The consequences of suggesting false childhood food events

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ABSTRACT

We combined data across eight published experiments (N = 1369) to examine the formation and consequences of false autobiographical beliefs and memories. Our path models revealed that the formation of false autobiographical belief fully mediated the pathway between suggesting to people that they had experienced a positive or negative food-related event in the past and current preference for that food. Suggestion indirectly affected intention to eat the food via change in autobiographical belief. The development of belief with and without memory produced similar changes in food preferences and behavior intention, indicating that belief in the event drives changes in suggestion-related attitudes. Finally, positive suggestions (e.g., "you loved asparagus the first time you tried it") yielded stronger effects than negative suggestions (e.g., "you got sick eating egg salad"). These findings show that false autobiographical suggestions lead to the development of autobiographical beliefs, which in turn, have consequences for one's attitudes and behaviors.

1. Introduction

In The Hunting of the Snark, Lewis Carroll noted, "what I tell you three times is true" (Carroll, 1996, p. 680). However, suggesting just once that an event occurred in one's past suffices to increase the degree to which people believe that the event is true (Mazzoni, Loftus, & Kirsch, 2001). Not only does suggestion make a false event seem true and memorable, false memories have consequences for people's attitudes and behaviors (Bernstein & Loftus, 2009).

Researchers have proposed that false suggestion produces attitudinal and behavioral consequences via the formation of false autobiographical beliefs and memories (Bernstein, Pernat, & Loftus, 2011; Mazzoni et al., 2001; Scoboria, Mazzoni, Kirsch, & Relya, 2004). Research has shown that merely suggesting to people that they experienced a particular event in the past, for example, that they had become ill after eating spoiled peach yogurt, can directly affect how much peach yogurt they consume currently (Scoboria, Mazzoni, & Jarry, 2008). However, other studies have shown that the consequences surrounding suggested food-related events are stronger in those who come to believe the suggestion than in those who do not believe the suggestion (e.g., Berkowitz, Laney, Morris, Garry, & Loftus, 2008). Thus, it is unclear whether suggestions directly affect suggestion-related attitudes and behaviors or

whether belief in the suggested events drives changes in suggestion-related attitudes and behaviors.

The right-hand side of Fig. 1 depicts a simplified schematic of the Theory of Planned Behavior (Ajzen, 1991). This theory provides a framework for discussing links between preferences, behavior intention, and behavior. The theory proposes that attitudes toward a behavior (in the current work, measured as preference ratings for suggested foods) influence behavior intention (here, measured as intention to eat a suggested food), which in turn influence engagement in the behavior (eating the food). The theory also states that available beliefs linking behavior to outcomes influence attitudes, and that other normative beliefs influence behavior intention (Ajzen, 2002). Thus, it is possible that belief in suggested events will influence suggestion-related attitudes and behavior intention, as depicted in Fig. 1 (pathways b_1, b_2, b_3). Alternatively, the effects of suggestion may be direct (pathways c_1, c_2, c_3), and the development of belief is irrelevant to suggestion-related attitudes and behavior intention.

To examine these possibilities, we re-analyzed eight published experiments involving the formation and consequences of false autobiographical beliefs and memories. The combined dataset permitted us to disentangle the direct effects of suggestion from indirect effects mediated by belief in the suggested event, which was not possible in the individual studies. The original, smaller studies categorized participants in terms of those who did ("believers") and did not believe the suggestion ("non-believers"). Such categorization requires assumptions about when false beliefs have and have not developed, and omits substantial

