

Developmental Differences across Middle Childhood in Memory and Suggestibility
for Negative and Positive Events

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Running Head: Memory and Suggestibility for Emotional Events across Middle
Childhood

Abstract

In the present study, we investigated age differences in children's eyewitness memory and suggestibility for negative and positive events that children often experience during middle childhood. We first examined 216 8- to 12-year-olds' ratings of the frequency and intensity of personal negative and positive experiences (Study 1). Based on those ratings, videotapes depicting the most frequent and intense negative (an accident) and positive (a family excursion) events were developed. A new sample of 227 8- to 12-year-olds was tested for memory of the videotapes using the three-stage post-event misinformation procedure (Study 2). Compared to 8- to 9-year-olds, 10- to 12-year-olds exhibited less memory malleability and less compliance with false information. Age improvements in recognition accuracy were also evident for children who watched the negative event, but not for those who watched the positive event. Compliance predicted misinformation effects, particularly in regard to peripheral details. Thus, using ecologically representative emotional events, age differences in suggestibility and memory accuracy emerged, especially for negative events. Theoretical and forensic implications concerning children's eyewitness memory and suggestibility are discussed.

Keywords: Misinformation effect; Compliance; Recognition accuracy; Valence; Centrality; Middle childhood.

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That post-event misinformation can lead people to report information never actually witnessed is often referred to as the misinformation effect (e.g., Loftus, Miller, & Burns, 1978). Misinformation effects have been extensively documented for children and adults (e.g., Ceci, Ross, & Toglia, 1987; Lehman et al., 2010; London, Bruck, & Melnyk, 2009; Roebbers & Schneider, 2000; Schwartz-Kenney & Goodman, 1999; Saunders, 2012). In doing so, many previous developmental studies relied on neutral stories or films as stimuli (see Paz-Alonso, Larson, Castelli, Alley, & Goodman, 2009, for review). Although these studies advance scientific knowledge of children's memory and suggestibility, few if any previous developmental studies examined children's memory and suggestibility for central compared to peripheral information in negative events that frequently occur during the age period investigated. Additionally, few studies have examined developmental changes in children's susceptibility to the misinformation effect specifically during middle childhood. Most past studies examining misinformation effects in children have focused on early childhood (e.g., Bright-Paul & Jarrold, 2009, 2012; Elischberger, 2005; Memon, Holliday, & Hill, 2006; Roberts & Powell, 2007; Roebbers & Schneider, 2005), or age-related differences between early and middle childhood (e.g., Bright-Paul, Jarrold, & Wright, 2005; Holliday, Douglas, & Hayes., 1999; London et al., 2009; Pezdek & Roe, 1995; Poole & Lindsay, 2002). Yet child witnesses who fall in the middle childhood age group are more likely than younger child witnesses to testify in criminal cases (e.g., Goodman et al., 1992; Gray, 1993; Quas & Goodman, 2012). Finally, few misinformation effect studies with children have examined the influence of compliance in contributing to misinformation findings.

The present research investigated age differences in children's eyewitness memory and suggestibility for representative negative and positive events that children

self-reported as often experienced during middle childhood. We had three primary goals: (a) to characterize the frequency and intensity of negative and positive experiences as reported by 8- to 12-year-olds (Study 1); (b) to investigate age differences in memory and suggestibility for central and peripheral information in relation to the valence of representative events (Study 2); and (c) to examine whether children's compliance predicts misinformation effects (Study 2). It is important for theories of memory development generally and for the science of child forensic psychology specifically to study age differences in memory and suggestibility for emotional events during middle childhood and to determine if misinformation effects during this age period are predicted by compliance.

Misinformation Effects and Compliance

Theories of the misinformation effect have emphasized trace alteration (e.g., Loftus, 1975), trace strength (e.g., Brainerd & Reyna, 1998), memory coexistence and retrieval blocking (e.g., Bekerian & Bowers, 1983; Eakin, Schreiber, & Sergent-Marshall, 2003), source attribution errors (e.g., Johnson, Hashtroudi, & Lindsay, 1993), activation-based associative networks (Ayers & Reder, 1998), response bias and social-demand factors (e.g., McCloskey & Zaragoza, 1985), and social contagion (Roediger, Meade, & Bergman, 2001). Methodology to test underlying mechanisms includes the classic post-event misinformation paradigm (comparing original and falsely suggested information; Loftus, 1979), the modified test (comparing the original and new "foil" information; McCloskey & Zaragoza, 1985), and the source monitoring test (specifying source; Johnson et al., 1993). However, a theoretical issue rarely addressed developmentally, but one that has been examined in adults (Paz-Alonso & Goodman, 2008; Paz-Alonso, Goodman, & Ibabe, 2013), concerns the relation between compliance (i.e., responding "yes" to specific-incorrect questions; Gee & Pipe, 1995;

Roebbers & Schneider, 2000; Shapiro, Blackford, & Chiung-Fen, 2005) and misinformation effects. This theoretical issue, in contrast to ones arising from the spread of false information from other witnesses (Gabbert, Memon, & Allan, 2003; Roediger, et al., 2001), is of special interest because it concerns differences between individuals' own tendencies to comply with misleading questions as opposed to memory malleability effects. In most of the classic postevent misinformation-effect studies, it is not possible to separate compliance from memory failures. Due to potentially different underlying cognitive and social mechanisms, misinformation effects and compliance should be distinguished (e.g., Gee & Pipe, 1995; Roebbers & Schenider, 2000). In the present study, after children viewed either a negative or positive film, they were presented with a narrative text (misinformation or control). Later, at retrieval, questions related to the previously presented misinformation (i.e., *misinformation questions* to measure misinformation effects) and questions that included false information that was not presented previously (i.e., *specific-incorrect questions* to measure compliance) were asked. In this way, misinformation effects and compliance were separately indexed and relations between the two assessed.

Age, Memory, and Suggestibility

Although there are often age differences in children's memory and suggestibility, with preschool children typically being particularly prone to error (but see Brainerd, Reyna, & Ceci, 2008), under certain conditions, memory error and suggestibility levels can remain high in the school years (Bruck & Ceci, 2004). This may be especially true for compliance and interrogative suggestibility (e.g., Cassel, Roebbers, & Bjorklund, 1996; Gudjonsson, 1988; Roebbers & Schneider, 2000; Scullin & Ceci, 2001). Developmental differences in memory and acceptance of misinformation exist during middle childhood, with, for example, younger children showing greater

error than older children (e.g., Cassel & Bjorklund, 1995; Eisen, Goodman, Qin, Davis, & Clayton, 2007; Roebbers, Schwarz, & Neumann, 2005).

However, previous misinformation effect studies that included children aged 7 to 12 years and adolescents produced mixed results. For instance, Ceci et al.'s (1987, Experiment 1) research did not uncover age differences in misinformation effects between 7- to 9- and 10- to 12-year-olds. A lack of age difference was also reported in a study including two groups of children aged 7 and 12 years (Af Hjelmsater, Granhag, Stronmwall, & Memon, 2008). Finally, Lee's (2004) experiment did not detect developmental differences in misinformation effects between children aged 8- to 9- and 15- to 17-years-old. In contrast, other studies examining misinformation effects reported significant age differences in resistance to misinformation during middle childhood. For instance, in Ackil and Zaragoza's (1995) study, 7-year-olds showed a higher proportion of misinformation errors relative to 9- to 11-year-olds. Similarly, Otgaar, Candel, Merckelbach, and Wade (2009) reported that providing false information in the form of a text while being presented with a target event increased misinformation effects in 7- and 8-year-old but not in 11- to 12-year-old children.

Thus, empirical evidence from misinformation studies concerning age differences in middle childhood is inconclusive and contradictory, with some studies revealing significant age differences and others finding no developmental effects during this age period. Of interest, none of these previous studies employed events shown to be representative of experiences from children's lives that systematically varied in emotional valence.

Event Valence and Centrality

Behavioral and neuroimaging research indicates that adults evince particularly robust memory for negatively valenced, emotionally arousing materials compared to

neutral, nonarousing stimuli (e.g., Budson et al., 2006; Cahill & McGaugh, 1998; Christianson, 1992; Kensinger & Schacter, 2006). Relative to neutral and positive nonarousing stimuli, negative arousing material facilitates attentional and elaborative processes during encoding, which may account, at least in part, for the demonstrated gains in memory for negative versus neutral stimuli (e.g., Kensinger, 2004; Libkuman, Stabler, & Otani, 2004; Sharot & Phelps, 2004). Furthermore, although central information generally is remembered better than neutral information, the difference becomes even greater for negative, high arousing events (e.g., Adolphs, Denburg, & Tranel, 2001; Phelps, 2006). However, studies of events with thematically induced arousal at times show that central as well as peripheral details are well remembered, with no evidence of narrowing memory effects for central relative to peripheral information (e.g., Laney, Campbell, Heuer, & Reisberg, 2004).

