2 Misinformation Effect in Older Versus Younger Adults
A Meta-Analysis and Review

Lindsey E. Wylie, Lawrence Patihis, Leslie L. McCuller, Deborah Davis, Eve M. Brank, Elizabeth F. Loftus, and Brian H. Bornstein

Introduction

The United States is getting older. According to the U.S. Census Bureau, adults over the age of 65 were the fastest growing subpopulation in 2010, and in fact, more people were over the age of 65 than in any previous census (U.S. Census Bureau, 2011). These age trends are projected to continue so that by 2050, one in every five persons will be aged 65 or older (Shrestha & Heisler, 2011). This increase in the proportion of older adults is not only happening in the United States; the United Kingdom projects an estimated 23% increase of adults over 65 years of age between 2010 and 2018 (Rutherford, 2012). In Asia, where 55% of the world’s population of older people live, the proportion of the population aged 60 and over is expected to increase from 11% in 2012 to 24% in 2050 (United Nations, 2012). Even lesser developed regions of the world are expecting an aging of their populations with similar trends in both absolute and relative size of the older adult populations (United Nations, 2012). Demographic projections indicate that in the next several decades the world will see an increase in older adults never before experienced. Because older adults will make up a large proportion of the population, we can expect more older adults to become involved in the legal system, often as witnesses to key events (Eglit, 2004). Psycholegal researchers have extensively studied eyewitness memory for events (e.g., Toglia, Read, Ross, & Lindsay, 2006); however, inconsistent findings about age differences between older and younger adults in eyewitness ability make it difficult to form conclusions about how eyewitness age should influence policy and practice, if at all (e.g., Dodson & Krueger, 2006; Loftus, Levidow, & Duensing, 1992).

Generally speaking, older adults are perceived as having difficulties with cognition and memory compared with younger adults. Although not always the case, it is well known that memory performance in older adults can decrease with age (Moulin, Thompson, Wright, & Conway, 2007). A research review and quantitative meta-analysis can assist in understanding whether these memory differences are due only to age or whether there are additional methodological factors that are related to how memory is measured that may contribute to these differences. This chapter reviews research examining age differences in
memory distortion arising from misleading postevent influences. The goals of this chapter are twofold: (a) to examine age differences between older and younger adults in susceptibility to misinformation and (b) to identify factors that may moderate age differences between older and younger adults. First, we review previous research that has examined age differences in the misinformation effect. Then, we present the results from a meta-analysis that quantitatively measures overall effects and moderators. Last, we discuss legal implications, methodological issues, and suggestions for future research.

What Is the Misinformation Effect?

More than 30 years of research have found that when people receive misleading information after an event, it can lead to memory distortion for the original event (e.g., Loftus, Miller, & Burns, 1978). This phenomenon is now widely referred to as the misinformation effect (Loftus, 2005). Misinformation experiments typically involve three phases. In Phase 1, participants are exposed to a complex event, usually through a video, slides, or photographs. In Phase 2, some time later and unbeknownst to them, participants who are in a misled condition are presented—usually via questions or a narrative description—with some inaccurate information about the event that is intended to mislead them about specific details. In Phase 3, participants’ memory for the original event is tested. Research has demonstrated that the inaccurate information in Phase 2 may become part of the original memory.

For example, one of the earliest experiments in this area involved showing a series of slides, including one of a car stopped at a stop sign (see Figure 2.1; from Experiment 2 in Loftus et al., 1978; other participants saw the same car stopped at a yield sign). After a delay, participants were provided with misleading information (e.g., a “yield” sign when they had seen the “stop” sign, or vice versa) surreptitiously embedded within a recall question. Later the participants

![Figure 2.1](image)

*Figure 2.1* Basic design of a classic misinformation study (Loftus et al., 1978). These materials were also used in one of the studies in our meta-analysis (Bornstein, Witt, Cherry, & Greene, 2000).
were asked what they remembered of the original event. The findings revealed that of those who received the misleading information, 57% indicated they saw the “yield” sign (i.e., the misleading item) in the original event. Numerous replications of this methodology demonstrate, in general, that a sizable proportion of participants incorporate the misleading information into their memory for the event detail compared with control groups who do not receive misleading information (see Davis & Loftus, 2007, for a review). Following these early studies using the misinformation paradigm, subsequent research has examined potential moderators of the misinformation effect—including the age of the witness.

The Misinformation Effect in Older Adults

When older adults are subjected to the misinformation paradigm, most studies have found that they are more susceptible to misinformation than younger adults (e.g., Polczyk et al., 2004; Roediger & Geraci, 2007). However, several studies have not found significant age differences (e.g., Bornstein, Witt, Cherry, & Greene, 2000; Coxon & Valentine, 1997; Dodson & Krueger, 2006; Marche, Jordan, & Owre, 2002) or reverse effects where younger adults are more susceptible to misinformation than older adults (e.g., Marche et al., 2002). In one of the earliest known published studies of the topic, Cohen and Faulkner (1989) had both older (between 62 and 82 years old) and younger (between 25 and 45 years old) participants watch a short video, followed by exposure to either accurate or misleading information. The study found that older adults were not only more susceptible to misinformation, but they also were more confident that their flawed memory was correct. Age differences for the misinformation effect also have been demonstrated in more ecologically valid field settings such as during massage therapy (Mueller-Johnson & Ceci, 2004) and a museum visit (Loftus et al., 1992).

General Memory Deficiencies and Source Monitoring

To understand whether older adults’ greater susceptibility to misinformation is merely the result of general memory deficiencies (due to encoding or retrieval), many studies have measured both general memory for nonmisleading details and memory for misleading details. These studies, however, have yielded mixed findings. Some studies have found that older adults performed more poorly on general memory tasks than younger adults, suggesting that deficiencies in general memory ability may contribute to age differences in the misinformation effect (e.g., Karpel, Hoyer, & Toglia, 2001; Schacter, Koutstaal, Johnson, Gross, & Angell, 1997; Searcy, Bartlett, & Memon, 2000), whereas other studies have found that older adults performed as well as younger adults on remembering the events they witnessed but were more likely to be influenced by misinformation (e.g., Cohen & Faulkner, 1989; Loftus et al., 1992).
General memory differences also depend upon the type of memory that is being tested. For instance, older adults perform more poorly on memory tasks that require self-initiated effort and spontaneous use of retrieval strategies, but they perform better when the task is less demanding and they are provided retrieval cues (e.g., see Bornstein, 1995; Craik, 1977). Within eyewitness research, this is demonstrated by age differences when memory is tested as free recall questions (i.e., open-ended question on memory for detail) or facial recognition (i.e., lineups). Research reviews have indicated that even though older adults seem to freely recall fewer correct details than younger adults, there are fewer age differences for recognizing event details or crime perpetrators (Bornstein, 1995; Moulin et al., 2007). Perhaps retrieval cues assist older adults with problems in source monitoring, which has been the primary explanation for age differences in previous misinformation studies (e.g., Karpel et al., 2001; Mueller-Johnson & Ceci, 2004), because the cues provide older adults with the contextual information necessary to retrieve accurate memories.