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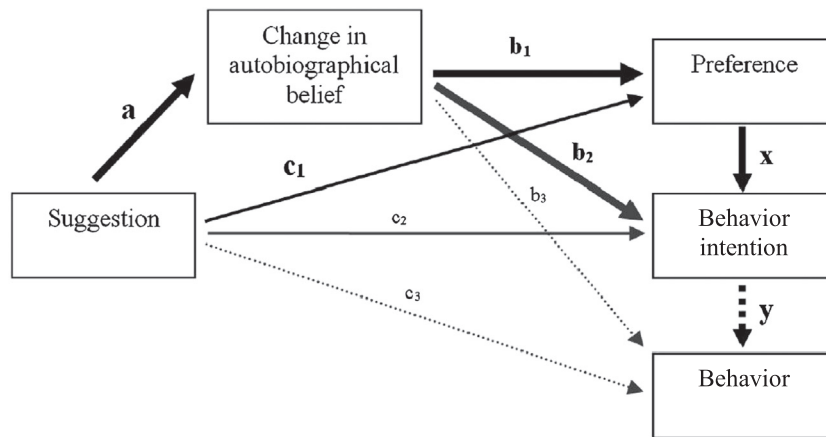
Fig. 1. Theoretical model depicting direct and indirect (mediated by autobiographical belief) links between suggestion and suggestion-related attitudes. The right hand side of the figure depicts the Ajzen and Gilbert Cote (2008) model of the influence of attitudes upon behavior intentions (x), which in turn influence behavior (y). Pathway (a) depicts the direct link between suggestion and change in autobiographical belief. Pathway (c_1) depicts the direct link between suggestion and preference ratings (c_2 and c_3 depict direct links with behavior intention and behavior). Pathway (b_1) depicts the indirect link between suggestion and preference via autobiographical belief (b_2 and b_3 depict indirect links with behavior intention and behavior). Solid lines depict pathways that are potentially testable using the current data. Dotted lines depict pathways that are untestable using the current data. Thick lines depict the prediction that the development of autobiographical belief mediates the link between the suggestion and changes in suggestion-related attitudes.

information due to dichotomization of the originally continuous variables, when estimating whether suggestion has affected autobiographical beliefs, attitudes and behavior intention. The method of testing these effects in prior studies was necessitated by the smaller sample sizes in the studies, resulting in insufficient statistical power to treat variables in a continuous manner. Consequently, prior studies have not estimated the magnitude of suggestion's effects on suggestion-related beliefs, attitudes, and behavior intention.

Researchers are also interested in the degree to which suggestive procedures lead to the development of false autobiographical beliefs (belief in the occurrence of the suggested event without accompanying recollection) versus false memories (belief with accompanying recollection). It is unknown whether false beliefs exert as much influence on other attitudes (e.g., preferences, behavior intentions) and behavior relative to the development of false autobiographical memories. Studies that use brief non-elaborative suggestions, such as those used in the current work, produce very few subjective endorsements of memory. Typically researchers must use elaborate and time-intensive procedures to produce detailed and robust false memories (see Hyman & Pentland, 1996; Loftus & Pickrell, 1995; Otgaar, Scoboria, & Smeets, 2013; Scoboria, Wysman, & Otgaar, 2012 for examples and further discussion; see Nash, Wade, & Lindsay, 2009 for a method that produces vivid 'miniature' false memories more rapidly). The few false memories that result from the brief suggestions analyzed herein are not amenable to statistical analysis within their single studies. Thus, the relative influence of false autobiographical beliefs versus false memories on other suggestion-related attitudes (preferences for a food following a suggestion about a childhood experience with the food) remains unexplored. Combining studies creates sufficient numbers of false memories to permit comparison with false autobiographical beliefs.

Here, we briefly outline the general procedure used in false food memory studies. Most studies on the consequences of suggesting false food events involve two sessions separated by one week. In Session 1, adult participants complete questionnaires designed to measure their childhood experiences with and current preferences for different foods. In Session 2, participants receive false feedback concerning their Session 1 responses that might lead them to believe that they experienced particular food-related events in their past. Embedded within this false feedback is a critical event denoting either a positive or negative experience, such as "you loved asparagus the first time you tried it" or "you got sick eating egg salad." Participants then complete many of the measures that they completed in Session 1, in addition to questionnaires that measure whether

participants have adopted a memory or belief for the critical event, and their intention to eat the food.

To measure the formation of false food beliefs and memories, researchers assess whether receiving false feedback about a critical food event in childhood increases participants' confidence that they experienced this event in their childhood (pathway a in Fig. 1). To measure the consequences of false food beliefs and memories, researchers assess whether receiving false feedback about the food event changes participants' attitudes and behaviors surrounding that food (pathways b_1, b_2, and b_3 in Fig. 1).

An aspect of the suggestions that varies across studies is whether people receive feedback that they *loved* a food or became *sick* on a food when younger. It is worthwhile to consider whether these suggestions are equally effective. It is possible that positive suggestions are more effective than negative suggestions. For example, true positive autobiographical memories influence intentions and behavior more so than true negative autobiographical memories (Kuwabara & Pillemer, 2010; Pezdek & Salim, 2011). Presumably the same should hold for objectively false beliefs or memories, because these are subjectively believed to be genuine. It is also possible that positive and negative suggestions differ in effectiveness because they target different levels of specificity. Telling people that they enjoyed a food is less behaviorally specific than telling them they got sick from that food. Conway and Pleydell-Pierce (2000) theorize that memory cues that are more specific place greater constraints on efforts to locate information in memory, which reduces the likelihood of successful retrieval. Building on this argument, Hessen Kayfitz and Scoboria (2012) found that false memories are less likely to develop as the information provided with suggestions becomes more specific.

