

## RESEARCH ARTICLE

# Memory for Free: Gist-Based False Recall of an Advertisement in Young and Older Adults

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## ABSTRACT

Advertisers may mislead people into sharing personal information by wording their advertisements to encourage engagement. Advertisements may be effective because people rely on schematic information when retrieving information from memory, which can lead to gist-based false memory. The present study examined how young and older adults falsely remember viewing the word “free” in an advertisement. In two experiments, participants viewed an advertisement for 30s (Experiment 1) or an unlimited time (Experiment 2). Participants either viewed an advertisement where “free” was stated thrice or was never stated but included synonyms. When “free” was stated, both age groups recalled “free” more often than it was stated. When “free” was not stated, both age groups falsely recalled the word “free.” Thus, people tend to overestimate the frequency of keywords and will falsely recall certain words, even when a specific thematic word is not in an advertisement, which could have implications for later decision-making.

## 1 | Introduction

Every day we come across hundreds of advertisements, whether through television ads we watch, radio ads we listen to, billboards we see, or ads we view while browsing online. We often do not realize how many ads we encounter daily. Since there is an abundance of advertisements, companies have a lot of competition when pushing their advertisements to consumers. Therefore, advertisers have become skillful at designing advertisements that entice people, often by using different tricks and tactics (Federal Trade Commission 2013).

These tricks and tactics that advertisers use can sometimes make their advertisements misleading. Misleading advertising refers to a discrepancy between the factual information that the advertisement is advertising and the consumer's beliefs that were generated from the advertisement (Gaeth and Heath 1987). Misleading advertising can pose a risk to citizens and consumers.

The Federal Trade Commission (FTC; Anderson 2019) reported over 40 million consumers were victims of fraud or deception during 2017, about three-quarters of which involved advertising or sales. Advertisements can be costly and difficult to regulate (e.g., Cain 2011). Therefore, although there are regulations for creating advertisements that require them to be honest and truthful (FTC 2024a, 2024b), advertisements may be able to get around already existing regulations by using deceitful language to get people to engage with their ads (Murphy et al. 2023b). This could include using specific verbiage and framing advertisements in a particular way to make the viewer come out of the viewing advertisement experience with a desire to engage with the advertisement (Kim 2006; Tversky and Kahneman 1981).

False memories when viewing advertisements have been shown in many different studies. False memories are defined as people having definitive memories of events or information that have not occurred (Brainerd and Reyna 2005). People have

been found to remember false information after viewing websites (Schlosser 2006). In addition, advertisements have even been found to alter one's memory of a product (Rajagopal and Montgomery 2011), and other ads have been found to alter one's childhood memories (Braun et al. 2002; Braun-LaTour et al. 2004). Therefore, the power of creating false memories in consumers through advertisements can be detrimental in certain contexts.

False memory has been studied extensively in the context of the Deese-Roediger-McDermott (DRM) paradigm (Roediger and McDermott 1995). In this paradigm, participants study lists of words that are semantically related to each other and are then tested on their memory for these words in a later memory test. When participants recall words in these lists, they may have false memories of a word/words that are semantically related to the studied lists but were not actually included in the lists, called critical lures. Therefore, false memories are shown to occur for semantically related information (Balota et al. 1999; Roediger et al. 1998). The source monitoring theory has been used to explain this phenomenon (Johnson and Raye 1981). This theory states that our memories, including thoughts, images, and feelings are influenced by our prior experiences. Therefore, in the DRM paradigm, one's false memories of the critical lures are attributed to having prior experiences with the words in the lists being paired with the critical lures, thus creating a sense of familiarity with the critical lures (LaTour et al. 2014). Spreading activation can also partially explain the DRM phenomenon (Meade et al. 2007). Spreading activation is the idea that related concepts are linked in memory, and when one concept is activated, other concepts that are linked to it become activated as well (Anderson 1983). In the DRM paradigm, when the participant is asked to remember the words in the lists, the critical lures may be activated due to spreading activation, thus leading to false memories of the critical lures. Advertisements may be able to produce similar false memories in individuals.

Advertisers might capitalize on the idea that consumers only remember the gist of the information rather than specific details. People often rely on schematic information rather than details like specific verbiage when retrieving information from memory (e.g., Alba and Hasher 1983). Generally, schemas are used to help us remember newly learned information, especially when we are consistently flooded with a lot of different stimuli that we cannot remember every detail of (e.g., Castel 2005). However, since we use schemas in memory retrieval, this can lead to errors in our memory, including creating false memories entirely (e.g., Brewer and Treyns 1981; Murphy et al. 2023b). When people view advertisements specifically, they create gist-based false memories when looking at advertisements (LaTour et al. 2014).

Fuzzy-trace theory explains how we go about remembering verbatim and gist-based information (Brainerd and Reyna 2005; LaTour et al. 2014; Reyna and Brainerd 1998). Fuzzy-trace theory suggests that when people are remembering information, they store verbatim and gist-based information in parallel. The verbatim information is the surface features of the target, essentially meaning it is the true original information. The gist traces are formed using different storage mechanisms and are the underlying meaning of the information, which can lead to

the creation of false memories (LaTour et al. 2014; Mestre 2006). The verbatim information fades in our memory faster than the gist-based information; therefore, false memories may endure when details of certain events are tested after a longer period of time.