In legal settings, children's testimony is usually required in relation to emotionally charged events. Consequently, studies of possible developmental differences in child witness memory and resistance to misinformation for emotional material is an urgent priority in application of basic memory research to the law (e.g., Brainerd, Holliday, Reyna, Yang, & Toglia, 2010; Brainerd & Reyna, 2005). Developmental evidence on the effects of valence on children's memory and suggestibility is relatively sparse, with a handful of studies indicating that young children are more likely to assent to positive or neutral false events than to negative false events (e.g., Ceci, Loftus, Leitchman, & Bruck, 1994; Schaaf, Alexander, & Goodman, 2008; but see Otgaar, Candel, & Merckelbach, 2008). Thus, the prioritized processing that children (like adults) give to negative compared to neutral and positive stimuli may increase the likelihood that negative information will be subsequently remembered and more resistant to suggestions (e.g., Cordon, Melinder, Goodman, &

Edelstein, 2013). However, developmental evidence using the Deese/Roediger-McDermott (DRM) task has shown age increases during middle childhood (7- to 11-years-old) in false memory effects for negative-valenced materials relative to neutral and positive-valenced stimuli (Brainerd et al., 2010; Howe, Candel, Otgaar, Malone, & Wimmer, 2010). Moreover, effects of negative-valenced information on memory and suggestibility may be subject to age-related changes during middle childhood years (Brainerd et al., 2010).

Although data from adults are relatively consistent in highlighting the heightened advantage of central over peripheral details for negatively arousing versus more neutral stimuli (e.g., Christianson & Loftus, 1991), data from children are more mixed. In some studies, whereas elementary school children exhibited fewer inaccuracies to central than peripheral specific questions, younger children's proportion of errors to specific questions (i.e., questions phrased so as not to be intentionally misleading) are similar for both central information and peripheral details of events (Eisen, Goodman, Qin, Davis, & Crayton, 2007). Nevertheless, overall, studies with children tend to confirm that information central to negatively arousing stimuli is better retained than peripheral information (e.g., Howe, Courage, & Peterson, 1994). Moreover, even for children, central versus peripheral information is less likely to be affected by misinformation (e.g., Goodman, Hirschman et al., 1991; Roebbers & Schneider, 2000; Schwartz-Kenney & Goodman, 1999). Thus, especially under negatively arousing conditions, core details of the events may, at least at times, receive preferential processing by children.

Despite the fact that central information is generally better retained and more resistant to misleading information than peripheral details in adults and children (Christianson, 1992; Reisberg & Heuer, 2004), such differential memory is not

necessarily a stable phenomenon (e.g., Wessel, van der Kooy, & Merckelbach, 2000). The use of different criteria to classify centrality may determine, to some extent, inconsistencies in the pattern of memory and suggestibility results (e.g., Burke et al., 1992; Christianson & Lindholm, 1998; Christianson & Loftus, 1991; Heath & Erickson, 1998; Heuer & Reisberg, 1990; Paz-Alonso et al., 2013). Ibabe and Sporer (2004) developed a set of criteria that distinguishes central from peripheral details, specifically for information that occurs during the main incident of an emotional event and/or that is related to the event's main characters. Based on the integrative character of this definition and its facility for use with videos, central and peripheral information in the second study of this paper was defined based on Ibabe and Sporer's (2004) criteria.

STUDY 1

One of our goals was to use negative and positive representative events (i.e., events that usually occur during the age period under investigation) to examine children's memory and suggestibility. To our knowledge, few studies have detailed the types of autobiographical and emotionally intense events experienced by children. Most extant studies of relevance focused on narrative content and structure rather than memory and suggestibility (e.g., Bohanek, Fivush, & Walker, 2005; Fivush, Marin, Crawford, Reynolds, & Brewin, 2007). In Study 1, we sought to characterize the most frequent and emotionally intense positive and negative events experienced by elementary-school aged children, as reported by them. We based the stimuli for Study 2 on these findings.

Method

Participants

A total of 216 8- to 12-year-olds (55% females; $M = 10.04$ years; $SD = 1.37$) from three different schools in Spain participated. Schools were selected from neighborhoods with

different average household income according to municipal statistics, ranging from lower-middle to upper socioeconomic status. Parents gave consent for children's participation. The study followed the guidelines of the Helsinki Declaration for studies involving human subjects. Approximately, 90% of the children were Caucasian (nonHispanic), and the remaining 10% represented a variety of ethnic groups.

Materials and Procedure

Children were interviewed individually by a single experimenter. First, participants were asked to write a brief description of up to four negative and up to four positive events (order counterbalanced). Specifically, children were told, "Please describe briefly the four most positive/negative events that have happened to you recently." The experimenter specifically prompted children to report events that happened to them within the last year. Children could provide fewer than four events if they so desired. After all the events were reported, participants rated the emotional intensity of each positive and negative autobiographical event using a 5-point Likert scale from 0 = "not intense at all" to 4 = "very intense."

Coding

All the negative and positive events reported by the children were categorized by two independent coders (blind to hypotheses) into two separate categories, to account for differences in the children's descriptions (e.g., to ensure "A birthday party" and "My 5th birthday party" were categorized together and were both considered positive by the children). The negative category included a total of 37 different events, and the positive category consisted of 40 different experiences. Inter-judgment agreement between independent coders was .82 for the negative classification and .85 for the positive one. All disagreements were resolved through discussion.

Results

Two separate 2 (Age: 8- to 9- vs. 10- to 12-year-olds) X 2 (Gender) X 2 (Event Valence: negative vs. positive) analyses of variance (ANOVAs) were carried out with the total number of reported experiences and the mean intensity attributed to them as the dependent measures. The main effect of participant gender was not statistically significant in these ANOVAs, $F_s(1, 204-212) \leq 2.87$, $p_s \geq .10$, $\eta^2_{ps} \leq .01$. Analysis of the total number of reported events revealed statistically significant main effects of age, $F(1, 212) = 70.08$, $p < .001$, $\eta^2_p = .25$, and event valence, $F(1, 212) = 25.51$, $p < .001$, $\eta^2_p = .11$. Children aged 8 to 9 ($M = 2.37$, $SD = .09$) reported a significantly lower number of events than did older children ($M = 3.38$, $SD = .08$). Overall participants reported a higher number of positive ($M = 3.06$, $SD = .07$) than negative ($M = 2.68$, $SD = .08$) experiences.

Similarly, the significant main effects of age, $F(1, 204) = 6.63$, $p < .05$, $\eta^2_p = .03$, and event valence, $F(1, 204) = 93.16$, $p < .001$, $\eta^2_p = .31$, emerged in the analysis of mean emotional intensity. Younger children ($M = 3.12$, $SD = .07$) attributed lower emotional intensity to the reported experiences relative to older children ($M = 3.35$, $SD = .05$). Also, across participants, the emotional intensity attributed to the reported experiences was higher for positive events ($M = 3.52$, $SD = .04$) versus negative events ($M = 2.94$, $SD = .06$).

Additional analyses were also conducted for the more frequently self-reported experiences. Table 1 shows these more frequent negative (out of 37) and positive (out of 40) autobiographical events, as well as the mean intensity attributed to each of them. Within the more frequently indicated *negative* events, 41% of the children reported “accidents/illnesses” (e.g., “falling off a bicycle,” “having a cold,” “having surgery”), 37% of them indicated “fights with friends” (e.g., “arguments while playing games”),

and 20% reported “unexpected negative experiences” (e.g., “getting stuck in the elevator” and “something breaks”). Within the frequently indicated *positive* events, 37% of the children reported “excursion/travel with parents” (e.g., “going somewhere for vacation,” “going to the park”), 34% of them indicated “playing with friends,” and 27% reported “unexpected pleasant experiences” (e.g., “getting presents”).

Regarding event frequency, older children reported significantly more often the negative events “unexpected unpleasant experiences” (16%) and “negative evaluations at school” (12%) relative to younger children (4% and 1%, respectively), $X^2(1, 23-44) \geq 9.57, p < .01$. Older children also indicated more frequently the positive event “winning contests/competitions” (12%) compared to young children (1%), $X^2(1, 29) = 11.16, p < .01$. Female participants reported more frequently the negative event “fights with siblings and family members” (10%) and the positive event “field trips at school” (11%) relative to male participants (3% and 4%, respectively), $X^2(1, 29-32) \geq 4.51, p < .05$.

Finally, to decide further about the negative and positive experiences for use as stimuli in our second study, additional analyses were conducted regarding the emotional intensity of the most frequently reported negative and positive experiences. There were no statistically significant differences between the emotional intensities that the children attributed to their most negative (i.e., “accidents/illnesses”) and positive (i.e., “excursions/travels with parents”) frequently reported experiences, $t(37) = 1.22, p = .23$. Also, no significant difference was found between the mean emotional intensity rates for the most frequently reported negative (i.e., “accidents/illnesses”) and positive (i.e., “excursions/travels with parents”) experiences, and the reported events with the highest negative (i.e., “negative evaluations at school”) and positive mean emotional intensity ratings (i.e., “playing with siblings and family members”), $t(13) \leq .88, p \geq .54$. Similarly, no significant age differences were observed for these most frequently

Table 1

Mean percentage of most frequent negative and positive reported autobiographical experiences and mean (and standard deviation) emotional intensity attributed to them

Autobiographical Experiences	Frequency (%)	Mean Intensity (SD)
Negative Events		
Accidents/Illnesses	41	4.08 (1.01)
Fights with friends	37	3.99 (0.91)
Unexpected unpleasant experiences	20	3.75 (1.20)
Fights with siblings and family members	13	3.55 (1.12)
Negative evaluations at school	13	4.36 (0.78)
Parental anger/punishment	13	3.57 (0.96)
Positive Events		
Excursions/Travels with parents	37	4.62 (0.75)
Playing with friends	34	4.51 (0.63)
Unexpected pleasant experiences	27	4.49 (0.68)
Field trips at school	15	4.22 (0.91)
Playing with siblings and family members	13	4.68 (0.61)
Winning contests/competitions	13	4.52 (0.57)

reported negative (i.e., “accidents/illnesses”) and positive (i.e., “excursions/travels with parents”) events in regard to their frequency, $X^2(1, 215) \leq 2.18, p \geq .14$, nor in terms of the emotional intensity that children attributed to them, $F(1, 73-88) \leq .68, p \geq .41$.

