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Competing Cues: Older Adults Rely on Knowledge in the Face of Fluency

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Abstract

Consumers regularly encounter repeated false claims in political and marketing campaigns, but very little empirical work addresses their impact among older adults. Repeated statements feel easier to process, and thus more truthful, than new ones (i.e., *illusory truth*). When judging truth, older adults' accumulated general knowledge may offset this perception of fluency. In two experiments, participants read statements that contradicted information stored in memory; a post-experimental knowledge check confirmed what individual participants knew. Unlike young adults, older adults exhibited illusory truth only when they lacked knowledge about claims. This interaction between knowledge and fluency extends dual-process theories of aging.

Keywords

aging; fluency; knowledge; illusory truth

We face unsubstantiated or false claims on a daily basis, whether listening to politicians misrepresent facts on the radio or driving past misleading billboards. Campaigns range from subtly deceptive (e.g., sugary cereals make up "part of a healthy breakfast") to fantastical (anti-aging products will "take 20 years off your face"). Repetition of such claims makes them easy to process, or *fluent. Fluency*, or subjective ease of processing, informs a variety of judgments (see Alter & Oppenheimer, 2009); it can be interpreted as liking (Iyengar & Lepper, 2000), confidence (Schwartz & Metcalfe, 1992), frequency (Tversky & Kahneman, 1973), fame (Jacoby, Kelley, Brown, & Jasechko, 1989), or *familiarity* (i.e., evidence of past experience; Schwartz, 1982).[1] Fluency also inflates perceived truth: Repeated statements seem truer than new statements (i.e., *illusory truth*; Hasher, Goldstein, & Toppino, 1977). This basic effect has been replicated dozens of times (see Dechêne, Stahl, Hansen, &

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[1]Unkelbach (2007) notes that "fluency" connotes an experience, while "familiarity" implies an interpretation of that experience (i.e., the feeling that there is something "about" a stimulus).

Wänke, 2010, for a meta-analysis), yet few data speak to older adults' vulnerability to the illusion.

This oversight is surprising, since current models of illusory truth emphasize a dynamic that shifts with age. According to Unkelbach and Stahl's (2009) multinomial model, people rely on fluency only if they fail to recollect whether or not a statement came from a credible source. Critically, the interplay between these two processes changes with age. Dual-process theories contrast how aging selectively impairs *recollection* (i.e., the ability to "relive" an event), while leaving familiarity (i.e., the feeling that an event occurred) intact (Light, 2012; Koehn & Yonelinas, 2014). As a result, repetition exerts "ironic effects" (Jacoby, 1999): Repetition increases recollection and reduces false memories in young adults, while it boosts familiarity and increases false memories in older adults (e.g., Benjamin, 2001; Budson, Daffner, Desikan, & Schacter, 2000; Light, Patterson, Chung, & Healy, 2004; McDermott & Chan, 2006; Skinner & Fernandes, 2009; Watson, McDermott, & Balota, 2004). A similar pattern unfolds when older adults evaluate truth. After a delay, young adults accurately assign more "false" ratings to trivia statements (e.g., *Corn chips contain twice as much fat as potato chips*) paired with a "false" label three times, compared to items presented once; by contrast, repeatedly presenting statements with a "false" label increases the likelihood that older adults misjudge them to be "true" later (Skurnik, Yoon, Park, & Schwartz, 2005). In daily life, though, incoming information rarely appears with an explicit "truth tag" and may lack an identifiable source altogether.

Moreover, while recollection *can* play a role in judging truth, people rarely spontaneously think back to information's original source (e.g., R. Marsh, Landau, & Hicks, 1997). Consistent with this idea, Henkel and Mattson (2011) found that young adults exhibited an illusory truth effect for statements they later identified (correctly or incorrectly) as coming from an unreliable source. Without an explicit prompt to retrieve a source, fluency drives truth judgments, and age-related differences should disappear. Indeed, repeating trivia statements (e.g., *Austria and Switzerland are linked by the Brenner Pass*; Mutter, Lindsey, & Pliske, 1995) or false marketing claims (e.g., *British Airways has flown the greatest number of transcontinental passengers;* Law, Hawkins, & Craik, 1998) boosts truth ratings to a similar extent in young and older adults. These isolated studies merit replication, but more importantly, they ignore a third process involved in evaluating truth: retrieval of relevant knowledge.