Older adults are generally found to be more susceptible to creating false memories than young adults due to cognitive declines (Jacoby and Rhodes 2006). Older adults are found to be more likely to report false memories of critical lures when tested using a DRM paradigm (Norman and Schacter 1997). In addition, aging-related differences in young and older adults tend to occur more for verbatim information than for gist-based information (Brainerd and Reyna 2005; LaTour et al. 2014). Older adults are prone to falsely remember detailed verbal information and primarily rely on gist-based memory as a way to remember information (e.g., Adams 1991; Devitt and Schacter 2016). Older adults generally remember the main message of information when trying to remember information from a passage, but misremember verbatim detail, while young adults are better at recalling specific details (e.g., Adams 1991; Adams et al. 1997; Brainerd and Reyna 2004). While older adults may have difficulty remembering specific information when comparing products, older adults may retain gist-based information for certain aspects of a product, such as which one is a better price (Flores et al. 2017), suggesting that gist-based memory can inform future purchasing decisions.

Older adults may be more likely to falsely remember details from past events. For example, Schacter et al. (1997) found that older adults showed more false memory recollections when viewing videos compared to young adults. They speculate that this could be a result of a deficit in source-monitoring abilities in older adults. Older adults' higher incidence of false memories may be a result of how older adults process misleading information (Jacoby and Rhodes 2006; Jacoby et al. 2005). Jacoby and Rhodes (2006) suggest that if the information is misleading, older adults may forgo making any further attempt to retrieve the correct information from memory and may instead accept the misinformation as being correct. Older adults are 10 times more likely than young adults to falsely remember information when the information is misleading (Hay and Jacoby 1999). Therefore, misleading advertisements may be more likely to create false memory recollections in older adults.

## 2 | The Current Study

The present study aimed to further explore false memory for potentially misleading information. We aimed to examine how well younger and older adults can monitor and recall how frequently a keyword is presented. More specifically, the present study aimed to investigate whether people falsely remember aspects of an advertisement for a complimentary sample. Companies often use tactics, such as promotions, to advertise their product and increase consumer incentives (Raghubir et al. 2004). Company promotions can include offering consumers free gifts, samples, and trial packages. While free samples may be a nice way to try out a new product, they can be misleading in what is required of the consumer to receive the "free" item. "Free" samples are

rarely truly “free” because they often require the consumer to provide personal information about themselves to receive it. This personal information could include one's name, address, email, and credit card information. In some cases, companies have used this information for future promotion of their products (Haan 2024). In more serious and illegal situations, companies have been entirely misleading in what they would do with the provided personal information. For example, in 2016, the FTC alleged that the company Nutraclick automatically enrolled consumers into their membership program upon signing up for a free sample and billed these consumers from \$29.99 to \$79.99 annually without the consumers' knowledge (Federal Trade Commission 2020). In another recent FTC case (2024a, 2024b), TurboTax was found to be deceiving consumers by running ads claiming that they provide “free” tax products and services to consumers; however, the majority of consumers did not qualify for these “free” services. Therefore, although the FTC has existing regulations for these companies, many “free” products or samples can be misleading and hard to regulate, which is why it is important to understand how consumers perceive these ads. In addition, it is important to study the potential age-related differences in these perceptions because older adults may be particularly vulnerable to being misled by them (Jacoby and Rhodes 2006; Jacoby et al. 2005).

Therefore, in the present study, we aimed to investigate aspects of the complimentary sample advertisement, such as if people will falsely remember the word “free” when the word is or is not explicitly stated. We hypothesized that people would falsely remember the word “free” in an advertisement for a complimentary sample when the word was not explicitly stated. When the word “free” was explicitly stated, we expected that people would remember viewing the word more often than it was explicitly stated. We also aimed to investigate how age impacts memory for specific information in an advertisement. We predicted that older adults would falsely remember the word “free” more often than young adults. In addition, for a more exploratory analysis, we aimed to see if young or older adults would be more inclined to engage with the advertisement to receive the “free” sample. Previous literature has shown that older adults have higher levels of trust in others compared to young adults (Bailey and Leon 2019), as well as higher rates of older adults falling victim to scams that require older adults to share personal information to receive something in return (FTC 2022). Therefore, we predicted that older adults would be more inclined than young adults to provide personal information to receive the “free” sample because some older adults may be more likely to trust the advertisement and this would be in line with statistics indicating older adults falling for scams related to “free” items (e.g., sweepstakes, prize winnings).

### 3 | Experiment 1

Experiment 1 investigated participants' memory of information within advertisements by having participants view an advertisement and then answer follow-up questions on the information within the advertisement. The advertisement was for a complimentary sample and was shown to each participant for 30s before they were asked follow-up questions about the advertisement.

## 3.1 | Method

### 3.1.1 | Participants

An a priori power analysis indicated that for a 2 (condition: free, no free) × 2 (age: young, older) between-subjects ANOVA, assuming alpha = 0.05 and power = 0.95, 249 participants in total would be needed to reliably detect a medium effect size ( $n_p^2 = 0.05$ ). One hundred and sixty-seven young adult and 176 older adult participants were recruited from CloudResearch ([www.cloudresearch.com](http://www.cloudresearch.com); Chandler et al. 2019). Participants were excluded for either not answering or providing nonsensical answers to the open-ended questionnaire, specifically for the question asking how often the word “free” was stated in the advertisement. Therefore, the resulting sample size after exclusions was 125 young adult participants (age range = 18–35,  $M = 25.38$ ,  $SD = 3.74$ ; 85 female) and 126 older adult participants (age range = 60–92,  $M = 71.89$ ,  $SD = 6.20$ ; 76 female). All participants completed the experiment online. Participants were compensated US \$10/h.