Discussion

In summary, Study 1 characterized the most frequent negative and positive autobiographical events, as well as their emotional intensity, as reported by a middle childhood sample. The most frequently reported negative and positive events were “accidents/illnesses” and “excursion/travel with parents,” respectively. The emotional intensity attributed to these experiences did not significantly differ between each other, or in relation to the reported negative and positive experiences with the highest mean

intensities. Therefore, these events were selected as content for the video clips designed to examine children's memory and suggestibility in our second study.

STUDY 2

The main research goal was to investigate effects of age, misleading information, and event valence on children's memory and suggestibility for central versus peripheral information about emotional events. The experiment conformed to a 2 (Age: 8- to 9-year-olds, 10- to 12-year-olds) x 2 (Event Valence: negative, positive) x 2 (Condition: misinformed, control) x 2 (Centrality: central, peripheral) mixed factorial design with the latter factor varied within-participants.

We examined: 1) The misinformation effect, specifically, participants' performance on 10 *misinformation questions* that referred to false post-event details included in a narrative; 2) compliance in relation to 10 *specific-incorrect questions* that included inaccurate information not presented previously; 3) recognition accuracy performance on 20 *specific-correct questions* that only included correct information about the target film; and, 4) associations between children's misinformation effects and compliance with false information included in specific-incorrect questions.

Several predictions were advanced: 1) Younger compared to older children differences would exhibit greater suggestibility (misinformation effects and compliance). 2) Children would show better memory and less suggestibility for negative versus positive events, and for central versus peripheral details. 3) Associations would exist between misinformation effects and compliance, especially for peripheral details.

Method

Participants

A sum of 227 children (49% females), divided into two age groups (8- to 9-year-olds, $M = 8.55$, $SD = .50$) and 10- to 12-year-olds ($M = 11.16$, $SD = .86$) participated.

All came from a school in Study 1 that served middle to upper-middle class families.

Parents gave consent for children's participation. The study followed the guidelines of the Helsinki Declaration for research involving human subjects. About 90% of the children were Caucasian (nonHispanic); 10% represented other ethnic groups.

Materials

For the presentation phase of this study, *two parallel videos* were constructed based on results from Study 1. The total length of both videos was 3 min 40 s, and they each consisted of three sections: introduction (1 min 40 s), emotional focus (1 min), and end (1 min). Both videos showed the same day outing and were identical except for 30 s of the emotional-focus section in which the children were either injured from falling off their bicycles (negative event) or continued to ride their bicycles happily (positive event). Specifically, in the emotional focus part of the videos, the family either 1) shares the most cheerful and positive interaction of the video: each parent takes one child off the bike, and they start playing with each other on the ground; or 2) has the most negative moment during the video: the children fall off the bike and end up on the ground crying and complaining about pain in their knees and arms. The ages of the girl (9.7 years-old) and boy (10.4 years-old) actors fell within the age range of Study 2 participants.

The common parts to the negative and positive videos were designed to be neutral and non-arousing. In the *introduction*, the family is home having breakfast and getting ready to go out. Then, they drive to a park, unload the car's trunk, and sit down around a table. Next, the children (a boy and a girl) get a bicycle, while the father helps them. In the *end* part of the video it is possible to see the family getting into the car to go back home, the car leaving the park, and some scenes inside the car showing the children falling sleep on the drive home.

Two versions of a *narrative text* about the videotapes with a similar length were constructed to be read before administration of the memory test. In the misinformation version, the narrative included 10 false post-event details (e.g., “The children had a snack”; in fact, they did not). In the control version, no false post-event details were included.

To assess event memory, a *multiple-choice recognition test* with 40 specific questions was constructed in the form of a questionnaire (Table 2). Half of the questions were specific-correct (e.g., “Was the father’s hair dark and short?”, when in fact his hair was dark and short; “During the trip, did the mother run toward the children?”, when in fact she did so). Ten questions from the remaining half were specific-incorrect to tap compliance (e.g., “Did the mother push the bicycle at any time?”, when in fact she did not push it; “Did the film show a park with swings and children playing during the trip?”, when in fact there was not a park with swings and children playing; “Did the boy take the ball from the girl’s hands while playing?”, when in fact the boy was playing with the ball by himself). The remaining 10 were misinformation questions and concerned the same 10 false items that were included in the misleading narrative (e.g., “Did the children have a snack?”). These types of questions were randomly intermixed on a single recognition test that all participants received. Each question contained four answer options: one correct, two incorrect (e.g., for the misinformation condition, the misinformation and a new foil item served as the two separate incorrect alternatives), and a “don’t know” alternative. For example, one of the questions and its response options were as follows: “Did the children have a snack? A) Yes (misled item), b) Yes, and the parents did too (new foil item), c) No (correct item), d) Don’t know. Only a handful of misinformation-effect studies have included an explicit “don’t know” response alternative (e.g., Higham, 1998; Roebbers & Schneider,

2000). Allowing participants to decide whether to produce or withhold an answer when uncertain is a critical factor increasing overall memory accuracy (Koriat & Goldsmith, 1994, 1996). Moreover, in forensic contexts, answering “don’t know” is preferable to answering incorrectly (e.g., Wells & Bradfield, 1998).

Table 2

Question types and response alternatives in the recognition test to examine misinformation effects, compliance, and recognition

	Misinformation Effects	Compliance	Recognition Accuracy
Question Type	<i>Misinformation Questions</i> (n = 10)	<i>Specific-Incorrect Questions</i> (n = 10)	<i>Specific-Correct Questions</i> (n = 20)
	Concerned false details embedded in the misinformation narrative	Included inaccurate information (information not presented previously in the film or narrative)	Included correct information about the film
Example	“During the breakfast, were the children in the bathroom at any time?” (when in fact the children were not shown in the bathroom)	“Did the mother push the bicycle at any time” (when in fact she did not push the bicycle)	“Did the father have short dark hair?” (when in fact he had short dark hair)
Recognition Test: Response Alternatives	<i>Misled</i> : “Yes, they were brushing their teeth.” <i>New foil</i> : “No, children were in their room picking up their toys.” <i>Correct</i> : “No, children weren’t in the bathroom at any time.” <i>DK</i> : <i>I don’t know</i>	<i>Compliant</i> : “Yes, while the children were riding the bike.” <i>Incorrect</i> : “No, the father was the one who pushed the bike.” <i>Correct</i> : “No, the children rode the bike without anybody pushing them.” <i>DK</i> : <i>I don’t know</i>	<i>Correct</i> : “Yes, the father had short dark hair.” <i>Incorrect</i> : “No, the father had long dark hair” <i>Incorrect</i> : “No, the father had short blonde hair.” <i>DK</i> : <i>I don’t know</i>

Twenty of the 40 recognition test questions were answered correctly with a response of “yes,” and the remaining half were answered correctly with a response of “no.” Also, for the two incorrect alternatives, the response options were counterbalanced across questions answered correctly with a “yes” option and questions answered correctly with a “no” option. To avoid response biases, order of appearance of the correct alternative was also counterbalanced across the recognition test questions, with the exception that the “don’t know” alternative always appeared last.

Finally, consistent with Ibabe and Sporer's (2004) classification system, central details were defined as those that occurred during the critical event and/or that were related to the event's main characters. (e.g., "Did the mother push the bicycle at any time?"). According to these criteria, 20 of the 40 recognition test questions tapped central information, and the half remaining tapped peripheral information (e.g., Can a radio-cassette be seen inside the car?). Information centrality was counterbalanced for all question types: Specific-correct (i.e., 10 central and 10 peripheral questions), specific-incorrect (i.e., 5 central and 5 peripheral questions), and misinformation (i.e., 5 central and 5 peripheral questions).

Procedure

Within each age group, children were randomly assigned to one of the four conditions: Negative event-misinformed, $n = 59$; negative event-control, $n = 55$; positive event-misinformed, $n = 55$; and positive event-control, $n = 58$. The classic three-stage procedure used in research on the misinformation effect was employed (Loftus et al., 1978). Children watched the negative or positive video version in small groups without being informed of the study's purpose (e.g., that it concerned memory). For the rest of the session, children were tested individually. Each child performed a 5- to 7-min filler task (i.e., answering questions about general knowledge). Immediately thereafter, the child read the narrative (misleading or control). Again, following the narrative and before the recognition test, the child completed a similar filler task (5-7 min). Next, the recognition test was introduced, including the instruction, provided repeatedly, to answer all of the recognition test questions only on the basis of what was actually seen in the video. After completing the recognition test, participants were asked not to discuss the film or study procedure with others.

Results

First, we were interested in confirming that the selected negative and positive events based on Study 1 were really representative of negative and positive emotional autobiographical events frequently experienced by the new sample of participants within the same age range than participants in Study 1. To this end, participants in Study 2 were asked whether or not they ever had experienced an event as the one showed in the video, and to rate the emotional intensity of the event they just watched on a 5-point Likert scale (from 0 = “not intense at all” to 4 = “very intense”).

For participants who watched the negative event, 71% indicated that they had experienced a similar event. They also attributed an average emotional intensity of 3.05 ($SD = 1.19$) to the negative event. Among the participants who watched the positive event, 78% of them reported having experienced a similar event, and attributed an emotional intensity of 3.46 ($SD = 1.33$) to this event. Thus, most participants in Study 2 had similar negative and positive experiences, and they attributed a high emotional intensity to both events (over 3 points on a scale from 0 to 4).

