A JOURNAL OF THE ASSOCIATION FOR PSYCHOLOGICAL SCIENCE aps

# The Consequences of False Memories for Food Preferences and Choices

**Daniel M. Bernstein[1] and Elizabeth F. Loftus[2]**

*[1]Kwantlen Polytechnic University and University of Washington and [2]University of California, Irvine*

**ABSTRACT**—***False memories, or memories for events that never occurred, have been documented in the real world and in the laboratory. In the real world, false memories involving trauma and abuse have resulted in real-life consequences. In the laboratory, researchers have just begun to study the consequences of false memories. We review this laboratory-based work and show how false memories for food-related experiences (e.g., becoming ill after eating egg salad) can lead to attitudinal and behavioral consequences (e.g., lowered self-reported preference for and decreased consumption of egg salad).***

Assume for a moment that your brother suggests to you that a small dog bit you when you were a child. Assume also that this event never occurred and that you do not recall it. Your brother insists he's right and after repeated prodding you start to believe this happened to you. A scenario similar to this one has been recreated in recent laboratory experiments that reveal an important insight into human memory: People can be led to believe that entire events occurred in their past that never actually happened. In some cases, these beliefs are accompanied by sensory detail that makes them seem authentic. We call these "rich false memories."

Rich false memories can be very difficult to distinguish from real memories. Returning to the dog bite example, what happens after you come to believe that this event occurred? Will you now feel uncomfortable around small dogs? Will you prefer a cat or a bird to a dog if given the choice of a pet to acquire? If you do come to avoid small dogs, this would suggest that false beliefs and memories have repercussions—they can affect later thoughts, attitudes, and even behaviors.

Address correspondence to Daniel M. Bernstein, Kwantlen Polytechnic University, 12666 72nd Avenue, Surrey, British Columbia V3W 2M8, Canada; e-mail: Daniel.bernstein@kwantlen.ca or Elizabeth F. Loftus at eloftus@uci.edu.

Traditionally, there have been two types of false memory studies: those that demonstrated false memory implantation and those that demonstrated spontaneous false memories in the absence of explicit efforts at implantation (e.g., see Brainerd & Reyna, 2005). Our focus here is on the former. Some of the research on implanted false memories was fueled by a societal controversy regarding the authenticity of recovered memories (Lindsay & Read, 1994; Loftus, 1993). Many studies established the ability to implant false memories for a variety of events, some of which would have been impossible (e.g., meeting Bugs Bunny at Disney) or traumatic (e.g., animal attacks) had they happened. These studies implanted the false memories using suggestive methods like plying subjects with false information or guiding them through imagination exercises (see Desjardins & Scoboria, 2007). The main interest of researchers was in demonstrating that rich false memories could be implanted (accompanied by a sense of recollection), but in some cases, a mere false belief was implanted (with no accompanying episodic detail; see Smeets, Merckelbach, Horselenberg, & Jelicic, 2005). Many researchers saw applicability to the repressed memory controversy swirling around society, but out in the real world of repressed memory claims, the false memories were wreaking consequences (e.g., accusations made in criminal courts, family dynamics destroyed). Back in the laboratory, the consequences of false memories were not being examined. Thus, researchers became interested in exploring whether experimentally induced false memories could also be shown to have consequences.

It seemed natural to assume that if a person had a bad experience with some object, then that person might avoid the object later. With this thought in mind, we turned our attention to food. If we could make people believe that they had a bad experience with a particular food, would they later avoid that food?

## DOCUMENTING THE CONSEQUENCES OF FALSE MEMORIES

In our first study, we made people believe that as children they got sick eating some food (Bernstein, Laney, Morris, & Loftus,





