Session 3 (in the laboratory), an assistant asks the parent about disclosures since the phone call (if needed to confirm assignment to the nondisclosure condition), and the child participates in an interview about the science experience.

The Current Study

This study was a test of the Germ Detective paradigm in which children were assigned to one of two interview conditions: early interview phases conducted without a body diagram (the conventional-first condition) or an initial phase conducted with a diagram (the diagram-first condition). We included interview phases with and without body diagrams because there is converging evidence that diagrams often increase accurate and inaccurate reports of touching compared with verbal questions alone. These increases have been found in studies of innocuous touching (e.g., Brown, Pipe, Lewis, Lamb, & Orbach, 2012; Poole & Dickinson, 2011) and in medical analog studies (Bruck, Kelley, & Poole, 2016; Steward & Steward, 1996). By contrasting conventional and diagram-assisted interviewing, we were able to evaluate whether diagrams would also increase true and false reports in the Germ Detective paradigm and whether the benefits and risks of diagrams were comparable among children who had and had not previously disclosed. (For studies that did not find a benefit from diagrams, see Bruck, 2009, and Brown, Pipe, Lewis, Lamb, & Orbach, 2007).

In the conventional-first condition, interviewers followed preparatory phases with open-ended prompts about Germ Detective and then yes-no questions about wrongdoing and touching delivered without a diagram (followed by prompts to elaborate). Two diagram-assisted phases completed the interview: yes-no question about whether touching had occurred (with prompts to elaborate) and yes-no questions about touching to specific body parts (with prompts to elaborate). This protocol was therefore a typical verbal interview with two diagram-assisted phases tacked onto the end (Figure 1). In the diagram-first condition, interviewers followed preparatory interview

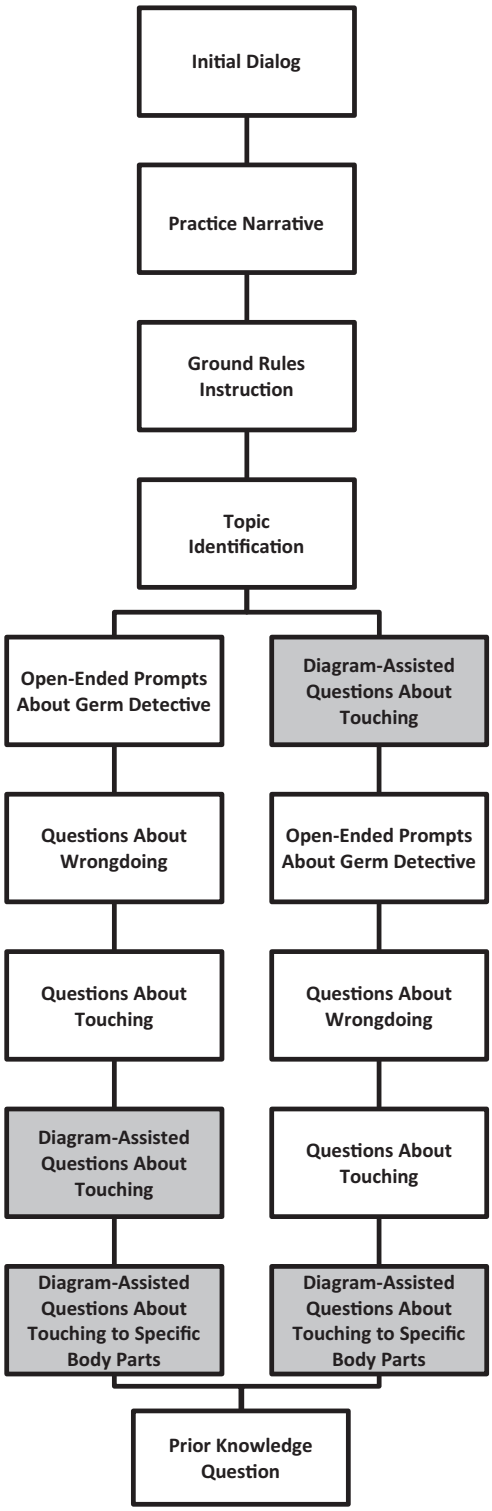

Figure 1. Placement of diagram assisted phases (shaded phases) in the conventional-first (left) and diagram-first (right) conditions. Questions about wrongdoing, touching, and touching to specific body parts consisted of yes-no questions followed by requests to elaborate (after "yes" responses).

phases with the diagram-assisted questions about touching, the three conventional phases (open-ended prompts and questions about wrongdoing and touching delivered without a diagram), and the final diagram-assisted phase of questions about touching to specific body parts. (As in the conventional-first condition, all yes-no questions were followed by prompts to elaborate.) This protocol therefore mimicked the diagram-focused interviews we have seen in which interviewers try to elicit disclosures with diagrams but turn to conventional techniques when children fail to disclose or to encourage new reports. Both conditions ended with diagram-assisted yes-no questions because we needed a sufficient number of children in a single condition who added new disclosures late in the interview to contrast the performance of children who had and had not previously disclosed.

By embedding two interview conditions in the Germ Detective paradigm, we were able to address three major questions:

1. Is Germ Detective a promising analog procedure? To answer this question, we evaluated (a) how salient the touches were (as measured by the percentage of children who blocked touches, spontaneously disclosed touching, and disclosed during interviews); and (b) whether reporting patterns across open-ended questions of the science experience and more targeted questions about touching mirrored typical findings in the eyewitness literature.

2. Are differences in performance across interview protocols comparable for children who have and have not previously disclosed? By evaluating interactions between disclosure history and interview condition, we explored whether it is important to consider children's disclosure histories when comparing interview techniques.

3. Do diagrams effectively and safely elicit reports of innocuous but inappropriate touching? To extend previous findings about diagrams, we compared children's performance in the conventional-first and diagram-first conditions.