Source monitoring refers to judgments about the source of the information rather than the content of the information (Johnson, Hashtroudi, & Lindsay, 1993); thus, older adults may be less able to discern whether information was encoded during Phase 1 (original information) or Phase 2 (misleading information). Misinformation research has found that when asked to remember whether the source of the information was from the original presentation or subsequent presentations of information, older adults had decreased false responding compared with older adults who were just asked to recognize the information as true in a yes–no recognition task (Multhaup, de Leonardis, & Johnson, 1999; Roediger & Geraci, 2007). When comparing whether these effects hold true for younger adults who have lower rates of false responding, it appears that prompting younger adults to identify the source of the information does not change false responding (Roediger & Geraci, 2007). Source monitoring, like that demanded by the misinformation effect paradigm, is a cognitively demanding task and one that older adults do better at when asked to consider the source more carefully.

**Participant Age**

The age of the sample in misinformation effect studies also may influence acceptance of misinformation because definitions of older adult and younger adult vary across studies (Brank, 2007). Mostly, studies have examined older adults as a single homogeneous sample, even though deficiencies in memory may differ within older adult subgroups. In addition, most studies have utilized college students as their younger sample, but a few studies have included samples that include people approaching middle age (Cohen & Faulkner, 1989; Loftus et al., 1992; Ross, Spencer, Blatz, & Restorick, 2008). In an ecologically valid setting, Loftus et al. (1992) had museumgoers watch a video of a political rally and provided a postevent text narrative containing misinformation. Those under age 10 and those over age 65 were the most susceptible to
misinformation, but between the ages of 11 and 65, susceptibility to misinformation seemed to plateau (see Table 2.1). Wylie, Brank, and Bornstein (2012) examined different age groups of older adults (under age 75 and age 75 and older; they also treated age as a continuous variable). The “old-older” adults were more susceptible to misinformation than the “young-older” adults, and the “young-older” adults’ acceptance of misleading information was not any different from that of college students. This study suggests a general pattern whereby having an older sample of older adults may contribute to greater susceptibility; however, additional studies are required that consider this pattern as well as how the age of the younger adult sample may affect findings.

**Methodological Differences**

Studies that have examined age differences in the misinformation effect have employed a variety of methods. For example, some studies have presented the original event stimulus (Phase 1) as a video (e.g., Schacter et al., 1997), slides (e.g., Karpel et al., 2001), or word pairs (e.g., Jacoby, Bishara, Hessels, & Toth, 2005). Similarly, studies have presented the misleading information (Phase 2) as text in questions (Dodson & Krueger, 2006), text in narratives (e.g., Roediger & Geraci, 2007), or photographs (e.g., Rémy, Taconnat, & Isingrini, 2008). Acceptance of misinformation (Phase 3) also has been tested in a variety of methods. Studies have tested memory using both recognition (e.g., Mitchell, Johnson, & Mather, 2003) and recall (e.g., Saunders & Jess, 2010). Finally, studies also have varied the time between the presentation of the event and the misinformation, such that the difference was sometimes immediate (e.g., Mitchell et al., 2003) or a matter of weeks (Schacter et al., 1997). This variety highlights both the diversity in methods for examining the misinformation effect and the need for a meta-analysis to provide insight into possible factors that might moderate and explain age differences in misinformation susceptibility.
Meta-Analysis

Although a review of the literature is informative with respect to the moderating effects of variables for individual studies, meta-analytic procedures provide an aggregate analysis of the overall effects across studies with different methods. Furthermore, given inconsistent findings from studies that have examined age differences for the misinformation effect, a meta-analysis is valuable for determining whether there is an overall effect (and the magnitude of such an effect) when comparing older and younger adult samples as well as to investigate possible moderators.

Method

Locating Studies

An online search was conducted using the following databases: PsycINFO, PubMed, Social Science Citation Index (Social SciSearch), and Education Resources Information Center (ERIC). The keywords included were older with eyewitness, elderly with eyewitness, aging with eyewitness, age difference with eyewitness, older with false memory, elderly with false memory, aging with false memory, age difference with false memory, older with misinformation, elderly with misinformation, aging with misinformation, and age difference with misinformation. Given a possible publication bias for studies with statistically significant findings, attempts were made to collect unpublished data. E-mails requesting unpublished studies were sent to a psychology and law LISTSERV and to researchers who have published in the area of the misinformation effect and/or aging and eyewitness memory. In addition, a complete search was conducted of references cited in articles and book chapters already obtained.

Selection Criteria

Studies were included that compared younger adults with older adults and were excluded when comparison groups included only children. As noted, definitions of when a person becomes an “older adult” can be quite fluid and differ depending on the source (Brank, 2007). The lowest mean age reported among the older groups within the located studies was 64 years old; the highest mean age was 81 years old. Younger adults’ groups had mean ages ranging from 17 to 35 years old. If the study included a young adult sample, an older adult sample, and a child sample, we coded only the comparisons made between the younger and older adults and excluded comparisons that involved children (e.g., Coxon & Valentine, 1997). In addition, we did not include studies with a single sample that examined only young adults or only older adults (e.g., Chan, Thomas, & Bulevich, 2009). Other exclusion criteria included studies that compared older adults who had Alzheimer’s disease or other forms of brain damage affecting memory. Furthermore, we did not
include studies that involved only memory recall without first providing misleading information, such as studies examining false recognition using methodology like the Deese–Roediger–McDermott paradigm (Deese, 1959; Roediger & McDermott, 1995) because this paradigm involves false memories created by word associations but does not involve the introduction of misleading information directly. Because each effect size should be derived from an independent sample, studies also were checked for independence and included only if the participant data were original and not republished.

Sample

The final sample consisted of 39 independent effect sizes examining the misinformation effect with a total of 3,534 participants (older adults = 1,415; young adults = 2,119). The final sample included 19 published articles, one published book chapter, and three unpublished dissertations or theses. Study publication dates (or filing dates for dissertations and theses) ranged from 1989 to August 2012. Most of the studies included college students for the young adult sample; however, three studies included community samples for the young adult sample: Cohen and Faulkner (1989), with $M_{\text{age}} = 35$ years old; Loftus et al. (1992), with ages ranging from 19 to 35; and Ross et al. (2008), with $M_{\text{age}} = 33$ years old. The older adult participants in all the studies were community dwellers.

Coded Variables

Three authors (LEW, LP, LLM) of the current chapter participated in coding such that each study was independently coded twice to ensure accuracy. We coded several variables thought to be related to either individual sample differences or methodological differences. Any discrepancies were discussed and modified based on consensus of the coders. The variables of interest were age of the older adult sample, the presence of a crime in the stimulus, how the initial event was presented, the method for misinforming participants, the amount of time between the initial stimulus and the misinformation provided, the amount of time between the misinformation and the memory test, whether the induction of misinformation was a within- or between-groups variable, and acceptance of misinformation (the dependent measure in each study, generally reported as means or proportion of participants who were misled). We also coded for publication-related variables such as whether the study was published and year of publication.