PERSPECTIVES on Psychological Science

2005b). Subjects completed questionnaires in the laboratory, including a personality questionnaire and a Food History Inventory. Subjects returned 1 week later, and were told that we had entered their responses to these questionnaires into a computer that had generated a profile of their early childhood experiences with food. Subjects believed that this profile was tailored individually to them, based on personal information that they had supplied. All subjects received three identical filler items on this profile that were true of many children (e.g., "eating chocolate birthday cake made you happy") and one critical item. For half the subjects, this critical item was "you got sick after eating a hard-boiled egg." For the remaining subjects, the critical item was, "you felt ill after eating a dill pickle." Next, subjects answered follow-up questions about the chocolate cake item and their critical item to ensure that they processed the false feedback. Then, subjects completed the Food History Inventory again and two food preference questionnaires. We found that in relation to control subjects who received no false feedback about dill pickles, those subjects who came to believe that as children they had become sick eating dill pickles (believers) reported less preference for and willingness to eat dill pickles as adults. A similar pattern of results emerged for hard-boiled eggs, our other critical item. So, this study established that you could make people believe they got sick eating particular foods and that these subjects would later report less interest in eating those foods.

### How About Fattening Foods?

Our first attempt to extend this work to fattening foods involved potato chips. We found that we could make people believe that as children they had gotten sick eating potato chips. However, we did not find that they avoided potato chips as adults. In pondering these results, we looked more closely at the literature on genuine taste aversions that reveals that food aversions arise with novel foods, not ones that are commonly eaten (Koh & Bernstein, 2005). Thus, we designed a study to make people believe they had gotten sick on strawberry ice cream (a novel food) or chocolate chip cookies (a more common food; Bernstein, Laney, Morris, & Loftus, 2005a). We implanted false beliefs about strawberry ice cream in up to 40% of subjects. In comparison with control subjects, who received no false feedback about strawberry ice cream, the 40% of subjects who believed the false feedback later reported less willingness to eat strawberry ice cream at a party and less general preference for strawberry ice cream. In contrast, those who received the false cookie suggestion did not increase their confidence that they had gotten sick eating a chocolate chip cookie as a child, nor were their subsequent preferences affected. Thus, we demonstrated that these techniques could turn people away from a fattening novel food like strawberry ice cream but not from a fattening common food like chocolate chip cookies, a result that could potentially assist in dieting techniques (see Practical Implications).

### Positive False Memories

If a negative false memory can make people like a food less, then a positive false memory should make them like it more. We explored this question next (Laney, Morris, Bernstein, Wakefield, & Loftus, 2008).

Subjects completed the same measures as in our previous studies. When it came to the false feedback, however, some subjects learned that they loved asparagus the first time they tried it as children. We ensured that subjects processed the feedback, and then we examined its impact. Positive false feedback made some subjects more confident that the event had occurred (believers). Moreover, in comparison with control subjects who received no false feedback about asparagus, this increased confidence among believers was accompanied by increased self-reported preference for asparagus and self-reported willingness to pay more for asparagus at the grocery store. Finally, subjects who believed that they had loved asparagus the first time they tried it rated a photograph of asparagus as more appetizing and less disgusting than did control subjects. Thus, this study confirmed for us that you can implant a positive experience about a healthful food—asparagus—with positive consequences: People would report wanting asparagus more.

### Imagined Versus Real Eating Behavior

Astute readers will notice that the consequences discussed so far involved self-reported food preferences (see Table 1). Subjects tell us how much they like a food in general or how much they think they would eat it at an imaginary party or restaurant. Would these suggestive manipulations also reveal consequences when subjects were given the opportunity to actually eat the key foods? Recent research reveals that the answer is "yes."

In our first attempt to demonstrate the behavioral consequences of false memory, we falsely suggested to some subjects that they loved asparagus the first time they tried it. We then measured the formation and self-reported consequences of false beliefs and memories for this event. Next, we contacted subjects via email and told them that we would feed them during their final laboratory visit. In this e-mail, we asked subjects to rank order a list of sandwiches and vegetables (including asparagus) that they would like served during the final visit. As expected, in comparison with control subjects, those subjects who came to believe that they loved asparagus the first time they tried it were more enthusiastic about the prospect of eating asparagus (a prospect that they, unfortunately, did not get to enjoy; Laney, Bowman-Fowler, Nelson, Bernstein, & Loftus, 2008).