Method

Participants

Families were recruited by posting advertisements in local papers and distributing fliers in schools and day care centers. To reduce information transmission across children, only one child participated per family. Children received $30 for each of the two laboratory sessions.

The final sample included 287 children (44.6% female) ranging from 4 to 8 years of age ($M = 6.58$, $SD = 1.43$). (Table 1 presents sample sizes by age in years.) Just under half (129) lived in small town/rural communities in the Midwest. The children at this site were predominantly Caucasian (87.4%, 1.6% African American, 0.8% American Indian, 2.4% Asian, 7.9% multiracial); 5.4% were ethnically Hispanic/Latino. These families were economically diverse: 27.2% of the 125 parents who disclosed family income reported incomes less than $30,000 per year, and 50.4% reported incomes under $50,000 per year. Children at the second site ($n = 158$), in the New York metropolitan region, were also predomi-

nantly Caucasian (74.2%, 7.10% African American, 7.7% Asian or Pacific Islander, 11.0% "some other race" or multiracial); 9.5% of the parents at this site reported that their children were ethnically Hispanic/Latino. These families had higher incomes than those from the Midwest site, with only 7.9% reporting family incomes under $50,000 per year. All children were fluent in English, but 8.4% of the families reported that another language was also spoken in the home.

We treated age as a continuous variable in analyses but divided children into two age groups to table data and to explore interactions involving age: 138 younger children (4.04 to 6.49 years, M_{age} = 5.30 years, SD = .74) and 149 older children (6.51 to 8.99 years, M_{age} = 7.76 years, SD = .71). Sample sizes by age group and interview condition were as follows: conventional-first, younger = 71 and older = 74; diagram-first, younger = 67 and older = 75. Mean ages were comparable across the two interview conditions (conventional-first = 6.59 years, SD = 1.44, diagram-first = 6.56 years, SD = 1.41), p = .87, and this was true for children without previous disclosures, p = .68, and those with previous disclosures, p = .87. The percentages of females were nearly identical across conditions (conventional-first = 44.1%, diagram-first = 45.1%), Fisher's exact test, p = .91, and the number of blocked touches did not vary significantly as a function of disclosure history or interview condition in a factorial analysis, ps > .62. There were 67 children without previous disclosures and 78 with previous disclosures in the conventional-first condition, versus 61 children without previous disclosures and 81with previous disclosures in the diagram-first condition.

Procedure

Session 1: Target event and parent tasks. Assistants obtained parental consent and child assent (for children less than 7 years of age) or consent (for children 7 years or older) immediately after each family arrived to the laboratory for the initial session. An assistant then spoke with the child about germs and explained that the child would play some germ detective games with Mr. Science that "help children learn how to stay healthy." The assistant also explained that to keep children healthy, "We are asking Mr. Science not to put his skin on your skin, so he doesn't pass on any germs" and that the child should "be a germ detective and remind him about the rule" should he forget. The assistant ended the instructions by saying, "I'm supposed to ask you if you remember this new rule. What is Mr. Science's new rule?" (followed by "That's right" or repetition of the rule).

The assistant then walked the child to a demonstration room where Mr. Science and the child completed three germ education activities: water bottle sneeze (estimating the distance a sneeze can travel), glitter transfer (simulating how touching transfers germs), and germ glow (learning the proper way to wash hands by watching Mr. Science wash off a cream that is only visible under a black light). For safety, each child wore a laboratory apron and safety glasses throughout the session and put on cotton gloves for the glitter transfer activity.

Mr. Science (one of six assistants playing this role) twice attempted to touch the child during these activities, ostensibly to brush water off the child's cheek and later to shake the child's hand. Each time, Mr. Science underscored the touch. For example, if the child did not block (i.e., prevent) a touch from occurring, Mr. Science remarked, "Oh, I think I just broke a rule. What did I do? [Child's response.] That's right. I'm not supposed to pass germs on by touching your skin." After each session, Mr. Science recorded whether touches were delivered or blocked by the child, and these records were verified against video recordings by another assistant. Staff members noted any spontaneous disclosures of inappropriate touching that the child made to laboratory staff members or parents in hallways and waiting rooms.

While the child visited with Mr. Science, the parent filled out a demographic information form and a child temperament questionnaire (which we did not analyze for the current study). The parent then received a wallet-sized card with instructions to listen to what the child reported about Germ Detective but "not to ask questions about Germ Detective or share what YOU know." The card had a place to write down what the child said about Mr. Science breaking the germ rule, and the parent was asked to bring this card back to the final session.

Session 2: Questioning or nonquestioning phone call. Approximately 6 days later, a laboratory manager called the parent to confirm the next day's memory interview and to ask whether the child had reported touches or attempted touches since leaving the laboratory. Children who had disclosed in the laboratory or had a reported touch, attempted touch, or broken rule were assigned to the questioning phone call condition and put on the phone for a conversation about the touching. After orienting information, the assistant said, "We need to know if Mr. Science remembered the rule. Did Mr. Science touch your skin?" Children who said "yes" were asked to tell about the touching (with the interviewer asking clarification questions when needed), followed by "Did Mr. Science touch you somewhere else?" (with prompts to tell about the touching) until the child said "no." Children who responded "no" initially were asked to "think about Mr. Science Germ Detective. Was there a time he forgot the rule and touched part of you with his fingers?", followed by prompts to describe reported touches and to recall other touches.

Children who had no documented disclosures were randomly assigned to the questioning or nonquestioning phone call condition with restrictions to balance the number of disclosing and nondisclosing children across boys and girls of various ages. For a nonquestioning phone call, the assistant introduced herself, mentioned the upcoming appointment in the laboratory, and said, "So we'll see you on [day of the week], okay?"

Session 3: The final interview. The final interview was conducted by one of 15 assistants who interviewed in both conditions. Children were randomly assigned to the conventional-first or diagram-first interview condition unless an assignment was dictated by requirements to balance the number of boys and girls of various ages and disclosure histories across conditions. Protocols for the two interview conditions contained the same substantive phases but in different orders (see Figure 1).

