Hedonic Escalation: When Food Just Tastes Better and Better

CAMMY CROLIC
CHRIS JANISZEWSKI

Hedonic escalation is the increased liking of each additional bite of a palatable food. Hedonic escalation is more likely to occur when (1) a palatable food consists of a complex combination of flavors, and (2) a person is motivated to taste additional flavors on each successive bite. Consequently, hedonic escalation is more prevalent when people can identify more flavors (pilot study), attend to additional flavors on each taste trial (study 1), have an opportunity to identify an additional flavor on each taste trial (study 2), and isolate distinct flavors on each taste trial (study 3). Changes in hedonic escalation can be attributed to increased sensitization to flavors as opposed to changes in the rate of habituation (study 4). Hedonic escalation can also increase consumption (study 5) and influence food choices (study 6). Collectively, these studies show that hedonic escalation is enabled by the opportunity to identify an additional source of hedonic experience on each successive taste of a food.

Keywords: sensitization, consumption, liking, memory

The single greatest standard used in assessing the quality of a wine is complexity. The more times you can return to a glass of wine and find something different in it—in the bouquet, in the taste—the more complex the wine. The very greatest wines are not so much overpowering as they are seemingly limitless.

—Matt Kramer, *Wine Spectator*

Cammy Crolic is associate professor of marketing (Cammy.Crolic@sbs.ox.ac.uk), University of Oxford, Saïd Business School, Park End Street, Oxford OX1 1HP, United Kingdom. Chris Janiszewski (cjaniszewski@bus.miami.edu) is the Leonard M. Miller Chair of Marketing, University of Miami, Coral Gables, FL, 33124-6524, and the Russell Berrie Eminent Scholar Chair and Professor of Marketing, Warrington College of Business Administration, University of Florida.
This research is based on the doctoral dissertation of the first author. The authors thank Liz Janiszewski (HTIG), Jeff Galak, and the *JCR* review team for their assistance in improving this article. Both authors contributed equally to this work. The appendix is included in the online version of the article.

Vicki Morwitz served as editor, and Pierre Chandon served as associate editor for this article.

Advance Access publication July 17, 2016

Matt Kramer's description of a fine wine provides insight into the enjoyment of an exceptional wine. The pleasure of the taste experience should not dissipate over time. Instead, a great wine should allow enjoyment to grow with each additional sip (i.e., hedonically escalate). Hedonic escalation can be a function of the complexity created by the blend of grapes or of the wine opening up, a process in which aeration softens tannins so that subtler flavors can be discerned. In either case, the enjoyment of the wine improves because each additional sip provides an opportunity to layer a new flavor experience on top of the previous one.

The idea that the liking of a palatable food can escalate within a consumption episode (i.e., hedonic escalation) is not adequately explained by existing models of food hedonics. Investigations into food hedonics uniformly show that the sustained consumption of a palatable food leads to adaptation and satiety (Galak, Kruger, and Loewenstein 2013; Redden 2008; Redden and Haws 2013; Rolls et al. 1981a). Adaptation is an ongoing reduction in a hedonic response that results from continued consumption (Nelson and Meyvis 2008; Nelson, Meyvis, and Galak 2009), whereas satiety is the point at which a person has consumed to fullness and/or no longer enjoys additional consumption (Galak et al. 2013; Rolls et al. 1981a; Rolls,

 • Vol. 43 • 2016
DOI: 10.1093/jcr/ucw032

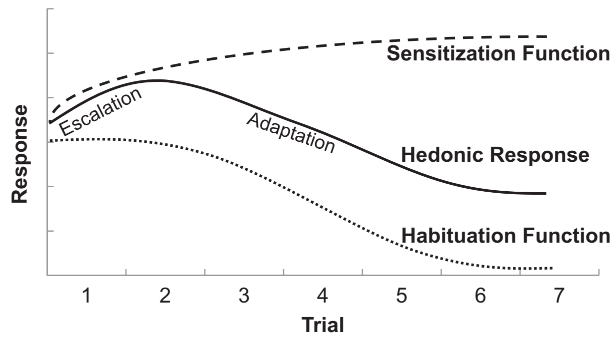
Rolls, and Rowe 1983). Although there has been progress on identifying strategies for slowing the rate of adaptation (Epstein et al. 1993a; Epstein, Mitchell, and Caggiula 1993; Galak et al. 2013), there is little insight into how to enable and influence hedonic escalation.

In contrast to the food hedonics literature, the literature on motivated eating investigates instances of increased responsiveness to a palatable food. Investigations into the motivation for eating focus on the desire to eat, as measured by the pace of eating. Numerous demonstrations have shown that the pace of eating can increase over time, and the volume and pace of eating are influenced by the palatability of food (Bellisle et al. 1984; Bellisle and Le Magnen 1980; Cornell, Rodin, and Weingarten 1989; Yeomans 1996). However, the causal relationship between (1) the motivation to eat, and (2) the liking of the food is unclear (Berridge 2009; Epstein et al. 2008; Havermans 2011). It is certainly true that people consume more of a tasty food (i.e., liking → motivation). Yet it is difficult to know if a greater motivation to eat increases how much one likes a food or if the liking of a food can increase independently of the motivation to eat, as suggested by the opening vignette about wine.

The goal of this research is to extend models that have been used to account for the motivation to eat into the domain of food hedonics. In doing so, we account for an escalation in the liking of a palatable food, as well as the adaptation that must occur as satiety approaches. We adapt the dual-process approach that has been used to account for motivated eating (Epstein et al. 2007; Epstein et al. 2008). Specifically, we propose that the hedonic response to eating is a function of a sensitization response (i.e., an increased responsiveness to repeated stimulation) and a habituation response (i.e., a decreased responsiveness to repeated stimulation) (Epstein et al. 2007; Epstein et al. 2008; Groves and Thompson 1970). As shown in figure 1, these two response functions combine to produce a hedonic response curve that includes escalation and adaptation. We conduct a pilot study to show that sensitization influences the hedonic response to the trial-by-trial consumption of food. Studies 1 through 4 investigate strategies for influencing the amplitude of the sensitization function, relying primarily on the flavor layering idea illustrated by the wine vignette. Studies 5 and 6 illustrate implications of hedonic escalation.

FIGURE 1

DUAL-PROCESS MODEL OF AN INDIVIDUAL'S HEDONIC RESPONSE TO THE REPEATED CONSUMPTION OF A FOOD



NOTE.—The figure is adapted from Groves and Thompson (1970) and Epstein et al. (2008). The sensitization function is the dashed line, the habituation function is the dotted line, and the hedonic response is the solid line. The hedonic response is an integration of the sensitization and habituation functions. Hedonic escalation (labeled "Escalation") is the increased hedonic response in the initial trials. Adaptation is the decreased hedonic response in the later trials.

HEDONIC RESPONSES TO FOOD CONSUMPTION

Hedonic Adaptation

Hedonic adaptation is the decreased liking of an experience over repeated trials. A considerable amount of consumer behavior research has investigated hedonic adaptation. Outside of the food domain, there is evidence of hedonic adaptation to music (Ratner, Kahn, and Kahneman 1999), television programming (Nelson et al. 2009), photos (Redden 2008), a massage (Nelson and Meyvis 2008), material purchases (Nicolao, Irwin, and Goodman 2009), and winning a lottery (Brickman, Coates, and Janoff-Bulman 1978). Within the domain of food, hedonic adaptation has been shown to be an incredibly robust phenomenon (Epstein et al. 2009; McSweeney and Swindell 1999; Redden 2015). Consequently, there has been a strong focus on mitigating the adaptation effect. Adaptation can be slowed by increasing the time between food events (Galak et al. 2013), interposing the consumption of different food items (Epstein et al. 1993a), interposing a nonfood event (Epstein et al. 1993b), and reframing the food event at a more abstract level (Redden 2008). Importantly, regardless of the mitigation strategy, adaptation can only be slowed; these strategies do not increase liking.

A number of mediating processes have been hypothesized to account for hedonic adaptation including habituation (Epstein et al. 2009; Galak et al. 2013; McSweeney and Swindell 1999; Rolls, Rowe, and Rolls 1982), a feeling of fullness (Cecil 2001; Mook and Votaw 1992), a reduction in the appeal of the food (Inman 2001), and goal fulfillment (Laran and Janiszewski 2009). Given our interest in changes in liking within a consumption episode (e.g., liking across bites), we focus on habituation in which habituation refers to "reductions in both physiological and behavioral responses to eating that occur as an eating episode progresses" (Epstein et al. 2009, 384). For food stimuli, habituation is characterized by a decrease in the ability to appreciate flavor, as opposed to a loss in the ability to taste flavor (Rolls et al. 1983).

Hedonic Escalation

Hedonic escalation is the increased liking of each additional bite of a palatable food. (Epstein et al. 2008, 254). While hedonic escalation is consistent with anecdotal experiences (as the wine vignette shows), there is surprisingly little empirical support for the phenomenon. The lack of evidence is a function of the research agenda in the food hedonics literature and the motivated eating literature. Although both literatures have investigated habituation, only the motivated eating literature has investigated behaviors that are consistent with a sensitization response (Bellisle and Le Magnen 1980; Cornell et al. 1989; Yeomans 1996). For example, Yeomans (1996) found that a highly palatable pasta (i.e., sauce seasoned with oregano) was eaten at an accelerated rate (e.g., more pasta was eaten in the second two minutes than in the first two minutes), whereas a less palatable pasta (i.e., unseasoned sauce) was not. Consequently, evidence for hedonic escalation must be inferred from evidence showing increased consumption, a tenuous inference given that motivation and liking are disassociated in some situations (Berridge 2009; Finlayson, King, and Blundell 2007; Garbinsky, Morewedge, and Shiv 2014; Morewedge, Huh, and Vosgerau 2010) but not others (Havermans et al. 2009; Rolls et al. 1981a).

Given the lack of research on hedonic escalation, a necessary starting point is to conceptualize how hedonic escalation might occur. One approach to conceptualizing hedonic escalation is to consider the potential interaction of the motivation and liking systems (Berridge 2009). To illustrate, consider alliesthesia and reverse alliesthesia. Alliesthesia occurs when an increase in motivation (e.g., increase in hunger) results in an increase in the liking of an incentive-compatible stimulus (e.g., palatable food) (Cabanac 1979; Rolls et al. 1983). That is, motivation → liking. Reverse alliesthesia occurs when an increase in liking (e.g., eating a more palatable food) results in an increase in the motivation to consume (Bellisle and Le Magnen 1980; Bellisle et al. 1984; Brendl, Markman, and Messner 2003; Wadhwa, Shiv, and Nowlis 2008; Yeomans 1996). That is, liking → motivation. A feedback loop between these two processes could create hedonic escalation across a series of trials. That is, a bite of a tasty food could increase the motivation to eat (reverse alliesthesia), which makes the next bite taste better (alliesthesia), which increases the motivation to eat (reverse alliesthesia), and so on. In effect, hedonic escalation could be a consequence of a reverse alliesthesia–alliesthesia feedback loop. Of course, escalation would not continue ad infinitum. Escalation should be characterized by diminishing marginal increases in liking, as observed in many instances of sensitization (Epstein et al. 2008; Groves and Thompson 1970; Leyton 2007).