Analysis of Effect Sizes

According to the procedures outlined by Lipsey and Wilson (2001), standardized effect sizes were calculated for the mean differences between older and younger adults for each study’s dependent variable.$^2$ For studies where all
Misinformation Effects

groups received misinformation (i.e., no control group), we compared mean differences for older and younger adults. For studies that were between groups on the misinformation variable (i.e., compared a control condition to a misled condition), we compared mean differences for older adults and younger adults in only the misled condition so that effect sizes would be comparable to the within-groups studies. If there were data for more than one age group that fell within our defined age parameters, (Loftus et al., 1992; Wylie et al., 2012), the data were merged and a single effect size was computed.

Effect sizes were calculated as product–moment correlation coefficient $r$ values and then transformed using Fisher’s $Z$ transform (Hedges & Olkin, 1985; Lipsey & Wilson, 2001) because of problematic standard error formation associated with product-moment correlation coefficients (e.g., Rosenthal, 1994). All analyses then were converted back to the more familiar units of $r$ and are presented in the text as weighted mean effect sizes ($r_m$). Finally, for all studies that reported null effects, an effect size of 0 was employed (Rosenthal, 1995). By convention, when two groups are contrasted, a positive sign is assigned to effect sizes in the hypothesized direction (i.e., older adults are more susceptible), and a negative sign is assigned to effect sizes that are not in the hypothesized direction (i.e., older adults are less susceptible). Because studies have different sample sizes and effect sizes derived from sample statistics, each effect size was weighted using the inverse sampling error variance so that studies with larger samples would be given more weight than studies with smaller samples. A fail-safe N ($N_{fs}$) was calculated in order to determine the number of studies with averaged null effects that would need to be retrieved to bring the $p$-value above a specific level of significance ($\alpha = .05$). This allows estimates of the resistance to the “file drawer threat” (Rosenthal, 1995).

Homogeneity analysis revealed that the sample was not homogeneous at a greater probability than chance from sampling error ($Q = 557.61, df = 38, p < .001$); thus a mixed random effects model for testing moderators was used (Lipsey & Wilson, 2001). All effect size analyses and tests for homogeneity were conducted using Wilson’s (2010) meta-analysis macros for SPSS.

Results

Our first goal was to test the overall hypothesis that older adults are more susceptible to misinformation than younger adults. Of the 39 independent effect sizes, 31 showed effect sizes in the predicted direction (i.e., older adults are more susceptible to misinformation than younger adults); eight studies showed either the opposite effect or a null effect. Meta-analytic results revealed that older adults were more susceptible to misinformation. The computed random-effects weighted mean effect size was $r_m = .35$, 95% confidence interval (CI) [.22, .47], $Z = 4.94, p < .001; N_{fs} = 22$, which suggests a medium effect size (Lipsey & Wilson, 2001) in favor of the hypothesis that older adults are more susceptible to misinformation than younger adults. The
Nₙ calculation indicated that 22 studies with null results would be needed to reverse these findings. Table 2.2 contains a summary of the studies included with their effect sizes and effect size standard errors, and Figure 2.2 shows the results graphically.

**Table 2.2** Study Characteristics for All Studies in the Meta-Analysis—in Chronological Order

<table>
<thead>
<tr>
<th>First author¹</th>
<th>Year</th>
<th>N</th>
<th>Older adult mean age</th>
<th>Younger adult mean age</th>
<th>Effect size Zₑ</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams-Price</td>
<td>1989</td>
<td>120</td>
<td>b</td>
<td>b</td>
<td>−0.06</td>
<td>.09</td>
</tr>
<tr>
<td>Cohen</td>
<td>1989</td>
<td>64</td>
<td>70</td>
<td>35</td>
<td>0.29</td>
<td>.13</td>
</tr>
<tr>
<td>Loftus</td>
<td>1992</td>
<td>631</td>
<td>b</td>
<td>b</td>
<td>0.96</td>
<td>.04</td>
</tr>
<tr>
<td>Coxon</td>
<td>1997</td>
<td>95</td>
<td>70</td>
<td>17</td>
<td>0.00</td>
<td>.10</td>
</tr>
<tr>
<td>Schacter (shown once)</td>
<td>1997</td>
<td>32</td>
<td>68</td>
<td>18</td>
<td>0.12</td>
<td>.19</td>
</tr>
<tr>
<td>Schacter (shown thrice)</td>
<td>1997</td>
<td>32</td>
<td>68</td>
<td>18</td>
<td>0.33</td>
<td>.19</td>
</tr>
<tr>
<td>Schacter (shown once)</td>
<td>1997</td>
<td>32</td>
<td>68</td>
<td>19</td>
<td>0.37</td>
<td>.19</td>
</tr>
<tr>
<td>Searcy (Elvis)</td>
<td>2000</td>
<td>78</td>
<td>69</td>
<td>24</td>
<td>0.46</td>
<td>.12</td>
</tr>
<tr>
<td>Searcy (chipped-tooth)</td>
<td>2000</td>
<td>78</td>
<td>69</td>
<td>24</td>
<td>0.04</td>
<td>.12</td>
</tr>
<tr>
<td>Bornstein</td>
<td>2001</td>
<td>80</td>
<td>69</td>
<td>20</td>
<td>0.00</td>
<td>.11</td>
</tr>
<tr>
<td>Karpel</td>
<td>2001</td>
<td>122</td>
<td>73</td>
<td>19</td>
<td>0.20</td>
<td>.09</td>
</tr>
<tr>
<td>Marche (shown once)</td>
<td>2002</td>
<td>46</td>
<td>71</td>
<td>24</td>
<td>−0.69</td>
<td>.15</td>
</tr>
<tr>
<td>Marche (shown repeatedly)</td>
<td>2002</td>
<td>45</td>
<td>71</td>
<td>24</td>
<td>0.23</td>
<td>.15</td>
</tr>
<tr>
<td>Mitchell</td>
<td>2003</td>
<td>102</td>
<td>76</td>
<td>20</td>
<td>0.46</td>
<td>.10</td>
</tr>
<tr>
<td>Gabbert (confederate)</td>
<td>2004</td>
<td>105</td>
<td>69</td>
<td>21</td>
<td>−0.32</td>
<td>.10</td>
</tr>
<tr>
<td>Gabbert (narrative)</td>
<td>2004</td>
<td>105</td>
<td>69</td>
<td>21</td>
<td>−0.17</td>
<td>.10</td>
</tr>
<tr>
<td>Mueller-Johnson</td>
<td>2004</td>
<td>113</td>
<td>76</td>
<td>20</td>
<td>0.45</td>
<td>.10</td>
</tr>
<tr>
<td>Polczyk</td>
<td>2004</td>
<td>109</td>
<td>64</td>
<td>22</td>
<td>0.27</td>
<td>.10</td>
</tr>
<tr>
<td>Dodson</td>
<td>2006</td>
<td>72</td>
<td>68</td>
<td>19</td>
<td>0.32</td>
<td>.12</td>
</tr>
<tr>
<td>Roediger (yes–no test)</td>
<td>2007</td>
<td>23</td>
<td>75</td>
<td>19</td>
<td>1.62</td>
<td>.22</td>
</tr>
<tr>
<td>Roediger (source test)</td>
<td>2007</td>
<td>25</td>
<td>75</td>
<td>19</td>
<td>0.55</td>
<td>.21</td>
</tr>
<tr>
<td>Bulevich (E1)</td>
<td>2007</td>
<td>30</td>
<td>76</td>
<td>19</td>
<td>0.21</td>
<td>.19</td>
</tr>
<tr>
<td>Ross (collaborative)</td>
<td>2008</td>
<td>33</td>
<td>74</td>
<td>33</td>
<td>0.81</td>
<td>.18</td>
</tr>
<tr>
<td>Ross (nominal)</td>
<td>2008</td>
<td>31</td>
<td>74</td>
<td>33</td>
<td>0.89</td>
<td>.19</td>
</tr>
<tr>
<td>Rémy(full-attention)</td>
<td>2008</td>
<td>30</td>
<td>70</td>
<td>26</td>
<td>0.76</td>
<td>.19</td>
</tr>
<tr>
<td>Rémy(demanding task)</td>
<td>2008</td>
<td>30</td>
<td>71</td>
<td>28</td>
<td>1.08</td>
<td>.19</td>
</tr>
<tr>
<td>Saunders (contradictory)</td>
<td>2010</td>
<td>80</td>
<td>70</td>
<td>22</td>
<td>0.18</td>
<td>.11</td>
</tr>
<tr>
<td>Saunders (memorable)</td>
<td>2010</td>
<td>80</td>
<td>72</td>
<td>21</td>
<td>0.41</td>
<td>.11</td>
</tr>
<tr>
<td>Holliday (cognitive interv.)</td>
<td>2011</td>
<td>30</td>
<td>66</td>
<td>22</td>
<td>−0.21</td>
<td>.19</td>
</tr>
<tr>
<td>Holliday (structured interv.)</td>
<td>2011</td>
<td>29</td>
<td>66</td>
<td>22</td>
<td>0.37</td>
<td>.19</td>
</tr>
<tr>
<td>Bulevich (E1: cued recall)</td>
<td>2012</td>
<td>36</td>
<td>74</td>
<td>20</td>
<td>0.74</td>
<td>.17</td>
</tr>
<tr>
<td>Bulevich (E1: recognition)</td>
<td>2012</td>
<td>60</td>
<td>74</td>
<td>20</td>
<td>0.51</td>
<td>.13</td>
</tr>
<tr>
<td>Bulevich (E2: cued/standard)</td>
<td>2012</td>
<td>26</td>
<td>73</td>
<td>20</td>
<td>0.52</td>
<td>.21</td>
</tr>
<tr>
<td>Bulevich (E2: cued/support)</td>
<td>2012</td>
<td>27</td>
<td>73</td>
<td>20</td>
<td>0.32</td>
<td>.21</td>
</tr>
</tbody>
</table>