Preparatory phases. For both conditions, the interviewer began by introducing herself and asking whether the child would talk loudly for the audio recorder. She then asked, "Do you know how to spell your name?", "Do you live in a house, an apartment, or something else?", and "Tell me all the people who live there with you" (followed by "Does anyone else live with you?" until the child said "no"). For children in the diagram-first condition, the interviewer recorded the child's responses on a flip board with a marker.

The interviewer then asked how old the child was and what grade (or school/daycare) the child was in before initiating a practice interview by saying,

> I'm interested in what children do in (grade level) now. Tell me about a day at your school (or home school), from the time you get to school until the time you come home. Tell me everything you can about a day at school.

The interviewer initiated talk with reluctant children by saying, "What do you do when you first get to school?" and encouraged talking by asking, "What happens next?" until the child described the end of the school day. The interviewer completed early interview phases by delivering four ground rules instructions: do not guess (with practice; i.e., "For example, what is my dog's name?"), tell me if I say something you do not understand (with practice), tell me if I say something wrong (with practice), and tell the truth. (See Dickinson, Brubacher, & Poole, 2015, for children's performance during the ground rules phase.)

Topic introduction. The interviewer then said, "Good, I'm going to ask you about something else now. Did you come to the university a few weeks ago to go into the science room and play Germ Detective?" If the child said, "No," the interviewer reminded the child of the science room, the money they had received, and the topic of the program (how to stay healthy). If necessary, the interviewer displayed a lab coat and safety glasses to orient the child to the topic of conversation. Nineteen children said "no" when asked if they recalled coming to the university but remembered when interviewers delivered a second verbal prompt. Four children who responded "no" to both verbal prompts were shown the lab coat and safety glasses, and all four subsequently answered questions about the Mr. Science experience.

Open-ended prompts about Germ Detective. The interviewer delivered four open-ended prompts about the science experience: (a) "I want to know what happened that day at Germ Detective. Start with the first thing that happened and tell me everything you can, even things you don't think are very important." (b) "Tell me more about what happened at Germ Detective." (c) "Sometimes we remember a lot about how things looked. Tell me how everything looked at Germ Detective." (d) "Sometimes we remember a lot about sounds or things that people said. Tell me all the things you heard at Germ Detective." For each report of wrong-doing or touching, the interviewer prompted the child to tell what happened.

Questions about wrongdoing. The interviewer transitioned by saying, "Now I have some other questions to ask about the time you played Germ Detective" and asked, "Did someone do something wrong while you were playing Germ Detective?" (or "You said [child's words]. Did someone do something else wrong while you were playing Germ Detective?"). The interviewer then asked the child to tell what happened and repeated the "something else wrong" prompt until the child said "no."

Questions about touching. Next the interviewer asked, "Did someone touch you when you came to play Germ Detective?" (or "You said [child's words]. Did someone touch you somewhere else when you came to play Germ Detective?"), followed by "Tell me what happened." The interviewer repeated the "somewhere else" prompt until the child said "no."

Diagram-assisted questions about touching. The interviewer asked the child to pick which of three line drawings of children looked most like her/him. These diagrams of children wearing an underwear top and bottom depicted facial features, a belly button, and knee creases but no nipples or genitalia. After explaining that children have different names for things, she pointed to nine body parts (hair/head, nose, lips, face, shoulder, arm, hand, knee, and feet) while asking, "What's this?" Next she asked if the child got hugs from Mom or Dad and where s/he was touched when hugged, followed by a demonstration if the child failed to respond. (The interviewer hugged herself and said, "S/he touches you right here, on your shoulders, right?") She then asked, "When you came to play Germ Detective, did someone touch you in any places on this picture?" (or "any of the other places on this picture" for children who had already disclosed) while motioning her finger around the body diagram. Each report of touching was marked on the body diagram and the child was asked, "Who touched you there?" followed by "Did someone touch you anywhere else?" After marking all reported touches, the interviewer returned to each report and asked two open-ended questions that invited the child to tell everything that had happened.

Diagram-assisted questions about touching to specific body parts. The interviewer placed a new diagram on the flip board and said, "When you came to play Germ Detective, did someone touch you here?" while pointing in sequence to each of the previously labeled body parts that were not the subject of a previous disclosure during the current interview. If the child responded "yes," the interviewer prompted with "What happened" and other questions, if needed, to clarify who had done the touching and what body part had been touched.

Prior knowledge question. Finally, the interviewer asked whether someone told the child what would happen with Mr. Science, followed by clarification questions to assess what the child knew. No child reported hearing details about target events prior to participating.

Debriefing

Following the interview, the parent signed a debriefing consent form to grant permission for use of the child's data now that sessions were completed, to permit use of recordings in research presentations, and to approve archiving of the interview transcript (with identifying information removed) for future studies. An assistant explained a modified form to the child and supervised recording of the child's choices with the parent as witness.

Data Coding

Audio recorded interviews were transcribed by one of the assistants and reviewed by another, with a third resolving discrepancies. At each site, two coders independently read notes of laboratory disclosures and all phone interviews, along with all interview transcripts, and recorded reports of touching or attempted touching into a template of protocol phases. The content of each report was described by a 12-item code that summarized the following information: (a) the body part involved (e.g., "face," with "xxxx" for touch reports that did not mention the body part); (b) whether it was the first incident of touching to that body part or a subsequent incident; (c) whether the touch was delivered or

blocked; (d) whether the touch was a target face/hand touch, a nontarget touch to the skin, or some other nontarget touch; (e) whether the child reported more than just the location of the touch (i.e., did or did not provide narrative information about the touch); and (f) whether the report was accurate, false, minimized (a delivered touch described as "tried to touch," which was converted to an accurate report of an attempted touch for data analyses), or unknown (in the case of a few vague touch reports). Disclosures during the final interview also included codes for (g) the interview phase, (h) whether the report was disclosed before the current interview or not, and (i) whether this was the first report of this touch during the current interview or a repeated report.