Next, a series of 2 (Age: 8- to 9-year-olds vs. 10- to 12-year-olds) x 2 (Event Valence: negative vs. positive) x 2 (Misleading Information: misinformed vs. control) x 2 (Centrality: central vs. peripheral) mixed ANOVAs was conducted, with centrality as the only within-subject factor. All significant effects are reported.

Misinformation Effects

Participants' answers to the 10 misinformation questions were scored as misled (i.e., consistent with the narrative's misinformation), new foil (i.e., the new alternative that included incorrect information not presented in the video or in the misleading narrative), correct (i.e., information presented in the video), and “don't know” responses (Table 3).

Memory and Suggestibility for Emotional Events across Middle Childhood

Table 3

Mean proportions of misled, new foil, correct, and “don’t know” responses to misinformation questions by Age, Misleading Information, and Centrality

Age	Misinformed			Control			Total		
	Central	Peripheral	Mean	Central	Peripheral	Mean	Central	Peripheral	Mean
Total									
Misled Responses	.40 (.27)	.43 (.27)	.42 (.24)	.10 (.14)	.13 (.15)	.11 (.12)	.25 (.27)	.28 (.26)	.27 (.24)
New Foil Responses	.10 (.13)	.04 (.09)	.07 (.09)	.05 (.10)	.08 (.12)	.07 (.08)	.07 (.12)	.06 (.11)	.07 (.09)
Correct Responses	.45 (.29)	.42 (.26)	.43 (.24)	.79 (.21)	.60 (.22)	.69 (.17)	.62 (.31)	.51 (.26)	.56 (.25)
“Don’t know” Responses	.05 (.12)	.11 (.16)	.08 (.12)	.06 (.12)	.19 (.23)	.13 (.14)	.06 (.12)	.15 (.20)	.10 (.13)
8- to 9-years-old									
Misled Responses	.47 (.24)	.43 (.25)	.45 (.20)	.13 (.16)	.21 (.16)	.17 (.12)	.31 (.27)	.33 (.24)	.32 (.22)
New Foil Responses	.11 (.15)	.05 (.10)	.08 (.10)	.09 (.12)	.10 (.14)	.09 (.10)	.10 (.14)	.07 (.12)	.09 (.10)
Correct Responses	.36 (.25)	.39 (.25)	.38 (.21)	.73 (.26)	.57 (.23)	.65 (.20)	.53 (.31)	.48 (.26)	.50 (.25)
“Don’t know” Responses	.06 (.14)	.13 (.17)	.09 (.14)	.05 (.12)	.12 (.18)	.09 (.13)	.06 (.13)	.12 (.18)	.09 (.13)
10- to 12-years-old									
Misled Responses	.35 (.29)	.43 (.28)	.39 (.26)	.08 (.13)	.07 (.12)	.08 (.10)	.21 (.26)	.24 (.28)	.23 (.25)
New Foil Responses	.09 (.12)	.04 (.09)	.06 (.08)	.03 (.08)	.08 (.11)	.05 (.07)	.06 (.10)	.06 (.11)	.06 (.08)
Correct Responses	.51 (.30)	.44 (.27)	.48 (.26)	.83 (.17)	.61 (.22)	.72 (.14)	.66 (.29)	.53 (.26)	.60 (.24)
“Don’t know” Responses	.05 (.11)	.09 (.14)	.07 (.10)	.06 (.11)	.24 (.24)	.15 (.14)	.06 (.11)	.17 (.21)	.11 (.13)

Note. Standard deviations in parentheses.

The analysis of proportion of misled responses revealed significant main effects of age, $F(1, 219) = 9.97, p < .01, \eta^2_p = .04$, and misleading information, $F(1, 219) = 141.04, p < .001, \eta^2_p = .39$. Younger compared to older children produced a higher proportion of misled responses. Children in the misinformed condition selected a higher proportion of misled alternatives than did those in the control condition.

The ANOVA for the new foil responses failed to reveal any significant effects. In contrast, the analysis of correct responses showed, consistent with results from the misled response analysis, that older children were more correct in responding to misinformation questions than 8- to 9-year-olds, $F(1, 219) = 9.15, p < .01, \eta^2_p = .04$. Also, the main effects of misleading information, $F(1, 219) = 87.03, p < .001, \eta^2_p = .28$, and centrality, $F(1, 219) = 33.87, p < .001, \eta^2_p = .13$, were subsumed by a significant Misleading Information x Centrality interaction, $F(1, 219) = 20.77, p < .001, \eta^2_p = .09$. Simple effects analyses revealed that children who did not receive misinformation

produced a higher proportion of correct responses to central than peripheral misinformation questions, $F(1, 112) = 60.47, p < .001, \eta^2_p = .35$. However, misinformed participants did not exhibit significant differences in their correct responses in relation to misinformation centrality.

Finally, a significant main effect of centrality emerged in the analysis of “don’t know” responses, $F(1, 219) = 46.55, p < .001, \eta^2_p = .18$. As would be expected, questions related to central misinformation generated a lower proportion of “don’t know” responses than questions that referred to peripheral misinformation.

In summary, we found age-related differences in misinformation effects for emotional events, even with the inclusion of an explicit response alternative that permitted participants to say “don’t know.” Of special interest, children who did not receive misinformation were more correct to central versus peripheral misinformation questions, but this difference for centrality did not emerge for the misinformed group. There were no significant effects of event valence on misinformation acceptance.

Participants’ Compliance and Performance on Specific-Incorrect Questions

To examine children’s compliance for false information presented only at the retrieval phase, responses to the 10 specific-incorrect questions were scored as proportion compliant (i.e., “yes” incorrect responses). Incorrect (i.e., “no” incorrect responses), correct, and “don’t know” responses were also examined (Table 4). A series of 2 (Age: 8- to 9-year-olds vs. 10- to 12-year-olds) x 2 (Event Valence: negative vs. positive) x 2 (Misleading Information: misinformed vs. control) x 2 (Centrality: central vs. peripheral) mixed model ANOVAs, with the latter factor varied within-participants, was conducted separately for each type of response (e.g., compliant response, correct response) as the dependent measure.

The analysis of compliant responses showed significant main effects of age and centrality. Compared to older children, 8- to 9-year-olds complied more with the inaccurate information contained in specific-incorrect questions, $F(1, 219) = 23.54, p < .001, \eta^2_p = .10$. Also, consistent with prediction, peripheral versus central specific-incorrect questions resulted in a higher proportion of compliant responses, $F(1, 219) = 45.34, p < .001, \eta^2_p = .17$. Moreover, a significant Event Valence x Misleading Information interaction emerged, $F(1, 219) = 16.54, p < .001, \eta^2_p = .07$ (Figure 1). Scheffé post-hoc analyses revealed that children assigned to the control condition (i.e., those who were not misinformed) who watched the negative event produced a lower proportion of compliant responses than those who watched the positive event, $p < .05$. This difference for event valence was not significant for misinformed participants. Although not indexing compliance per se, children's incorrect (i.e., responding incorrectly "no" to specific-incorrect questions), correct, and "don't know" responses to the specific-incorrect questions were also of interest. Separate ANOVAs revealed significant centrality main effects. Specific-incorrect questions related to central versus peripheral information resulted in a lower proportion of incorrect responses, $F(1, 219) = 27.30, p < .001, \eta^2_p = .11$, a higher proportion of correct responses, $F(1, 219) = 61.29, p < .001, \eta^2_p = .22$, and also a lower proportion of "don't know" responses, $F(1, 219) = 53.46, p < .001, \eta^2_p = .20$. Moreover, the main effect of age was significant for correct responses, $F(1, 219) = 18.71, p < .001, \eta^2_p = .08$. Compared to younger children, 10- to 12-year-olds produced a higher proportion of correct responses to specific-incorrect questions.

In summary, compared to older children, younger children were less correct and complied more with false information embedded in specific-incorrect questions. Also, compliance was lower for control participants who watched the negative event than

Table 4

Mean proportions of compliant, incorrect, correct, and “don’t know” responses to specific-incorrect questions by Age and Centrality

Age	Centrality		Mean
	Central	Peripheral	
Total			
Compliant Responses	.13 (.16)	.22 (.20)	.18 (.16)
Incorrect Responses	.12 (.15)	.06 (.10)	.09 (.09)
Correct Responses	.58 (.23)	.43 (.22)	.50 (.18)
“Don’t know” Responses	.17 (.19)	.29 (.25)	.23 (.19)
8- to 9-years-old			
Compliant Responses	.18 (.20)	.27 (.22)	.23 (.18)
Incorrect Responses	.15 (.15)	.08 (.10)	.11 (.09)
Correct Responses	.52 (.21)	.38 (.24)	.45 (.19)
“Don’t know” Responses	.15 (.19)	.27 (.27)	.21 (.21)
10- to 12-years-old			
Compliant Responses	.09 (.12)	.18 (.18)	.13 (.13)
Incorrect Responses	.10 (.14)	.05 (.10)	.08 (.08)
Correct Responses	.63 (.23)	.47 (.20)	.55 (.16)
“Don’t know” Responses	.18 (.19)	.30 (.24)	.24 (.18)

Note. Standard deviations in parentheses.

for those control participants who watched the positive event. But this response pattern was only true for children who did not receive misleading information. As expected, children’s performance was superior for central compared to peripheral specific-incorrect questions regardless of the response options.