(Continued)
Table 2.2 (Continued)

<table>
<thead>
<tr>
<th>First author(a)</th>
<th>Year</th>
<th>(N)</th>
<th>Older adult mean age</th>
<th>Younger adult mean age</th>
<th>Effect size (Z_r)</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulevich (E2: recg/standard)</td>
<td>2012</td>
<td>30</td>
<td>73</td>
<td>20</td>
<td>1.05</td>
<td>.19</td>
</tr>
<tr>
<td>Bulevich (E2: recg/support)</td>
<td>2012</td>
<td>30</td>
<td>73</td>
<td>20</td>
<td>1.19</td>
<td>.19</td>
</tr>
<tr>
<td>Hess</td>
<td>2012</td>
<td>192</td>
<td>69</td>
<td>20</td>
<td>−0.03</td>
<td>.07</td>
</tr>
<tr>
<td>Wylie (nonpatronizing)</td>
<td>2012</td>
<td>76</td>
<td>74</td>
<td>21</td>
<td>0.42</td>
<td>.12</td>
</tr>
<tr>
<td>Wylie (patronizing)</td>
<td>2012</td>
<td>76</td>
<td>74</td>
<td>21</td>
<td>0.09</td>
<td>.12</td>
</tr>
</tbody>
</table>

Note. E1 = Experiment 1; interv. = interval; E2 = Experiment 2; recg = recognition.
\(a\)Condition in parentheses.
\(b\)Only age ranges were reported.

Figure 2.2 Graphical representation of meta-analytic results. Effect size measures represented are in \(Z_r\) units. The grey boxes surrounding the points represent the weight given to a study, and the error bars are 95% confidence intervals. E1 = Experiment 1; E2 = Experiment 2; recog = recognition.
Moderator Analyses

Our next goal was to identify any moderating variables that might explain the variability among effect sizes. For categorical variables, we used an inverse variance weight mixed random effects model analog to the one-way analysis of variance ANOVA method. For continuous variables, we used a modified random effects regression model estimated in maximum likelihood (see Table 2.3).

Sample Variables

Mean age of the samples. Our first analysis examined whether the age of the older and younger adult samples moderated the age differences found in misinformation studies using the continuous mean age variable for each sample. Longitudinal studies following healthy aging adults have found an age-related decline in the ability to acquire and retrieve new information (e.g., Small, Stern, Tang, & Mayeux, 1999), and previous eyewitness research has acknowledged theoretical differences between young-older and old-older adults (Brimacombe, Jung, Garrioch, & Allison, 2003). If studies compare young adults with different age groups of older adults, then differences across studies might be due to sample selection and biological aging but not necessarily procedural differences in methodology. Two studies were excluded from this analysis because they did not report the mean ages of their samples and instead reported age ranges (Adams-Price, 1989; Loftus et al., 1992).

In a regression that included the mean ages for the older and younger adult samples, the findings revealed that the mean age of the older adults was a significant predictor of effect size variability, $B = .06, SE = .02, 95\% CI [.02, .10], Z = 3.09, p < .01$. The regression weight indicates that as the mean age of the older adult sample increased, so did the effect sizes comparing older and younger adults on susceptibility to misinformation. On the other hand, the mean age of the younger adults was not a significant predictor of effect size, $B = .02, SE = .01, 95\% CI [-.01, .05], Z = 1.17, p = .24$; this is not surprising considering the lack of variability in age for the younger adult samples. It does seem that sample age is an important factor to consider because a substantial proportion of the effect size variability was accounted for by the mean age group predictors ($R^2 = .22$).