Our next attempt to establish the behavioral consequences of false food memories involved actual food served to subjects in the laboratory. In this study, we suggested to some subjects that they had become ill after eating egg salad as children. In comparison with control subjects, those who came to believe the false feedback ate fewer egg salad sandwiches shortly after receiving the false suggestion and up to 4 months later in what

**TABLE 1**
*False Food-Memory Studies Reviewed in This Article*

| Study and critical item (false memory) | Results |
|---|---|
| Bernstein et al. (2005a)[a] | |
| Sick from strawberry ice cream. | False beliefs and memories for strawberry ice cream only. |
| Sick from chocolate chip cookies. | Decreased self-reported preference for strawberry ice cream. |
| Bernstein et al. (2005b)[a] | |
| Ill from dill pickles. | False beliefs and memories. |
| Sick from hard-boiled eggs. | Decreased self-reported preference. |
| Laney, Morris, et al. (2008) | |
| Loved asparagus. | False beliefs and memories. |
| | Increased self-reported preference and willingness to pay more for asparagus at grocery store. |
| | Photograph of asparagus rated as more appetizing and less disgusting. |
| Laney, Bowman- Fowler, et al. (2008) | |
| Loved asparagus. | False beliefs and memories. |
| | Increased self-reported preference. |
| | Subjects gave asparagus higher rank order in anticipation of eating asparagus at final testing session. |
| Scoboria et al. (2007) | |
| Sick from peach yogurt. | Subjects ate less peach yogurt and rated its appearance, taste, odor, and texture lower. |
| Geraerts et al. (2008) | |
| Sick from egg salad. | False beliefs and memories. |
| | Decreased self-reported preference. |
| | Subjects ate fewer egg salad sandwiches. |

[a]Critical item manipulated between subjects.

subjects believed was an unrelated food and beverage taste study. An experimenter, blind to experimental conditions, measured eating behavior by recording the number of egg salad sandwiches consumed by each subject. Although the false memory behavioral consequences persisted up to 4 months, they diminished in strength (Geraerts et al., 2008).

Another research laboratory has also confirmed the occurrence of consequences flowing from the development of a false food memory. Subjects who were told that they likely became ill after eating spoiled peach yogurt as children ate less peach yogurt and rated its appearance, taste, odor, and texture lower than did control subjects 1 week after receiving the false feedback (Scoboria, Mazzoni, & Jarry, 2008). The authors successfully disguised the true nature of the study by leading subjects to believe that they were participating in unrelated market research on food and beverage taste. Together, these studies show that false food memories can affect real eating behavior.

### Demand Characteristics

If subjects guessed our hypotheses, they could behave in a way that confirms the hypotheses. They could have simply claimed they remembered getting sick, for example, and told us they didn't want the food, not because they felt that way, but because they wanted to be helpful subjects.

Several lines of evidence argue against this. First, recall that we succeeded in implanting false beliefs and memories about becoming ill after eating strawberry ice cream but not after eating chocolate chip cookies. If demand characteristics were operating, we would expect our false feedback manipulation to work with any item that we suggested. Second, we tested whether subjects who rated highly on social desirability and suggestibility were more likely to believe our false feedback. We failed to find any evidence for this. Third, we queried subjects at the end of our studies. After removing those who guessed that the study related to memory distortion, our conclusions did not change.

We also devised a new method for dealing with demand that we call "The Red Herring Technique" (Laney, Kaasa, et al., 2008). In this study, we led subjects to believe, without actually telling them, that the purpose of the study was to investigate the problem of obesity in American children (the red herring). This red herring served as an extra layer of deception beyond our false cover story (that we were investigating the link between personality differences and food preferences). Our "double cross" procedure worked: We lured many subjects away from the true aim of our study toward the red herring so that they believed that our study was about the problem of obesity in American children. Our findings leave us confident that the typical false memory–consequences results are not due to demand characteristics.

## WHAT'S GOING ON?

How do we explain these findings? Have we simply associated positive and negative details with the critical food so that when

the food is mentioned later the positive or negative reaction springs to mind? Or is it important that subjects develop a rich false memory before we see consequences? In one study, rather than trying to implant false beliefs and memories, we instead trained subjects to associate certain critical foods (e.g., asparagus, broccoli) with positive or negative words (e.g., *love*, *hate*). This association technique did not alter subjects' self-reported preference for the critical food (Baillie, Bernstein, & Greenwald, 2007). We believe that in contrast to simple associative learning, more powerful manipulations like elaboration and imagination are necessary to change people's food preferences and choices. These techniques can produce false beliefs and memories, which may then be responsible for the food-related consequences that we and other researchers have observed. After all, in most of our studies, it is the subjects who believe the false feedback who show the largest consequences. For example, in our food photograph study described earlier, it was the subjects who believed the suggestion that they loved asparagus as a child who later rated the asparagus photo as more appetizing and less disgusting.