### 3.1.2 | Procedure

Young and older adult participants were first randomly separated into two groups. One group viewed an advertisement that mentioned the word “free” three times, as well as four instances of other verbiage that had a similar meaning to the word “free,” such as (e.g., “complimentary sample,” or “no cost to you”). The other group viewed an advertisement that did not mention the word “free” at all, and instead, included seven instances of other verbiage that had a similar meaning to the word “free.” Examples of the advertisements can be viewed in Figure 1.

(a)

I have an exciting new offer for you, and it is completely free! You do not pay anything up front. Are you interested in learning more about this amazing offer?

This is a once in a lifetime offer and as I said, the first part is completely at no cost to you! We will send you a free sample for you to enjoy.

Once you get the complimentary sample, only then do you need to decide if you want to receive more in the mail.

To send you the complimentary sample, we need your name, date of birth, and mailing address.

We may also request your credit card information to confirm your account, bill for postage of future products, but only after you authorize us to do so once you have received the free sample.

(b)

I have an exciting new offer for you, and it is at no cost to you! You do not pay anything up front. Are you interested in learning more about this amazing offer?

This is a once in a lifetime offer and as I said, the first part is at no cost to you! We will send you a complimentary sample for you to enjoy.

Once you get the complimentary sample, only then do you need to decide if you want to receive more in the mail.

To send you the complimentary sample, we need your name, date of birth, and mailing address.

We may also request your credit card information to confirm your account, bill for postage of future products, but only after you authorize us to do so once you have received the complimentary sample.

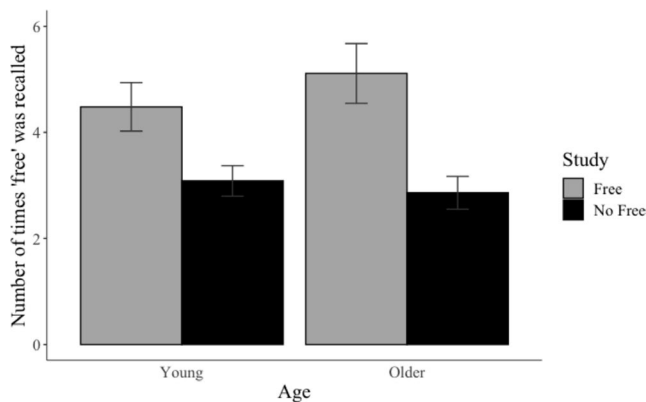
**FIGURE 1** | The “free” (a) and “no free” (b) advertisements that were shown to young and older adults.

Each group viewed the advertisement for 30s and then were immediately asked three follow-up questions about the advertisement they just viewed. The follow-up questions included, “How many times did the passage mention the word ‘free’?”, “What type of information do you need to provide in order to receive the complimentary sample?”, and “How inclined are you to provide this information in order to receive the complimentary sample?”

This study’s design and analyses were not preregistered. Data were analyzed using Jamovi (The Jamovi Project 2023), and all figures were made using R Studio (RStudio Team 2020), specifically using the “ggplot2” package (v3.3.3; Wickham 2016). All information needed to reproduce the analyses is available on OSF, including stimuli, data, and analysis code. Informed consent was acquired, and the study was completed in accordance with the UCLA Institutional Review Board.

### 3.2 | Results

A 2 (condition: free, no free) by 2 (age: young, older) between subjects ANOVA was used to analyze participants’ memory for how often they thought the word “free” was mentioned in each of the versions of the advertisement. The “free” version of the advertisement is the condition that includes three instances of the word “free” plus four instances of verbiage similar to the word “free.” The “no free” version of the advertisement is the condition that included no instances of the word “free” and only included seven instances of verbiage similar to the word “free” (e.g., “complimentary sample”). The ANOVA revealed a significant main effect of condition where participants remembered the word “free” significantly more in the “free” condition ( $M = 4.79$ ,  $SD = 3.66$ ) than in the “no free” condition ( $M = 2.98$ ,  $SD = 2.14$ ),  $F(1, 203) = 19.07$ ,  $p < 0.001$ ,  $n_p^2 = 0.09$ . There was no main effect of age group,  $F(1, 203) = 0.27$ ,  $p = 0.63$ ,  $n_p^2 = 0.001$ , nor was there an age group by condition interaction,  $F(1, 203) = 1.04$ ,  $p = 0.31$ ,  $n_p^2 = 0.005$ . The results are shown in Figure 2.



**FIGURE 2** | The number of times participants remembered the word “free” being in the advertisement they viewed, for young and older adults, separated by the advertisement each group viewed in Experiment 1. In the Free condition, the word “free” was presented three times, whereas in the No Free condition the term “free” was never explicitly mentioned. Error bars reflect the standard error of the mean.

Young adult participants in the “free” condition remembered that the word “free” was in the advertisement significantly more than the actual three times ( $M = 4.48$ ,  $SD = 3.33$ ),  $t(52) = 3.52$ ,  $p = 0.002$ . Likewise, older adult participants in the “free” condition remembered the word “free” being in the advertisement more than three times ( $M = 5.11$ ,  $SD = 3.99$ ),  $t(49) = 3.74$ ,  $p < 0.001$ . On average, 50.9% of young adults and 50.9% of older adults recalled the word “free” in the advertisement more than three times.