SENSITIZATION AS A SOURCE OF HEDONIC ESCALATION

The reverse alliesthesia–alliesthesia feedback loop conceptualization of hedonic escalation suggests that escalation might occur, but the conceptualization does not provide insight into the source of the escalation. Kent Berridge's work (2001, 2009) on the neurological foundations of liking suggests a possible source of hedonic escalation. Berridge proposes that the flavors in a taste experience act as "keys that unlock [the] activation of brain 'liking' systems" (Berridge 2009, 537). Berridge observes that these "flavor keys" can be innate or learned. He illustrates this idea with four examples. First, a sweet flavor can provide pleasure because it turns an array of keys that release opioids (Peciña and Berridge 2005). This is an innate response. Second, an aversive flavor (e.g., the bitter flavor of coffee, hoppy beer, or tonic water) can provide pleasure if it is associated with other rewarding flavors (i.e., has been conditioned to keys that release opioids) (Havermans and Jansen 2007). This is a learned response. Third, any pleasurable flavor, innate or learned, increases pleasure as its intensity increases (i.e., the more intense the flavor, the more keys that are turned). Finally, any pleasurable flavor, innate or learned, loses its ability to please with repetition (i.e., a constant flavor turns fewer keys on each successive trial). This last observation reinforces the idea that hedonics are not a property of a stimulus but an interpretation of a taste experience that can change over time (i.e., it is contingent on the rate of opioid release).

We refer to the pleasure-releasing flavors in a food as sensitizing agents, the collection of which comprise the sensitization function (figure 1). We propose that the shape of the sensitization function depends on the number and intensity of the flavors being experienced on any one taste occasion. If more flavors are added to a food, or more flavors are experienced with each successive bite of food, sensitization should increase. Likewise, if flavors are experienced with more intensity, or increasing intensity with each successive bite, sensitization should increase. For example, if tasting instructions asked a person to taste a blend of flavors on each trial (i.e., a single flavor) versus taste an additional flavor on each successive trial (i.e., an increasing array of flavors), the latter framing should allow the person to experience more sensitizing agents on each successive trial (i.e., flavor A on trial 1, flavor A and B on trial 2, flavor A and B and C on trial 3, etc.) and, consequently, greater hedonic escalation. Of course, this prediction only holds if each flavor is palatable within the context of the other flavors (e.g., cinnamon with nutmeg and vanilla as opposed to cinnamon with fennel and mustard).

The prediction that tasting additional palatable flavors allows for greater sensitization requires the assumptions that (1) multiple palatable flavors can be discriminated, (2) sensitization from individual palatable flavors is additive (i.e., the sensitization from a primary flavor in trial 1 is reexperienced and added to the sensitization from a secondary flavor in trial 2), and (3) the influence of a flavor on sensitization can be exaggerated or minimized through a salience or interference manipulation (e.g., a secondary flavor may have been present in trial 1, but making it more salient in trial 2 allows it to generate more sensitization). With respect to discriminating and appreciating multiple palatable flavors, we expect that familiarity with a complex flavor profile allows a person to sensitize to a greater extent (study 1). This prediction is supported by evidence that the ability to taste more flavors in a food results in a better consumption experience (Latour, Latour, and Feinstein 2011). We also expect that helping a person discriminate flavors, either through instruction (i.e., providing the flavors; study 1) or opportunity (i.e., allowing more time to identify flavors; study 2) should increase sensitization.

> **H1**: A series of taste trials should be increasingly appreciated when each trial discriminates an additional palatable flavor.

A second potential approach to creating sensitization is altering the salience of specific sensitizing agents (i.e., flavors) relative to others. For example, highlighting a specific flavor, relative to other flavors, in a food could increase the sensitization. This prediction is based on two observations. First, when flavors are distinctive, the motivation to consume increases (Rolls et al. 1981b). For example, more yogurt is consumed when there are distinct flavors (e.g., hazelnut, black currant, and orange), compared to when flavors are similar (e.g., raspberry, strawberry, and cherry) (Rolls et al. 1981b). Second, as discussed earlier, an increase in the motivation to consume can result in increased liking that leads to an increased motivation to consume (i.e., the reverse alliesthesia–alliesthesia feedback loop). Consequently, flavor salience should encourage sensitization.

> **H2**: A series of taste trials should be increasingly appreciated when each trial makes a specific, palatable flavor more salient relative to other flavors.

Seven studies are used to investigate hedonic escalation. A pilot study shows that hedonic escalation occurs and is correlated with the ability to identify additional palatable flavors. Study 1 demonstrates that attention to an additional flavor on each taste trial increases the amount of hedonic escalation (hypothesis 1). Study 2 finds that people must be given the opportunity to extract information (i.e., identify different flavors), during the repeated tasting of a novel food, in order for hedonic escalation to occur. Study 3 finds that hedonic escalation to a familiar food can be increased by encouraging people to make the contrast between flavors salient on each additional trial (hypothesis 2). Study 4 assesses whether an alternative process (i.e., a process other than sensitization) is responsible for the differences in hedonic escalation observed in the first three studies. Study 5 and Study 6 provide evidence for the consequences of hedonic escalation on consumption and choice, respectively.

PILOT STUDY

To date, evidence for hedonic escalation is limited. The majority of what does exist uses consumption, instead of liking, to measure response escalation, a finding that could be attributed to motivation instead of liking. When liking has been measured (Kahneman and Snell 1992), the measures have been analyzed in combination with motivation measures and thus are nondiagnostic of hedonic escalation. Further, even the evidence for response escalation is tenuous (Epstein et al. 2008). Response escalation effects only occur for a minority of the participants, so that on aggregate the overall sample shows adaptation. Consequently, the pilot study had two objectives: (1) show that some people exhibit hedonic escalation to the taste of a food, even if the majority of people do not, and (2) confirm that people who hedonically escalate taste more flavors in a food.

Method

Participants and Design. A total of 111 undergraduate students participated in exchange for extra credit. The study was a one-cell design with five product replicates (SunChips Garden Salsa, Pringles Loaded Baked Potato, Chex Mix Muddy Buddies Brownie Supreme, Ranch Flavored Wheat Thins, and Snyder's Sweet and Salty Salted Caramel Pretzel Pieces) and five ratings of each replicate. This resulted in 555 observations.

Procedure. Participants entered a behavior lab and sat in private carrels. The carrels contained five plastic bags, each containing six pieces of a snack that had been labeled (T, P, S, C, and Z) and a computer. A Qualtrics survey was preloaded on each computer and led participants through the experiment. Participants were told the study investigated the liking of food and were informed of allergy risks. After providing consent, they were told,

> You will be asked to repeatedly taste several products. You will start with the first product and taste it five times in a row. Then, you will move to the second product and taste it five times. This will continue for each product. Please taste each product when instructed and answer the questions as accurately as you can.

Next, participants tasted the products. Participants were told to find the bag containing the first snack (SunChips).

The snack appearance was described and the label given (T) to ensure participants tasted the correct food. Participants were given 10 seconds to taste the first chip. On the next screen, they were asked, "How much did you enjoy the taste?" (1 = "It was good"; 9 = "It was extraordinary"). Participants then tasted and rated the remaining four chips using the same procedure. After tasting all five SunChips, prior product experience was assessed by asking, "Have you had these particular tortilla chips before?" (yes/no). If the answer was yes, the participant indicated how many times they had previously eaten the SunChips. The procedure was then repeated for the Pringles, Chex Mix, Wheat Thins, and Pretzel Pieces.

After all of the samples had been tasted and rated five times, participants were asked to taste the last sample in each bag and list all of the flavors they could taste.

Results

The data were analyzed in accordance with the two objectives of the study. First, the data were analyzed as a repeated-measure analysis of variance (ANOVA) (taste occasion factor with five trials) with five food replicates. There was a taste occasion by replicate interaction ($F(16, 1760) = 1.88$, $p < .05$). As shown in table 1, this effect emerged because there was a stronger hedonic decline over trials for some replicates ("All" rows for each replicate). Collapsing across replicates (Total-All line in table 1), the linear effect of taste trials was significant ($F(1, 110) = 18.68$, $p < .01$), but the quadratic effect was not ($F(1, 110) = .12$, $p > .1$). A planned contrast showed that the second taste trial was not rated differently than the first taste trial ($F(1, 110) = 1.41$, $p > .1$), but the fifth taste trial was rated lower than the first taste trial ($F(1, 110) = 16.12$, $p < .01$). Thus the aggregate analysis shows hedonic adaptation but no evidence of hedonic escalation. This result confirms that a majority of participants did not show hedonic escalation.

The second analysis investigated hedonic escalation. For each food, an individual's evaluation profile (i.e., the five hedonic ratings of a specific food) was classified as showing either hedonic escalation (i.e., the liking of the food rose before it fell), hedonic adaptation (i.e., the liking of the food fell or fell before it rose), or stable ratings (i.e., the liking of the food did not vary across the five trials).

TABLE 1

PILOT STUDY RESULTS

		Taste trial					Significance tests		
	n	1	2	3	4	5	a × b	Linear	Quadratic
SunChips									
Escalation	37	5.57	6.19	6.41	6.27	6.38		13.15*	9.08*
Stable	9	7.67	7.67	7.67	7.67	7.67			
Adaptation	65	6.68	6.45	5.91	5.57	5.31		110.21*	.36*
All	111	6.39	6.46	6.22	5.98	5.86	84.72*	6.55*	8.55*
Pringles									
Escalation	36	4.00	4.83	5.03	5.06	5.03		16.88*	25.32*
Stable	15	4.07	4.07	4.07	4.07	4.07			
Adaptation	60	5.30	4.62	4.10	3.82	3.65		81.36*	11.84*
All	111	4.71	4.61	4.40	4.25	4.15	76.91*	2.02*	3.04*
Chex Mix									
Escalation	39	4.31	4.85	5.33	5.39	5.46		44.29*	14.64*
Stable	19	4.11	4.11	4.11	4.11	4.11			
Adaptation	53	5.45	4.76	4.42	4.17	4.02		73.48*	18.71*
All	111	4.82	4.68	4.69	4.59	4.54	111.71*	.29*	1.56*
Wheat Thins									
Escalation	30	4.23	4.80	5.00	4.90	4.83		11.83*	15.55*
Stable	26	3.69	3.69	3.69	3.69	3.69			
Adaptation	55	5.07	4.91	4.11	3.78	3.76		51.85*	22.28*
All	111	4.52	4.39	4.25	4.06	4.02	45.49*	2.55*	4.26*
Snyder's									
Escalation	44	4.80	5.57	5.80	5.73	5.82		21.13*	24.58*
Stable	19	3.74	3.74	3.74	3.74	3.74			
Adaptation	48	5.75	5.13	4.75	4.42	4.40		37.11*	11.33*
All	111	5.03	5.09	4.99	4.82	4.85	57.03*	.13*	3.10*
Total									
Escalation	186	4.60	5.27	5.54	5.50	5.54			
Stable	88	4.26	4.26	4.26	4.26	4.26			
Adaptation	281	5.68	5.21	4.69	4.39	4.25			
All	555	5.09	5.05	4.91	4.74	4.68		18.68*	.12*

NOTE.—The a × b interaction is a test of the taste trial by hedonic classification (escalation vs. adaptation) interaction. The linear and quadratic tests are on the taste trial factor.