Because we had the original raw data, we conducted a mega-analysis in which we combined the studies into a single dataset. Mega-analysis involves the direct combination of data from multiple studies that have used the same or similar designs and measurement instruments. Mega-analysis has advantages over meta-analysis in that datasets can be combined to enhance statistical power, permitting examination of hypotheses that cannot be tested within single studies. This approach has been used to combine datasets in areas such as genetics (Whalley et al., 2012), functional neuroimaging (Hallahan et al., 2011), and psychiatric treatment (de Maat et al., 2008; Thase et al., 1997). The current study used the combined dataset to address three novel goals: (1) to test the direct versus indirect (mediated by autobiographical belief) effects of suggestion on suggestion-related preferences and behavior intention; (2) to examine the impact of the development

Table 1
Experiments and measures included in analysis.

Experiment	N included	Target food(s)	Suggestion	Time 1 measures			Time 2 measures			
				Food history	Food preference	Behavior intention	Food history	Food preference	Behavior intention	Memory vs. belief
Bernstein et al. (2005a, Exp 2)	Suggestion = 150 Control = 150	Hard boiled eggs Pickle	Sick	Y			Y	Y	Y	
Bernstein et al. (2005b, Exp 1)	Suggestion = 72 Control = 35	Strawberry ice cream Chocolate chip cookie	Sick	Y	Y	Y	Y	Y	Y	Y
Bernstein et al. (2005b, Exp 2)	Suggestion = 119 Control = 60	Strawberry ice cream	Sick	Y	Y	Y	Y	Y	Y	Y
Laney, Bowman Fowler, Nelson, Bernstein, and Loftus (2008)	Suggestion = 189 Control = 111	Asparagus	Sick Loved	Y	Y		Y	Y	Y	Y
Laney, Kaasa, et al. (2008)	Suggestion = 117 Control = 53	Asparagus	Sick Loved	Y	Y		Y	Y	Y	Y
Laney, Morris et al. (2008, Exp 1)	Suggestion = 45 Control = 52	Asparagus	Loved	Y		Y	Y	Y	Y	Y
Laney, Morris et al. (2008, Exp 2)	Suggestion = 31 Control = 23	Asparagus	Loved	Y	Y	Y	Y	Y	Y	Y
Geraerts et al. (2008)	Suggestion = 109 Control = 53	Egg salad sandwich	Sick	Y	Y	Y	Y	Y	Y	Y

Note: Exp = Experiment.

of false autobiographical beliefs vs. false memories on the same variables; (3) to assess the relative strength of positive vs. negative suggestions on food preferences and behavior intention.

2. Materials and method

2.1. Studies combined for analysis

We included the following studies in our analyses: Bernstein, Laney, Morris, and Loftus (2005a; Experiment 2); Bernstein, Laney, Morris, and Loftus (2005b; Experiments 1 & 2); Laney, Bowman Fowler, Nelson, Bernstein, and Loftus (2008); Laney et al. (2008); Laney, Morris, Bernstein, Wakefield, and Loftus (2008, Experiments 1 & 2); & Geraerts et al. (2008). Each study followed a similar design, with baseline measures taken one week before a suggestion session. During the suggestion session, individuals received personalized feedback allegedly derived from their baseline responses that either suggested a false childhood food event (suggestion participants) or did not suggest an event (controls). Immediately after, participants completed post-manipulation measures of belief that the event occurred, food preference for the target food (and other foods), and behavior intention for the target food (and other foods). Table 1 displays the studies and their characteristics.

2.2. Measures

2.2.1. Food history inventory

In different studies, participants rated between 19 and 24 food-related experiences on a scale from 1 (definitely did not happen before 10 years of age) to 8 (definitely did happen before 10 years of age). The critical food item appeared somewhere in the middle of the questionnaire.

2.2.2. Food preference inventory

In different studies, participants rated between 62 and 64 food items on a scale from 1 (definitely don't like to eat) to 8 (definitely like to eat). The critical food item appeared somewhere in the middle of the questionnaire.