Young adult participants in the “no free” condition remembered that the word “free” was in the advertisement significantly more than the actual zero times ( $M = 3.08$ ,  $SD = 2.11$ ),  $t(53) = 10.7$ ,  $p < 0.001$ . Likewise, older adult participants in the “no free” condition remembered the word “free” being in the advertisement significantly more than zero times ( $M = 2.86$ ,  $SD = 2.19$ ),  $t(49) = 9.21$ ,  $p < 0.001$ . Seventy-two percent of young adult participants and 76% of older adult participants remembered the word “free” in the advertisement more than zero times.

Chi-squared tests of independence were performed to examine the relationship between age and inclination to provide information for receiving the complimentary sample from the advertisement. Inclination responses were scored and split into three categories: “not inclined,” “unsure,” and “inclined.” In the “free” condition, the relation between these variables was not significant,  $\chi^2(2, N = 97) = 5.36$ ,  $p = 0.07$ . In the “no free” condition, the relation between these variables was significant,  $\chi^2(2, N = 98) = 17.9$ ,  $p < 0.001$ , where young adults were more inclined to provide information to receive the complimentary sample than older adults. The results are shown in Table 1.

### 3.3 | Discussion

Consistent with our hypotheses, participants recalled viewing the word “free” more often than was stated in the “free” condition’s advertisement. Participants also recalled viewing the word “free” in the “no free” advertisement despite the word “free” never being mentioned. Therefore, consistent with prior research, individuals seem to remember the gist of what is being said in the advertisement even if that memory is inaccurate. This further supports the idea of individuals relying on schematic information when recalling information from memory (Braun-LaTour et al. 2004) because individuals seem to remember seeing several instances of words in the passage that have a similar meaning to the word “free” (e.g., “complimentary”) and therefore misremember more instances of the word “free.”

Interestingly, there was no age difference between the number of times that the word “free” was recalled in either condition. This finding was contrary to our hypotheses. Prior research has shown that older adults rely on gist-based memory more often than young adults due to an age-related shift in reliance on using gist-based memory more in the retrieval process of short-term memories (Wingfield et al. 1995). However, in this experiment, young and older adults similarly falsely recalled the word “free” more often than it was explicitly stated. A few possibilities could



**TABLE 1** | The number of participants who stated they were inclined to engage with the potential offer in Experiment 1.

Age group	Free condition			$\chi^2$	V
	Inclination				
	Not inclined	Unsure	Inclined		
Young	27 (−1.02)	7 (0.33)	15 (1.59)	6.97*	0.26
Older	42 (0.97)	6 (−0.31)	6 (−1.51)		
Age group	No free condition			$\chi^2$	V
	Inclination				
	Not inclined	Unsure	Inclined		
Young	32 (−0.48)	2 (−1.17)	12 (2.05)	10.5*	0.32
Older	46 (0.43)	8 (1.05)	3 (−1.84)		

Note: \* $p < 0.05$ . Adjusted standardized residuals appear in parentheses below group frequencies.

have contributed to this result. First, older adults may not have as much of an impaired ability to recall verbatim detail as previously thought. Another possibility could be that older adults may have perceived the advertisement as particularly important to remember because the advertisement appeared “scam-like.” Older adults have been shown to have enhanced memory for information that is particularly important; therefore, if this advertisement was deemed important or potentially dangerous, older adults may focus on remembering important aspects of the advertisement (e.g., Hargis and Castel 2017; Hargis and Castel 2018; Middlebrooks et al. 2016).

When we asked young and older adults how inclined they would be to provide personal information to receive the “complimentary sample” young adults in the “no free” condition were significantly more inclined to provide the information. There was no significant age difference in the “free” condition; however, these results still provide some evidence for young adults being more inclined to engage with an advertisement that could potentially be risky to engage with, such as a scam. Speculatively, young adults could be more inclined to engage with the advertisement because they might have fewer financial resources than older adults. Another possibility could be that older adults may have had more experience with “scam-like” advertisements and are therefore more cautious and skeptical when engaging with them (Nolte et al. 2021; Petty and Andrews 2008; Yang et al. 2024). Several older adults wrote in the open response of this experiment that the advertisement seemed like a “scam” and that they would never be inclined to engage.

## 4 | Experiment 2

In Experiment 2, we aimed to investigate whether participants viewing the advertisement for an unlimited amount of time would affect participants’ ability to recall the information in the advertisement. We predicted that those who studied the advertisement for a longer amount of time would have a more accurate recall of the information in the advertisement (Ariel et al. 2009; Doshier 1976; Thiede and Dunlosky 1999). In addition, we were interested to know how long young and older adults would study the advertisement if they were given the ability to self-pace their

study time, as this may enhance memory (Dunlosky et al. 2003; Murphy et al. 2023a). We predicted that older adults would study the advertisement for longer than young adults due to older adults’ slower cognitive processing and a desire to compensate for potential memory deficits (Castel et al. 2013b; Hines et al. 2009).