Performance on Specific-Correct Questions

Participants’ performance on 20 specific-correct questions was examined to assess recognition accuracy. These questions did not contain false information, and they were not related to the misinformation contained in the narrative text. Therefore, children’s responses to the two incorrect alternatives were scored together as proportion of incorrect responses. Three ANOVAs, as described earlier, were computed separately for proportion of correct, incorrect, and “don’t know” responses (Table 5).

Table 5

Mean proportions of correct, incorrect, and “don’t know” responses to specific-correct questions by Age and Centrality

Age	Centrality		Mean
	Central	Peripheral	
Total			
Correct Responses	.75 (.15)	.61 (.15)	.68 (.12)
Incorrect Responses	.16 (.13)	.23 (.14)	.19 (.11)
“Don’t know” Responses	.09 (.12)	.16 (.16)	.13 (.12)
8- to 9-years-old			
Correct Responses	.74 (.17)	.60 (.16)	.67 (.13)
Incorrect Responses	.16 (.12)	.26 (.14)	.21 (.11)
“Don’t know” Responses	.10 (.15)	.14 (.15)	.12 (.14)
10- to 12-years-old			
Correct Responses	.75 (.15)	.61 (.15)	.68 (.11)
Incorrect Responses	.16 (.14)	.21 (.13)	.18 (.11)
“Don’t know” Responses	.09 (.10)	.18 (.16)	.14 (.11)

Note. Standard deviations in parentheses.

Analyses revealed significant main effects of centrality across all three dependent measures. Specific-correct questions related to central versus peripheral information resulted in a higher proportion of correct responses, $F(1, 219) = 119.79, p < .001, \eta^2_p = .35$, a lower proportion of incorrect responses, $F(1, 219) = 43.58, p < .001, \eta^2_p = .17$, and a lower proportion of “don’t know” responses, $F(1, 219) = 51.65, p < .001, \eta^2_p = .19$. Moreover, the analysis of incorrect responses showed a significant Age x Event Valence interaction, $F(1, 219) = 8.51, p < .01, \eta^2_p = .04$ (Figure 2). Simple effects revealed that, compared to younger children, 10- to 12-year-olds who watched the negative event produced a lower proportion of incorrect responses, $F(1, 113) = 11.84, p < .01, \eta^2_p = .10$. The simple effect of age was not significant for participants assigned to the positive event condition. Also, of special interest, older children who watched the negative event produced a lower proportion of incorrect responses than those who

watched the positive event, $F(1, 137) = 6.18, p < .05, \eta^2_p = .04$. However, this effect of event valence was not significant for 8- to -9-year-olds.

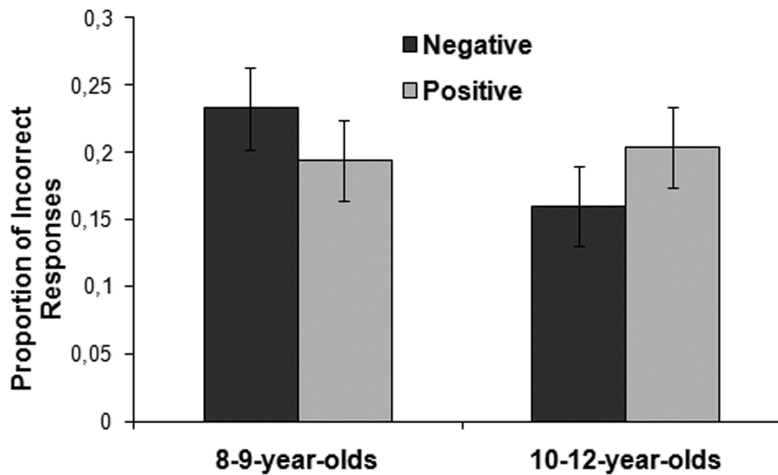


Figure 2. Mean proportions of incorrect responses to specific-correct questions as a function of Event Valence and Age.

In summary, participants' performance on specific-correct questions was superior for central versus peripheral information. Significant effects of centrality emerged across all dependent measures. Developmental differences in children's performance for negative versus positive emotional events were observed. Older children assigned to the negative event condition were less incorrect than younger children, and older children were less incorrect in answering specific-correct questions about the negative than the positive video.

Correlations between Participants' Performance on Misinformation Questions and Specific-Incorrect Questions

Correlational analyses examined whether, as predicted, children's responses to misinformation questions and specific-incorrect questions were significantly related. A significant correlation between errors to the misinformation questions and compliance with specific-incorrect questions was expected especially for peripheral false

information. Half of the participants were exposed to the misinformation narrative, and thus could be included in these analyses. Children’s age was partialled (Table 6).

Table 6

Correlations between participants’ responses to specific-incorrect questions and misinformation questions for central and peripheral information

Misinformation Questions				
Specific-Incorrect Questions	Misled Responses	New Foil Responses	Correct Responses	“Don’t know” Responses
	Total			
Compliant Responses	.20*	.34**	-.16	-.25**
Incorrect Responses	-.01	.12	.09	-.24*
Correct Responses	-.09	-.08	.24*	-.24*
“Don’t know” Responses	-.03	-.25**	-.14	.53***
	Central Information			
Compliant Responses	.03	.18*	-.08	-.09
Incorrect Responses	-.03	-.02	.09	-.12
Correct Responses	-.03	-.05	.14	-.20*
“Don’t know” Responses	.04	-.08	-.17	.42**
	Peripheral Information			
Compliant Responses	.25**	.28**	-.20*	-.26**
Incorrect Responses	-.01	.11	.12	-.25**
Correct Responses	-.08	-.04	.20*	-.17
“Don’t know” Responses	-.13	-.23*	-.06	.45***

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

Overall, when centrality was not considered, the correlation between compliant responses to specific-incorrect questions (i.e., compliance) and misled responses to misinformation questions (i.e., misinformation effect) was significant. Children who complied more with specific-incorrect questions were also more suggestible in terms of the misinformation effect. However, this significant correlation was primarily the result of children’s performance on peripheral questions. Thus, certain children showed a *general* tendency to accept false information (misinformation presented in the narrative and in specific-incorrect questions), especially in regard to peripheral details. Also, compliance with false information in specific-incorrect questions was significantly

associated with new foil response errors, and this was true for both central and peripheral false information. A comparable pattern was observed for correct responses to specific-incorrect questions and correct responses to misinformation questions overall. Children who could resist inaccurate information contained in specific-incorrect questions were also less adversely affected by misinformation, especially regarding peripheral false information.

Finally, the correlations between saying “don’t know” to the specific-incorrect and misinformation questions were especially high and significant, indicating that some children had a tendency to say “don’t know.” And, of interest, responding “don’t know” to misinformation questions was negatively associated with errors in responding to specific-incorrect questions (i.e., compliant and incorrect responses). Also, there was a significant negative correlation between “don’t know” responses to specific-incorrect questions and new foil incorrect responses to misinformation questions. These significant negative associations were also primarily the result of children’s performance regarding peripheral false information.

Discussion

Our second study investigated age-related differences in memory and suggestibility for central and peripheral information as a function of the emotional valence of representative events and in the extent to which children’s compliance predicted misinformation effects. For doing so, we tested misinformation effects, compliance and recognition accuracy in a new sample of 227 8- to 12-year-old children. Our results revealed that older children showed less memory malleability and compliance with false information relative to younger children. Moreover, developmental improvements in recognition accuracy were evident only for the children who watched the negative event, but not for those who watched the positive event.

Finally, children's compliance with false information predicted misinformation effects, especially in regard to peripheral details.

GENERAL DISCUSSION

The present studies investigated the frequency and intensity of negative and positive events experienced by typically developing 8- to 12-year-olds and age-related differences during this childhood period in eyewitness memory and suggestibility for representative experiences as a function of event valence and information centrality. Our results constitute the first empirical evidence showing age-related decreases in suggestibility (misinformation effects and compliance) during middle childhood using representative and intense emotional (negative and positive) stimuli, as well as showing that compliance predicted misinformation effects for peripheral false information during this age period. Moreover, consistent with previous evidence, our results suggest that middle childhood participants exhibit lower compliance to false information embedded in specific-incorrect questions for negative versus positive events, and that the memory advantage of negative information for recognition memory also increases during this age period.

Representative Emotional Experiences during Middle Childhood Years

Our first study characterized children's ratings of their more frequent negative and positive autobiographical experiences and the emotional intensity of such experiences. Similar to the findings of previous studies on children's and adults' narrative content and structure of emotional autobiographical experiences, most of the self-reported events by our middle childhood sample included negative and positive experiences involving relationships (e.g., "playing with friends," "fights with friends"), including with family (e.g., "parental anger/punishment," "excursions/travels with parents"); school events (e.g., "negative evaluations at school," "field trips at school");

and experiences focused on the self (e.g., “accidents/illness,” “winning contests/competitions”) (e.g., Bohanek et al., 2005). “Accidents/illnesses” and “excursions/travels with parents” were, respectively, the most widely reported negative and positive autobiographical experiences with high emotional intensity during this age period.

Middle childhood is one of the most prevalent age periods in which child witnesses are required to testify in criminal cases in relation to emotionally charged events (e.g., Quas & Goodman, 2012). However, much of the research on child witnesses’ memory and suggestibility has extensively relied on neutral events as stimuli. Although children’s testimony is also required at times about neutral events, understanding children’s memory and suggestibility about representative negative and positive events is important for a comprehensive theory of memory and emotion development and for applications of basic research to the law. Our study sheds light on the type of emotional experiences that can be utilized as representative target events in studies of children’s memory and suggestibility. The use of these target events with elementary-school aged children helps to ensure that information is self-relevant and emotionally intense, and may substantially increase the ecological validity of the results. Finally, it is also important to indicate that despite advantages of the utilized procedures, our study differs from more ecological field studies and studies wherein participants’ memory and suggestibility is examined in regard to highly stressful events experienced (e.g., Goodman, Quas, Batterman-Faunce, Riddlesberger, & Kuhn, 1997). In our study, participants viewed emotionally arousing events experienced by others.