2.2.3. Behavior intention

In some studies, participants completed a Party Questionnaire in which they rated between 20 and 37 foods on a scale from 1 (definitely no) to 8 (definitely yes), indicating their willingness to eat various foods at a party. In other studies, participants completed a Restaurant Questionnaire in which they rated between 19 and 32 foods on a scale from 1 (definitely no) to 8 (definitely yes), indicating their willingness

to order various foods at a restaurant.[1] The critical food item appeared somewhere in the middle of the questionnaire.

2.2.4. Memory versus belief questionnaire

Participants rated three food-related experiences on a categorical scale. Participants were asked to select one of three categories: if they had a specific memory for the event, if they believed the event occurred but did not have a specific memory, or if they were positive that the experience did not occur in their past.

2.3. Description of the dataset

We combined the data from eight published experiments into a single database, eliminating a small number of cases (<25) with substantial missing data, and all individuals with a baseline food history score above the scale midpoint on the critical item (216 cases). This is typically done in such research, because the focus is on the development of beliefs and memories in individuals who at first indicate a lack of belief. The final dataset contained 1369 cases (736 female, 454 male, 179 no gender available; age range 17–50, mean age 20.34, SD = 3.02, age available for 83% of the total). Of these, 832 participants received the suggestion and 537 were controls. Of suggestion participants, 606 (72.8%) were told that they were sick and 226 (27.2%) were told that they loved the target food. We imputed a small number (33) of missing data points using the expectation maximization procedure (Acock, 2012).

Not all variables were available in all studies. Baseline food preference was not collected in two studies (total N = 874), and baseline behavior intention was not collected in three studies (total N = 971). To maximize the utility of the data, we included variables that were available for the entire dataset. These were: baseline food history; post-suggestion food history; post-suggestion food preference; post-suggestion behavior intention; and memory versus belief. We also coded group (suggestion, control), direction of suggestion (sick, loved), and target food.

2.4. Data preparation and screening

We screened the data to evaluate the suitability of combining all data. The control groups in each study showed similar pre–post changes between the two measurement points. Item intercorrelations indicated that items were related in similar manners within each study. Item distributions and linearity of associations amongst variables showed

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[1] Three experiments used a 1–7 point scale; visual inspection of the item distributions indicated that this did not affect the distribution of responses.

reasonable similarity across the studies. The sick and loved suggestion groups showed statistically equivalent baseline scores on the food history, $M_{diff} = .01$ [95% CI_{diff} -.11, .13]; $t (1367) = .14, p = .88$. When sample and food type were included in analyses reported below, no statistically significant relations emerged. Analysis of multivariate outliers indicated no problematic cases. These screening procedures suggest that the study samples were drawn from similar populations, and that combining them for omnibus analysis was appropriate.

Analyses are potentially complicated by the fact that the suggestion for sick groups is predicted to cause decreases in food preference and behavior intention, while the suggestion for loved groups is predicted to cause increases in these variables. To facilitate analyses and to simplify the development of path models, the scores for food preference and behavior intention were reflected around the mean for each variable when the suggestion was negative (sick on food). This serves to place the effects for the loved and sick suggestions in the same (positive) direction, while retaining the same relationships with the other variables. The reflection procedure did not alter the findings, but did allow the elimination of complex interactions from the analyses, simplifying the reporting of results.

3. Results

3.1. Regression models

The modeling examined whether providing the suggestion had a direct effect on preferences and behavior intention for the target food, or as hypothesized whether change in belief in the occurrence for the target event mediated this link. The direct pathways between suggestion and each of the other variables (change in food history, food preference, behavior intention) were tested, after which the final models were conducted to predict preference and behavior intention separately. The final model included the following parameters: group (suggestion, control), suggestion type (sick, loved), baseline food history, change in food history rating, and the change in food history by direction of suggestion and group by direction of suggestion interactions.
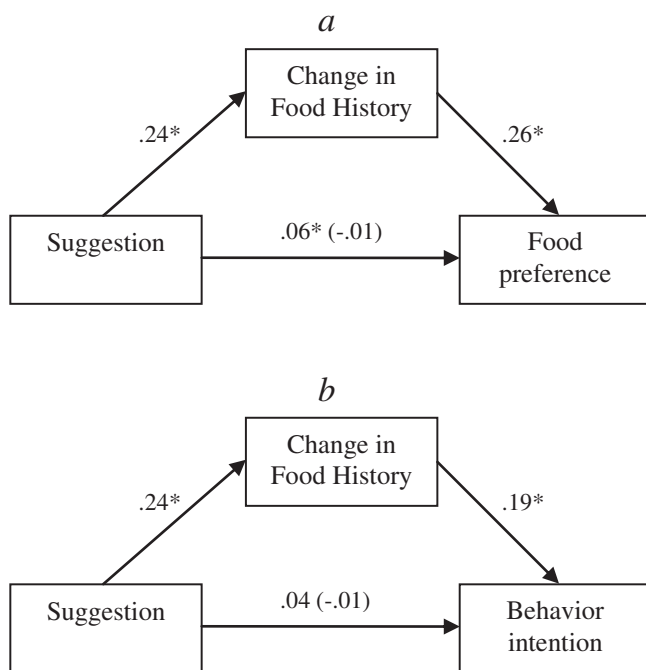