## 4.1 | Method

### 4.1.1 | Participants

An a priori power analysis indicated that for a 2 (condition: free, no free)  $\times$  2 (age: young, older) between-subjects ANOVA, assuming alpha = 0.05 and power = 0.95, 249 participants would be needed to reliably detect a medium effect size ( $n_p^2 = 0.05$ ). One hundred and thirty-eight young adults and 162 older adult participants were recruited from CloudResearch ([www.cloudresearch.com](http://www.cloudresearch.com); Chandler et al. 2019). Participants were excluded for either not answering or providing nonsensical answers to the open-ended questionnaire, specifically for the question asking how often the word “free” was stated in the advertisement. Therefore, the remaining sample size after exclusions was 130 young adult participants (age range = 18–33,  $M = 24.50$ ,  $SD = 3.98$ ; 74 female, 54 male, 2 other) and 132 older adult participants (age range = 60–86,  $M = 70.55$ ,  $SD = 6.21$ ; 74 female). Participants completed the experiment online and were compensated US \$10/h.

### 4.1.2 | Procedure

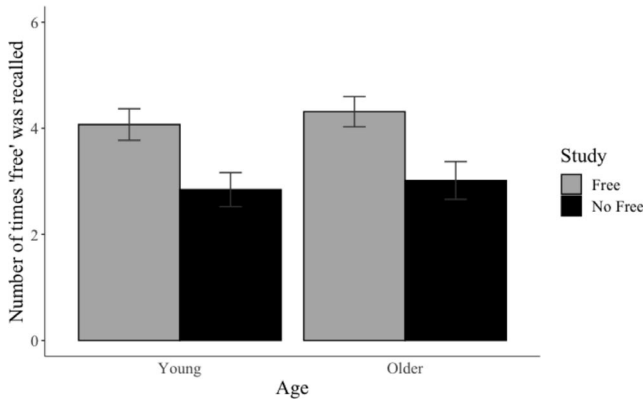
The procedure in Experiment 2 closely replicated the procedure in Experiment 1. Participants were split into the “free” and “no free” groups at the beginning of the experiment. Participants were shown the same advertisements that were shown in Experiment 1 and were asked the same follow-up questions. However, participants in Experiment 2 were shown the advertisement for an unlimited amount of time and were told they could advance from viewing the advertisement at any time. After viewing the advertisement, all participants answered the same three follow-up questions that were asked in Experiment 1. The follow-up questions included, “How many times did the passage mention the word ‘free’?”, “What type of information

do you need to provide in order to receive the complimentary sample?”, and “How inclined are you to provide this information in order to receive the complimentary sample?”

This study’s design and analyses were not preregistered. Data were analyzed using Jamovi (The Jamovi Project 2023), and all figures were made using R Studio (RStudio Team 2020), specifically using the “ggplot2” package (v3.3.3; Wickham 2016). All information needed to reproduce the analyses is available on OSF, including stimuli, data, and analysis code. Informed consent was acquired, and the study was completed in accordance with the UCLA Institutional Review Board.

## 4.2 | Results

A 2 (condition: free, no free) by 2 (age: young, older) between subjects ANOVA was used to analyze participants’ memory for how often the “word” free was mentioned in each of the versions of the advertisement. There was a main effect of condition where



**FIGURE 3** | The number of times participants remembered the word “free” being in the advertisement they viewed, for young and older adults, separated by the advertisement each group viewed in Experiment 2. In the Free condition, the word “free” was presented three times, whereas in the No Free condition the term “free” was never explicitly mentioned. Error bars reflect the standard error of the mean.

the word “free” was recalled significantly more in the “free” condition ( $M = 4.20, SD = 2.19$ ) than in the “no free” condition ( $M = 2.93, SD = 2.60$ ),  $F(1, 229) = 15.89, p < 0.001, \eta_p^2 = 0.07$ . There was no main effect of age,  $F(1, 229) = 0.43, p = 0.51, \eta_p^2 = 0.002$ , nor an age by condition interaction,  $F(1, 229) = 0.01, p = 0.91, \eta_p^2 = 0.00$ . The results are shown in Figure 3.

Young adult participants who were in the “free” condition remembered viewing the word “free” significantly more than three times ( $M = 4.09, SD = 2.24$ ),  $t(54) = 3.62, p < 0.001$ . Older adult participants also remembered viewing the word “free” significantly more than three times in the “free” condition ( $M = 4.31, SD = 2.18$ ),  $t(58) = 4.63, p < 0.001$ . On average, 57% of young adults and 67.8% of older adults reported that “free” was present in the advertisement more than three times.

Young adult participants in the “no free” condition remembered viewing the word “free” significantly more than zero times ( $M = 2.84, SD = 2.44$ ),  $t(57) = 8.88, p < 0.001$ . Older adult participants also remembered viewing the word “free” significantly more than zero times in the “no free” condition ( $M = 3.02, SD = 2.76$ ),  $t(59) = 8.47, p < 0.001$ . On average, 74% of young adult and 78% of older adult participants reported that they remembered reading “free” in the advertisement more than zero times.

To examine the relationship between age and one’s inclination to provide information to receive the advertised product, chi-squared tests of independence were performed. In the “free” condition, the relationship between age and inclination was significant,  $\chi^2(2, N = 103) = 6.97, p = 0.031$ , where young adults were more inclined to provide information to receive the complimentary sample than older adults. In the “no free” condition, the relation between age and inclination was also significant,  $\chi^2(2, N = 103) = 10.5, p = 0.005$ . Young adults were also more inclined to provide information to receive the complimentary sample than older adults. The results are shown in Table 2.

A 2 (condition: free, no free) by 2 (age: young, older) between subjects ANOVA was used to analyze participants’ study time of the advertisements. There was no main effect of the condition (Free:

**TABLE 2** | The number of participants who stated they were inclined to engage with the potential offer in Experiment 2.