Intuitively, it seems improbable that repeating contradictions of well-known facts (e.g., *A date is a dried plum*) makes people believe them. In fact, a recent meta-analytic review states that illusory truth only emerges when claims are "ambiguous, that is, participants have to be uncertain about their truth status because otherwise the statements' truthfulness will be judged on the basis of their knowledge" (Dechêne et al., 2010, p. 239). Similarly, Unkelbach and Stahl (2009) tested their multinomial model with obscure materials (knowledge parameter probabilities ranged from .01 to .05), presuming that knowledge eliminates the effect. However, we recently demonstrated that fluency can "trump" knowledge in young adults; repeating false statements (e.g., *A date is a dried plum*) increased young adults' beliefs in those claims, even when they "knew better" (e.g., that drying plums produces prunes, not dates). Multinomial modeling confirmed that young adults sometimes rely on fluency despite having contradictory knowledge stored in memory (Fazio, Brashier, Payne, & Marsh, 2015).

This pattern may not extend to older adults, who match or even outperform young adults on measures of general knowledge (e.g., Arbuckle, Cooney, Milne, & Melchior, 1994; Bahrick, 1984; Bowles & Poon, 1985; Burke & Peters, 1986; Cornelius & Caspi, 1987; Mitchell, 1989; Perlmutter, 1978; Staudinger, Cornelius, & Baltes, 1989). Do older adults rely on their impressive knowledge bases, even when fluency leads to a different response? Previous studies cannot address this question, given their ambiguous or fictitious materials (Law et al., 1998; Mutter et al., 1995; Skurnik et al., 2005). The simplest prediction is that, like young adults, repetition sways older adults' truth ratings regardless of their knowledge. Intriguingly, one experiment hints that instead, knowledge "protects" older adults. Parks and Toth (2006) indirectly examined the role of knowledge using brand names. They identified similar illusory truth effects in older and young adults for claims about unfamiliar brands (e.g., Raven's); interestingly, older adults exhibited a numerically smaller effect than young adults for claims about familiar brands (e.g., Chapstick). While suggestive, this pattern did not reach statistical significance, and the specific product claims were designed to be unknown even for well-known brands (e.g., *Chapstick contains seven percent wax*).

In two experiments, we specifically tested the independent contributions of fluency and knowledge to young and older adults' truth judgments. We measured whether participants held knowledge *directly* relevant to each claim, unlike Parks and Toth's (2006) brand manipulation. Participants rated their interest in claims, then judged the truth of these statements as well as new items. Finally, they completed a post-experimental knowledge check to establish which facts each participant had stored in memory. This design accommodates differences in the number of facts known by each age group, allowing us to focus instead on whether older adults draw on their knowledge more reliably than young adults do.

Experiments 1 and 2

These experiments share a design and very similar methods, so we report them together. They differ in the delay to final test (none in Experiment 1, two days in Experiment 2) and the strength of the fluency manipulation. Fluency effects emerge when something feels *relatively* easy to process compared to other items: They disappear when participants only rate repeated statements at test (Dechêne, Stahl, Hansen, & Wänke, 2009). To maximize the discrepancy between repeated and new items in Experiment 2, participants rated statements twice (rather than once) during the exposure phase. In addition, they rated a greater proportion of new statements during the truth phase. Both of these changes typically boost the size of the illusory truth effect (Dechêne et al., 2010), allowing a stronger test of our hypotheses in Experiment 2.

Method

Participants—Participants were tested individually or in small groups of up to three people. The Duke University Institutional Review Board approved all procedures. In Experiment 1, 40 Duke University undergraduates (24 female; 18 – 22 yrs) participated for course credit; forty-two students (32 female; 18 – 22 yrs) participated in Experiment 2. Forty-five community-dwelling older adults (26 female; 66 – 82 yrs) participated for monetary compensation in Experiment 1. Thirty-six older adults (20 female; 70 – 83 yrs) participated in Experiment 2. Two older and two young adults completed Experiment 2's online exposure phase but did not attend their in-lab sessions. We also excluded an older adult who reported misunderstanding the truth rating scale.