*Indicates $p < .05$.

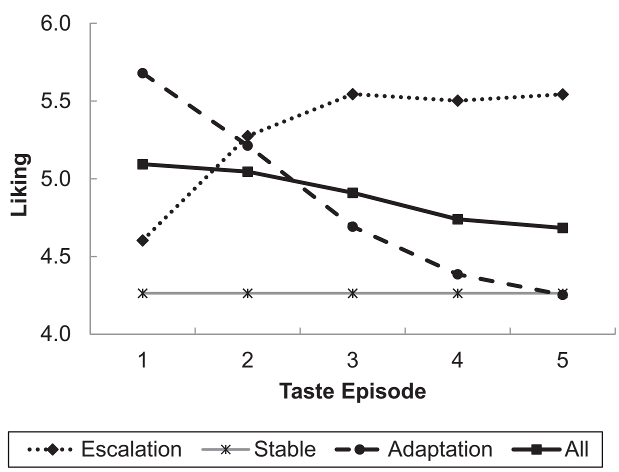
This coding scheme captured all possible patterns of data. Evidence for hedonic escalation (e.g., 7-8-7-6-5, 7-7-8-7-7, or 7-7-7-7-8) could be differentiated from evidence for hedonic adaptation (e.g., 7-7-5-4-3, 7-6-7-6-5) and stable ratings (e.g., 7-7-7-7-7). We note that this coding scheme was more conservative than classifying a pattern as hedonic escalation when any of the remaining trials exceeded the rating of the first trial (e.g., 7-6-5-5-8), an outcome that occurred in 1.6% of the cases. We also note that any increase after a decline, which does not exceed the initial trial rating (10.8% of the cases), is not hedonic escalation because it could be attributed to dishabituation during the later trials.

Table 1 provides descriptive data for the five replicates, parsed by whether the participant exhibited hedonic escalation, stable ratings, or hedonic adaptation (figure 2 shows a graph of the aggregate data). There are three relevant findings for the 555 observations. First, 33.5% of the product tastings (186/555) showed hedonic escalation, 50.6% (281/555) showed hedonic adaptation, and 15.9% (88/555) showed stable ratings. Second, although not represented in the table, 73% of the participants (81/111) showed hedonic escalation to at least one of the five foods. Third, the hedonic classification (escalation vs. adaptation) by taste occasion interaction, on the five taste ratings, was significant for each replicate (table 1, a $\times$ b column). In general, people that hedonically escalated showed a quadratic increase in ratings over time and people that hedonically adapted showed a quadratic decrease in ratings over time.

There is an anomaly in the data (figure 2). The initial aggregate taste rating in the escalation classification ($M = 4.60$) is lower than the initial aggregate taste rating in the adaptation classification ($M = 5.68$). This occurs because the adaptation classification includes 40 tastings (14.2%) where the first rating was the scale maximum (i.e., a first trial rating of 9, by definition, cannot be classified as escalation). After controlling for this bias, the mean in the adaptation classification drops to 5.13.

FIGURE 2

PILOT STUDY RESULTS



A final analysis correlated the amount of hedonic escalation with the number of flavors a participant identified in a food. For each food, a simple count of the number of identified flavors was tallied. This variable was correlated with the hedonic escalation score. The hedonic escalation score was computed as the number of rating increases before a decline (e.g., 5-5-5-5-7 would be an escalation score of 1, 5-6-7-6-6 would be an escalation score of 2, 5-6-7-8-9 would be an escalation score of 4). Thus the hedonic escalation score ranged from 0 to 4. The correlations for the five product categories were .12 ($p = .23$) for the SunChips, .40 ($p < .01$) for the Pringles, .15 ($p = .14$) for the Chex Mix, .29 ($p < .01$) for the Wheat Thins, and .24 ($p = .01$) for the Pretzel Pieces. A meta-analysis of the five correlations, unadjusted for sampling error (a more conservative test owing to the repeated-measure design), was significant ($r = .24$, $z = 2.38$, $p < .01$).

Discussion

The pilot study demonstrates four critical findings. First, people can experience hedonic escalation. Second, when data are considered on a person by product level, 33.5% of the tastings exhibited hedonic escalation, an indicator of sensitization. Third, 73% of the participants exhibited hedonic escalation to at least one of the foods, suggesting that a majority of people can exhibit increased pleasure to repeated stimuli. Fourth, the amount of hedonic escalation positively correlated with the number of flavors a person could identify. This provides preliminary support that there is a relationship between the ability to taste additional flavors on each successive trial and hedonic escalation.

STUDY 1

The pilot study showed that hedonic escalation is correlated with the ability to identify more flavors in a palatable food. Yet the pilot study only shows that some people hedonically escalate; it does not explain why some people hedonically escalate. In study 1, we wanted to investigate the hypothesis that the ability to taste additional flavors across trials results in more sensitization, which, in turn, leads to greater hedonic escalation (hypothesis 1). To test this hypothesis, we made two important changes to the procedure. First, we wanted to directly manipulate the independent variable that was hypothesized to influence the amount of sensitization (i.e., the ability to discriminate additional flavors). To do this, some participants were asked to focus on the overall flavor, whereas other participants were asked to identify an additional flavor on each successive trial. It was expected that focusing on an additional flavor on each successive trial would increase sensitization, but only for participants who had no experience with the product. Participants who had experience with the product should already know the flavors of the product and should be able to identify additional flavors on each trial without prompting.

Second, the procedure used a dependent measure that should be maximally sensitive to changes in the amount of hedonic escalation. The pilot study used an interval scale to measure liking. Study 1 used a series of forced choices to measure liking (e.g., "Is this taste better or worse than the last taste?"). Specifically, each taste experience was compared to the prior taste experience, and the amount of hedonic escalation was operationalized as the number of "better" responses that occurred prior to a "worse" response. The reasons for this change were twofold. First, a forced choice is a more discriminating measure than an interval scale. Interval scales rely on boundaries between each scale point, so that similar but not equal experiences are classed into the same response category (Parducci 1965; Volkmann 1951). A choice task forces discrimination, if differences exist. If differences do not exist, choice will be random—an outcome that should add error to the dependent measure but should not bias the means of any one experimental condition. Second, a forced-choice procedure does not suffer from the limitations of scale-end point labeling. A participant who rates an initial taste as a "9" on a 9-point scale can like a product more on subsequent trials but cannot express this increased liking when the scale is bounded. A forced-choice procedure avoids both of these issues.

Method

Participants and Design. Eighty undergraduate students participated in exchange for extra credit. The study design was a 2 (flavor focus of each taste experience: constant, varied) × 2 (prior product experience: no, yes) experimental design with four forced choices. Each participant was randomly assigned to one of the flavor focus conditions, with prior consumption experience as a measured variable. Two participants elected not to eat the chips and one participant admitted to not following instructions. The final sample size was 77 participants.

Note that an additional condition, with memory interference between taste trials, was also run in this procedure. These data are not discussed owing to expositional complexity. A complete report of the study is available in the online appendix.

Procedure. This study was one of a set of unrelated studies in a 40 minute session. Participants sat in private carrels that contained a computer and five Dorito Taco Flavored Tortilla Chips in a plastic bag. A Qualtrics program led participants through the experiment. First, they read about potential allergy risks and consented to participation. After consenting, participants read that the study would examine their liking for food. They were told that the repeated consumption of food could result in increased, decreased, or varied liking over time.

At this point, the procedure varied according to the experimental conditions. Participants were told to taste a chip and to "try to make a memory of how good this chip tastes." The participants were given 10 seconds to taste the chip before they could advance to the next screen. Then, participants in the varied flavor focus condition were asked, "What is the dominant flavor of the chip?" Participants in the constant flavor focus condition were not asked to identify a dominant flavor.

Next, participants in the varied flavor focus condition were told, "Please taste another chip. After tasting the chip the first time, you said you tasted [dominant flavor]. Try to taste an additional flavor when you taste the second chip." The flavor listed by the participant after tasting the first chip was inserted into the instruction. After tasting the second chip, participants in the varied flavor focus condition were asked, "What is the additional flavor of the chip?" Participants in the constant flavor focus condition were told, "Please taste another chip. Try to make a memory of how good this chip tastes." Then, participants in both conditions were asked, "Was the overall taste of the second chip better or worse than the taste of the first chip?" Participants responded by choosing either "Better" or "Worse." The procedure was repeated for three more chips, with the varied flavor focus condition participants being asked to identify a new flavor with each additional taste. The constant flavor focus condition participants continued to focus on remembering how good the chip tasted.

After tasting the food, all participants were asked product experience, covariate, and demand awareness questions. First, participants indicated whether they had consumed the chips previously (measured independent variable). Specifically, participants were asked, "Have you ever had these particular chips before? (yes/no)." Participants who answered "yes" were then asked how many times they had eaten the chips. Next, participants were asked about factors that had the potential to impact food preferences and hence could be used as covariates to reduce error variance. The critical covariate was how hungry they were prior to tasting the chips (1 = Not at all; 11 = Extremely) because hunger has been shown to influence taste perceptions (Cabanac 1979; Rolls et al. 1983). Other possible covariates were how often participants ate salty snacks (1 = Never; 11 = Several times a day), and how often they ate healthy snacks (1 = Never; 11 = Several times a day). Then participants were asked about their overall liking of the chips (1 = Not at al1; 11 = Very much). Next, in order to assess demand awareness, participants were asked if they thought the experimenters wanted them to answer the taste questions in a specific way (yes/no) and, if so, selected a hypothesis from a list (e.g., like chips more over time, like chips less over time, like chips more [less] then less [more] over time, purpose other than chips liking). Next, to screen for appropriate participation, participants were asked how seriously they took the study and whether or not they ate the chips when instructed. Finally, participants answered demographic questions.

Dependent Measure

The amount of hedonic escalation was operationalized as the number of consecutive times a person stated that the current taste experience was better than the prior taste experience. The second taste experience had to be better than the first taste experience for the amount of hedonic escalation to be nonzero. For example, if a participant reported that only the second taste experience was better than the prior taste experience (e.g., a pattern of better, worse, worse, worse), the hedonic escalation score was 1. Yet if a participant reported the fourth and fifth taste experiences were better than the immediately prior tastes (e.g., a pattern of worse, worse, better, better), the hedonic escalation score was zero. In the latter case, the series of hedonic experiences would not fit the definition of hedonic escalation (figure 1) and would be more consistent with dishabituation. The minimum hedonic escalation score was zero (e.g., the second taste was not better than the first). A score of zero would indicate a person experienced habituation. The maximum hedonic escalation score was 4 (e.g., each successive taste was better than the prior taste). A score of 4 would indicate a person experienced more sensitization than habituation and thus their hedonic response was characterized by increasing liking. A score of 2 would indicate a person initially experienced sensitization, but that habituation exceeded sensitization on bites four and five.