Methodological variables

Presence of Crime

A previous meta-analysis conducted by Deffenbacher, Bornstein, Penrod, and McGorty (2004; see also Penrod & Bornstein, 2007) suggested that increased stress could negatively affect the accuracy of eyewitnesses and that the presence of a staged crime increases effect sizes for the effects of stress on memory.
Table 2.3 Descriptives and Estimates for Moderator Analysis

<table>
<thead>
<tr>
<th>Moderator</th>
<th>Q</th>
<th>k</th>
<th>Level</th>
<th>B(SE)/r_m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>11.02*</td>
<td>37</td>
<td>Older adults</td>
<td>.06 (.02)**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>37</td>
<td>Younger adults</td>
<td>.01 (.01)</td>
</tr>
<tr>
<td>Presence of crime</td>
<td>0.87</td>
<td>28</td>
<td>Crime</td>
<td>.46***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>No crime</td>
<td>.32***</td>
</tr>
<tr>
<td>Presentation of the event</td>
<td>0.01</td>
<td>28</td>
<td>Video</td>
<td>.35***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>Slides/photographs</td>
<td>.35*</td>
</tr>
<tr>
<td>Method for misinforming participants</td>
<td>4.19</td>
<td>13</td>
<td>Narrative</td>
<td>.48***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15</td>
<td>Recall questions</td>
<td>.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>Photographs</td>
<td>.49*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Audio</td>
<td>.23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Confederates</td>
<td>.41†</td>
</tr>
<tr>
<td>Interval between initial stimulus and test for misinformation</td>
<td>1.96</td>
<td>27</td>
<td>No more than 1 hour</td>
<td>.38***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>Between 1 hour and 24 hours</td>
<td>.35**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Greater than 24 hours</td>
<td>.01</td>
</tr>
<tr>
<td>Test type</td>
<td>3.93</td>
<td>4</td>
<td>Free recall</td>
<td>.42**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>Forced/Multiple choice</td>
<td>.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td>Recognition</td>
<td>.41***</td>
</tr>
<tr>
<td>Design for misinformation variable</td>
<td>5.21*</td>
<td>25</td>
<td>Within groups</td>
<td>.46***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14</td>
<td>Between groups</td>
<td>.14</td>
</tr>
<tr>
<td>Publication date</td>
<td>6.34*</td>
<td>18</td>
<td>1989–2005</td>
<td>.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21</td>
<td>2006–present</td>
<td>.55***</td>
</tr>
<tr>
<td>Publication status</td>
<td>0.09</td>
<td>35</td>
<td>Published</td>
<td>.39***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Unpublished</td>
<td>.16</td>
</tr>
</tbody>
</table>

Note. Age is the only variable that was continuous; thus B and SE (in parentheses) are reported instead of r_m.
†p < .10. *p < .05. **p < .01. ***p < .001.
Furthermore, the meta-analysis results revealed the effects of stress on accuracy were moderated by age (children vs. adults). On the basis of these findings, we coded each study according to the content of the initial stimulus presented. Studies were coded as either crime (e.g., stealing a purse, robbery, murder; \( n = 28 \)) or no crime (e.g., listening to a short story; \( n = 10 \)). There was no moderating effect for presence of a crime on acceptance of misinformation, \( Q(1) = 0.87, p = .35 \). Although not a significant predictor for the variability in effect sizes, both stimulus types produced effect sizes that were significantly different from zero. The effect size was somewhat larger for noncrime stimuli, \( r_m = .46, 95\% \text{ CI } [0.20, 0.66], Z = 3.31, p < .001 \), than for the crime stimuli, \( r_m = .32, 95\% \text{ CI } [0.16, 0.47], Z = 3.77, p < .001 \). This pattern (albeit not significantly contributing to differences across studies) suggests that age differences may be more pronounced when the stimulus does not elicit stress. Future research should explore age differences within the eyewitness stress paradigm.

**Presentation of the Event**

Studies differed in the way they presented the initial event about which participants would later be misled. The studies were coded as either video (\( n = 28 \)) or slides/photographs (\( n = 9 \)). One study used an audio narrative and another study used a live event, but because only one study had each of these kinds of stimuli, they were dropped from the analysis. The manner in which the initial event was presented was a variable of interest due to differences in processing goal-directed stimuli (e.g., visually searching a still slide) versus stimulus-driven stimuli (e.g., a moving object’s involuntarily drawing visual attention in a video) as well as basic differences in the way visual and auditory stimuli are encoded (Corbetta & Shulman, 2002; Tulving & Thompson, 1973). Moderator analyses demonstrated that the type of stimulus used did not significantly predict differences in study effect sizes, \( Q(1) = 0.01, p = .98 \). In examining each method separately, however, both video presentations, \( r_m = .35, 95\% \text{ CI } [0.19, 0.50], Z = 4.07, p < .001 \), and slide/photographs, \( r_m = .35, 95\% \text{ CI } [0.06, 0.59], Z = 2.31, p = .02 \), showed significant effect sizes.

**The Method for Misinforming Participants**

Campbell, Edwards, Hrswill, and Helman (2007) have suggested that the modality of the presentation of the misinformation might influence test performance due to encoding specificity. Most studies embedded the misleading information into recall questions (\( n = 15 \)), followed by narratives (\( n = 13 \)), photographs (\( n = 5 \)), a confederate (\( n = 4 \)), and audio (\( n = 2 \)). One study misled participants with photographs containing misleading items, but this was dropped from analysis because of the small sample size. Moderator analyses demonstrated that how participants were misled did not significantly predict differences in study effect sizes, \( Q(1) = 4.19, p = .38 \). Of these approaches, two methods demonstrated significant effect sizes, including photographs, \( r_m = .49, 95\% \text{ CI } [0.09, 0.75], Z = 2.38, p < .05 \), and narratives, \( r_m = .48, 95\% \)
CI [.25, .66], \( Z = 3.82, p < .001 \). Use of confederates showed marginal significance, \( r_m = .41, 95\% \text{ CI } [-.04, .72], Z = 1.80, p = .07 \), but being misled with audio files, \( r_m = .23; 95\% \text{ CI } [-.27, .64], Z = 0.90, p = .37 \), and recall questions \( r_m = .18, 95\% \text{ CI } [-.05, .40], Z = 1.54, p = .12 \), did not demonstrate a significant mean effect size.

Time Interval From Encoding/Event to Retrieval/Test for Misinformation

Studies differed in the amount of time between the initial event and testing for misinformation. It is well established that longer retention intervals increase forgetting, for eyewitness events as well as for other kinds of episodic and semantic information (Bartlett & Memon, 2007; Deffenbacher, Bornstein, McGorty, & Penrod, 2008; Ebbinghaus, 1885/1913), and previous eyewitness research has found an increased difference between older and younger adults on recognition accuracy, with the delay increasing from 35 minutes to 1 week between presentation and testing (Memon, Bartlett, Rose, & Gray, 2003). We coded the amount of time that had passed between the initial event and when the participants were tested. The event-to-misinformation test interval was coded according to three categories: no greater than 1 hour \((n = 27)\), greater than 1 hour but less than 24 hours \((n = 9)\), and greater than 24 hours \((n = 3)\). The three studies that were coded as greater than 24 hours had participants leave and return (i.e., 3 weeks and 4 weeks). Results for this condition should be taken with caution because the sample sizes are small. Moderation analyses revealed that there was no significant moderation effect for retention interval, \( Q(2) = 1.96, p = .37 \), and there does not appear to be a difference in effect sizes between the no greater than 1 hour filler, \( r_m = .38, 95\% \text{ CI } [.22, .53], Z = 4.51, p < .001 \), and intervals greater than 1 hour but less than 24 hours, \( r_m = .35, 95\% \text{ CI } [.05, .59], Z = 2.29, p < .05 \); however, effect sizes do appear to decrease once participants are asked to return more than 24 hours later, \( r_m = .01, 95\% \text{ CI } [-.48, .49], Z = 0.04, p = .97 \). Research should continue to examine the role of delay and age differences in acceptance of misinformation.