Design—Both experiments had a 2 (age: young, older) × 2 (repetition: repeated, new) × 2 (knowledge: known, unknown) mixed design. Repetition was manipulated within subjects, while knowledge varied within subjects.

Materials—We selected 176 facts from Tauber and colleagues' (2013) general knowledge norms that spanned a range of expected knowledge, then generated an additional 24 (Experiment 1) and 224 (Experiment 2) items of varying difficulty. The number of items differs across experiments, as Experiment 2 included more new items. We were most interested in how people evaluate false claims in their environment, so we converted facts (e.g., *The Theory of Relativity was proposed by Einstein*) into false statements by referring to plausible, but incorrect, alternatives (e.g., *The Theory of Relativity was proposed by Newton*). See Table 1 for sample statements. To prevent response bias, we included an equal number of true fillers. We divided the statements into two (Experiment 1) or four (Experiment 2) sets of 100 items. Half of each set appeared as falsehoods (i.e., critical items) and the other half appeared as truths (i.e., fillers) for all participants. One set repeated across exposure and truth rating phases, whereas the remaining one (Experiment 1) or three (Experiment 2) set(s) appeared for the first time during the truth rating phase. Repetition was counterbalanced across participants.

The final knowledge check consisted of multiple-choice questions about the falsehoods. The three answer options included the correct answer, the target misinformation presented earlier, and a *don't know* option. For example, the question *Who proposed the Theory of Relativity?* was accompanied by *Einstein*, *Newton*, and *don't know* answer choices. Since these items include both true (e.g., *Einstein*) and false (e.g., *Newton*) information, they do not encourage a response bias and no fillers were needed. For each participant, we categorized items as *known* or *unknown* based on knowledge check performance.

Procedure—After giving informed consent, participants completed the first phase of the experiment, the *exposure phase*; in Experiment 2, this phase took place online.[2] Participants rated 100 statements for subjective interest, using a 6-point scale from 1 (*very interesting*) to 6 (*very uninteresting*). They completed this task once (Experiment 1) or twice (Experiment 2). The experimenter informed participants that some statements were true and others false.

Either immediately after exposure (Experiment 1) or one to three days later (Experiment 2), participants completed the second part of the experiment, the *truth rating phase*, in the lab. In addition to the warning that they would encounter true and false statements, the

[2]We cannot rule out the possibility that participants looked up answers during the online exposure phase (Experiment 2), but reaction time data suggest that this took place infrequently, if at all. Very few (<1%) interest ratings took longer than 60s.

experimenter told participants that some statements appeared earlier in the experiment, while others were new. Participants rated 200 (Experiment 1) or 400 (Experiment 2) statements for truthfulness, using a scale from 1 (*definitely false*) to 6 (*definitely true*).

Following the truth rating phase, participants completed the final *knowledge check*. Participants answered 100 (Experiment 1) or 200 (Experiment 2) multiple-choice questions with three response options: the correct answer, the alternative embedded in the falsehood seen earlier, and *don't know*. The experimenter asked participants to indicate *don't know* instead of guessing any answers. We classified each statement as *known* or *unknown* on the basis of whether a given participant could answer the corresponding question correctly later. That is, a "known falsehood" refers to a knowledge check question that a participant answered correctly and saw in a false framing during the earlier exposure and truth rating phases. Participants did not receive explicit labels or any other indications that specific statements were true or false.

Results

The alpha level for all statistical tests was set at .05. As discussed above, analyses focused on responses to falsehoods (i.e., critical items). Planned comparisons tested whether illusory truth varied with knowledge, within each age group.