At the two sites, coder pairs agreed 91% and 93% of the time, respectively, on the presence of discrete touch reports. Percentage agreement at one site was 87% for whether the child reported more than just the touch location, Cohen's $\kappa = .75$, and 92% at the second site, $\kappa = .83$. For all other variables, percentage agreement ranged from 90% to 97%, κs ranged from .81 to .92. Disagreements were resolved by discussion while revisiting individual transcripts.

Results

Unless otherwise noted, we analyzed children's performance as a function of age, disclosure history, and interview condition with a generalized linear model procedure (Proc Glimmix, SAS version 9.4). We used a negative binomial distribution with a log link function for count variables and binary logistic for dichotomous variables, entering age in years as a continuous variable (to 2 decimal places) and trimming nonsignificant interaction terms to test lower-order effects.

Sessions 1 and 2: Children's Reactions to Touching and Early Disclosures

Reactions to Mr. Science's touching showed that the Germ Detective procedure successfully converted innocuous touches into salient touches the children perceived to be inappropriate. Table 1 reports the percentages of children in each age group who blocked neither, one, or both touches. (Most children who blocked a single touch—97.6%—blocked the second.) Just over half the children blocked one or more touches, with defensive reactions being less frequent among younger than older children, $\chi^2_{\text{linear} \times \text{linear}}$ $(1, N = 287) = 27.68$, $p < .001$. The children's reactions were varied and often dramatic: Some children merely put their heads down and turned away from Mr. Science, but others vocalized or scolded him while recoiling from an attempted touch.

For children who received at least one completed touch ($n = 262$), Figure 2 reports the percentages of younger and older children who disclosed touching or attempted touching while still in the laboratory (Session 1), before the phone call, and during the phone call (Session 2). In Session 1, younger and older children were equally likely to spontaneously disclose inappropriate touching (about 10%), Fisher's exact test, $p > .99$, and even 8.0% of the 4-year-olds spontaneously talked about Mr. Science's indiscretion soon after leaving the demonstration room. More younger than older children disclosed touching or attempted touching before the phone call (a laboratory disclosure and/or parental report of a disclosure, 47.0% vs. 39.8%, respectively), but this difference was not significant, Fisher's exact test, $p = .26$.

Table 1
Percentage of Children Who Blocked Mr. Science's Touches (by Age)

		Number of touches blocked		
Age	*n*	0	1	2
4	50	74.0	26.0	.0
5	57	57.9	36.8	5.3
6	59	44.1	45.8	10.2
7	62	32.3	51.6	16.1
8	59	37.3	52.5	10.2
Overall	287	48.1	43.2	8.7

The bottom line in Figure 2 reports the percentages of children with and without previous disclosures who disclosed when asked about touching on the phone. (No child disclosed touching during a nonquestioning phone call. Due to assistant errors that did not prevent children from being assigned to a disclosure condition, $n = 256$ for this line of data.) All of the older, touched children in the disclosure phone call condition disclosed touching or attempted touching, regardless of whether they had previously disclosed or not. Younger children were significantly more likely to disclose on the phone if they had previously disclosed, Fisher's exact test, $p = .009$. It is interesting that even the youngest children usually disclosed when prompted to discuss touching or attempted touching on the phone, with 69.0% of all 4-year-olds in the disclosure phone call condition mentioning Mr. Science's inappropriate behavior.

In sum, the children's behavior during Sessions 1 and 2 confirmed that touches delivered during Germ Detective were salient (Question 1a). Even the youngest children sometimes prevented touches from occurring and spontaneously disclosed, and the majority of children assigned to the questioning phone call disclosed. Table 2 reports children's disclosure status upon arrival for the final interview.

Session 3: Performance in the Conventional-First and Diagram-First Interviews

Disclosures in the conventional-first condition. To assess whether performance across phases of the conventional-first condition mirrored typical findings (Question 1b), which speaks to the external validity of the paradigm, we computed the number of children who made a new disclosure of touching or attempted touching in each interview phase and the accuracy of these disclosures (Table 3). For each phase, we counted any new nonspecific (e.g., "He touched me twice") or specific (e.g., "He shook my hand") disclosure of touch or attempted touch but ignored repeated reports. When a child made a nonspecific report in one phase but then reported the body part in another phase, the specific report appears as a new disclosure in Table 3 (because proceeding to the next phase clarified the report). Thus the findings in Table 3 report disclosures gained as interviewers progressed through the interview.

Because children who disclosed during one phase had fewer potential disclosures to make in later phases, the data in Table 3 do not meet assumptions for omnibus mixed-model analyses (due to negative dependencies across phases). For this reason, we con-