Fig. 2. Standardized regression coefficients for the links between suggestion and food preference (panel a) and behavior intention (panel b) as mediated by change in food history ratings. The standardized coefficient for suggestion and food preference after controlling for change in food history ratings is in parenthesis. *$p < .05$.

Table 2
Model coefficients when predicting food preference.

Variable	Coeff.	SE	t	p	95% CI
Constant	2.96	.20	14.38	<.001	
Baseline food history	.61	.10	6.01	<.001	.41, .81
Change in food history	.42	.05	8.49	<.001	.32, .51
Group (suggestion, control)	−.07	.07	−1.04	0.297	−.21, .06
Direction of suggestion (sick, loved)	−.80	.14	−5.54	<.001	−1.08, −.52
Change in food history × direction of suggestion	.32	.07	4.42	<.001	.18, .46

3.1.1. Food preference

As shown in Fig. 2, panel a, suggestion directly predicted both food preference, $F (2, 1367) = 4.54, p = .033$, and change in food history ratings, $F (2, 1364) = 68.29, p < .001$. The full mediational model was statistically significant, $F (5, 1361) = 20.19, p < .001$; change in food history fully mediated the direct effect of suggestion on preference. In addition, the effects of direction of suggestion and the change in food history by direction of suggestion interaction were significant (see Table 2 for model coefficients). Examination of the interaction revealed that suggestion affected food history ratings, which in turn affected food preference, and this effect was larger for the "loved" than for the "sick" suggestion (see Fig. 3, panel a).

3.1.2. Behavior intention

As shown in Fig. 2, panel b, suggestion did not directly predict behavior intention, $F (1, 1364) = 2.00, p = .158$. The full model revealed an indirect effect of group on behavior intention, $F (2, 1367) = 68.29, p < .001$. The direction of suggestion and direction of suggestion by food history interactions were also significant (see Table 3 for coefficients). As with food preferences, suggestion affected food history ratings, which in turn affected behavior intention, and this effect was larger for the "loved" than for the "sick" suggestion (see Fig. 3, Panel b).

To summarize the results of these mediational analyses, we found that the direct effect of suggestion on food preference was mediated fully by change in food history ratings. Suggestion was not directly related to behavior intention, but suggestion affected behavior intention indirectly via change in food history ratings.

3.1.3. Combined model

We assessed the feasibility of testing the combined model: suggestion → food history → food preferences → behavior intention; however, this could not be accomplished statistically. This was because food preference and behavior intention correlated substantially at baseline (for those with baseline data, $r = .77, N = 502$), and across the entire sample post-manipulation food preference and behavior intention also showed a strong correlation ($r = .69$). This left little distinct variance to be predicted. Thus, it was not possible to draw any statistical conclusion about this potential causal chain. However, the fact that suggestion affected food preferences directly but influenced behavior intention indirectly suggests that this model may indeed hold, given a different method of data collection. We address this issue in the Discussion section.

3.2. Believers and rememberers

We classified participants as *believers* and *rememberers* using the procedure from Scoboria, Mazzoni, Jarry, and Bernstein (2012). We designated suggestion participants who indicated memory and increased on the food history scale as rememberers, and suggestion participants who indicated belief and increased on the food history scale as believers. We designated the remaining suggestion participants as non-believers.