Knowledge check—We first assessed knowledge check performance to ensure that our materials spanned a range of difficulty. Young adults answered many of the knowledge check questions correctly (known items; Experiment 1: 40%; Experiment 2: 37%). They responded to some of the questions with falsifications (Experiment 1: 22%; Experiment 2: 8%), but more frequently responded *don't know* (Experiment 1: 38%; Experiment 2: 55%). We collapsed across incorrect and *don't know* responses (unknown items; Experiment 1: 60%; Experiment 2: 63%). Unsurprisingly, older adults outperformed young adults on the knowledge check: They answered more questions correctly (Experiment 1: 63%; Experiment 2: 52%) and responded with falsifications (Experiment 1: 15%; Experiment 2: 7%) and *don't know* (Experiment 1: 21%; Experiment 2: 41%) less often. Again, we collapsed across incorrect and *don't know* responses (unknown items; Experiment 1: 37%; Experiment 2: 48%). The high *don't know* rate for both groups indicates that correct answers corresponded to actual knowledge, rather than guesses. Note that the knowledge check likely underestimates people's knowledge, since viewing the false version of a statement may bias people to choose the wrong answer later (Bottoms, Eslick, & Marsh, 2010; Kamas, Reder, & Ayers, 1996).

Truth ratings—We conducted a 2 (age: young, older) × 2 (knowledge: known, unknown) × 2 (repetition: repeated, new) mixed ANOVA on participants' truth ratings for falsehoods. The number of known and unknown items varied for each participant, depending on his or her knowledge check performance (Experiment 1: minimum trials per cell = 6, M trials per cell = 25; Experiment 2: minimum trials per cell = 8; M trials per cell = 50). To preview, both experiments yielded the same pattern: Young adults exhibited illusory truth, regardless of their stored knowledge, whereas knowledge protected older adults. The relevant data appear in Figure 1.

Replicating the standard illusory truth effect, repeated falsehoods (Experiment 1: $M = 3.55$; Experiment 2: $M = 3.35$) received higher truth ratings than new falsehoods (Experiment 1: $M = 3.33$; Experiment 2: 3.09) [Experiment 1: $F(1, 83) = 22.39$, $p < .001$, $\eta_p^2 = .21$; Experiment 2 $F(1, 76) = 34.21$, $p < .001$, $\eta_p^2 = .31$]. As expected, known falsehoods (Experiment 1: $M = 2.93$; Experiment 2: 2.58) received lower (i.e., more accurate) truth ratings than unknown ones (Experiment 1: $M = 3.95$; Experiment 2: $M = 3.87$) [Experiment 1: $F(1, 83) = 331.90$, $p < .001$, $\eta_p^2 = .80$; Experiment 2: $F(1, 76) = 486.67$, $p < .001$, $\eta_p^2 = .87$].

Overall, older adults (Experiment 1: $M = 3.26$; Experiment 2: $M = 2.96$) used the truth rating scale more cautiously than young adults (Experiment 1: $M = 3.62$; Experiment 2: $M = 3.48$) [Experiment 1: $F(1, 83) = 10.32$, $p = 0.002$, $\eta_p^2 = .11$; Experiment 2: $F(1, 76) = 25.15$, $p < .001$, $\eta_p^2 = .25$]; they (Experiment 1: known $M = 2.67$, unknown $M = 3.84$; Experiment 2: known $M = 2.21$, unknown $M = 3.71$) also applied their knowledge more consistently than young adults (Experiment 1: known $M = 3.19$, unknown $M = 4.06$; Experiment 2: known $M = 2.94$, unknown $M = 4.02$) [Experiment 1: $F(1, 83) = 7.18$, $p = 0.009$, $\eta_p^2 = .08$; Experiment 2: $F(1, 76) = 13.36$, $p < .001$, $\eta_p^2 = .15$] did. Since illusory truth is a *relative* effect defined by the difference between ratings of repeated and new items, our design accommodates any baseline differences in young and older adults' approaches to the task.