Results

Covariates. An initial analysis assessing the influence of potential covariates showed that the frequency of eating salty and healthy snacks did not influence the dependent measure. These covariates were also nonsignificant in all later studies. The degree of hunger was measured with the intent to use it as a covariate. It will be included in the analyses of data in this and all subsequent studies. When exclusion of the covariate materially influenced the results of a key test (e.g., interaction, simple main effect), we disclose this at the conclusion of the analyses. The online appendix contains the covariate-free analyses from each experiment.

Hedonic Escalation. Given that the dependent measure was a count of the number of initial trials with increased liking, a Poisson regression was used to analyze the data. An analysis with hunger as a covariate ($\chi^2(1) = 3.23$, $p = .07$) showed a flavor focus by prior experience interaction on the amount of hedonic escalation ($\chi^2(1) = 6.79$, $p < .05$), but no main effect of flavor focus ($\chi^2(1) = 1.29$, $p > .1$) or prior experience ($\chi^2(1) = .82$, $p > .1$) (figure 3 shows the covariate adjusted means). For participants who claimed to have no experience with the product ($n = 33$), varying the flavor focus ($M = 2.24$) resulted in more hedonic escalation than a constant flavor focus ($M = 1.04$; $\chi^2(1) = 5.01$, $p < .05$). This result was consistent with hypothesis 1. For participants who claimed they had experience with the product ($n = 44$), there was no influence of flavor focus ($M_{\text{varied}} = 1.58$; $M_{\text{constant}} = 2.18$; $\chi^2(1) = 1.82$, $p > .1$).

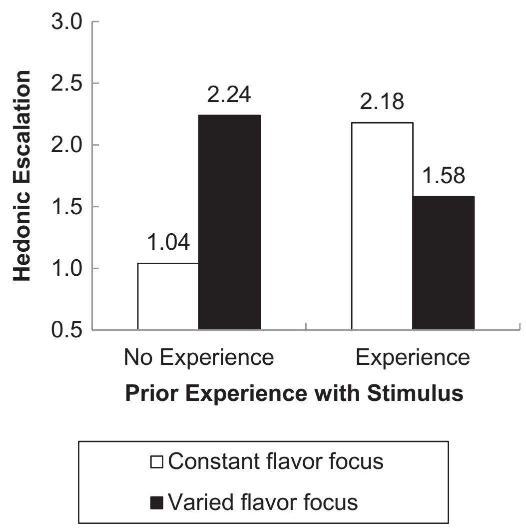
Hypothesis Guessing. Twenty-eight participants had a hypothesis about the study's intent. Six thought they should like chips more over time, 2 thought they should like the chips less over time, 18 thought they should like chips more [less] then less [more] over time, and 2 thought there was purpose other than understanding the liking of the chips. Claimed awareness of any hypothesis, or of one specific hypothesis, did not vary by condition (all $\chi^2 < 1$). When claimed demand awareness, or claimed awareness of any specific hypothesis, was treated as an independent variable, it did not interact with the treatment variables (all $p > .1$).

Discussion

Study 1 documented the influence of sensitization on the amount of hedonic escalation. Participants who were explicitly asked to attend to additional flavors across trials showed more hedonic escalation. Admittedly, few people consume food in this manner. Yet it is important to note

FIGURE 3

STUDY 1 RESULTS



that more sensitization can occur when people are instructed to taste additional flavors, as was the case in the varied flavor focus condition or when a person has the requisite knowledge to discriminate additional flavors on each subsequent trial, as was the case for those who had experience with the food.

Study 1 also used a novel measure of hedonic escalation. A forced-choice measure was used because it was more sensitive than an interval scale and addressed the heterogeneity of initial preferences problem (i.e., a person rating their first taste experience at the lowest or highest point on an interval scale). Yet there might be a concern that the forced-choice measure encourages participants to report hedonic escalation. We argue against this concern. If participants were unable to respond to a forced-choice measure in a way that accurately described their experience, either because they were unable to discern differences between successive bites or because they did not understand the task, they would have responded randomly. If participants responded randomly on each forced-choice judgment, the escalation score would have been .94 in each condition (the average escalation score across the 16 possible response patterns). The fact that (1) the escalation score was greater than .94 in three of the four conditions, (2) there was an interaction, and (3) hypothesis guessing could not account for the results suggest that the nature of the dependent measure was not responsible for the findings. The forced-choice measure was used because it had advantages for measuring hedonic escalation.

STUDY 2

In study 1, we showed that attending to an additional flavor on each successive consumption trial increased the amount of hedonic escalation for people who had no experience with the product. We also claimed that people who had experience with the product naturally attended to an additional flavor on each successive consumption trial. In each case, this resulted in increased sensitization. To further investigate how experiencing additional flavors increases sensitization, study 2 manipulated whether or not participants were given a list of flavors prior to iterative tastes of an unfamiliar product. When a list of flavors was provided, this information should be more accessible while tasting the food and a greater amount of hedonic escalation should occur. Thus we directly manipulated the mediating process (i.e., knowledge of flavor information) that we thought differentiated the people who were inexperienced with the product from those who were experienced with the product in study 1.

Study 2 also manipulated the opportunity for flavors to be identified spontaneously via a manipulation of the rate of consumption. We anticipated that slowing down the rate of consumption would allow people to have more discriminating experiences (Peron and Allen 1988), identify more flavors, sensitize to a greater degree, and exhibit more hedonic escalation. When flavor information was not provided, slowed consumption should increase sensitization because it should provide the opportunity to identify additional flavors. However, when flavor information was provided, slowing the pace of consumption should not aid in identifying additional flavors because they had already been provided.

Method

Participants and Design. A total of 190 undergraduate students participated in exchange for extra credit. The study design was a 2 (flavor profile: unknown, known) × 2 (tasting speed: slowly, quickly) between-subject experimental design. Each participant was randomly assigned to one of the four conditions. Two participants elected not to consume the product, four participants admitted to not following instructions, and three participants had extreme prior experience with the product (i.e., more than 50 prior experiences when the median was 0, $M = 4.49$, $SD = 13.56$), a problem given that the product was specifically selected to be novel. After removing these participants, the final sample size was 181 participants.

Procedure. The study was one of a set of unrelated studies in a 40 minute session. Participants sat in private carrels that contained a computer and five 1 ounce servings of Welch's Chillers Mango Passion Fruit Juice, a blend of mango, apple, and passion fruit juices. Each serving was packaged in a 1 ounce condiment container and sealed with a lid. Participants followed the same introductory procedure as in study 1.

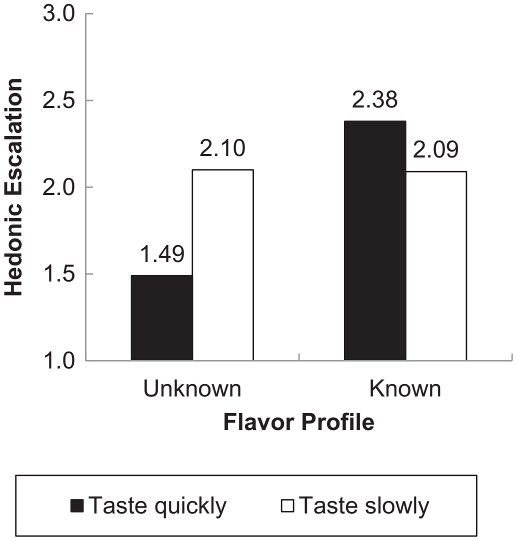
Next, the availability of the flavor profile was varied. Participants in the unknown flavor profile condition were told, "The juice you will taste is a novel mixture of juices." In the known flavor profile condition, participants were told, "The juice you will taste is a popular brand of mango, apple, and passion fruit flavored juice from the grocery store." Then, the pace of tasting was manipulated. Participants in the slow tasting procedure condition were told, "We want you to drink slowly. The juice should be in your mouth a minimum of five seconds before you swallow." Participants in the quick tasting procedure condition were told, "We want you to drink quickly." The remainder of the procedure was equivalent to study 1.

Results

Hedonic Escalation. The amount of hedonic escalation was calculated in the same manner as in study 1 (figure 4 shows the covariate adjusted means). A Poisson regression with thirst as a covariate ($\chi^2(1) = 5.04$, $p < .05$) showed a flavor profile by tasting procedure interaction ($\chi^2(1) = 4.28$, $p < .05$), a main effect of knowledge of the flavor profile

FIGURE 4

STUDY 2 RESULTS



($\chi^2(1) = 4.16$, $p < .05$), and a null effect of the tasting procedure ($\chi^2(1) = .82$, $p > .1$) on the amount of hedonic escalation. When the flavor profile was unknown, a slow tasting procedure ($M = 2.10$) resulted in more hedonic escalation than a quick tasting procedure ($M = 1.49$; $\chi^2(1) = 3.85$, $p = .05$). When the flavor profile was known, the slow and quick tasting procedure resulted in an equivalent amount of hedonic escalation ($M_{quickly} = 2.38$, $M_{slowly} = 2.09$; $\chi^2(1) = .77$, $p > .1$). It is also the case that providing a flavor profile increased hedonic escalation in the quick tasting procedure ($M_{unknown} = 1.49$, $M_{known} = 2.38$; $\chi^2(1) = 7.71$, $p < .01$) but not in the slow tasting procedure ($M_{unknown} = 2.10$, $M_{known} = 2.09$; $\chi^2(1) = 0$, $p > .1$). When thirst was excluded from the model, the simple main effect of tasting procedure in the unknown flavor profile condition became marginally significant ($\chi^2(1) = 3.03$, $p = .08$).

Hypothesis Guessing. Fifty-nine participants had a hypothesis. Seven thought they should like the juice more over time, 12 thought they should like the juice less over time, 26 thought they should like the juice more [less] then less [more] over time, and 14 thought there was purpose other than understanding the liking of the juice. The claimed awareness of any hypothesis did not vary by condition (all $\chi^2 < 1.62$). When claimed demand awareness, or claimed awareness of any specific hypothesis, was treated as an independent variable, it did not interact with the treatment variables (all $p > .1$).

Discussion

The results of study 2 show that, when given an opportunity (i.e., more time to taste a beverage), participants lacking explicit flavor knowledge could isolate additional flavors in a beverage and use these flavors to sensitize to the beverage across repeated trials. When participants were given flavor information in advance, they could use that knowledge to identify flavors more easily and sensitize to the beverage. These results are important because they show that simple marketing activities, such as informing people about the flavors in a food or beverage, can increase hedonic appreciation during consumption.