Type of Test

We coded the studies based on three methods of memory measurement: cued recall \((n = 11)\), free recall \((n = 4)\), and recognition \((n = 24)\). Frequently, studies provided cued recall questions about critical items of misinformation (e.g., what color was the thief’s jacket?), whereas others would simply allow for free recall of all the details a participant remembered from the initial event. Recognition question type studies consisted of studies that used yes/no recognition, forced choice or multiple choice. The rationale for combining these test types is that none requires the respondent to generate the answer but rather asks for a recognition judgment based on the information given. Previous memory research has found that older adults have more difficulty with cued recall tests than they do with recognition tests because of increased cognitive demand.
in recall tests (Craik & McDowd, 1987). Hence, age differences in misinformation studies could depend upon the type of memory test used when testing acceptance of misinformation. Moderator analyses demonstrated that the type of test used (recognition, cued or free recall), $Q(2) = 3.93, p = .14$, did not significantly predict differences in study effect sizes. In examining each method separately, however, both free recall and recognition showed significant effect sizes, with the largest mean effect size for free recall measures, $r_m = .49$, 95% CI $[.10, .75]$, $Z = 2.40$, $p < .05$, followed by recognition $r_m = .41$, 95% CI $[.25, .55]$, $Z = 4.83$, $p < .001$. Conversely, studies using cued recall demonstrated a nonsignificant mean effect size, $r_m = .14$, 95% CI $[-.12, .39]$, $p = .28$.

Of the three coded methods for measuring acceptance of misinformation, free recall and recognition were significantly different from zero, suggesting that there are significant age differences for susceptibility to misinformation using these dependent variables but not with cued recall (given the small number of studies using free recall, that result should be interpreted with caution).

**With or Without Control Groups**

In the sample of studies we located, some studies gave misinformation to the entire sample ($n = 25$), whereas others included a group that was given misinformation and a control group that was not given misinformation ($n = 14$). Moderation analysis revealed that the studies without control groups had significantly larger effects sizes than those with control groups, $Q(1) = 5.21, p < .05$. Furthermore, those studies without a control group had a mean effect size that was significantly different from zero, $r_m = .46$, 95% CI $[.30, .60]$, $Z = 5.22$, $p < .001$, whereas the mean effect size for studies with control groups was not significantly different from zero, $r_m = .14$, 95% CI $[-.10, .37]$, $Z = 1.12$, $p = .26$.

In other words, the design of the study for the misinformation variable explains some of the variability in the effect sizes across studies. Because participants in the present analysis all received misinformation, regardless of the design, it is unclear why the presence or absence of an unanalyzed control group would make a difference. It is possible that some other variable or variables was or were confounded with the design; however, we were unable to identify any.

**Publication Variables**

In addition to estimator and system variables, moderator analyses also were conducted on two publication variables to examine whether effect size varied because of year of publication or publication status (Table 2.3).

**Publication Date**

Study publication date was categorized into two variables based on a median split and categorized as studies published or filed before 2006 ($n = 18$) or 2006 and later ($n = 21$). A significant moderation effect, $Q(1) = 6.34, p < .05$, was
detected, where more recent studies had a larger effect size, $r_m = .55$, 95% CI [0.34, 0.76], $Z = 5.23$, $p < .001$, than earlier studies, $r_m = .16$, 95% CI [−0.05, 0.38], $Z = 1.52$, $p = .12$.

Publication Status

To test whether there is a publication bias whereby effect sizes vary according to publication status, studies were coded as either published ($n = 35$) or unpublished ($n = 4$). There were no significant moderator effects for publication status, $Q(1) = .89$, $p = .35$; however, published studies had a mean effect size that was significantly different from zero, $r_m = .39$, 95% CI [.24, .54], $Z = 5.09$, $p < .001$, whereas unpublished studies did not, $r_m = .16$, 95% CI [−.28, .61], $Z = .72$, $p = .47$. Although there were relatively few unpublished studies in the analysis and there may be a lack of power to detect differences, the (nonsignificant) trend suggests there may be a bias in favor of publishing studies that obtain an age effect.

Discussion

In this meta-analysis, we have examined whether there are age differences between older and younger adults in the misinformation effect and the relative size of that effect across multiple studies. We found that older adults are significantly more susceptible to misinformation and that overall the effect is moderate in magnitude ($r_m = .35$). The strongest moderator for effect size variability appears to be the mean age of the samples—namely, when the mean age of the older adult sample is higher, differences between older and younger adults are larger. One reason for this could be developmental differences in memory between young-older adults and old-older adults; however, few eyewitness memory studies have acknowledged that older adults are heterogeneous and should probably be examined as separate samples (Brimacombe et al., 2003; Mueller-Johnson, Toglia, Sweeney, & Ceci, 2007)—as has been acknowledged in studies that examine children of different ages as separate samples (Pozzulo & Lindsay, 1998).

Previous research has suggested some underlying mechanisms for these developmental differences. One of the most noted reasons for differences in the misinformation effect is that older adults have problems with source monitoring compared with younger adults (Cohen & Faulkner, 1989; Hashtroudi, Johnson, & Chrosniak, 1989; Johnson et al., 1993; Rabinowitz, 1989). Research also has demonstrated that older adults’ problems with source monitoring can be improved by giving older adults explicit instructions to monitor memory (Bulevich & Thomas, 2012). Another possible mechanism that may explain aging differences in misinformation is structural changes in the brain that occur during normal aging (Anstey & Maller, 2003; Mungus et al., 2002; Pantel, Kratz, Essig, & Schröder, 2003; Scahill et al., 2003; Sullivan & Ruffman, 2004). Specifically, research has linked source monitoring type memory
problems to frontal lobe functioning of the brain and has suggested that this area of the brain is one of the first to decline with age (Albert & Kaplan, 1980; Craik, Morris, Morris, & Loewen, 1990; McIntyre & Craik, 1987; Woodruff, 1982). Taken together, this evidence tells us that one possible reason for older adults’ susceptibility to misinformation may be poorer source monitoring due to an age-related decline in frontal cortex functioning. Research on perception, attention, and working memory also show age-related declines (for a review, see Davis & Loftus, 2005).

Another moderator that accounted for the variability in effect sizes included the design of the study, where studies that measured misinformation without a control group (no misinformation) demonstrated stronger age differences than studies that had a control group. As noted, however, we are not clear as to why design may be moderating age differences; this effect may be confounded with another variable. There also were moderating effects for publication date, whereby more recent studies were more likely to show age difference effects than older studies. Several moderators, however, did not significantly explain the variability in effect sizes, even though some variables still contributed to significant effect sizes. We found that event type (crime or no crime), how the event was presented (video or slides/photographs), the method for misleading participants (narrative, recall questions, photographs, audio, or confederate), test type (free recall, cued recall, or recognition), publication status, and the time between the initial event and test for misinformation had no reliable influence on the magnitude of age-related deficits in the misinformation effect.