The three-way interaction among age, knowledge, and repetition was significant in Experiment 2, $F(1, 76) = 4.03$, $p = .048$, $\eta_p^2 = .05$, and not in Experiment 1, $F(1, 83) = 2.08$, $p = .153$, , $\eta_p^2 = .02$, though the pattern of means was the same. Older adults exhibited illusory truth for unknown [Experiment 1: repeated $M = 4.00$; new $M = 3.69$, $t(44) = 3.89$, $p < .001$; Experiment 2: repeated $M = 3.85$; new $M = 3.57$, $t(35) = 4.76$, $p < .001$] but not known [Experiment 1: repeated $M = 2.72$; new $M = 2.62$, $t(44) = 1.31$, $p = .197$; Experiment 2: repeated $M = 2.28$; new $M = 2.14$, $t(35) = 1.75$, $p = .09$] falsehoods. Conversely, young adults demonstrated illusory truth for both known [Experiment 1: repeated $M = 3.31$; new $M = 3.06$, $t(39) = 2.00$, $p = .052$; Experiment 2: repeated $M = 3.12$; new $M = 2.77$, $t(41) = 3.60$, $p = .001$] and unknown falsehoods [Experiment 1: repeated $M = 4.17$; new $M = 3.94$, $t(39) = 3.42$, $p = .001$; Experiment 2: repeated $M = 4.15$; new $M = 3.89$, $t(41) = 5.06$, $p < .001$].

We cannot address whether initial interest influenced illusory truth, as participants did not rate their interest in new items (which, by definition, did not appear at exposure). For completeness, we note that an illusory truth effect emerged for true fillers: Repeated truths (Experiment 1: $M = 4.74$; Experiment 2: $M = 4.63$) received higher truth ratings than new ones (Experiment 1: $M = 4.60$; Experiment 2: $M = 4.45$) [Experiment 1: $t(84) = 4.88$, $p < .001$; Experiment 2: $t(77) = 5.84$, $p < .001$].

Discussion

The present research investigated older adults' vulnerability to fluency when evaluating claims that contradicted their stored knowledge. Young and older adults responded similarly when fluency provided the only cue for truth; when neither recollection nor knowledge retrieval could play a significant role (i.e., for unknown items), both age groups exhibited a robust illusory truth effect. These data complement the findings that repetition increases liking (Halpern & O'Connor, 2000; Wiggs, 1993) and truth judgments (Law et al., 1998, Mutter et al., 1995), regardless of age.

Most interestingly, we identified a protective effect of knowledge among older, but not young, adults. Repetition misled young adults even when they held relevant knowledge about a claim, replicating Fazio and colleagues' (2015) finding that young adults sometimes neglect their knowledge when they can use fluency instead. When claims contradicted older adults' stored knowledge, however, repetition exerted little to no influence on their truth ratings. In other words, the literature's assumption that statements must be "ambiguous" for illusory truth to occur (Dechêne et al., 2010) applies selectively to older adults, a group ironically assumed to be more vulnerable to fluency. Typically, older adults exhibit more automatic, or "habitual," responses than young adults due to a breakdown of controlled processes (i.e., recollection; Hay & Jacoby, 1996; Hay & Jacoby, 1999; Jacoby & Rhodes, 2006). In an inversion of this pattern, older adults engaged in controlled processes (i.e., knowledge retrieval) more consistently than did young adults. This finding is robust, as we replicated it with binary (i.e., *true* or *false*) truth ratings in a smaller experiment ($n = 21$), where older adults exhibited illusory truth for unknown (repeated $M = 0.60$; new $M = 0.48$), but not known (repeated $M = 0.30$; new $M = 0.26$), statements, $F(1, 20) = 6.86$, $p = .016$, $\eta_p^2 = .26$.

Critically, older adults' performance cannot be attributed to the fact that they simply know more than young adults. Rather than relying on norms, we defined items as known or unknown on the basis of each individual's knowledge check performance. Thus, our conditional analyses controlled for the quantity of knowledge held by each age group. Instead, our results may reflect the structure of older adults' knowledge: Much like experts (Chi, Feltovich, & Glaser, 1981; Medin, Lynch, Coley, & Atran, 1997), older adults likely hold knowledge that has been frequently rehearsed and is highly organized. These qualities reduce the effort associated with retrieving and applying relevant facts, which may explain the discrepancy between our findings and older adults' documented "reluctance" to retrieve recent events (i.e., episodic retrieval; Touron, 2015). Alternatively, older adults' resilience may reflect a strategic bias to rely on knowledge (see Umanath & Marsh, 2014, for a review).