STUDY 3

Thus far, the focus of the research has been on how to increase the amount of hedonic escalation through the identification of additional flavors. People who are inexperienced with a palatable food can be assisted in flavor identification, whereas people who have experience with a palatable food need no assistance. Yet people who are familiar with a palatable food can still be encouraged to have a greater amount of sensitization. Sensitization can also depend on the relative salience of flavors (hypothesis 2). For example, increasing attention to the contrast between flavors should heighten the impact of each flavor on sensitization.

Method

Participants and Design. Sixty-two undergraduate students participated in exchange for extra credit. The study was a 2 cell between-subject design in which the taste focus was constant or contrasting. Each participant was randomly assigned to one of the two conditions.

Procedure. The study was one of a set of unrelated studies in a 40 minute session. Participants sat in private carrels containing a computer and a plastic bag with five Cool Ranch Doritos. Cool Ranch Doritos were chosen because we wanted all participants to have experience with the food, and this flavor of Doritos is popular with our subject population. Participants followed the same introductory procedure as in prior studies.

After the introduction, participants were asked to think about what makes Cool Ranch Doritos taste good. Participants were given a list of five flavors (salt, corn, cheddar cheese, onion, and garlic) and asked to select three flavors that "(1) you know you will be able to taste while eating the Doritos, and (2) you will enjoy tasting." Participants then selected their three favorite flavors.

Next, participants were given instructions about how to taste the chips. Participants in the constant taste condition were told, "Each time you taste a Dorito, try to focus on how the individual flavors of [favorite flavor 1], [favorite flavor 2], and [favorite flavor 3] blend together to form the overall taste of the Dorito." Participants in the contrasting taste condition were told, "Each time you taste a Dorito, try to focus on how one of the flavors [favorite flavor 1, favorite flavor 2, favorite flavor 3] stands out a little more than the other two." These participants indicated which flavor stood out from the other two. All participants were given the same instructions prior to tasting each chip. Then they indicated whether the current chip tasted better or worse than the prior chip. As with the previous two studies, this judgment was made after tasting the second, third, fourth, and fifth chips. The remaining measures (e.g., experience, covariates, demand awareness) were identical to those used in prior studies.

Results

Hedonic Escalation. The amount of hedonic escalation was calculated in the same manner as in studies 1 and 2. A Poisson regression with hunger as a covariate ($\chi^2(1) = .95$, $p > .1$) showed a main effect of taste focus on the amount of hedonic escalation ($\chi^2(1) = 5.11$, $p < .05$). A tasting procedure that encouraged the participant to isolate the flavor that stood out from the others ($M = 2.13$) resulted in more hedonic escalation than a procedure that encouraged the participant to focus on the combined flavor profile ($M = 1.23$).

Hypothesis Guessing. Eighteen participants had a hypothesis. Two thought they should like the chips more over time, three thought they should like the chips less over time, nine thought they should like the chips more [less] then less [more] over time, and four thought there was purpose other than understanding the liking of the chips. Claimed awareness of any hypothesis, or of one specific hypothesis, did not vary by condition (all $\chi^2 < 1.25$). When claimed demand awareness, or claimed awareness of any specific hypothesis, was treated as an independent variable, it did not interact with the treatment variable (all $p >$ .1).

Discussion

Study 3 provides further evidence that sensitization contributes to the amount of hedonic escalation. Unlike study 2, the participants in study 3 were familiar with the food they were eating. Participants knew the flavors in the food and could anticipate specific flavors that would contribute to their enjoyment. Yet participants exhibited more hedonic escalation when they were encouraged to isolate the most salient flavor on each taste trial, as opposed to being encouraged to blend the flavors together. This implies that sensitization is sensitive to the salience of individual flavors.

STUDY 4

Manipulating the ability to taste additional flavors is one way to show that the degree of sensitization can be influenced. Yet any claim of a change in the amount of sensitization should be met with caution because changes in the amount of sensitization are inferred from a hedonic response curve (figure 1). A hedonic response curve measures liking as a function of both sensitization and habituation. Consequently, the hedonic response curve is sensitive to the timing of the onset of habituation (figure 1). That is, an increase in the amount of hedonic escalation could be a consequence of changes in the onset or amount of habituation as opposed to an increase in sensitization. If habituation began immediately (i.e., on trial 1), and an intervention reduced the onset of this habituation, then the amount of hedonic escalation could increase without any change in the sensitization function. We label this alternative hypothesis the *dishabituation hypothesis*.

The dishabituation hypothesis can be addressed by using an intervention that should influence the amount of sensitization and habituation in different ways. Memory interference for prior taste experiences is such an intervention: interference should increase hedonic escalation if the escalation is caused by dishabituation but decrease the hedonic escalation if the escalation is caused by sensitization. First, consider the fact that interfering with memory for prior consumption experiences reliably results in dishabituation (Epstein et al. 2009; Nelson et al. 2009; Redden 2015). If dishabituation is responsible for the hedonic escalation effect, interference should increase escalation in the conditions where it has been shown to occur (e.g., varied flavor focus). Second, recall that sensitization is conceptualized to occur when current flavors build on flavors from prior taste trials, as shown in study 1. Interference should limit memory for flavors from prior taste trials and limit one's ability to layer a new flavor on top of a reexperienced flavor. Thus if sensitization is responsible for the hedonic escalation effect, interference should decrease escalation in the conditions where it has been shown to occur (e.g., varied flavor focus).

> **H3**: *Sensitization function process*: Interfering with the memory for flavors experienced in prior trials should decrease the amount of hedonic escalation.

> **H3alt**: *Habituation function process (dishabituation hypothesis)*: Interfering with the memory for flavors experienced in prior trials should increase the amount of hedonic escalation.

Thus in the memory interference varied flavor focus condition, we would expect to observe greater hedonic escalation if the escalation is driven by habituation (hypothesis 3alt) and less hedonic escalation if it is driven by sensitization (hypothesis 3).

Method

Participants and Design. A total of 167 undergraduate students participated in exchange for extra credit. The study design was a 2 (flavor focus of each taste experience: constant, varied) × 2 (memory interference: no, yes) × 3 (flavor order counterbalance) between-subject experimental design. Each participant was randomly assigned to one of the 12 conditions. Eight participants admitted to not following instructions, and three participants failed an attention screen question. The final sample size was 156 participants.

Procedure. This study was run with a set of unrelated studies. Participants sat in private carrels that contained a computer, a white clamshell box concealing a 1 ounce serving of Sabra Tuscan Herb Garden Hummus in a condiment cup, a sampling spoon, and a bag of unsalted soda crackers (only for the memory interference condition). Participants followed the same introductory procedure as in prior studies.

At this point, the procedure varied according to the experimental conditions. The two no-interference conditions are discussed first. Participants were told to taste a spoonful of "dip" and to "try to make a memory of how good this spoonful of dip tastes." The participant was given 10 seconds to taste the dip before advancing to the next screen. Next, participants were asked to take a second taste. For participants in the constant flavor focus condition, the instructions read, "Try to make a memory of how good THIS spoonful of dip tastes." For participants in the varied flavor focus condition, the instructions read, "Try to pay attention to the HERBAL flavor of the dip and its overall flavor," and then they were asked to rate the pungency of the herbal flavor from 1 ("Not herbal") to 11 ("Very herbal"). All participants then responded to the critical dependent measure, "Was the overall taste of the second spoonful of dip better or worse than the overall taste of the first spoonful of dip?" Participants indicated whether the second taste was "Better" or "Worse" than the first.

The same procedure was repeated for the third, fourth and fifth tastes of hummus. Participants in the constant flavor focus condition were always instructed to attend to the overall flavor. Participants in the varied flavor focus condition attended to and assessed the lemon, garlic, and tomato flavors during the subsequent trials. There was a counterbalance of flavor order in the varied flavor focus condition. This counterbalance was included because there was a concern that the flavors might be ordered by increasing distinctiveness, tastiness, or some other value-producing dimension. Order 1 (herbal, lemon, garlic, and tomato flavor), order 2 (lemon, herbal, tomato, and garlic flavor), and order 3 (garlic, tomato, herbal, and lemon flavor) did not interact with the memory interference variable ($\chi^2(1)$'s < 1) and are not discussed further.

Participants in the memory interference condition tasted a soda cracker between the tastes of hummus. Participants were told to "try to make a memory of how good this cracker tastes." Afterward, participants in the memory interference condition were asked to report on a scale of 1 ("Not at all") to 11 ("Very much") how much they enjoyed the bite of cracker. Except for these intervening tastes of soda crackers, the memory interference procedure was identical to the no-interference procedure. The remaining measures (e.g., experience, covariates, demand awareness) were identical to those used in prior studies.

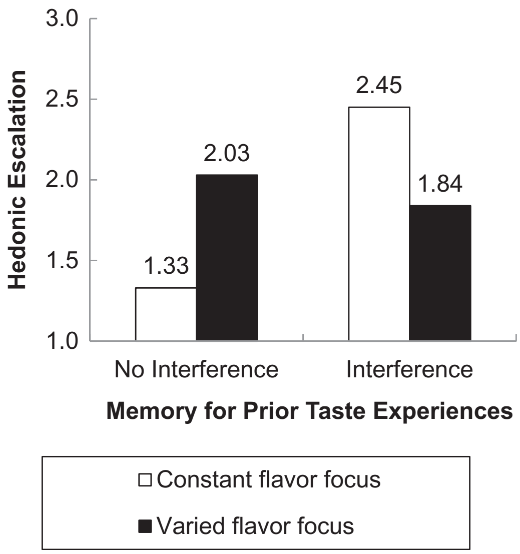
Results

Hedonic Escalation. The amount of hedonic escalation was calculated in the same manner as in prior studies (figure 5 shows the covariate adjusted means). A Poisson regression with hunger as a covariate ($\chi^2(1) = .73$, $p > .1$) showed a flavor focus by memory interference interaction ($\chi^2(1) = 6.07$, $p < .01$), no main effect of flavor focus ($\chi^2(1) = .23$, $p > .1$), and a marginally significant main effect of memory interference ($\chi^2(1) = 3.17$, $p = .08$) on the amount of hedonic escalation. When there was no memory interference, a varied flavor focus ($M = 2.03$) resulted in more hedonic escalation than a constant flavor focus ($M = 1.33$; $\chi^2(1) = 3.17$, $p = .08$), replicating results from study 1. When there was memory interference, a varied flavor focus ($M = 1.84$) resulted in less hedonic escalation than a constant flavor focus ($M = 2.45$; $\chi^2(1) = 3.09$, $p = .08$). This result is consistent with the sensitization (hypothesis 3), but not habituation (hypothesis 3alt), being responsible for changes in the amount of hedonic escalation.

Hypothesis Guessing. Seventy-four participants had a hypothesis. Nine thought they should like the dip more over time, two thought they should like the dip less over time, 49 thought they should like the dip more [less] then

FIGURE 5

STUDY 4 RESULTS



less [more] over time, and 14 thought there was purpose other than understanding the liking of the dip. Claimed awareness of any hypothesis, or of one specific hypothesis, did not vary by condition (all $\chi^2 < 2.02$). When claimed demand awareness, or claimed awareness of any specific hypothesis, was treated as an independent variable, it did not interact with the treatment variables (all $p > .1$).