The failsafe N analysis suggested that 22 studies with null effects would be required to reverse the principal finding of an age effect. Although this number of studies is not extremely large, it is unlikely that so many exist in the file drawers of memory-distortion labs, given the inclusion here of several unpublished studies, the small number of researchers working in the area, and the difficulty of conducting research on elderly samples. However, the small failsafe N demonstrates a clear need for future studies. The fact that more recent studies had larger effect sizes could either mean the researchers are designing better, cleaner, and more controlled experiments or perhaps that there is a file drawer problem that has increased in recent years. It seems the former is more likely true because in our analysis, whether the article was published did not moderate the effect of age comparisons on susceptibility to misinformation.

Recommendations for Future Research

There were several potential moderating variables that were of interest for this meta-analysis but were not included because too few studies included the variable. These studies raise potential moderating variables that show promise for understanding age differences for the misinformation effect and should
be considered in future research. In addition, we discuss other related research findings that add context to the relationship between age and susceptibility to misinformation. The context provided by this related research is important to consider when making recommendations for future research and policy. Because these areas are not the main focus of the chapter, we will just reference them briefly (for more detail, see reviews by Bornstein, 1995; Davis & Loftus, 2005; Spencer & Raz, 1995).

Confidence

Confidence in memory reports can, of course, be influential in convincing others (e.g., police, judges, jurors) that the witness is credible. Almost half of the studies in our sample measured participant confidence in their judgments (43%). The findings were mixed: Some studies found that older adults were more confident in their false memories than younger adults (Cohen & Faulkner, 1989; Dodson & Krueger, 2006; Karpel et al., 2001; Mitchell et al., 2003), whereas others found that younger adults reported more confidence (Adams-Price, 1989; Bulevich, 2007; Wylie et al., 2012), and still others found no age–confidence differences at all (Bulevich & Thomas, 2012; Searcy et al., 2000). Similar to recommendations with other age groups, therefore, confidence should be taken with caution when assessing the credibility of older witnesses. Future research should examine whether confidence varies within older adult age groups and other variables that may moderate the effects of confidence and acceptance of misleading information.

Cognitive Interview Versus a Standard Structured Interview

As noted previously, older adults often have difficulties with generating contextual retrieval cues (Vakil, Hornik, & Levy, 2008). One method that has been explored for improving general memory accuracy for older eyewitnesses (i.e., without misinformation) is the Cognitive Interview versus the standard structured interview. The Cognitive Interview, which asks eyewitnesses to restate the context using multiple perspectives, has been demonstrated to elicit more information from older adults without reducing accuracy (Mello & Fisher, 1996). One study in our sample (Holliday et al., 2011) found that using either a structured interview (i.e., traditional interviewing techniques) or a cognitive interview can affect false responding. When tested using a modified Cognitive Interview, the older adults showed no misinformation effect, but when tested using the standard structured interview the older adults showed a misinformation effect (see also Holliday & Albon, 2004, where the Cognitive Interview reduced the misinformation effect in children). Future research should follow up on Holliday et al.’s (2011) findings, to examine whether the Cognitive Interview improves source monitoring and whether this is, indeed, a reliable method for reducing susceptibility to misinformation.
Distinctiveness Heuristic

Although they did not use a classic misinformation design, Dodson and Schacter (2002) found a novel way to reduce false memory rates in the elderly. Participants saw words or pictures, some of which were repeated, and they were later asked to recognize what they had witnessed. When older adults were primed to expect their memory to be vivid and distinct (the distinctiveness heuristic), the findings revealed that older adults showed less false recognition, and performance was similar to younger adults. Thus, telling older adults that their memory should be distinct and vivid seems to prevent false memory reports arising from weak nonvivid traces. These weak traces, after all, may have their source not in actual memory, but in reconstructions from ideas or imaginings. Given that false memory rates declined, the distinctiveness heuristic may be a promising area of research that should be investigated further within misinformation effect research.

Mood States

Previous research has noted that a person’s mood can influence the accuracy of memory (Forgas, Laham, & Vargas, 2005), and this applies to the misinformation effect as well. More specifically, negative mood seems to inhibit, whereas positive mood promotes, the misinformation effect (Forgas et al., 2005). The one study that measured mood in our sample found that negative mood in younger participants explained why older adults were more susceptible to the misinformation effect (Hess, Popham, Emery, & Elliot, 2012). According to Hess et al. (2012), negative moods are associated with careful scrutiny, whereas positive moods are associated with less careful and systematic attention. Hess and colleagues hypothesized that because older adults are more likely to have positive mood, they are less likely to scrutinize the misinformation carefully or actively consider the source. One caveat that should be noted, however, is that the authors were not reliably able to induce negative mood for older adults. Future research should further explore how mood and emotion affect memory and susceptibility to misinformation, as well as explore methods for inducing mood in different age groups.

Stereotype Threat and Assimilation

Research has shown that older adults are often perceived according to negative stereotypes (Cuddy, Norton, & Fiske, 2005) about their cognitive and memory abilities (Hertzog, Lineweaver, & McGuire, 1999; Kite & Johnson, 1988; Levy, 2003). Not only could these stereotypes affect perceivers such as investigators or jury members, but they also may affect memory performance for older adults themselves. Several studies have shown that when older adults are primed with negative stereotypes of aging (Levy, 1996; Stein, Blanchard-Fields, & Hertzog, 2002) or are subjected to stereotype threat conditions that create anxiety for confirming negative age stereotypes (Earles & Kersten, 1998; Hess, Auman,
Colcombe, & Rahhal, 2003), memory performance declines. One study in our sample (Wylie et al., 2012) examined the effect of patronizing communication on the misinformation effect and found that patronizing communication actually decreased susceptibility to misinformation. Although this suggests a paradoxical effect, other findings from this study suggest that participants who perceived and believed they would be subjected to age discrimination were more suggestible. Conversely, another study indicated that older adults’ false-memory susceptibility in a false-memory word recall paradigm decreased when negative stereotypes associated with aging and memory were deemphasized (Thomas & Dubois, 2011).

Although research in this area has not yet fully identified the mechanisms that contribute to poor memory performance associated with stereotypes, some research has found connections between poor performance and sympathetic physiological responses such as skin conductance, blood pressure, and heart rate (Levy, Hausdorff, Hencke, & Wei, 2000), whereas others have found that effects are due to the self-relevance of the stereotypes (O’Brien & Hummert, 2006). Future research should examine the effects of aging stereotypes and perhaps focus on strategies to improve older adults’ memory using this strategy. If researchers can find inventive ways to reverse the stereotype that older adults have poor cognition and memory, then it is possible that this could reduce memory errors in older adults. For instance, a recent study on stereotype threat and self-affirmation found that racial stereotype threat could be neutralized by a self-affirming writing exercise immediately before the test (Cohen, Garcia, Apfel, & Master, 2006). These kinds of manipulations could be attempted with older adults and the misinformation effect.