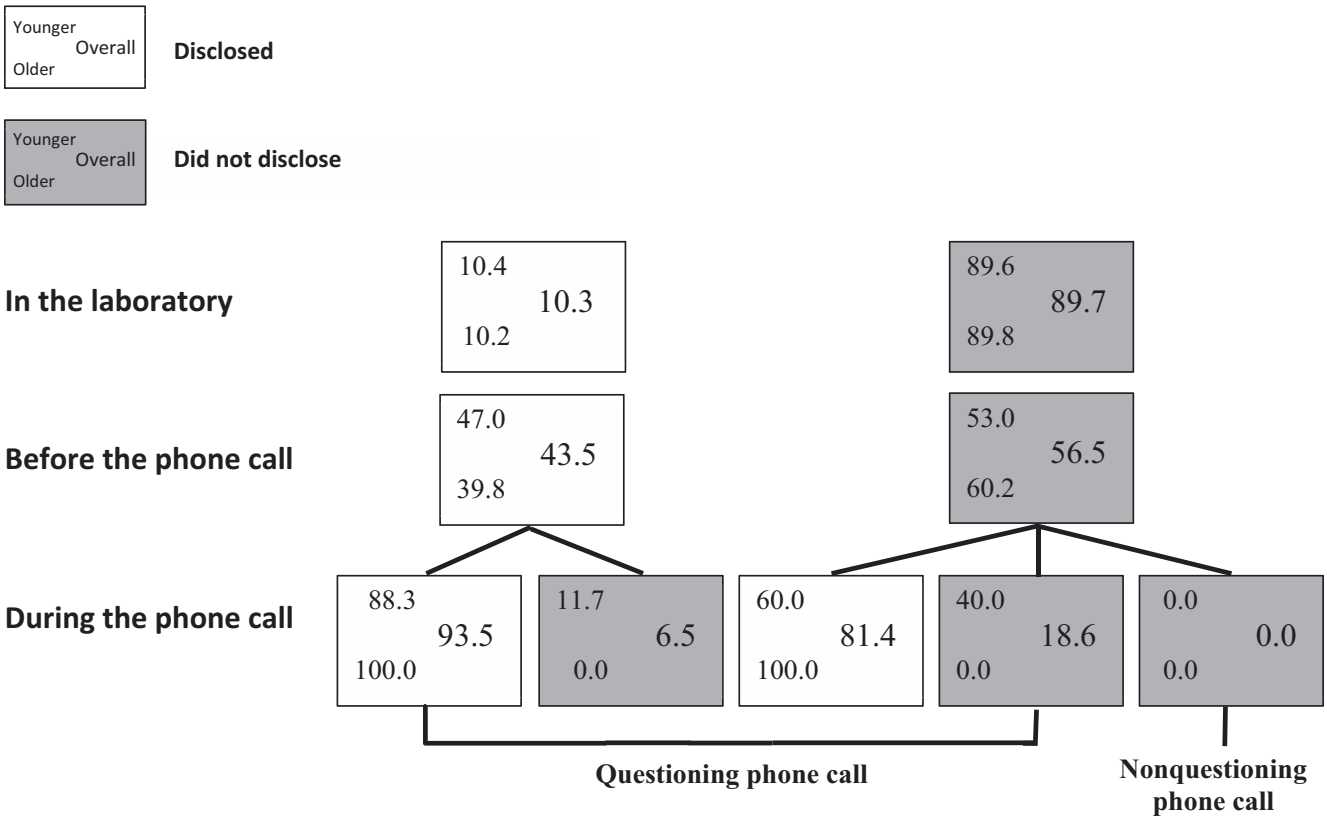

Figure 2. Percentage of children who disclosed a touch or attempted touch in the laboratory, before the phone call, and during the phone call.

ducted more targeted analyses. During open-ended prompting, the percentage of children who disclosed any touches or attempted touches (accurate or inaccurate) increased with age, $F(1, 143) = 4.50$, $p = .04$, estimated incidence rate ratio (IRR) for a 1-year increase (IRR_{year}) = 1.33, 95% CI [1.02, 1.74]. Furthermore, the percentage who disclosed during open-ended prompting was significantly less than the percentage making a new disclosure during the first phase of more focused questions, related samples McNemar test, $p < .001$, and this was true for younger and older children, $ps < .02$. Notice that only 40 of the 145 children (27.6%) disclosed touching during open-ended prompting, but twice as many did so when interviewers asked about wrongdoing. Despite the fact that more older than younger children had already disclosed by the second interview phase, there was an age trend favoring older children in this phase as well, $F(1, 143) = 9.06$, $p = .003$, $IRR_{year} = 1.45$, 95% CI [1.14, 1.90). As shown in Table 3, new disclosures continued to emerge as the interview unfolded, confirming earlier findings that children do not always immediately report touches they are capable of remembering (e.g., Brown et al., 2007).

Table 2
Session 3: Percentages of Children With No Previous Disclosure and With a Previous Disclosure Upon Arrival for the Interview (by Age)

		Disclosure condition	
Age	*n*	No previous disclosure	Previous disclosure
4	50	44.0	56.0
5	57	38.6	61.4
6	59	44.1	55.9
7	62	43.5	56.5
8	59	52.5	47.5
Overall	287	44.6	55.4

The mean number of inaccurate reports did not show a significant age trend in any interview phase, $ps > .10$. This replicates the lack of age trends for nonsuggested errors in the traditional Mr. Science paradigm (see Poole & Lindsay, 2001, Session 2). Treating individual disclosures as the unit of analysis, there was a higher percentage of accurate disclosures during the first three interview phases (open-ended prompts about Germ Detective and questions about wrongdoing and touching without a diagram, when 85.1% of disclosures were accurate) compared with the fourth phase (diagram-assisted questions about touching, when 55.0% of disclosures were accurate), Fisher's exact test, $p < .001$. This comparison demonstrates how accuracy declined when interviewers continued to press for disclosures. Compared with diagram-assisted questions about touching, accuracy dropped again when interviewers delivered diagram-assisted questions about touching to specific body parts (when only 21.1% of the individual disclosures were accurate), Fisher's exact test, $p = .016$.

Table 3
Conventional-First Interview Condition: Number of Children With Any New Disclosures in Each Interview Phase and Mean Percentage Correct Disclosures

	Interview phase									
Age	*n*	Open-ended prompts about Germ Detective	*n*	Questions about wrongdoing	*n*	Questions about touching	*n*	Diagram-assisted questions about touching	*n*	Diagram-assisted questions about touching to specific body parts
4	4	100.0 (.0)	7	92.9 (18.9)	3	100.0 (.0)	7	72.9 (46.4)	3	20.8 (26.0)
5	8	72.9 (39.8)	13	85.9 (30.3)	5	80.0 (44.7)	11	63.6 (45.2)	0	
6	7	78.6 (39.3)	20	80.8 (33.5)	4	62.5 (47.9)	6	50.0 (54.8)	3	33.3 (57.7)
7	10	100.0 (.0)	19	81.6 (38.0)	8	87.5 (23.1)	8	45.8 (42.5)	2	.0 (.0)
8	11	92.4 (17.3)	21	95.2 (15.0)	6	100.0 (.0)	8	68.8 (45.8)	3	33.3 (57.7)
Overall	40	88.8 (26.8)	80	86.7 (29.3)	26	86.5 (30.2)	40	60.7 (45.2)	11	23.9 (40.5)

Note. The number of children with one or more new disclosures in each phase is out of 145 children in the conventional-first interview condition. Standard deviations are in parentheses. Because repeated disclosures were ignored, the disclosures reported for each phase were new or revised disclosures. Questions about wrongdoing, touching, and touching to specific body parts consisted of yes-no questions followed by requests to elaborate (after "yes" responses).