Supplemental Analysis. A supplemental analysis was done to ensure that flavor ratings did not vary across the conditions. This was a concern because the hypothesis is that a person can better remember and combine flavors in the no-interference condition, not that each flavor profile will be better discerned in the no-interference condition. An ANOVA showed no influence of memory interference on the herbal ($M_{\text{no interference}} = 8.02$, $M_{\text{interference}} = 7.78$; $F(1, 80) = .28$, $p > .05$), lemon ($M_{\text{no interference}} = 6.21$, $M_{\text{interference}} = 6.75$; $F(1, 80) = .96$, $p > .05$), garlic ($M_{\text{no interference}} = 8.21$, $M_{\text{interference}} = 7.80$; $F(1, 80) = .88$, $p > .05$), and tomato ($M_{\text{no interference}} = 6.17$, $M_{\text{interference}} = 6.00$; $F(1, 80) = .11$, $p > .05$) flavor ratings.

Discussion

The results of study 4 are consistent with the hypothesis that sensitization contributes to the amount of hedonic escalation. The critical finding was that interfering with memory for the prior taste experience changed the positive influence of a varied flavor focus manipulation (the no-interference conditions in figure 5) into a negative influence (the interference conditions in figure 5). This could only occur if the benefits of the varied flavor focus manipulation relied on memory for the prior taste experience (hypothesis 3). If the varied flavor focus manipulation led to dishabituation, then the memory interference manipulation should have made the amount of hedonic escalation in the varied flavor focus/interference condition even stronger (hypothesis 3alt). We note the varied flavor condition also should have increased perceived variety across taste experiences (e.g., flavor A in trial 1, flavor B in trial 2). Given that increases in perceived variety should lead to dishabituation (Kahn and Wansink 2004), we can infer that perceived variety is not responsible for the escalation effect. A more complete discussion of the predictions, results, and alternative hypotheses in this study is provided in the online appendix.

One other finding in the study 4 bears discussion. Hedonic escalation in the constant flavor focus condition did increase when there was interference. This effect can be attributed to dishabituation. Recall that the constant flavor focus condition focused people on the overall experience, with no attention to individual flavors. This type of procedure reliably results in hedonic adaptation (Galak et al. 2013; Nelson et al. 2009). Moreover, the rate of hedonic adaptation declines when there is memory interference between consumption episodes (Epstein et al. 2009; Redden 2015). Thus the study 4 data confirm that memory interference can reduce habituation (constant flavor focus condition in figure 5), a common finding in the hedonic appreciation literature (Redden 2015).

STUDY 5

In study 5, we examine the effect of hedonic escalation on consumption. Recall that the explanation for the existence of hedonic escalation is the reverse alliesthesia–alliesthesia feedback loop. An initial bite of a palatable food increases the motivation to eat that then increases the liking of the next bite of food, and so on. The implication is that the amount of hedonic escalation should be positively correlated with the amount of consumption. Study 5 tests this prediction by examining how much a person chooses to consume following procedures designed to vary the amount of hedonic escalation.

Study 5 examined this issue using the salience manipulation from study 3 and the memory interference manipulation from study 4, with one exception. The study used a relevant versus irrelevant interference condition that did not rely on tasting another food. The relevant interference manipulation involved recalling the flavors of a nontarget food. The irrelevant interference manipulation involved recalling a prior consumption context (e.g., a location where one would eat a nontarget food). Changing the memory interference manipulation from eating a different food to remembering information allows us to claim more confidently that it is the diminished memory for the prior taste experience that inhibits sensitization, not some incidental factor. We predicted that when the amount of sensitization is enhanced (i.e., when people are instructed to focus on the most salient flavor in a food), people should consume more of the food. Conversely, when the amount of sensitization is inhibited (i.e., when people are instructed to blend the flavors together or their memory for the flavors in the prior taste episode was interfered with), people would consume less of the food. As in study 3, all participants were familiar with the food (Nacho Cheese Doritos).

Method

Participants and Design. A total of 184 undergraduate students participated in exchange for extra credit. The study design was a 2 (flavor focus of each taste experience: constant, contrasting) × 2 (memory interference task: relevant, irrelevant) between-subject experimental design. Each participant was randomly assigned to one of the four conditions. Data were collected between the hours of 1 and 4 PM because we wanted participants to have a moderate level of hunger. Ten participants did not follow instructions and one participant disclosed an eating disorder. The final sample size was 173 participants.

Procedure. The study was one of several unrelated studies completed in a 40 minute session. Participants sat in private carrels that contained a computer, a paper plate, and a 1.75 ounce bag of Nacho Cheese Doritos. Participants were told that they would be asked to eat one Dorito at a time and that they could repeat the procedure as many times as they wanted. When they no longer wanted to continue eating, they should call over the experimenter who would clear their plates. This instruction was given to signal to the participants that they would be unable to eat the Doritos after proceeding on to other tasks in the experimental session. After reading the instructions, participants were given a list of seven flavors (salt, corn, cheddar cheese, onion, garlic, tomato, and sugar) and asked to select three flavors that "(1) you know you will be able to taste while eating Doritos, and (2) you will enjoy tasting." Participants then selected their three favorite flavors.

As in study 3, participants were given instructions about how to taste the chips. Participants in the constant taste condition were told to focus on how the three selected flavors blended together to form the overall taste. Participants in the contrast condition were told to focus on how one of the selected flavors stood out a little more than the other two. Then participants indicated which flavor stood out from the other two.

After tasting the first Dorito, participants in the relevant interference conditions were asked to list all of the flavors in [Product X]. Conversely, participants in the irrelevant interference conditions were asked to list all of the events (activities, places, meals) where they would eat [Product X]. Product X was selected from a bank of 25 common foods (e.g., mashed potatoes, s'mores, pancakes, grilled cheese, and spaghetti). After completing this task, participants tasted a second Dorito following the same procedure as before and responded to either the relevant or irrelevant memory interference question. At this point, participants were asked "Do you want to taste another Dorito?" Participants who responded yes repeated the tasting and memory interference tasks until they indicated they were done tasting Doritos. After responding no, participants were instructed to call over the experimenter to remove the plate. The experience measures and covariates used in prior studies were included in this study. In addition, participants were asked to indicate their liking for Doritos in general because product liking influences consumption. Demand awareness measures were not included because the procedure did not include an introduction suggesting that the hedonic appreciation of food should vary over time.

Results

A test of the assumptions about prior experience with the product indicated that all but two (1.1%) of the participants were familiar with the product.

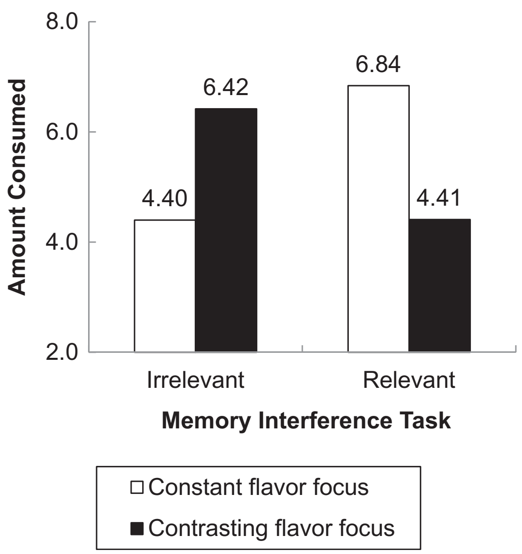
Consumption. Consumption was operationalized as the number of Doritos a participant chose to consume (figure 6 shows covariate adjusted means). An analysis of covariance with hunger and overall product liking as covariates ($F(2, 168) = 14.25$, $p < .01$) showed a significant flavor focus by memory interference interaction ($F(1, 168) = 6.77$, $p < .05$), no main effect of memory interference ($F(1, 168) = .07$, $p > .1$), and no main effect of flavor focus ($F(1, 169) = .05$, $p > .1$) on the number of Doritos consumed. When there was irrelevant interference, the contrasting flavor focus ($M = 6.42$) resulted in marginally more consumption than the constant flavor focus ($M = 4.40$; $F(1, 168) = 2.80$, $p = .10$). When there was relevant memory interference, the contrasting flavor focus ($M = 4.41$) resulted in less consumption than the constant flavor focus ($M = 6.84$; $F(1, 168) = 4.03$, $p < .05$). Removing the covariates from the analysis made the interaction marginally significant ($F(1, 170) = 3.26$, $p = .07$) and the simple main effect tests nonsignificant.

Discussion

The results of study 5 are consistent with the prediction that the amount of hedonic escalation can influence consumption. In conditions that were favorable to the development of sensitization, people consumed more. In conditions that were unfavorable to the development of sensitization, people consumed less. This provides additional support that sensitization is driven by appreciating additional flavors across taste episodes and that interfering with memory for previously tasted flavors inhibits this process. These results are consistent with the claim that the

FIGURE 6

STUDY 5 RESULTS



reverse alliesthesia–alliesthesia feedback loop contributes to hedonic escalation.

STUDY 6

Study 6 was motivated by the concern that studies 1 through 4 used a forced-choice preference measure for multi-trial sampling of the same food. An alternative approach is to use a forced-choice preference measure for two different foods after a series of taste experiences. For example, one could have a person engage in sequential taste experiences (e.g., pretzel, pretzel, chip) for the same product (e.g., pretzel) or nonsequential taste experiences (e.g., pretzel, chip, pretzel) for the same product (e.g., pretzel). One could then observe which of the two foods is eaten next. If hedonic escalation is higher when there are sequential taste experiences (e.g., pretzel, pretzel, chip) for the same product (e.g., pretzel), then people should be more likely to choose to eat that product on the next trial (e.g., pretzel) in the sequential condition than in the nonsequential condition. It should be noted that a dishabituation explanation (hypothesis 3alt) would predict the opposite. If nonsequential taste experiences allow for dishabituation, people should be more likely to choose to eat the same product on the next trial (e.g., pretzel) in the nonsequential condition than in the sequential condition.

Method

Participants and Design. A total of 156 undergraduate students participated in exchange for extra credit. There were counterbalanced treatments conditions (tasting sequence AAB and BAA) and a control condition (tasting sequence ABA). Nine participants admitted to not eating the food; five participants indicated they did not follow instructions. The final sample size was 142 participants (treatment group $n = 73$, control group $n = 69$).