Presently, we do not know whether self-reported and behavioral consequences associated with false food beliefs and memories are the result of a cognitive or visceral response toward the critical food or a combination of the two. By cognitive response, we mean that subjects ponder the critical item and likely recall the false event (e.g., that they got sick eating egg salad) when they report their preference for the item or decide to eat it. By visceral response, we mean that subjects react immediately to the critical item without pondering it. In our studies, this visceral response would look like a "gut" reaction to the critical food in the absence of thought (e.g., "egg salad—yuk!"). The bulk of our work thus far supports the cognitive response explanation more than the visceral response explanation. Future work will answer these questions.

## BOUNDARY CONDITIONS

Thus far, we have established that it is possible to implant false beliefs and memories regarding a variety of early childhood food-related experiences. The resulting false beliefs and memories, in many cases, are accompanied by altered food preferences and eating behavior. For some foods, especially junk foods like potato chips, we can implant a false memory that one became sick after eating potato chips as children, but this false belief has no measurable consequences: We cannot turn people off potato chips. For other commonly eaten (junk) foods, like chocolate chip cookies, we have been unable to implant false beliefs and memories that one got sick after eating cookies as children. So, our false food memory technique does not work with all foods. Of course, it is possible that other false memory techniques would work better (e.g., showing subjects doctored photographs in which they appear eating chocolate chip cookies as children; cf., Wade, Garry, Read, & Lindsay, 2002). It is also possible that one's previous experiences with a particular target event, such as getting sick after eating chocolate chip cookies, will determine whether one is susceptible to forming false memories for this event. For example, if someone has only a lifetime of positive memories regarding chocolate chip cookies, perhaps such memories help to guard him/her against the notion that he/she got sick after eating chocolate chip cookies as a child.

In addition to our technique working with some, but not all, foods, our technique does not work with all people. Across our studies, we have succeeded in implanting false beliefs and memories in fewer than half of our subjects. Therefore, some subjects are more resistant to forming false memories than others. This observation is hardly new (see Hyman & Billings, 1998); however, to date, it has been difficult to pinpoint who will develop false memories and who will not. Future work should aim to explore this important question.

Another factor worth considering is whether our false food memory effects extend beyond the sensory domain of taste. For example, it might be easier to distort memory for taste than for other sensory experiences, like sound and touch.

## PRACTICAL IMPLICATIONS

Obviously it appears that you can tamper with people's food choices, in principle. But how would you do it in practice? You can't put out a shingle saying "False memories for sale. We guarantee." People would undoubtedly resist the implantation if they knew you were deliberately trying to do it. Therapists could not ethically do this to patients because they can't deliberately deceive their patients even for the patients' own good. Parents might try this ploy on their overweight teenagers, although some might cringe at even that use. So where does this leave us? Putting this idea into practice will be trickier than it initially looks. One possibility is that a therapist might ask for blanket permission in an early session to use various techniques to bring about a positive outcome—a list that might include the planting of false beliefs. If permission is granted, then, much later, when the permission session is long forgotten, the suggestive technique might be attempted. At least then it would be done with a modicum of informed consent.

## FINAL REMARKS AND NEXT STEPS

Positive and negative false memories about a childhood experience can be implanted. Once implanted, these false memories have consequences: They affect what someone thinks and feels about that experience, they can endure, they have repercussions for later intentions and actions, and they can be virtually indistinguishable from true memories of childhood experiences (see Morris, Laney, Bernstein, & Loftus, 2006).

We chose to focus on the consequences of false food beliefs and memories, because these were easily manipulated. How-

ever, our interest is not in food per se, but rather in the consequences of false memory. Already evidence is emerging that other types of false memories have consequences too. For example, after exposing people to a doctored photo that made a peaceful demonstration appear more violent, subjects were less inclined to want to participate in a future protest (Saachi, Agnoli, & Loftus, 2007). Also, after implanting a false memory of being mistreated by the character Pluto at an amusement park, subjects indicated that they were not willing to pay as much for a Pluto souvenir (Berkowitz, Laney, Morris, Garry, & Loftus, 2008). Thus, false memories have measurable consequences. Future investigators will tell us more about exactly how false memories affect our lives.