To summarize, performance in the conventional-first condition replicated typical findings (e.g., Bruck et al., 2016; Steward & Steward, 1996): (a) most children failed to mention touching or attempted touching in response to early open-ended prompts to tell what happened, (b) cuing dramatically increased disclosures, and (c) accuracy rates were highest (but far from perfect) during the early (and more open-ended) interview phases. Reassured that the paradigm produced these expected reporting patterns, we next compared how children with and without previous disclosures behaved during the conventional-first and diagram-first interviews (Questions 2 and 3).

Disclosures as a function of previous disclosure history and interview condition. We could not score a child's performance during each interview phase and then sum across phases because children sometimes retracted reports as an interview progressed, converted accurate to inaccurate reports (e.g., by accurately saying that Mr. Science tried to touch but then reporting a completed touch), or converted inaccurate to accurate reports. To explore children's final decisions at various points in the interview, the following analyses parsed interview phases three ways and scored children's final decisions for each analysis: early substantive phases (Phases 1–3 of the conventional-first condition vs. Phase 1 of the diagram-first condition), Phases 1–4 (to compare two orders of the same interview phases), and the yes-no questions about touching to specific body parts.

Performance during the early substantive phases. These analyses contrasted children's performance during Phases 1–3 of the conventional-first interview (questioning without a diagram) with Phase 1 of the diagram-first condition (diagram-assisted questioning). To evaluate whether one condition pulled for disclosures more than the other, first the children were categorized as having disclosed in the final interview if they made any nonspecific (e.g., "He touched me twice") or specific (e.g., "He touched my face and hand") reports of touching or attempted touching, either accurate or inaccurate. We included accurate and inaccurate reports for this analysis because it is unknown how many nonspecific reports would have converted to inaccurate reports had interviewers in the conventional-first condition done more to insist that children specify the locations of nonspecific reports beyond asking what happened. Percentages of the children who had received at least one completed touch ($n = 262$) were compared as a function of age, disclosure history, and interview condition. The only significant finding was a marked increase in disclosures with increasing age, $F(1, 258) = 31.94$, $p < .001$, $IRR_{year} = 3.10$, 95% CI [2.09, 4.59]. Disclosure history did not predict disclosing, $p = .29$, nor did interview condition, $p = .42$. The percentages of children disclosing any touching or attempted touching in the conventional-first and diagram-first conditions were 87.2% and 83.7%, respectively. Thus the two interview procedures were equally effective at eliciting mention of inappropriate behavior, and this was true even when we tallied only accurate nonspecific and specific reports of delivered touches. (The percentages of children accurately disclosing delivered touches in the two interview conditions were 72.9% and 73.6%, respectively.)

What we did not anticipate was how ineffective a single prompt to describe a touch report would be during questioning without a diagram. In the conventional-first condition, 10 children whose accurate reports were only nonspecific did not elaborate when interviews said "Tell me what happened" (e.g., "I don't remember"), and 16 explained more but still did not mention which body part had been touched. (For other studies documenting unresponsiveness to open-ended invitations for clarification, see Korkman, Santtila, & Sandnabba, 2006, and Melinder & Gilstrap, 2009.) As a result of ineffective clarification in the conventional-first condition, the diagram-first condition produced a higher percentage of children with at least one accurate specific disclosure of touching or attempted touching (Table 4). For Table 4 and the corresponding factorial analysis, we included only children who received at least one delivered touch, excluding six in the conventional-first condition whose interviewers failed to deliver at least one clarification prompt after only nonspecific disclosures ($n = 256$).

The analysis of accurate specific reports revealed a significant Age × Disclosure History × Interview Condition interaction, $F(1, 248) = 6.93$, $p = .009$. Differences between interview conditions did not reach significance for younger children who had not previously disclosed, $p = .10$; younger children who had previously disclosed, $p = .51$; or older children who had previously disclosed, $p = 42$. Only older children who had not previously disclosed benefitted significantly from diagrams, $F(1, 48) = 7.71$, $p = .008$. However, due to the small number of older children without previous disclosures (24 in the conventional-first condi-

Table 4
Early Substantive Phases: Percentage of Children Who Made an Accurate Specific Touch Report (by Disclosure History, Interview Condition, and Age Group)

	No previous disclosure		Previous disclosure	
Age group	Conventional-first	Diagram-first	Conventional-first	Diagram-first
Younger	36.7	59.3	51.4	59.0
Older	54.2	96.2	94.4	89.2
Overall	44.4	77.4	72.6	73.7

Note. In the conventional-first condition, early substantive phases included open-ended prompts about Germ Detective and questions about wrongdoing and touching delivered without a diagram (Phases 1–3). In the diagram-first condition, the early substantive phase involved diagram-assisted questions about touching (Phase 1).

tion and 26 in the diagram-first condition), the odds ratio (*OR*) for this comparison was meaningless (as indicated by a wide confidence interval). To explore further, we inspected the performance of children who did not have previous disclosures at each year of age. Only the 4-year-olds disclosed with similar frequency in the conventional-first (25.0%) and diagram-first conditions (20.0%). (For 5-year-olds without previous disclosures, reporting rates were 50.0% and 80.0%, respectively; for children 5 years and older, rates were 50.0% and 86.7%). The diagram advantage remained highly significant for 5- to 8-year-olds, $F(1, 83) = 13.98$, $p < .001$ (with an unstable *OR* of 9.75, 95% CI [2.90, 32.74]).