Procedure. The study was one of a set of unrelated studies in a 40 minute session. Participants sat in private carrels that contained a computer and a divided container with the two foods. Participants were told, “Before you are several Garden Salsa SunChips and Salted Caramel Pretzel Pieces. We want you to eat the first three pieces of food in the following order. Specifically, try to pay attention to all of the interesting flavors in the Salted Caramel Pretzel Pieces.” Participants were then instructed on the order of tasting the products: pretzel, pretzel, chip or chip, pretzel, pretzel in the treatment condition and pretzel, chip, pretzel in the control condition. Then participants were instructed to eat the food that they expected to enjoy more. After eating the fourth piece of food, they were asked, “What did you just eat, a chip or a pretzel piece?” The experience measures and covariates used in prior studies were included in the study, including the participant’s general liking for Snyder’s Sweet and Salty Salted Caramel Pretzel Pieces and SunChips Garden Salsa.

Results

Choice. A logistic regression with hunger ($\beta = -.05$, $\chi^2 = .19$, $p > .1$), overall pretzel liking ($\beta = -1.68$, $\chi^2 = 22.50$, $p < .01$), and overall chip liking ($\beta = 2.43$, $\chi^2 = 26.36$, $p < .01$) as covariates showed a significant influence of the order of tasting ($\beta = 1.42$, $\chi^2 = 3.42$, $p = .06$). The repeated product (Pretzel Pieces) was chosen more frequently in the sequential tasting condition (55%) than in the nonsequential tasting condition (38%). The results are consistent with sensitization and inconsistent with dishabituation. We note that removing the covariates from the analysis made the effect nonsignificant ($\rho_{sequential} = .51$, $\rho_{nonsequential} = .42$, $\beta = .14$, $\chi^2 = 1.07$, $p > .1$).

GENERAL DISCUSSION

The results of seven studies provide insight into one source of hedonic escalation to food. Hedonic escalation was shown to be a function of a person’s ability to build a multilayered sensory experience across consumption trials. As the opportunity to build a multilayered sensory experience was enhanced, the amount of hedonic escalation increased. Hedonic escalation increased when people were encouraged to experience additional flavors (study 1), were given an opportunity to identify additional flavors (study 2), focused on the distinct or most salient flavors (study 3), and remembered flavors across trials (study 4). In turn, hedonic escalation led to increased consumption (study 5) and product choice (study 6). These effects are attributable to sensitization.

Sensitization is not a common explanation for the increased liking of a stimulus over time; thus it is important to discuss why two alternative sources of hedonic escalation are inconsistent with the data. First, the results are not a consequence of the fluency derived from a familiar sensory experience or a feeling of knowing (Berlyne 1970; Gordon and Holyoak 1983; Leder et al. 2004; Schwarz 2004). If this were the case, instructions that focused on a common sensory experience (e.g., constant flavor focus) should have led to more hedonic escalation than instructions that focused on a varied sensory experience (e.g., varied flavor focus). We expect that fluency processes are more relevant to liking for consumption episodes that are distributed over days (Kahneman and Snell 1992), as opposed to seconds. Second, it is unlikely that the results were a consequence of increased liking through anticipation (Papies et al. 2015; Pechmann and Ratneshwar 1992). For example, informing a participant of the flavors in a product should have maximized anticipation prior to the first bite, maximized enjoyment on the first bite, and limited hedonic escalation. The opposite result was observed in study 2.

Limitations

Sensitization via the accumulation of different flavor experiences across trials is most likely to occur when a sensory system can represent a multidimensional experience. For example, the sense of taste may be ideally suited to appreciate multidimensional hedonic stimuli. The tongue has the ability to concurrently taste saltiness, sweetness, sourness, bitterness, and savoriness (Kadohisa, Rolls, and Verhagen 2005; Rolls et al. 1982). Receptors in the tongue feed into the orbitofrontal cortex, where the reward value of taste is represented (Kadohisa et al. 2005; Rolls 2004). Thus the gustatory system has evolved not only to sensitize but to exhibit different amounts of sensitization to promote nutritional variety seeking and caloric intake.

It is more difficult to conceptualize sensitization to stimuli that are (1) multidimensional for other sensory systems or (2) are multidimensional across sensory systems (Auvray and Spence 2008; Elder and Krishna 2010; Spence 2010; Velasco et al. 2013). To illustrate, consider the visual system. The visual system integrates and organizes information as a consequence of currently active processing goals (Janiszewski 2008). The system does not naturally decompose stimuli into constituent parts, as is the case with taste. Thus it may be difficult to encourage a person to decompose art, a visual scene, or a picture of another person into distinct "parts" so that repeated exposure increases sensitization and hedonic escalation.

The intriguing question involves multisensory stimuli that do not involve taste, such as visual and aural (e.g., music video), visual and tactile (e.g., a stuffed animal, roller coaster), and visual and olfactory (e.g., a flower garden). These types of stimuli have unique sensitizing agents, yet these agents are not necessary integrated to create an overall perceptual experience (e.g., a music video may consist of related or unrelated information streams). The implication is an integrated, multisensory hedonic experience may have different consequences than an additive, multisensory hedonic experience.

Future Research

Future research may investigate how people respond to specific palatable foods over time. There are two possibilities: first, it may be that different subsets of people always hedonically escalate to specific foods (i.e., person A always hedonically escalates to potato chips and person B always hedonically escalates to chocolate). Second, it may be that people occasionally hedonically escalate to specific foods (i.e., person A and B hedonically escalate to potato chips on some occasions, chocolate on some occasions, etc.). If hedonic escalation is characterized by the former, then researchers should identify individual differences that predict the types of people who hedonically escalates to different products (i.e., a segmentation issue). Segmentation factors might include consumption expertise, consumption beliefs, and trait self-control. If hedonic escalation is characterized by the latter, researchers should focus on identifying contextual factors that encourage (discourage) hedonic escalation. Examples of contextual factors include need states, competing stimuli, perceived stimulus variability, perceived prior experience, and consumption goals. If hedonic escalation is characterized by both, there is a possibility that segmentation factors and contextual factors may interact to encourage or discourage hedonic escalation.

It would be worthwhile to identify other processes that impact the amount of sensitization. For example, it is well documented that different foods are more or less successful at encouraging sustained consumption (Kessler 2009). Food engineers combine fat, sugar, and salt to create a favorable taste experience. Although this idea is consistent with sensitization driven by an iterative layering of flavor experiences, we expect that food engineering impacts palatability using a more micro-process. Food engineers creates bursts of flavor intensity that depend on blends of sugar, salt, and fat being released at different points during the ingestion of a piece of food. Said another way, consuming a bite of food is akin to a stream of experiences that have multiple peaks. Engineering the timing of these peaks determines the *hedonic value* of a bite of food. Thus we investigate a person's ability to appreciate individual flavors across bites of food, whereas food scientists arrange the expression of flavor within a single bite of food. It may be that these bite-based peak experiences contribute to sensitization only after a consumption vocabulary has developed to identify different types of peaks (Latour and Latour 2010; West, Brown, and Hoch 1996).

Implications

If sensitization is context dependent, the experience of hedonic escalation for any one type of food is likely to be intermittent. This means that the hedonic escalation could create a reinforcement schedule that is a variable ratio. An implication is that people will often eat their favorite foods in an effort to experience hedonic escalation, accepting that escalation will occur a small percentage of the time. This may lead to rapid consumption or overconsumption (Galak et al. 2013). If this is so, public policy officials might consider how to counsel people to reduce indulgent food consumption. If consumers are searching for a hedonic escalation experience, they are likely to sample a number of foods (e.g., ice cream, potato chips, chocolate, nuts, cookies, popcorn) in an effort to achieve adequate hedonic escalation (i.e., people are jonesing for a hedonic escalation experience). If product sampling continues until hedonic escalation is achieved, it may be better to encourage two or three tastes of a specific snack food (i.e., consume a small portion to test for hedonic escalation) and, if unsuccessful, move on to the next food.

A second option would be to counsel people to engage in multisensory imagery, or to vividly imagine the taste, smell, and feel of the food in one's mouth, prior to consumption. Research conducted by Cornil and Chandon (forthcoming) suggests that multisensory imagery heightens anticipated pleasure. Thus if people were to engage in multisensory imagery prior to consuming the food, it may enhance their actual pleasure and increase the likelihood of achieving hedonic escalation. Furthermore, the authors say that multisensory pleasure focuses people on peak experiences occurring after only a small (vs. a large) portion. Thus the benefit would be twofold in that (1) hedonic escalation is more likely to occur on any given consumption episode reducing the number of foods a person must sample, and (2) focusing consumers on the fact that peak experiences occur early, they are more likely to taste only a small portion before moving on, if necessary. In contrast, the advice to have a measured portion of a specific food that has a low probability of creating hedonic escalation may encourage overconsumption. If people are left unsatisfied after eating the entire portion, there is a good possibility they will try again with another food. If the desire to experience hedonic escalation is hard wired, as many have concluded (Epstein et al. 2008; Rolls 2004), it may better to control food volume than to control food choices (Wansink 2004).

DATA COLLECTION INFORMATION

The first author supervised the collection of data with the help of research assistants. Participants were from the University of Florida. Data were collected between the fall of 2012 and the spring of 2016. The second author was responsible for the data analysis with input from the first author. Data were discussed and shared throughout the research process.

REFERENCES

Auvray, Malika and Charles Spence (2008), "The Multisensory Perception of Flavor," *Consciousness and Cognition: An International Journal*, 17 (September), 1016-31.

Bellisle, France, François Lucas, Rim Amrani, and Jacques Le Magnen (1984), "Deprivation, Palatability and the Microstructure of Meals in Human Subjects," *Appetite*, 5 (June), 85-94.

Bellisle, France and Jacques Le Magnen (1980), "The Analysis of Human Feeding Patterns: The Edogram," *Appetite*, 1 (June), 141-50.

Berlyne, Daniel E. (1970), "Novelty, Complexity, and Hedonic Value," *Perception and Psychophysics*, 8 (November), 279-86.

Berridge, Kent C. (2001), "Reward Learning: Reinforcement, Incentives and Expectations," in *Psychology of Learning and Motivation*, Vol. 40, ed. Douglas L. Medin, San Diego: Academic Press, 223-78.

—— (2009), "'Liking' and 'Wanting' Food Rewards: Brain Substrates and Roles in Eating Disorders," *Physiology & Behavior*, 97 (July), 537-50.

Brendl, Miguel C., Arthur B. Markman, and Claude Messner (2003), "The Devaluation Effect: Activating a Need Devalues Unrelated Objects," *Journal of Consumer Research*, 29 (March), 463-73.

Brickman, Philip, Dan Coates, and Ronnie Janoff-Bulman (1978), "Lottery Winners and Accident Victims: Is Happiness Relative?" *Journal of Personality and Social Psychology*, 36 (August), 917-27.

Cabanac, Michel (1979), "Sensory Pleasure," *Quarterly Review of Biology*, 54 (March), 1-29.

Cecil, Joanne E. (2001), "Oral, Gastric and Intestinal Influences on the Control of Appetite and Feeding in Humans," *Appetite*, 36 (June), 235-36.

Cornell, Carol E., Judith Rodin, and Harvey P. Weingarten (1989), "Stimulus-induced Eating When Satiated," *Physiology & Behavior*, 45 (April), 695-704.