Age Differences in Memory and Suggestibility during Middle Childhood

Findings from our second study revealed consistent age differences in misinformation effects, compliance, and recognition accuracy. First, children aged 10 to 12 exhibited a lower proportion of misled responses and a higher proportion of

correct responses to misinformation questions compared to children aged 8 to 9. There are only a handful of studies that have specifically examined misinformation effects across middle childhood groups. Our findings are consistent with previous misinformation studies showing age-related changes in misinformation effects between early and late middle childhood (e.g., Ackil & Zaragoza, 1995; Otgaar et al., 2009). Past null effects may simply reflect failures to detect existing differences, as noted by Holliday et al. (2002). Inconsistencies in the methods (e.g., type of target events, retention intervals) and in testing procedures (e.g., cued recall, recognition) between studies make it difficult to reconcile mixed results.

Second, identical age differences were also observed for specific-incorrect questions intended to measure compliance, with older children showing a lower proportion of compliant responses and a higher proportion of correct responses relative to younger children. Previous empirical evidence has consistently shown age-related improvements during middle childhood in the ability to correctly reject false information embedded in misleading questions (e.g., Cassel & Bjorklund, 1995; Roebbers et al., 2005). Thus, with age, compliance or acceptance of false information based on social influence decreases (e.g., Eisen et al., 2007). In the present study, misinformation effects thought to be due to cognitive and/or social factors (the latter including compliance) exhibited similar developmental trends.

Finally, our findings also showed that age effects in recognition accuracy interacted with event valence. More specifically, older children who watched the negative event were more correct in their responses to specific-correct questions than younger children who also watched the negative event. In contrast, there were no age differences for participants assigned to the positive event condition. This finding is consistent with results from previous studies showing age-related increases in

recognition accuracy during the middle childhood years (e.g., Flin et al., 1992). Also, recent evidence has suggested that negative versus positive materials are particularly likely to capture developmental differences in recognition memory (e.g., Brainerd et al., 2010; but see Cordon et al., 2013).

In sum, our findings confirm the existence of age-related increases in child witnesses' performance across middle childhood. Middle childhood has been characterized as a developmental period wherein improvements occur in higher cognitive functions, including response inhibition, cognitive inhibition, and working memory (e.g., Davidson, Amso, Anderson, & Diamond, 2006; Kail, 2002). Recent behavioral and neuroimaging evidence has also demonstrated important age increases in declarative memory in late middle childhood associated with maturational changes in medial temporal lobes and prefrontal cortex (e.g., Ghetti & Angelini, 2008; Paz-Alonso, Ghetti, Donohue, Goodman, & Bunge, 2008). Future research should examine the extent to which improvements in memory recollection and executive functioning mirror age differences in child witness memory and suggestibility during middle childhood.

Misinformation, Compliance, and Centrality Effects

Misinformation effects were robust across age groups even with the explicit response option of "don't know." The inclusion of this alternative helps to control for guessing and source monitoring conflicts between the original and suggested information alternatives (Higham, 1998). Overall, our results confirmed that misinformation increased children's selection of suggested items as having been seen in the original event. Can we therefore conclude that misinformation impaired/interfered with memory of the original information?

On the one hand, compared to other procedures (e.g., the modified procedure, McCloskey & Zaragoza, 1985), the inclusion of the suggested item among the response

alternatives to misinformation questions increased our recognition test sensitivity to capture certain forms of memory alteration (e.g., Belli, 1989; Loftus, Schooler, & Wagenaar, 1985). On the other hand, by including the suggested item as an alternative, we increased the possible influence of social factors on misinformation acceptance and the tendency to select the most recently encountered information (McCloskey & Zaragoza, 1985). To reduce social influence, we repeatedly told participants to respond only on the basis of what they saw and heard in the video (e.g., Chambers & Zaragoza, 2001). Moreover, we explored if responding “yes” incorrectly to specific-incorrect questions (i.e., compliance) was associated with misinformation effects, as an indication of the possible influence of social factors on misinformation effects.

Our results showed positive associations between these suggestibility measures, indicating that misinformed children who complied with the false information contained in specific-incorrect questions also tended to be suggestible in terms of the misinformation effect. However, the overall positive associations between compliance and misinformation were primarily the result of children’s performance regarding peripheral information. Weaker memory for less salient peripheral information may increase witness susceptibility to rely on suggested false information. In fact, centrality effects (i.e., better performance for central vs. peripheral information) were consistent across all the dependent measures included in the present study. According to trace strength theories, memory integrity depends on the verbatim or gist nature of the trace and on operations that affect trace-codification levels (e.g., Brainerd & Reyna, 1998). Emotionally intense materials such the ones used in the present study might facilitate elaborative processes, especially during encoding, leading to gains in memory for central versus peripheral information (e.g., Adolphs et al., 2001; Berntsen & Thomsen, 2005; Burke et al., 1992; Phelps, 2006). These results are also consistent with findings

from research using thematically induced arousing events, which are similar to the type of events we used in Study 2, showing better memory for central aspects than for peripheral details (e.g., Laney et al., 2004).

In sum, our findings suggest that even when trying to reduce social influences, misinformation effects in regard to peripheral information of emotional events were due to some extent to social factors. Of note, this social influence occurred with a methodological approach that incorporated common features involved in applied eyewitness settings (e.g., emotional events, a “don’t know” response option).

Effects of Event Valence on Children’s Memory and Suggestibility

As previously indicated, event valence interacted with age to affect children’s recognition accuracy. The negative event condition produced less incorrect responses in older versus younger children. Additionally, event valence interacted with the misleading information condition to influence participants’ compliant responses to specific-incorrect questions, such that children in the control group who watched the negative event produced fewer compliant responses than those who watched the positive event. Of interest, misinformed participants did not show the beneficial effect of the negative event valence in reducing compliant responses, which suggests that exposure to misinformation during the retention interval eliminates the beneficial effects of negative valence in reducing child witness compliance.

Overall, our results are consistent with evidence from the few existent studies examining the effects of event valence on children’s memory accuracy and compliance, which showed that children tend to be less accurate and to assent to a greater extent to positive or neutral false events compared to negative false events (e.g., Ceci & Huffman, 1997; Ceci et al., 1994; Schaaf et al., 2008).

The prioritized processing and greater attentional resources toward negative compared to positive and neutral stimuli, may increase the likelihood that negative information will be subsequently remembered and more resistant to suggestions (e.g., Cordon et al., 2013). These effects have been explained by the potentially greater adaptive value of dedicating special cognitive resources to negative information from different research paradigms and theoretical accounts, such as *post-stimulus elaboration* (Christianson, 1992), *bias towards negative information* account (Vaish, Grossmann, & Woodward, 2008), *range-frequency theory* (Helson, 1964), *diagnosticity theory* (Skowronski & Carlston, 1989), the *mobilization-minimization hypothesis* (Taylor, 1991), and *survival processing* (Nairne & Pandeirada, 2010).

Implications for Forensic Practice

Children's memory and suggestibility are key issues in child witness cases because of concerns about the reliability of children's evidence (e.g., Goodman & Quas, 2008). Moreover, because a hallmark of crimes is that their emotional content, the question of whether witness memory and suggestibility is affected regarding such content is of special relevance. Regardless of age, child witnesses exhibited higher memory accuracy and less suggestibility in regard to central compared to peripheral details of emotional events. The central nature of information may lead to stronger memory traces and decrease children's reliance on false information provided during memory interviews or by adult figures during the time interval between the crime and children's testimony.

However, our findings also suggest that, under certain conditions, younger children may be less accurate and less resistant to false information presented either during the retention interval (i.e., misinformation) or during the memory test (i.e., compliance) relative to older children, even within the restricted age range we studied.

Thus, an implication for forensic practice is to consider carefully the accuracy of information embedded in forensic interview questions and to assess, as possible, the extent to which children might have been exposed to false information during the interval between the crime under investigation and the forensic interview. This may be especially important when interviewing young children.

However, forensic implications of our findings should be carefully considered for several reasons. For example, in our study, children simply watched a movie, they were not tested with free recall questions, they were not interviewed in a forensic context, they knew that no one would get in trouble, and so forth. Thus, generalization to actual forensic situations involving child witnesses should be made very cautiously.

Conclusion

We characterized the 8- to 12-year-old's reports of the frequency and intensity of autobiographical negative and positive events they recently experienced. Using ecologically representative emotional events to examine children's memory and suggestibility, we found age-related increases in resistance both to misinformation effects and compliance within middle childhood. Age-related improvements in recognition accuracy were also evident between younger and older children who watched the negative event but not for those who watched the positive event. Compliance predicted misinformation effects, especially in regard to peripheral details. Finally, negative valence reduced compliance in children who were not previously misinformed and also reduced memory errors with age. These findings contribute to basic developmental research on memory and emotion, with implications for the science of child forensic psychology.