We returned data from children who blocked both touches to analyze inaccurate reports ($n = 281$, due to the six children removed for interviewer errors). The percentage of children making an inaccurate specific touch report (e.g., saying an attempted touch was delivered or reporting touch to an untouched body part) did not vary significantly as a function of age, disclosure history, or interview condition. Overall, 16.0% of the children made at least one inaccurate specific touch report during early substantive phases.

The children often provided some additional narrative information about specific touch reports during early substantive phases, such as how Mr. Science touched, why he touched, or when he touched in the sequence of events. A higher percentage of correct than incorrect reports contained additional information (87.8% vs. 71.2%, respectively), Fisher's exact test, $p = .004$. However, the percentage of reports containing some elaboration did not differ significantly across interview conditions: correct reports, $p = .12$; incorrect reports, $p = .13$.

Performance during Phases 1–4. Disclosures during the first four phases of the conventional-first and diagram-first conditions assessed whether the order of phases impacted disclosures for two protocols with the same interview phases. For the entire sample ($N = 287$), a factorial analysis of the percentage of children who made an accurate specific disclosure of touching or attempted touching detected only main effects of age, $F(1, 283) = 25.99$, $p < .001$, $IRR_{year} = 1.80$, 95% CI [1.44, 2.26] and disclosure history, $F(1, 283) = 14.88$, $p < .001$, $OR = 3.34$, CI [1.81, 6.19]. Fewer younger than older children disclosed touching to a specific body part (67.4% vs. 85.9%), and fewer children without previous disclosures did so compared with children who had previously disclosed (67.2% vs. 84.9%). The order of phases (i.e., interview condition) did not influence accurate disclosing, $p = .49$.

Regarding inaccurate disclosing, there was a significant Age × Interview Condition interaction, $F(1, 280) = 4.68$, $p = .03$. The percentage of younger children making a false disclosure was similar across the two interview conditions (conventional-first = 26.8%, diagram-first = 22.4%), $p = .55$, but more of the older children made a false disclosure in the conventional-first (31.1%) compared with the diagram-first (12.0%) condition, $F(1, 147) = 7.56$, $p = .007$, $OR = 3.31$, 95% CI [1.40, 7.82]. Because error rates did not vary significantly across conditions in the early interview phases, this finding suggested that there was an accuracy decline in the conventional-first condition when interviewers introduced body diagrams later in interviews. To confirm this directly, we compared the percentage of older children in the conventional-first condition who made an inaccurate disclosure during diagram-assisted questions about touching (Phase 4; 10 out of 74 children, or 13.5%) to the percentage of older children in the diagram-first condition who made errors during open-ended prompts about Germ Detective and questions about wrongdoing and touching (1 out of 75, or 1.3%). This difference was significant, $F(1, 147) = 5.31$, $p = .023$. (Due to the low percentage of children erring in response to open-ended prompts, the *OR* was unstable at 11.56, 95% CI [1.42, 94.42]). Thus body diagrams did not impair accuracy when used to elicit initial reports but were more detrimental than verbal questions alone when used to probe for additional disclosures later in interviews.

Performance during yes-no questions about touching to specific body parts. Few children made new accurate (4.5%) or inaccurate (5.9%) reports of touching or attempted touching when interviewers ended sessions with yes-no questions about touching to specific body parts (delivered with a diagram). The 287 children made 14 new accurate reports in the final interview phase and 24 new inaccurate reports, producing an accuracy rate of only 36.8% for new disclosures elicited by these yes-no questions, 95% CI [21.5%, 52.2%).

Neither the percentage of children making new accurate disclosures nor the percentage making new inaccurate disclosures was significantly associated with age, disclosure history, or interview condition. Looking at inaccurate reports, 6.5% of the younger children and 5.4% of the older children contributed one or more false reports in the final phase; for children with versus without previous disclosures, percentages were 6.3% and 5.7%, respectively. In the conventional-first condition, 6.2% of children added false reports in the final phase, compared with 5.6% in the diagram-first condition.

Discussion

This study demonstrated a way to produce memorable touching experiences in a laboratory eyewitness paradigm. Children often reacted to Germ Detective by blocking touches from occurring and even scolding Mr. Science, and many spontaneously disclosed the inappropriate touching to their parents. As in forensic interviews (Orbach, Shiloach, & Lamb, 2007), many children failed to disclose early in interviews, but disclosure rates increased as interviewers continued to prompt with increasingly targeted questions. The 28% of children who disclosed in response to early open-ended prompts in our conventional-first condition was similar to the rate of disclosing genital touching in a medical analog study (25% in Bruck et al., 2016) and higher than is usually obtained in studies of innocuous touching (e.g., no children reported target touching before the touch inquiry phase in Brown et al., 2007). These findings confirm that Germ Detective is a promising paradigm for testing interview innovations designed to increase children's accurate disclosures of touching. Most important, our disclosure history variable returned nuanced findings about diagram-assisted and unassisted interviews in that differences between protocols were attenuated among children who had previously disclosed.

Disclosure History and Body Diagram Findings

That we did not allow unlimited clarification prompts in the conventional-first condition likely contributed to the interaction between disclosure history and interview condition which proved the importance of building disclosure history into research designs. In the diagram-first condition, children who disclosed by pointing simultaneously reported touching and where they were touched. In the conventional-first condition, by contrast, children who had not previously disclosed were more often vague when verbally responding and did not always elaborate in response to a single prompt to tell what happened. As a result of ineffective clarification questioning in the conventional-first protocol, diagrams more effectively elicited information from children who had not previously disclosed. This interaction between disclosure history and interview condition suggests that protocol advantages demonstrated in analog studies of children without previous disclosures could be greater than interviewers would obtain in the field, where a substantial percentage of children have already disclosed.