We wondered if the degree of subjective belief or memory predicted the various outcome variables, because people with memories for the event might show greater change on these variables. Such a finding would indicate that the development of memory has a more substantial
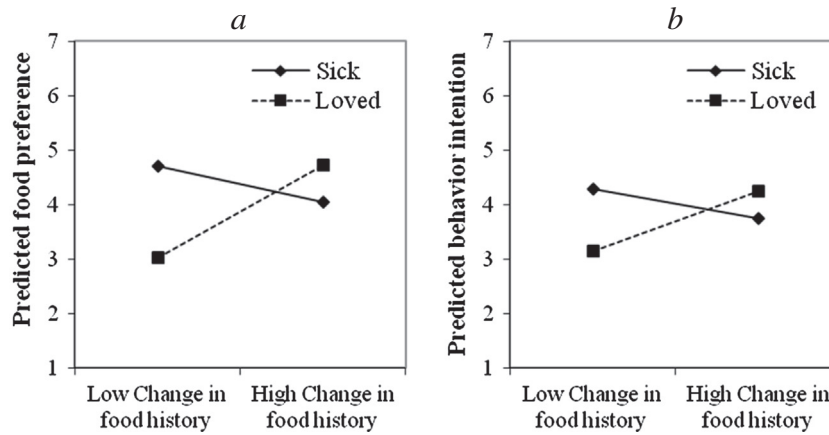
Fig. 3. Food preference (panel a) and behavior intention (panel b) ratings as a function of change in food history ratings and direction of suggestion. As is evident in the slopes, change in food preference and behavior intention is greater for the loved than for the sick suggestion. Note: The data for "sick" suggestion participants used to create these figures was not reflected, so as to show the influence of the direction of suggestion. "Low" and "high" change reflect -1 and $+1$ standard deviations according to the respective regression model.

influence than the development of autobiographical belief. Table 4 lists the post-manipulation ratings as a function of believer status. We examined the degree of overlap between 95% confidence intervals to determine statistically meaningful group differences. As expected, food history ratings were highest amongst rememberers, followed by believers, followed by non-believers and controls who did not differ. More importantly, for food preference and behavior intention ratings, rememberers and believers did not differ, and both exceeded non-believers and controls. Thus, it is belief in suggested events and not memory for suggested events that determines change in preferences and behavior intention. The effect sizes when contrasting believers (with or without memory) versus non-believers (combined control and nonbeliever) were statistically moderate: food preference, Cohen's $d = .58$ (95% CI .48, .67); behavior intention, $d = .40$ (95% CI .27, .52).

When considering the direction of suggestion, the proportion of rememberers, $X^2 = 15.52$, $p < .001$, $\phi = .14$ (12.83% vs. 4.95% for love and sick, respectively), and believers, $X^2 = 15.14$, $p < .001$, $\phi = .14$ (48.23% vs. 37.46% for love and sick, respectively), was greater following loved suggestions.

3.3. Suggestion-induced versus spontaneous beliefs/memories

This pooled analysis permitted the comparison of suggestion-induced versus spontaneous false autobiographical belief and memory rates. Because the memory vs. belief measure was not administered for control events for one study (Bernstein et al., 2005a, Experiment 2), we excluded this study when examining this issue. We compared the rates for the believer and rememberer categories between the suggestion and control groups. Across studies, the believer rate was 8.40% [95% CI 6.2, 10.9] for control and 40.40% [95% CI 37.1, 43.6] for suggestion participants, and the rememberer rate was 1.70% [95% CI 0.06, 2.9] for control participants and 7.10% [95% CI 5.4, 8.8] for suggestion participants. Thus, there were more believers, $\phi = .39$ [95% CI .35, .43], and rememberers, $\phi = .12$ [95% CI .08, .16], in the suggestion group than in the control group.

Table 3
Model coefficients when predicting behavior intention.

Variable	Coeff.	SE	t	p	95% CI
Constant	3.01	.20	14.94	<.001	
Baseline food history	.45	.09	4.55	<.001	.26, .65
Change in food history	.30	.05	6.29	<.001	.21, .40
Group (suggestion, control)	−.07	.07	−0.96	0.337	−.20, .07
Direction of suggestion (sick, loved)	−.60	.14	−4.27	<.001	−.88, −.33
Change in food history × direction of suggestion	.25	.07	3.56	<.001	.11, .39

4. Discussion

Several novel findings emerged from re-analysis of eight published experiments involving the formation and consequences of false autobiographical beliefs and memories. The primary finding was that the suggestion manipulation affected preference and behavior intention ratings. Suggesting to people that they had had either a positive (or negative) experience with a particular food in the past directly increased (or decreased) their current self-reported preference for that food (pathway c_1 in Fig. 1). Although present, this direct effect of suggestion on preference was weak. Change in food history ratings fully mediated the suggestion–food preference effect (pathway b_1 in Fig. 1). Additionally, although suggestion did not relate directly to behavior intention (pathway c_2 in Fig. 1), suggestion did indirectly influence behavior intention via change in food history ratings (pathway b_2 in Fig. 1). These results show that belief in the occurrence of a suggested food event fully mediates the pathways from suggestion to food preference and behavior intention.