References

- Ackil, J. K., & Zaragoza, M. S. (1995). Developmental differences in eyewitness suggestibility and memory for source. *Journal of Experimental Child Psychology, 60*, 57-83.
- Adolphs, R., Denburg, N. L., & Tranel, D. (2001). The amygdala's role in long-term declarative memory for gist and detail. *Behavioral Neuroscience, 115*, 983-992.
- Af Hjelmsater, E. M., Granhag, P. A., Stronmwall, L. A., & Memon, A. (2008). The effects of social influence on children's memory reports: The omission and commission error asymmetry. *Scandinavian Journal of Psychology, 49*, 507-513.
- Ayers, M. S., & Reder, L. M. (1998). A theoretical review of the misinformation effect: Predictions from an activation-based memory model. *Psychonomic Bulletin & Review, 5*, 1-21.
- Bekerian, D. A., & Bowers, J. M. (1983). Eyewitness testimony: Were we misled? *Journal of Experimental Psychology: Learning, Memory, and Cognition, 9*, 139-145.
- Belli, R. F. (1989). Influences of misleading postevent information: Misinformation interference and acceptance. *Journal of Experimental Psychology: General, 118*, 72-85.
- Berntsen, D. (2002). Tunnel memories for autobiographical events: Central details are remembered more frequently from shocking than from happy experiences. *Memory & Cognition, 30*, 1010-1020.
- Berntsen, D., & Thomsen, D. K. (2005). Personal memories for remote historical events: Accuracy and clarity of flashbulb memories related to World War II. *Journal of Experimental Psychology: General, 134*, 242-257.

- Bohanek, J. G., Fivush, R., & Walker, E. (2005). Memories of positive and negative emotional events. *Applied Cognitive Psychology, 19*, 51-66.
- Brainerd, C. J., & Reyna, V. F. (1998). Fuzzy-trace theory and children's false memory. *Journal of Experimental Child Psychology, 71*, 81-129.
- Brainerd, C. J., & Reyna, V. F. (2005). *The science of false memory*. New York: Oxford University Press.
- Brainerd, C. J., Reyna, V. F., & Ceci, S. J. (2008). Developmental reversals in false memory" A review of data and theory. *Psychological Bulletin, 134*, 343-382.
- Brainerd, C. J., Holliday, R. E., Reyna, V. F., Yang, Y., & Togli, M. P. (2010). Developmental reversals in false memory: Effects of emotional valence and arousal. *Journal of Experimental Child Psychology, 107*, 137-154.
- Bright-Paul, A., & Jarrold, C. (2009). A temporal discriminability account of children's eyewitness suggestibility. *Developmental Science, 12*, 647-661.
- Bright-Paul, A., & Jarrold, C. (2012). Children's eyewitness memory: Repeating post-event misinformation reduces the distinctiveness of a witnessed event. *Memory, 20*, 818-835.
- Bright-Paul, A., Jarrold, C., & Wright, D. (2005). Age-appropriate cues facilitate source-monitoring and reduce suggestibility in 3-to 7-year-olds. *Cognitive Development, 20*, 1-18.
- Brown, J. M. (2003). Eyewitness memory for arousing events: Putting things into context. *Applied Cognitive Psychology, 17*, 93-106.
- Bruck, M., & Ceci, S. J. (1999). The suggestibility of children's memory. *Annual Review of Psychology, 50*, 419-439.
- Bruck M., & Ceci, S. J. (2004). Forensic developmental psychology: Unveiling four common misconceptions. *Current Directions in Psychological Science, 13*, 229-232.

- Budson, A. E., Todman, R. W., Chong, H., Adams, E. H., Kensinger, E. A., & Krangel, T. S. (2006). False recognition of emotional word lists in aging and Alzheimer's disease. *Cognitive and Behavioral Neurology, 19*, 71-78.
- Burke, A., Heuer, F. y Reisberg, D. (1992). Remembering emotional events. *Memory and Cognition, 20*, 277-290.
- Cahill, L., & McGaugh, J. L. (1998). Mechanisms of emotional arousal and lasting declarative memory. *Trends in Neuroscience, 21*, 294-299.
- Cassel, W. S., & Bjorklund, D. F. (1995). Developmental patterns of eyewitness memory and suggestibility: An ecologically based short-term longitudinal study. *Law and Human Behavior, 19*, 507-532.
- Cassel, W. S., Roebbers, C. M., & Bjorklund, D. F. (1996). Developmental patterns of eyewitness responses to repeated and increasingly suggestive questions. *Journal of Experimental Child Psychology, 61*, 116-133.
- Ceci, S. J., & Huffman, M. L. C. (1997). How suggestible are preschool children? Cognitive and social factors. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*, 948-958.
- Ceci, S. J., Loftus, E. F., Leichtman, M. D., & Bruck, M. (1994). The possible role of source misattributions in the creation of false beliefs among preschoolers. *International Journal of Clinical and Experimental Hypnosis, 42*, 304-320.
- Ceci, S. J., Ross, D. F., & Tolia, M. P. (1987). Suggestibility of children's memory: Psycholegal implications. *Journal of Experimental Psychology: General, 116*, 38-49.
- Chambers, K. L., & Zaragoza, M. S. (2001). Intended and unintended effects of explicit warnings on eyewitness suggestibility: Evidence from source identification tests. *Memory & Cognition, 29*, 1120-1129.

Christianson, S. Å. (1992). Emotional stress and eyewitness memory: A critical review.

Psychological Bulletin, *112*, 284-309.

Christianson, S.-A., & HübINETTE, B. (1993). Hands up! A study of witnesses' emotional

reactions and memories associated with bank robberies. *Applied Cognitive*

Psychology, *7*, 365-379.

Christianson, S. Å., & Lindholm, T. (1998). The fate of traumatic memories in

childhood and adulthood. *Development and Psychopathology*, *10*, 761-780.

Christianson, S.-A., & Loftus, E. F. (1991). Remembering emotional events: The fate

of detailed information. *Cognition and Emotion*, *5*, 81-108.

Cordon, I. M., Melinder, A. M. D., Goodman, G. S., & Edelman, R. (2013). Children's

and adults' memory for emotional pictures: examining age-related patterns using the

Developmental Affective Photo System. *Journal of Experimental Child*

Psychology, *114*, 339-356.

Davidson, M. C., Amso, D., Anderson, L. C., & Diamond, A. (2006). Development of

cognitive control and executive functions from 4 to 13 years: evidence from

manipulations of memory, inhibition, and task switching. *Neuropsychologia*, *44*,

2037-2078.

Dougal, S., & Rotello, C. M. (2007). "Remembering" emotional words is based on

response bias, not recollection. *Psychonomic Bulletin & Review*, *14*, 423-429.

Eakin, D. K., Schreiber, T. A., & Sergent-Marshall, S. (2003). Misinformation effects in

eyewitness memory: The presence and absence of memory impairment as a function

of warning and misinformation accessibility. *Journal of Experimental Psychology:*

Learning, Memory, and Cognition, *29*, 813-825.

- Eisen, M. L., Goodman, G. S., Qin, J., Davis, S., & Crayton, J. (2007). Maltreated children's memory: Accuracy, suggestibility, and psychopathology. *Developmental Psychology, 43*, 1275-1294.
- Elischberger, H. B. (2005). The effects of prior knowledge on children's memory and suggestibility. *Journal of Experimental Child Psychology, 92*, 247-275.
- Fivush, R., Marin, K., Crawford, M., Reynolds, M., & Brewin, C. R. (2007). Children's narratives and well-being. *Cognition and Emotion, 21*, 1414-1434.
- Gabbert, F., Memon, A., & Allan, K. (2003). Memory conformity: Can eyewitnesses influence each other's memories for an event? *Applied Cognitive Psychology, 17*, 533-543.
- Gee, S., & Pipe, M. E. (1995). Helping children to remember: The influence of object cues on children's accounts of a real event. *Developmental Psychology, 31*, 746-758.
- Ghetti, S., & Angelini, L. (2008). The development of recollection and familiarity in childhood and adolescence: evidence from the dual- process signal detection model. *Child Development, 79*, 339-358.
- Goodman, G. S., Hirschman, J. E., Hepps, D., & Rudy, L. (1991). Children's memory for stressful events. *Merrill-Palmer Quarterly, 37*, 109-158.
- Goodman, G. S., & Quas, J. A. (2008). Repeated interviews and children's memory: It's more than just how many. *Current Directions in Psychological Science, 17*, 386-390.
- Goodman, G. S., Quas, J. A., & Ogle, C. M. (2010). Child maltreatment and memory. *Annual Review of Psychology, 61*, 325-351.

- Goodman, G. S., Taub, E. P., Jones, D. P. H., England, P., Port, L. K. et al (1992).
Testifying in criminal court. *Monographs of the Society for Research in Child
Development, 57* (5, Serial No. 229).
- Gray, E. (1993). *Unequal justice: The prosecution of child sexual abuse*. New York:
Free Press.
- Gudjonsson, G. H. (1988). Interrogative suggestibility: Its relationship with
assertiveness, social-evaluative anxiety, state anxiety and method of coping. *British
Journal of Clinical Psychology, 27*, 159-166.
- Heath, W. P., & Erickson, J. R. (1998). Memory for central and peripheral actions and
props after varied post-event presentation. *Legal and Criminological Psychology, 3*,
321-346.
- Helson, H. (1964). *Adaptation-level theory: An experimental and systematic approach
to behavior*. New York, NY: Harper and Row.
- Heuer, F., & Reisberg, D. (1990). Vivid memories of emotional events: The accuracy
of remembered minutiae. *Memory and Cognition, 18*, 496-506.
- Higham, P. A. (1998). Believing details known to have been suggested. *British Journal
of Psychology, 89*, 265-283.
- Holliday, R. E., Douglas, K., & Hayes, B. K. (1999). Children's eyewitness
suggestibility: Memory trace strength revisited. *Cognitive Development, 14*, 443-
462.
- Holliday, R. E., Reyna, V. F., & Hayes, B. K. (2002). Memory processes underlying
misinformation effects in child witnesses. *Developmental Review, 22*, 37-77.
- Howe, M. L., Candel, I., Otgaar, H., Malone, C., & Wimmer, M. C. (2010). The role of
valence in the development of immediate and long-term false memory illusions.
Memory, 18, 58-75.