Although two medical-analog studies also obtained more disclosures with diagram-assisted interviewing (Bruck et al., 2016; Steward & Steward, 1996), it is premature to conclude that diagrams outperform unassisted interviews because neither of these studies included the presubstantive phases (ground rules and a practice narrative) known to increase children's informativeness. Studies involving the preparatory phases and clarification prompts typical of forensic interviews are needed to determine whether diagrams increase touch reports, especially given our finding that the two protocols were equally effective in eliciting some mention of touching.

Introducing diagrams early in interviews did not increase false reports in the current sample. This finding contrasts with results from our previous investigation of body diagram-focused interviewing (Poole & Dickinson, 2011) which found an alarming increase in spontaneous and suggested false reports when children responded to diagrams. That study, however, differed from the current investigation in several important ways: Some children were exposed to misinformation about touching prior to the interview, the experienced and described touching events were not as salient (e.g., putting a wrist band on the child) as those experienced in the current study, and the interview took place 3 months (rather than 1 week) after the target event. Though more evidence is needed, the collective results of these studies suggest that body diagrams may be especially risky among misinformed children or when children are questioned about long-ago events.

The current study did yield a concerning result: diagram-assisted questions about touching led to high error rates among the older age group when used to prompt for additional disclosures following questions delivered without a diagram. Because error rates were low when conventional verbal phases followed a diagram phase, this finding was a consequence of continued cuing with diagrams rather than interview fatigue. Bruck (2009) also found that diagrams were detrimental when interviewers introduced them after unassisted questioning. We speculate that because confabulation is more likely when the mode of responding requires little mental effort, diagrams increase errors among children who are trying to cooperate by answering questions in the absence of additional relevant knowledge.

Ironically, some interviewing trainers are encouraging conventional approaches early in interviews but also endorsing the practice of resorting to diagrams when verbal approaches fail to produce a disclosure (e.g., Del Russo, 2014). Our findings suggest that among children who experienced target events without misinformation, this approach could be riskier than an older technique, the RATAC procedure, which placed diagrams early in interviews (Anderson et al., 2010). Nevertheless, advances in interviewing practices, along with the frequent finding that diagrams increase errors, supports the conclusion by the National Children's Advocacy Center (2015) that diagrams "should not be used as a matter of standard practice" and "should be introduced only if the child has made a verbal disclosure of maltreatment and other clarification options and approaches have been exhausted" (p. 2).

Finally, results from the last phase of yes-no questions illustrate the danger of relentless probing for new disclosures, especially when witnesses are young. Because errors increased during yes-no questioning in Bruck et al.'s (2016) study regardless of whether diagrams were present or not, it is likely that question format and their location in interviews, rather than the presence of a diagram, accounted for the high error rate in our study. Due to findings like these, current guidelines suggest approaches other than a series of yes-no questions about specific body parts to encourage disclosures, such as taking a short interview break prior to continuing with another round of less-targeted prompts (Poole, 2016). It is interesting that the alarming errors rates associated with yes-no questions about touching to specific body parts in the current study did not occur when initial (and broader) yes-no questions about wrong-doing and touching were followed by "Tell me" prompts, suggesting that this is the safer approach for eliciting disclosures from reticent children.

Caveats, Limitations, and Future Directions

Although Germ Detective improves upon existing analog paradigms, it is a mistake to assume that absolute levels of accurate and inaccurate disclosures are reliable estimates of values in actual

cases. Rather, the primary purpose of analog research is to learn how competing strategies compare, and relative findings have replicated remarkably well across studies with different methodologies. For example, rates of false reports differ depending on the memorability of events (Holliday et al., 1999), whether children have been exposed to misinformation, and other factors (Poole et al., 2015), but the finding that questions targeting specific information (including yes-no and option-posing questions) elicit more true and false reports than open-ended prompts is ubiquitous (Lyon, 2014). The purpose of analog paradigms like Germ Detective is not to determine whether a specific interviewing strategy is effective and safe but whether it is more effective and safer than an alternative strategy when used to interview children with and without previous disclosures.

Because few diagram studies investigated memorable touches or included misinformed children, the benefits and risks of diagrams are still largely unknown. There are many possibilities for future research. For example, the current study did not include untouched children, which was a decision we made to increase statistical power. (As in life, most children in our study were touched in some places but not others.) To fully understand how diagram-assisted and unassisted interviews fare in the Germ Detective paradigm, it is necessary to compare how untouched children, misinformed children, and a more diverse set of children (including children with intellectual disabilities) respond when assisted interviews are compared against unassisted interviews that permit the types of clarification attempts typical of forensic interviews.

Conclusion

In the field of intervention testing, analog studies are considered an essential research step that should not be bypassed even when it is possible to immediately conduct a large-scale field trial (Rogers, 2009). One reason is that analog studies help identify potentially harmful effects early in the testing process, which protects the public. Another reason for conducting analog studies is to capitalize on the control afforded by laboratory settings to explore the mechanisms driving benefits and risks, as we did in another study that identified poor cognitive control as a characteristic of children who repeatedly point to diagrams (Poole, Dickinson, Brubacher, Liberty, & Kaake, 2014).

Germ Detective is a promising paradigm because it produces variability in children's disclosure patterns and can be modified to simulate a number of case dynamics. For example, adding a group of untouched children and misinformation from parents would reveal how children react to an interviewing strategy when concerns about touching are unfounded. Also, Mr. Science could ask children not to disclose his mistakes, thereby creating an atmosphere of secrecy that would better simulate the hesitancy of sexually abused children who have not yet fully disclosed. (See Rush, Stolzenberg, Quas, & Lyon, 2015, for a successful paradigm involving such requests.) Replacing paradigms that incorporate numerous sanctioned touches with paradigms involving memorable and inappropriate touching may increase practitioners' confidence in research findings and speed the adoption of evidence-based practices.

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