Age group	Free condition			$\chi^2$	V
	Inclination				
	Not inclined	Unsure	Inclined		
Young	31 (−0.46)	10 (1.55)	5 (−0.47)	5.36	0.24
Older	40 (0.44)	3 (−1.47)	8 (0.44)		
Age group	No free condition			$\chi^2$	V
	Inclination				
	Not inclined	Unsure	Inclined		
Young	29 (−1.43)	5 (0.76)	16 (2.49)	17.9***	0.43
Older	45 (1.46)	2 (−0.77)	1 (−2.54)		

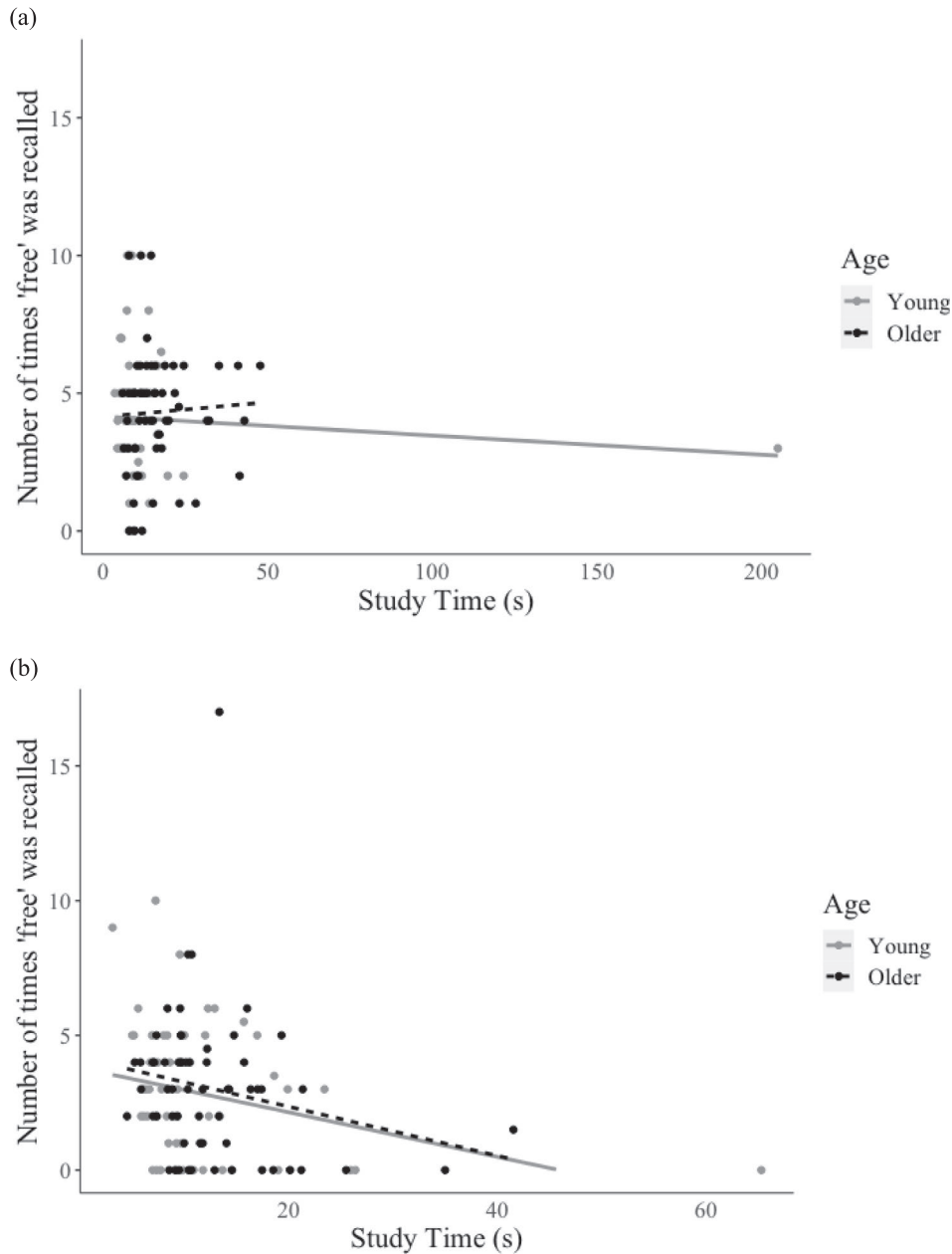
Note: \*\*\* $p < 0.001$ . Adjusted standardized residuals appear in parentheses below group frequencies.

$M_{\text{young}} = 12.34 \text{ s}$ ,  $SD_{\text{young}} = 0.54 \text{ s}$ ,  $M_{\text{older}} = 16.56$ ,  $SD_{\text{older}} = 1.27$ ; No Free:  $M_{\text{young}} = 11.54$ ,  $SD_{\text{young}} = 1.16$ ,  $M_{\text{older}} = 12.71$ ,  $SD_{\text{older}} = 0.84$ ,  $F(1, 229) = 1.41$ ,  $p = 0.24$ ,  $\eta_p^2 = 0.006$ , nor was there a main effect of age,  $F(1, 229) = 1.90$ ,  $p = 0.17$ ,  $\eta_p^2 = 0.008$ , or a condition by age interaction,  $F(1, 229) = 0.61$ ,  $p = 0.44$ ,  $\eta_p^2 = 0.003$ .