- Howe, M. L., Courage, M. L., & Peterson, C. (1995). Intrusions in preschooler's recall of traumatic childhood events. *Psychonomic Bulletin and Review*, 2, 130-134.
- Ibabe, I., & Sporer, S. L. (2004). How you ask is what you get: On the influence of question form on accuracy and confidence. *Applied Cognitive Psychology*, 18, 1-16.
- Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin*, 114, 3-28.
- Kail, R. (2002). Developmental change in proactive interference. *Child Development*, 73, 1703-1714.
- Kensinger, E. A. (2004). Remembering emotional experiences: The contribution of valence and arousal. *Reviews in the Neurosciences*, 15, 241-251.
- Kensinger, E. A., & Schacter, D. L. (2006). Processing emotional pictures and words: Effects of valence and arousal. *Cognitive, Affective, & Behavioral Neuroscience*, 6, 110-126.
- Koriat, A., & Goldsmith, M. (1994). Memory in naturalistic and laboratory contexts: Distinguishing the accuracy-oriented and quantity-oriented approaches to memory assessment. *Journal of Experimental Psychology: General*, 123, 297-315.
- Koriat, A., & Goldsmith, M. (1996). Monitoring and control processes in the strategic regulation of memory accuracy. *Psychological Review*, 103, 490-517.
- Laney, C., Campbell, H. V., Heuer, F., & Reisberg, D. (2004). Memory for thematically arousing events. *Memory & Cognition*, 32, 1149-1159.
- Lee, K. (2004). Age, neuropsychological, and social cognitive measures as predictors of individual differences in susceptibility to the misinformation effect. *Applied Cognitive Psychology*, 18, 997-1019.
- Lehman, E. B., McKinley, M. J., Thompson, D. W., Leonard, A. M., Liebman, J. I., Rothrock, D. D. (2010). Long-term stability of young children's eyewitness

- accuracy, suggestibility, and resistance to misinformation. *Journal of Applied Developmental Psychology*, *31*, 145-154.
- Libkuman, T. M., Stabler, C. L., & Otani, H. (2004). Arousal, valence, and memory for detail. *Memory*, *12*, 237-247.
- Loftus, E. F. (1975). Leading questions and the eyewitness report. *Cognitive Psychology*, *7*, 560-572.
- Loftus, E. F. (1979). *Eyewitness testimony*. Cambridge, MA: Harvard University Press.
- Loftus, E. F., Miller, D. G., & Burns, H. J. (1978). Semantic integration of verbal information into a visual memory. *Journal of Experimental Psychology: Human Learning and Memory*, *4*, 19-31.
- Loftus, E. F., Schooler, J. W., & Wagenaar, W. A. (1985). The fate of memory: Comment on McCloskey & Zaragoza. *Journal of Experimental Psychology: General*, *114*, 375-380.
- London, K., Bruck, M., & Melnyk, L. (2009). Post-event information affects children's autobiographical memory after one year. *Law Human Behavior*, *33*, 344-355
- McCloskey, M., & Zaragoza, M. S. (1985). Misleading postevent information and memory for events: Arguments and evidence against memory impairment hypotheses. *Journal of Experimental Psychology: General*, *117*, 171-181.
- Memon, A., Holliday, R. E., & Hill, C. (2006). Pre-event stereotypes and misinformation effects in young children. *Memory*, *14*, 104-114.
- Otgaar, H. P., Candel, I., & Merckelbach, H. (2008). Children's false memories: Easier to elicit for a negative than a neutral event. *Acta Psychologica*, *128*, 350-354.
- Otgaar, H. P., Candel, I., Merckelbach, H., & Wade, (2009). Abducted by a UFO: Prevalence information affects young children's false memories for an implausible event. *Applied Cognitive Psychology*, *23*, 115-125.

- Nairne, J. S., & Pandeirada, J. N. S. (2010). Adaptive memory: Ancestral priorities and the mnemonic value of survival processing. *Cognitive Psychology*, *61*, 1-22.
- Paz-Alonso, P. M., Ghetti, S., Donohue, S., Goodman, G. S., & Bunge, S. A. (2008). Neurodevelopmental correlates of true and false recognition. *Cerebral Cortex*, *19*, 2208–2216.
- Paz-Alonso, P. M., & Goodman, G. S. (2008). Trauma and memory: Effects of post-event misinformation, retrieval order, and retention interval. *Memory*, *16*, 58-75.
- Paz-Alonso, P. M., Goodman, G. S., & Ibabe, I. (2013). Adult eyewitness memory and compliance: Effects of post-event misinformation on memory for a negative event. *Behavioral Sciences & Law*, *31*, 541-558.
- Paz-Alonso, P. M., Larson, R., Castelli, P., Alley, D., & Goodman, G. S. (2009). Memory development: Emotion, stress, and trauma. In M. L. Courage & N. Cowan (Eds.), *The development of memory in infancy and childhood* (2nd Edition). Hove, England: Psychology Press.
- Paz-Alonso, P. M., Ogle, C. M., & Goodman, G. S. (2013). Children’s memory in scientific case studies of child sexual abuse: A review. In B. S. Cooper, D. Griesel, & M. Ternes (Eds.), *Applied issues in investigative interviewing, eyewitness memory, and credibility assessment* (pp. 143-171). New York: Springer.
- Pezdek, K., & Roe, C. (1995). The effect of memory trace strength on suggestibility. *Journal of Experimental Child Psychology*, *60*, 116-128.
- Phelps, E. (2006). Emotion and cognition: Insights from studies of the human amygdala. *Annual Review of Psychology*, *57*, 27-53.
- Poole, D. A., & Lindsay, D. S. (2002). Reducing child witnesses’ false reports of misinformation from parents. *Journal of Experimental Child Psychology* *81*, 117-140.

- Quas, J. A., & Goodman, G. S. (2012). Consequences of criminal court involvement for child victims. *Psychology, Public Policy, & Law, 18*, 392-414.
- Reisberg, D., & Heuer, F. (2004). Memory for emotional events. In D. Reisberg & P. Hertel (Eds.), *Memory and emotion* (pp. 3-41). New York: Oxford University Press.
- Roberts, K. P., & Powell, M. B. (2007). The roles of prior experience and the timing on misinformation presentation on young children. *Child Development, 78*, 1137-1152.
- Roebbers, C. M., & Schneider, W. (2000). The impact of misleading questions on eyewitness memory in children and adults. *Applied Cognitive Psychology, 14*, 509-526.
- Roebbers, C. M., & Schneider, W. (2005) The strategic regulation of children's memory performance and suggestibility. *Journal of Experimental Child Psychology, 91*, 24-44.
- Roebbers, C. M., Schwartz, S., & Neumann, R. (2005). Social influence and children's event recall and suggestibility. *European Journal of Developmental Psychology, 2*, 47-69.
- Roediger, H.L., Meade, M.L., & Bergman, E. (2001). Social contagion of memory. *Psychonomic Bulletin Review, 8*, 365-371.
- Saunders, J. (2012). The role of self-esteem in the misinformation effect. *Memory, 20*, 90-99.
- Schaaf, J. M., Alexander, K. W., & Goodman, G. S. (2008). Children's false memory and true disclosure in the face of repeated questions. *Journal of Experimental Child Psychology, 100*, 157-185.
- Schmidt, S. R. (2004). Autobiographical memories for the September 11th attacks: Reconstructive errors and emotional impairment of memory. *Memory & Cognition, 32*, 443-454.

- Schwartz-Kenney, B. M., & Goodman, G. S. (1999). Children's memory of a naturalistic event following misinformation. *Applied Developmental Science, 3*, 34-46.
- Scullin, M. H., & Ceci, S. J. (2001). A suggestibility scale for children. *Personality and Individual Differences, 30*, 843-856.
- Shapiro, L. R., Blackford, C., & Chiung-Fen, C. (2005). Eyewitness memory for a simulated misdemeanor crime: The role of age and temperament in suggestibility. *Applied Cognitive Psychology, 19*, 489-506.
- Sharot, T., & Phelps, E. A. (2004). How arousal modulates memory: Disentangling the effects of attention and retention. *Cognitive, Affective, & Behavioral Neuroscience, 4*, 294-306.
- Skowronski, J.J., & Carlston, D.E. (1989). Negativity and extremity biases in impression formation: A review of explanations. *Psychological Bulletin, 105*, 131-142.
- Taylor, S. E. (1991). Asymmetrical effects of positive and negative events: The mobilization-minimization hypothesis. *Psychological Bulletin, 110*, 67-85.
- Vaish, A., Grossmann, & Woodward, A. (2008). Not all emotions are created equal: The negativity bias in socialemotional development
- Wells, G. L., & Bradfield, A. L. (1998). "Good, you identified the suspect": Feedback to eyewitnesses distorts their reports of the witnessing experience. *Journal of Applied Psychology, 83*, 360-376.
- Wessel, I., van der Kooy, P., & Merckelbach, H. (2000). Differential recall of central and peripheral details of emotional slides is not a stable phenomenon. *Memory, 8*, 95-100.