## REFERENCES


Baillie, D.A., Bernstein, D.M., & Greenwald, A.G. (2007, May). *The Food IAT: Examining food preference within the context of implicit association*. Poster presented at Northwest Cognition and Memory, Vancouver, Canada.

Berkowitz, S.R., Laney, C., Morris, E.K., Garry, M., & Loftus, E.F. (2008). Pluto behaving badly: False beliefs and their consequences. *American Journal of Psychology*, *121*, 643–660.

Bernstein, D.M., Laney, C., Morris, E.K., & Loftus, E.F. (2005a). False beliefs about fattening foods can have healthy consequences. *Proceedings of the National Academy of Sciences, USA*, *102*, 13724–13731.

Bernstein, D.M., Laney, C., Morris, E.K., & Loftus, E.F. (2005b). False memories about food can lead to food avoidance. *Social Cognition*, *23*, 11–14.

Brainerd, C.J., & Reyna, V.F. (2005). *The science of false memory*. New York: Oxford University Press.

Desjardins, T., & Scoboria, A. (2007). "You and your best friend Suzy put slime in Ms. Smollett's desk": Producing false memories with self-relevant details. *Psychonomic Bulletin & Review*, *14*, 1090–1095.

Geraerts, E., Bernstein, D.M., Merckelbach, H., Linders, C., Raymaekers, L., & Loftus, E.F. (2008). Lasting false beliefs and their behavioral consequences. *Psychological Science*, *19*, 749–753.

Hyman, I.E., & Billings, F.J. (1998). Individual differences and the creation of false childhood memories. *Memory*, *6*, 1–20.

Koh, M.T., & Bernstein, I.L. (2005). Mapping conditioned taste aversion associations using c-Fos reveals a dynamic role for insular cortex. *Behavioral Neuroscience*, *119*, 388–398.

Laney, C., Bowman-Fowler, N., Nelson, K.J., Bernstein, D.M., & Loftus, E.F. (2008). The persistence of false beliefs. *Acta Psychologica*, *129*, 190–197.

Laney, C., Kaasa, S.O., Morris, E.K., Berkowitz, S.R., Bernstein, D.M., & Loftus, E.F. (2008). The Red Herring technique: A methodological response to the problem of demand characteristics. *Psychological Research*, *72*, 362–375.

Laney, C., Morris, E.K., Bernstein, D.M., Wakefield, B.M., & Loftus, E.F. (2008). Asparagus, a love story: Healthier eating could be just a false memory away. *Experimental Psychology*, *55*, 291–300.

Lindsay, D.S., & Read, J.D. (1994). Psychotherapy and memories of childhood sexual abuse: A cognitive perspective. *Applied Cognitive Psychology*, *8*, 281–338.

Loftus, E.F. (1993). The reality of repressed memories. *American Psychologist*, *48*, 518–537.

Morris, E.K., Laney, C., Bernstein, D.M., & Loftus, E.F. (2006). How should we define susceptibility to false memories? *American Journal of Psychology*, *119*, 255–274.

Sacchi, D., Agnoli, F., & Loftus, E.F. (2007). Changing history: Doctored photographs affect memory for past public events. *Applied Cognitive Psychology*, *21*, 1005–1022.

Scoboria, A., Mazzoni, G., & Jarry, J. (2008). Suggesting childhood food illness results in reduced eating behavior. *Acta Psychologica*, *128*, 304–309.

Smeets, T., Merckelbach, H., Horselenberg, R., & Jelicic, M. (2005). Trying to recollect past events: Confidence, beliefs, and memories. *Clinical Psychology Review*, *25*, 917–934.

Wade, K.A., Garry, M., Read, J.D., & Lindsay, D.S. (2002). A picture is worth a thousand lies: Using false photographs to create false childhood memories. *Psychonomic Bulletin & Review*, *9*, 597–603.