We conducted multiple linear regressions to predict the amount that participants would recall viewing the word “free” from the advertisement using study time of the advertisement and age group as predictors. The model was not significant for the “free” condition,  $F(2, 111) = 0.14$ ,  $p = 0.87$ ,  $R^2 = 2.22$ . However, the model was significant for the “no free” condition,  $F(2, 115) = 4.04$ ,  $p = 0.02$ ,  $R^2 = 2.53$ . The individual predictors were examined further and indicated that study time ( $t = 2.81$ ,  $p < 0.01$ ) was a significant predictor, but age group was not ( $t = 5.82$ ,  $p = 0.56$ ). Results are shown in Figure 4.

### 4.3 | Discussion

Consistent with our hypotheses and Experiment 1, participants recalled the word “free” being in the advertisement significantly more than was stated in the “free” and the “no free” conditions. Therefore, participants seem to be recalling the gist of the advertisement rather than the specific verbiage, despite having as much time to study the advertisement as they would like. There was also no difference in age for how often “free” was recalled in the different conditions. Therefore, despite prior research showing that older adults display higher levels of gist-based memory and more instances of false memory than young adults (Devitt and Schacter 2016; Jacoby and Rhodes 2006), the age groups performed similarly in falsely remembering the word “free” in the “no free” condition and remembering the word more often than was stated in the “free” condition.



**FIGURE 4** | The number of times young and older adults remembered the word “free” and how long they studied the advertisements in the free (a) and the no free (b) condition.

Contrary to our hypothesis and prior research, older adults did not study the advertisement longer than young adults in either condition (Hines et al. 2009). We predicted that those who studied the advertisement longer would be more accurate at recalling the number of times the word “free” was mentioned in each advertisement. However, study time was only a significant predictor for how often participants remembered the word “free” in the “no free” condition. Therefore, those who studied the advertisement longer in the “no free” condition recalled that “free” was stated less often than those who did not spend as long reading the advertisement, and this was true for both younger and older adults. So, studying advertisements for a longer amount of time may have some benefit for our memory of the specific details within the advertisements (Castel et al. 2013b; Doshier 1976).

Similar to Experiment 1, we investigated the relationship between age and willingness to provide information to receive the “free” sample mentioned in the advertisement. We found that in both conditions, young adult participants were significantly more inclined to engage with the advertisement further to receive the complimentary sample than older adults. Therefore, young adults may be more inclined to engage with advertisements than previously thought.

## 5 | General Discussion

The current study aimed to examine how people remember verbatim information in an advertisement. More specifically, we aimed to examine how well younger and older adults can monitor and recall how frequently a key word is presented. Spreading activation, or source memory errors, may cause people to falsely recall a central word as being presented more frequently, which could have implications for later behavior and decision-making. We investigated this by seeing if young and older adults would misremember the number of times the word “free” was mentioned in an advertisement for a complimentary sample in two versions where the word “free” was and was not present. We ran two experiments where participants studied the advertisement for 30 s (Experiment 1) or unlimited time (Experiment 2). In both experiments and conditions, young and older adults misremembered the word “free” more often than it was presented. In Experiment 1, 50.9% of young adults and 50.9% of older adults recalled the word “free” in the advertisement more than three times in the “free” condition. Seventy-two percent of young adult participants and 76% of older adult participants remembered the word “free” in the advertisement more than zero times in the “no free” condition. Similarly, in Experiment 2, 57% of young adults and 67.8% of older adults recalled the word “free” more than three times in the “free” condition. In the “no free” condition, 74% of young adult participants and 78% of older adult participants recalled “free” more than zero times. Therefore, in every version of the experiment, participants of both age groups experienced false memories of verbatim information. These findings were consistent with the fuzzy-trace theory and studies involving the creation of gist-based false memories and the reliance on schemas when trying to retrieve verbatim information from memory (Alba and Hasher 1983; Brainerd and Reyna 2005; LaTour et al. 2014; Reyna and Brainerd 1998). These findings also may be consistent with the concept of spreading activation (Anderson 1983). The word “free” may be activated when other

verbiage that is similar to the word “free” is viewed, such as “complimentary sample” or “no cost to you”, because they are closely related concepts. This spreading of activation could result in higher levels of false memory for the word “free.”

In terms of age-related differences, contrary to our hypothesis and prior research, both age groups similarly misremembered the number of times the word “free” was mentioned in the advertisement. The lack of differences could be due to the task within the experiment being short in length, without any break between studying the advertisement and answering the follow-up questions. It could be that older adults may show more instances of misremembering the information in the advertisement when needing to remember more information than just one specific word or phrase in an advertisement, such as when remembering more detailed associative information (Naveh-Benjamin 2000); therefore, showing an age difference between young and older adults. However, older adults have been shown to have reduced difficulty in remembering information when associations are meaningful or contain some schematic support (e.g., Castel 2005; Castel et al. 2013a; Craik and Bosman 1992). It could be that older adults, in certain circumstances, may not show higher instances of false memories than young adults depending on the information that is being studied. Murphy et al. (2023b) showed that young and older adults were similarly inaccurate in remembering verbatim information in a cognitive enhancement product advertisement; therefore, when viewing information in advertisements, young and older adults might be similarly inaccurate at remembering verbatim information, and older adults may not have as large of a deficit as previously thought (see also Hess 2005). Older adults may have perceived the advertisement as being particularly important to remember because the advertisement was “scam-like” and therefore important to remember details. Older adults have been shown to have enhanced memory for information that they deem as important; thus, if this advertisement was deemed important, engaging, or potentially suspicious, older adults may have tried to remember the contents of the advertisement more so than for information that is less relevant (e.g., Hargis and Castel 2017; Hargis and Castel 2018; Hess 2014; Middlebrooks et al. 2016).