Unfortunately, because of collinearity in the dependent measures we could not test a combined model wherein suggestion relates to food history ratings, which in turn relates to food preferences, which in turn relates to behavior intention (pathways a, b_1 and x in Fig. 1). Although we could not test this model, there are reasons to think that this model will turn out to be true. First, suggestion caused change in belief for some of our participants, producing a direct effect on preferences, and an indirect effect on behavior intention. This indicates that behavior intention is downstream of preferences when evaluating suggestion's effects on attitudes and behaviors. This is consistent with the theory of planned behavior, which states that behavioral attitudes inform behavior intention, which in turn inform actual behavior (Ajzen, 1991). Future studies should test the link between the development of false autobiographical beliefs and the complete model within the theory of planned behavior. One approach in future work could be to test the complete model by giving one group of experimental participants food preference pre- and post-suggestion and behavior intention post-suggestion only. The other experimental participants would receive behavior intention pre- and post-suggestion and preference post-suggestion only.

The second novel finding was that those people who came to believe the suggestion, whether they reported remembering the event or believing it, shifted their self-reported preference for and intention to eat the suggested food more so than those who resisted the suggestion or those not exposed to the suggestion. In fact, while those who indicated remembering showed greater increases in food history ratings, in terms of preference and behavior intention, participants who claimed to remember the suggested event were indistinguishable from those

Table 4
Post manipulation food history, food preference, and behavior intention ratings by believer status.

	Control (N = 537)	Non-believer (N = 437)	Believer (N = 336)	Rememberer (N = 59)
	Mean [95% CI]	Mean [95% CI]	Mean [95% CI]	Mean [95% CI]
Food history	2.02[a] [1.89, 2.15]	1.94[a] [1.80, 2.08]	4.01[b] [3.77, 4.26]	6.22[c] [5.90, 6.69]
Change in food history	0.41[a] [0.29, 0.53]	0.35[a] [0.22, 0.50]	2.00[b] [1.77, 2.24]	4.56[c] [4.17, 5.09]
Food preference*	4.31[a] [4.09, 4.51]	4.18[a] [3.96, 4.41]	4.99[b] [4.75, 5.25]	5.59[b] [5.00, 6.16]
Behavior intention*	4.02[a] [3.82, 4.23]	3.79[a] [3.58, 4.02]	4.59[b] [4.36, 4.84]	5.11[b] [4.51, 5.70]

Notes: Superscript letters across rows indicate statistically meaningful differences using between groups, as indicated by non-overlap in 95% CIs. * indicates post-manipulation food preferences and behavior intention; scores in negative suggestion groups are reflected so that all effects are in the positive direction. All participants in the non-believer, believer, and rememberer groups received the suggestion.

who reported belief that the event happened in their past (without memory). This finding accords well with arguments that belief in an event's occurrence, rather than a specific memory for the event, is the critical component in influencing behavior (Mazzoni & Scoboria, 2007; Scoboria et al., 2004). This finding also confirms that, to produce changes in attitudes and behavior intention, suggestions need not increase autobiographical belief to the upper end of the scale. In this dataset, the average Food History Inventory score associated with the development of false autobiographical belief fell below the scale mid-point, and the average increase was about two points on the eight-point scale. Perhaps the link between change in autobiographical belief and changes in other suggestion-related attitudes and behaviors is similar to the link that has been demonstrated between the plausibility of suggested events and the development of autobiographical beliefs: a small change can go a long way (Mazzoni et al., 2001). Future research might consider examining the degree to which belief needs to develop in order to facilitate changes in other suggestion-related variables.