Indeed, episodic memory deficits can encourage the use of knowledge as a compensatory technique (Bayen, Nakamura, Dupuis, & Yang, 2000; Spaniol & Bayen, 2002). Knowledge about music (Arbuckle, Vanderleck, Harsany, & Lapidus, 1990), occupations (e.g., banking, medicine; Besken & Gülgöz, 2009), and grocery shopping (Castel, 2005) boosts older adults' recall performance and can even eliminate age-related differences completely. Knowledge clearly plays a role in offsetting deficits in recollection, but our data address the other half of the dual-process framework: using knowledge to combat fluency. The present findings complement and extend, rather than contradict, dual-process theories of aging. Considering a third factor, retrieval of relevant knowledge, helps to explain older adults' schematic memory errors; "ironic" effects of repetition probably reflect both fluency and the use of knowledge to "fill in the gaps" (e.g., Henkel, 2013; McDermott & Chan, 2006; Skinner & Fernandes, 2009).

Of course, relying on knowledge is not usually the fastest strategy. Fluency naturally correlates with truth: On average, the single true version of a statement (e.g., *The capital of Argentina is Buenos Aires*) occurs more frequently in the environment than any one of its many possible falsifications (e.g., *The capital of Argentina is La Paz*, *The capital of Argentina is Lima*, *The capital of Argentina is Montevideo*, etc.). Thus, inferring truth from fluency typically leads to the correct judgment in less time than a more effortful strategy (Unkelbach, 2007). Older adults probably search memory for relevant knowledge in situations where the automatic, fluent response is the correct one.

Despite the time and effort involved, we expect that older adults' bias to use their knowledge improves the quality of their everyday judgments. For one, it challenges the widespread assumption that older adults are vulnerable consumers. The National Council on Aging (NCOA), for example, warns that financial scams directed at older adults constitute the "crime of the 21st century." Similarly, the National Institute on Aging (NIA) cautions that cosmetic and health products touting "anti-aging" benefits mislead a vulnerable population. These concerns are not borne out by survey data: Fraud victimization actually occurs less frequently in older than in young consumers (Ross, Grossman, & Schryer, 2014). The present data suggest that repeating false claims about an unknown product would mislead young and older consumers to a similar extent. Encouragingly, repeating false claims about a well-known product category probably would not sway older adults' judgments. Older adults' accumulated knowledge and their tendency to rely on it can provide powerful protection against misinformation and scams.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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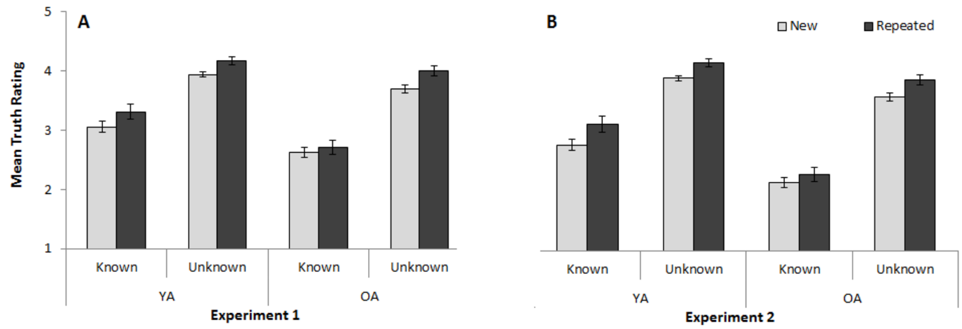

Figure 1.

Mean truth ratings for falsehoods as a function of age, knowledge, and repetition in Experiments 1 (A) and 2 (B). Error bars reflect standard error of the mean.

Table 1

Sample Statements and Multiple-Choice Questions

	Statement	Knowledge Check
Likely Known	Deer meat is called veal.	What is the name for deer meat? (*venison*)
	The largest ocean on Earth is the Atlantic.	What is the largest ocean on Earth? (*Pacific*)
	The fastest land animal is the leopard.	What is the fastest land animal? (*cheetah*)
Likely Unknown	The capital of Chile is Lima.	What is the capital of Chile? (*Santiago*)
	The author of “Brothers Karamazov” is Tolstoy.	Who is the author of “Brothers Karamazov”? (*Dostoyevsky*)
	Billy the Kid’s last name is Garrett.	What is Billy the Kid’s last name? (*Bonney*)

Notes. The correct answer to each multiple-choice question appears in parentheses.