We also aimed to investigate whether young or older adults would be more inclined to provide information to receive the complimentary sample. We predicted that older adults would be more inclined to engage with the advertisement to receive the complimentary sample due to older adults' higher reports of falling for scams that involve winning prizes, sweepstakes, and lotteries (FTC 2022) and higher levels of trust than young adults (Bailey and Leon 2019). However, we found that, contrary to our hypothesis, young adults were more inclined to provide information to receive the complimentary sample than older adults in the “no free” condition in Experiment 1 and both conditions in Experiment 2. Speculatively, young adults may be more inclined to engage with the advertisements due to having fewer financial resources, therefore making them want the “free sample” more or because older adults were more skeptical of the advertisement because it appeared “scam-like” (Nolte et al. 2021; Petty and Andrews 2008; Yang et al. 2024). However, our older adult sample is an online sample, which does require the older adults to have some knowledge of how to use a computer. Due to this



knowledge of using the internet, this older adult sample could be “wiser” online in terms of sharing information and therefore, may not reflect the general population (Armantier et al. 2024). These findings should be researched more and can have important implications for our understanding of how young and older adults interpret media that could be potentially risky to engage with.

Results were generally consistent across the two experiments, regardless of the differences in the study times of the advertisements between the two experiments. Interestingly, participants in the “free” version did seem to have higher rates of participants remembering “free” more often than was stated in Experiment 2 than in Experiment 1. This could be because in Experiment 2, participants could study the advertisement for as little as they wanted, and it could be that participants did not fully engage with the advertisement enough to accurately remember the amount that “free” was stated; however, more research should be conducted in order to understand if this is in fact the reason for this difference. Contrary to our original hypothesis, older adults did not study the advertisement longer than young adults in the self-paced experiment. We also found that study time was not a significant predictor of the amount of times that participants recalled the word “free” in the “free” condition, which was also contrary to our hypothesis. However, in the “no free” condition, study time was, in fact, a predictor of the amount that participants recalled the word “free.” This could be because participants who studied the advertisement for longer studied the advertisement more thoroughly and were able to be more accurate in remembering that the word “free” was never mentioned in the “no free” advertisement. We hypothesize that study time may have been a significant predictor for the “no free” condition and not the “free” condition because there may be a difference in the mechanisms for remembering binary items in the “no free” condition (whether free was present versus not) compared to remembering an exact number of the amount a present item was presented in the “free” condition. Further research should explore this potential explanation further.

Misremembering verbatim information within advertisements can be detrimental to consumers, and it is likely that both younger and older adults remember gist-based information. This can lead to inflated and inaccurate memory for specific wording that could be detrimental to consumers. Future research should seek to replicate these findings in different contexts including other types of advertisements and scams. It would also be worthwhile for future studies to investigate the potential misremembering of verbatim information in advertisements that are not printed, such as memory for phone calls or TV advertisements. One potential limitation of the current study could be that we were unable to validate that the participants thoroughly read the advertisement because of the online nature of the study (Greene and Naveh-Benjamin 2022). However, in real-world settings, people typically encounter numerous advertisements online. Therefore, testing participants in an online environment could enhance the ecological validity of the results. Another potential limitation is that we did not have a manipulation check in our procedure to verify that the participants understood that the question asking, “How many times did the passage mention the word ‘free’?” Therefore, it could be that participants did not fully understand the question and did not know they had

to only provide instances of the word “free” and not synonyms of the word “free”. Thus, future research should be conducted that includes a manipulation check in order to ensure that participants fully understood the question, and to determine if some people may interpret this question in terms of gist-based terms that share the meaning of free, without using this specific terminology.

The present study showed that both young and older adults falsely remember verbatim details of complimentary sample advertisements, such that people tend to remember that a specific implicated term (free) is present more frequently than it actually was in a descriptive advertisement. These findings have important implications for the potential role of spreading activation and source memory errors for remembering a central word more frequently than it was stated in younger and older adults. In addition, these findings contribute to our understanding of how we view advertisements, what we remember from advertisements when viewing them, and potentially how we make decisions about consumer products. These findings show that we can falsely remember specific wording for an advertised product, such as when the word “free” is never mentioned in the advertisement, showing how people tend to rely on gist-based memory and may inaccurately remember details of advertisements that are consistent with schemas and expectations.

#### Author Contributions

**Kylie O. Alberts:** conceptualization, investigation, writing – original draft, methodology, validation, visualization, writing – review and editing, data curation, resources, software, formal analysis. **Alan D. Castel:** conceptualization, funding acquisition, investigation, methodology, writing – review and editing, supervision, resources, project administration.

#### Conflicts of Interest

The authors declare no conflicts of interest.

#### Data Availability Statement

The data that support the findings of this study are openly available in OSF at <https://osf.io/45pu3/>, reference number DOI: [10.17605/OSF.IO/45PU3](https://doi.org/10.17605/OSF.IO/45PU3).

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