A third novel finding was that for both food preference and behavior intention, positive suggestions (loved the food the first time you tried it) had a stronger effect than did negative suggestions (got sick from the food). This finding is consistent with the limited research on false autobiographical belief and memory formation for positive versus negative events (see Mantonakis, Wudarzewski, Bernstein, Clifasefi, & Loftus, 2013; see also Kuwabara & Pillemer, 2010; Pezdek & Salim, 2011 for differences between true positive and negative memories). Specifically, it may be easier to convince people that they experienced a positive rather than a negative event in the past (Mantonakis et al., 2013), because memories for positive and negative experiences may serve different functions (Pillemer, 2009; see Bluck, Alea, Habermas, & Rubin, 2005). Moreover, in one study, university students rated their satisfaction with their university experience and recounted either a specific positive or negative university experience. Those who recounted a positive experience indicated stronger intentions to donate to the university, attend a class reunion, and recommend the university to others (Kuwabara & Pillemer, 2010). In another study, researchers suggested to some high school students that they had had a positive public speaking experience in childhood. After recounting a specific memory for this event, students showed better actual public speaking performance (Pezdek & Salim, 2011). As noted in the introduction, comparing 'sick' to 'loved' suggestions in the current work may be problematic, because these suggestions differ in terms of their specificity: The "love" suggestion was less specific than the "sick" suggestion. To address whether positive suggestions in fact produce stronger effects, future studies should equate the specificity of the suggestions.

In our view, these findings are consistent with current models of false belief and memory formation (Bernstein et al., 2011; Hyman & Kleinknecht, 1999; Pezdek, Finger, & Hodge, 1997; Scoboria et al., 2004). The models generally agree that for a false memory to develop, an unremembered event must first come to be viewed as a sufficiently

plausible part of the personal past. Following this, a degree of belief that the event occurred must develop, a mental representation for the event must be constructed, and the mental representation must be attributed as a memory (the order of these steps is not fixed). The result for some individuals is a vivid mental representation that shares similar features with other vivid personal memories.

Studies of false memory formation have revealed that false beliefs frequently develop without accompanying recollection. These *believed-not-remembered* events frequently arise in false memory studies and are prevalent in everyday remembering (e.g., family stories that are not recollected). Based on a combination of believed-not-remembered events and the discovery of *nonbelieved memories* (memories which have vivid mental imagery and a strong sense of reliving the past, but which are not believed to be true), Scoboria and colleagues (2014) have demonstrated that autobiographical belief judgments and recollection judgments are largely independent and presumably arise from distinct underlying processes. The current study provides further evidence for the proposition that autobiographical belief and recollection are distinct: We found that the development of belief and the development of memory (recollection) affect different variables. Compared to memory of past events, belief in the occurrence of past events is more important for altering attitudes and behaviors.

4.1. Limitations and future directions

Compared to control participants who did not receive suggestions regarding a critical food event, more than five times as many experimental participants who received suggestions developed false autobiographical beliefs, and more than four times as many experimental participants developed false memories. Although this difference is understandable, what might not be clear is why *any* control participants spontaneously developed false autobiographical beliefs and memories. There are several possible reasons for this: (1) Random error (some participants responded carelessly, indicating belief when they did not in fact believe that the event occurred); (2) spontaneous recollection of an actual or related experience; (3) repeated exposure to rating the event may have inflated familiarity for the event (Garry, Manning, Loftus, & Sherman, 1996; Jacoby, Kelley, & Dywan, 1989).

The present study tested and confirmed a model of the formation and consequences of false autobiographical beliefs and memories; however, all studies included in our analysis explored intended rather than actual behavioral consequences. Several published studies have demonstrated actual behavioral consequences of false autobiographical beliefs and memories (Geraerts et al., 2008; Mantonakis et al., 2013; Scoboria, Mazzoni, Jarry, & Bernstein, 2012; Scoboria et al., 2008). Further work is needed to establish whether the indirect link established in the current study between suggestion and behavior intention via autobiographical belief also holds for the link between suggestion and actual behavior.

5. Conclusions

Combining data across eight published experiments, we observed three novel findings. First, suggesting to people that they had had either a positive or negative experience with a certain food in the past directly affected their current self-reported preference for that food (food preference), but did not directly affect their intention to eat that food (behavior intention). Also, one's belief in the suggested event fully mediated the pathways from suggestion to food preference and behavior intention. The second novel finding was that those people who came to believe the suggestion, whether they reported remembering or believing the event occurred, altered their food preference and behavior intention more so than those who did not believe the suggestion or those not exposed to the suggestion. The third novel finding was that positive suggestions (loved the food the first time you tried it) had a stronger effect than did negative suggestions (got sick from the food) on food preferences and behavior intention. These findings show that false autobiographical suggestions can produce false autobiographical beliefs and memories, which have consequences for one's attitudes and behaviors.

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