Methodological Issues

The methodology used by the studies in our meta-analysis mostly involved comparing relatively small groups of younger adults (usually college aged) with older adults in the laboratory setting. The studies varied along a number of methodological dimensions, such as research design (with or without control groups), original event stimulus medium (videos or slides), misinformation format (text or photographs), and test format (recognition or recall). The statistical techniques used were typically the general linear model (ANOVA, t tests, correlation, or linear regression).

Most of the studies in the meta-analysis used controlled experimental designs in the laboratory. The advantage of these types of designs is that experimental control is high enough to be reasonably sure that it really is age that is associated with an increase in misinformation susceptibility. The weakness of experimental lab studies is that they sometimes have low ecological validity—that is, they are not mimicking real-life situations as closely as perhaps a field study would. Lab studies often take place on a college campus—a comfortable and familiar setting for the younger adults (often college students) but not necessarily for older adults. In general, a lack of
ecological validity means that one should be cautious when generalizing from the laboratory studies to actual events. However, the eyewitness literature in general shows that many findings are as strong, if not stronger, in more naturalistic settings (Penrod & Bornstein, 2007), and some studies have demonstrated that older adults, in particular, are more susceptible to misinformation in field settings (Mueller-Johnson & Ceci, 2004; Loftus et al., 1992). The present meta-analysis also found no difference in age effects as a function of one factor related to ecological validity, namely, whether participants witnessed a crime or a noncrime event.

**Recommendations for Legal and Judicial Policy**

**Minimizing Cognitive Demands**

Although it should be noted that the degree of cognitive deficits between older and younger adults can also be affected by a number of individual differences such as expertise, overall health, intelligence, formal education, and task details (Lerner, 1990), it is important to understand the cognitive limits older adults may have. Often the cognitive demands placed on crime victims or witnesses during an investigation can be overwhelming, which can be taxing on cognitive reserves and can negatively affect memory performance. When older adults are victims or witnesses they are often confronted with novel tasks, such as identifying perpetrators in a photo spread or being interviewed by police. Such tasks might strain older adults’ working memory and require divided attention and problem-solving skills that could quickly deplete older adults’ cognitive resources.

Although a number of these cognitive demands are unavoidable, our understanding of cognitive limitations should inform interactions with older adults whenever possible. Minimizing the number of tasks they are asked to perform at one time and eliminating unnecessary distractions during questioning might be feasible options to lessen the cognitive load in hopes of increasing memory performance in older adults. Although it is evident, in general, that cognitive processes can deteriorate with age, it is necessary to understand the direct link between these functions and additional factors within our control on performance of aging eyewitnesses.

**Interviewing Techniques**

The use of Cognitive Interview techniques reliably improves eyewitness performance (Fisher & Schreiber, 2006; Memon, Meissner, & Fraser, 2010), including for older adults (e.g., Mello & Fisher, 1996). Modified Cognitive Interviews have reduced the misinformation effect in children and older adults (Holliday & Albon, 2004; Holliday et al., 2011), and the effect is even larger for older than for younger adult witnesses (Memon et al., 2010). In the context of
this chapter, the finding that older adults have lower false memory rates when tested using a modified Cognitive Interview leads us to recommend that law enforcement especially consider adopting the Cognitive Interview technique when working with older witnesses—similar to recommendations made for all witnesses (Fisher & Schreiber, 2006).

When asking questions of older adults, interviewers should also ask them where the source of the memory is coming from because doing so has been shown to reduce misinformation errors (Multhaup et al., 1999; Roediger & Geraci, 2007). For example, instead of just asking a yes–no question about whether they have seen a detail or event, interviewers should ask older adults questions about where they encountered the detail or event—for example, in the original event, from something they heard another witness say, or from hearing about it in the media.

Negative mood is associated with more systematic and careful memory retrieval, and one study found that negative mood in younger adults accounted for the difference in older and younger adults’ susceptibility to misinformation (Hess et al., 2012). Of course, inducing negative mood in an actual eyewitness setting may be unethical and even impractical because most people are likely to already be in a negative mood when being asked questions about a crime. However, inducing systematic and effortful cognition may be feasible. To do this, interviewers could stimulate more analytical modes of thinking, which could increase systematic cognitive effort at the time of retrieval. This cognitive effort, especially when considering the source of a memory, can reduce false memory from misinformation. However, if such a procedure simply induces a criterion shift, then the tradeoff could be the reporting of less correct information and would need to be considered with caution.

**Understanding Ageism and Stereotype Assimilation**

In the legal setting there would be ethical and practical problems with treating older adults’ memory differently from that of younger adults (see Eglit, 2004, for a discussion of ageism in the legal system), and it would be unwise to dismiss an older adult’s testimony simply on account of age. Not only would treating older adults differently reinforce age–memory deficiency stereotypes in the minds of legal professionals and jurors, but it could also produce stereotype assimilation effects in the memory performance of the older witness. **Stereotype assimilation**, which is an umbrella term encompassing stereotype threat and self-stereotyping, refers to the process whereby stereotyped groups conform to behaviors consistent with their group’s stereotype (i.e., memory performance in older adults; O’Brien, & Hummert, 2006). This general recommendation is also important because there are exceptions to the rule on both a group and individual level. Some studies did not find that older adults were more susceptible to misinformation as a group. All the studies, even the ones that found an age effect, had overlap in the distributions so that there were individual exceptions—some older adults were less susceptible than some younger
adults. Memory distortion occurs in both younger and older adults, and the techniques to reduce contamination also would be beneficial with both younger and older adults. For these reasons it is reasonable to recommend changes to avoid memory contamination but to do so for all witnesses.

Summary

In conducting our meta-analysis, we found that older adults are more susceptible to memory distortion following misleading information compared with young adults. The older the older adults were, the larger the effect (compared with young adults). We found no moderating effect of the type of event (crime vs. no-crime), type of test (recognition vs. free recall vs. cued recall), or the time interval between event and misinformation. On the basis of the empirical studies, we recommended some interview techniques that could reduce memory distortion in older adults, such as the Cognitive Interview, source-monitoring questions, encouraging effortful thinking, and giving the expectation that real memory will be distinct and vivid. We recommend that future research look into misinformation susceptibility in older adults in the context of stereotype threat, the Cognitive Interview, and inducing effortful thinking. Given that people (in the United States and many other countries) are living longer and staying healthy longer, the involvement of elderly witnesses in criminal cases is almost certain to increase. It is therefore important to understand both the mechanisms of older witnesses’ susceptibility to the misinformation effect and how to alleviate it.

Notes

1. The first two authors contributed equally; joint first authorship with sequence chosen by reverse alphabetical order.
2. Some studies reported mean proportions or percentages of questions answered that included misleading information, whereas other studies reported mean scores based on the frequency of questions answered that included misleading information.
3. Given that the mean age of the older adult sample is a significant predictor, we examined whether controlling for age changed significance tests in subsequent analyses. For each moderator analysis, we included dummy-coded variables for each categorical predictor and both mean age variables. There were no changes in any significance tests, so results are not reported further for these analyses.

References

References marked with an asterisk indicate studies included in the meta-analysis.