Cornil, Yann and Pierre Chandon (forthcoming), "Pleasure as a Substitute for Size: How Multisensory Imagery Can Make People Happier with Smaller Food Portions," *Journal of Marketing Research*.

Elder, Ryan S. and Aradhna Krishna (2010), "The Effects of Advertising Copy on Sensory Thoughts and Perceived Taste," *Journal of Consumer Research*, 36 (February), 748-56.

Epstein, Leonard H., Anthony R. Caggiula, Joshua S. Rodefer, Lucene Wisniewski, and Shari L. Mitchell (1993a), "The Effects of Calories and Taste on Habituation of the Human Salivary Response," *Addictive Behaviors*, 18 (March-April), 179-85.

Epstein, Leonard H., John J. Leddy, Jennifer L. Temple, and Myles S. Faith (2007), "Food Reinforcement and Eating: A Multilevel Analysis," *Psychological Bulletin*, 133 (September), 884-906.

Epstein, Leonard H., Shari L. Mitchell, and Anthony R. Caggiula (1993b), "The Effect of Subjective and Physiological Arousal on Dishabituation of Salivation," *Physiology & Behavior*, 53 (March), 593-97.

Epstein, Leonard H., Jodie L. Robinson, Jennifer L. Temple, James N. Roemmich, Angela Marusewski, and Rachel Nadbrzuch (2008), "Sensitization and Habituation of Motivated Behavior in Overweight and Non-overweight Children," *Learning and Motivation*, 39 (August), 243-55.

Epstein, Leonard H., Jennifer L. Temple, James N. Roemmich, and Mark E. Bouton (2009), "Habituation as a Determinant of Human Food Intake," *Psychological Review*, 116 (April), 384-407.

Finlayson, Graham, Neil King, and John E. Blundell (2007), "Liking vs. Wanting Food: Importance for Human Appetite Control and Weight Regulation," *Neuroscience and Biobehavioral Reviews*, 31 (7), 987-1002.

Galak, Jeff, Justin Kruger, and George Loewenstein (2013), "Slow Down! Insensitivity to Rate of Consumption Leads to Avoidable Satiation," *Journal of Consumer Research*, 39 (February), 993-1009.

Garbinsky, Emily N., Carey K. Morewedge, and Baba Shiv (2014), "Does Liking or Wanting Determine Repeat Consumption Delay?" *Appetite*, 72 (January), 59-65.

Gordon, Peter C. and Keith J. Holyoak (1983), "Implicit Learning and Generalization of the 'Mere Exposure' Effect," *Journal*

of Personality and Social Psychology, 45 (September), 492-500.
Groves, Philip M. and Richard F. Thompson (1970), "Habituation: A Dual-Process Theory," *Psychological Review*, 77 (September), 419-50.
Havermans, Remco C. (2011), '"You Say It's Liking, I Say It's Wanting . . .'. On the Difficulty of Disentangling Food Reward in Man," *Appetite*, 57 (August), 286-94.
Havermans, Remco C., Nicole Geschwind, Sabine Filla, Chantal Nederkoom and Anita Jansen (2009), "Sensory-Specific Satiety Is Unaffected by Manipulations of Flavour Intensity," *Physiology & Behavior*, 97 (June), 327-33.
Havermans, Remco C. and Anita Jansen (2007), "Increasing Children's Liking of Vegetables Through Flavour-Flavour Learning," *Appetite*, 48 (March), 259-62.
Inman, J. Jeffrey (2001), "The Role of Sensory-Specific Satiety in Attribute-Level Variety Seeking," *Journal of Consumer Research*, 28 (June), 105-20.
Janiszewski, Chris (2008), "Goal-Directed Perception," in *Handbook of Consumer Psychology*, ed. Curtis P. Haugtvedt, Paul M. Herr, and Frank R. Kardes, New York: Taylor and Francis, 393-418.
Kadohisa, Mikiko, Edmund T. Rolls, and Justus V. Verhagen (2005), "Neuronal Representations of Stimuli in the Mouth: The Primate Insular Taste Cortex, Orbitofrontal Cortex and Amygdala," *Chemical Senses*, 30 (June), 401-19.
Kahn, Barbara E. and Brian Wansink (2004), "The Influence of Assortment Structure on Perceived Variety and Consumption Quantities," *Journal of Consumer Research*, 30 (March), 519-33.
Kahneman, Daniel and Jackie Snell (1992), "Predicting a Changing Taste: Do People Know What They Will Like?" *Journal of Behavioral Decision Making*, 5 (July), 187-200.
Kessler, David A. (2009), *The End of Overeating: Taking Control of the Insatiable American Appetite*, New York: Rodale.
Laran, Juliano and Chris Janiszewski (2009), "Behavioral Consistency and Inconsistency in the Resolution of Goal Conflict," *Journal of Consumer Research*, 35 (April), 667-84.
Latour, Kathryn A. and Michael S. Latour (2010), "Bridging Aficionados' Perceptual and Conceptual Knowledge to Enhance How they Learn from Experience," *Journal of Consumer Research*, 37 (December), 688-97.
Latour, Kathryn A., Michael S. Latour, and Andrew H. Feinstein (2011), "The Effects of Perceptual and Conceptual Training on Novice Wine Drinkers' Development," *The Cornell Hotel and Restaurant Administration Quarterly*, 52 (4), 1-13.
Leder, Helmut, Benno Belke, Andries Oeberst, and Dorothee Augustin (2004), "A Model of Aesthetic Appreciation and Aesthetic Judgments," *British Journal of Psychology*, 95 (November), 489-508.
Leyton, Marco (2007), "Conditioned and Sensitized Responses to Stimulant Drugs in Humans," *Progress in Neuro-Psychopharmacology & Biological Psychiatry*, 31, 1601-13.
McSweeney, Frances K. and Samantha Swindell (1999), "General-Process Theories of Motivation Revisited: The Role of Habituation," *Psychological Bulletin*, 125 (July), 437-57.
Mook, Douglas G. and Marianne C. Votaw (1992), "How Important Is Hedonism? Reasons Given by College Students for Ending a Meal," *Appetite*, 18 (February), 69-75.
Morewedge, Carey K., Young E. Huh, and Joachim Vosgerau (2010), "Thought for Food: Imagined Consumption Reduces Actual Consumption," *Science*, 303 (6010), 1530-33.
Nelson, Leif D. and Tom Meyvis (2008), "Interrupted Consumption: Disrupting Adaptation to Hedonic Experiences," *Journal of Marketing Research*, 45 (December), 654-64.
Nelson, Leif D., Tom Meyvis, and Jeff Galak (2009), "Enhancing the Television Viewing Experience Through Commercial Interruptions," *Journal of Consumer Research*, 36 (August), 160-72.
Nicolao, Leonardo, Julia R. Irwin, and Joseph K. Goodman (2009), "Happiness for Sale: Do Experiential Purchases Make Consumers Happier Than Material Purchases?" *Journal of Consumer Research*, 36 (August), 188-98.
Papies, Esther K., Tila M. Pronk, Mike Keesman, and Lawrence W. Barsalou (2015), "The Benefits of Simply Observing: Mindful Attention Modulates the Link Between Motivation and Behavior," *Journal of Personality and Social Psychology*, 108 (January), 148-70.
Parducci, Allen (1965), "Category Judgment: A Range-Frequency Model," *Psychological Review*, 72 (November), 407-18.
Pechmann, Connie and S. Ratneshwar (1992), "Consumer Covariation Judgments: Theory or Data Driven," *Journal of Consumer Research*, 19 (December), 373-86.
Peciña, Susana and Kent C. Berridge (2005), "Hedonic Hot Spot in Nucleus Accumbens Shell: Where Do μ-Opioids Cause Increased Hedonic Impact of Sweetness?" *Journal of Neuroscience*, 25 (December), 11777-86.
Peron, Rosalynn M. and Gary L. Allen (1988), "Attempts to Train Novices for Beer Flavor Discrimination: A Matter of Taste," *Journal of General Psychology*, 115 (October), 403-18.
Ratner, Rebecca K., Barbara E. Kahn, and Daniel Kahneman (1999), "Choosing Less-Preferred Experiences for the Sake of Variety," *Journal of Consumer Research*, 26 (June), 1-15.
Redden, Joseph P. (2008), "Reducing Satiation: The Role of Categorization Level," *Journal of Consumer Research*, 34 (February), 624-34.
——(2015), "Desire over Time: The Multi-Faceted Nature of Satiation," in *The Psychology of Desire*, ed. Wilhelm Hofmann and Loran F. Nordgren, New York: Guilford Press, 82-103.
Redden, Joseph P. and Kelly L. Haws (2013), "Healthy Satiation: The Role of Decreasing Desire in Effective Self-Control," *Journal of Consumer Research*, 39 (February), 1100-14.
Rolls, Barbara J., Edmund T. Rolls, Edward A. Rowe, and Kevin Sweeney (1981a), "Sensory Specific Satiety in Man," *Physiology & Behavior*, 27 (1), 137-42.
Rolls, Barbara J., Edward A. Rowe, and Edmund T. Rolls (1982), "How Sensory Properties of Foods Affect Human Feeding Behavior," *Physiology & Behavior*, 29 (September), 409-17.
Rolls, Barbara J., Edward A. Rowe, Edmund T. Rolls, Breda Kingston, Angela Megson, and Rachel Gunary (1981b), "Variety in a Meal Enhances Food Intake in Men," *Physiology & Behavior*, 26 (February), 215-21.
Rolls, Edmund T. (2004), "The Functions of the Orbitofrontal Cortex," *Brain Cognition*, 55 (June), 11-29.
Rolls, Edmund T., Barbara J. Rolls, and Edward A. Rowe (1983), "Sensory-Specific and Motivation-Specific Satiety for the Sight and Taste of Food and Water in Man," *Physiology and Behavior*, 30 (February), 185-92.
Schwarz, Norbert (2004), "Metacognitive Experiences in Consumer Decision Making," *Journal of Consumer Psychology*, 14 (4), 332-48.
Spence, Charles (2010), "The Multisensory Perception of Flavour," *The Psychologist*, 23 (September), 720-23.
Velasco, Carlos, Russell Jones, Scott King, and Charles Spence (2013), "Assessing the Influence of the Multisensory

Environment on the Whisky Drinking Experience," *Flavour*, 2 (23), 1-11.

Volkmann, John (1951), "Scales of Judgment and Their Implications for Social Psychology," in *Social Psychology at the Crossroads*, ed. John H. Rohrer and Muzafer Sherif, New York: Harper, 273-96.

Wadhwa, Monica, Baba Shiv, and Stephen M. Nowlis (2008), "A Bite to Whet the Reward Appetite: The Influence of Sampling on Reward-Seeking Behaviors," *Journal of Marketing Research*, 45 (August), 403-13.

Wansink, Brian (2004), "Environmental Factors That Increase the Food Intake and Consumption Volume of Unknowing Consumers," *Annual Review of Nutrition*, 24, 455-79.

West, Patricia M., Christina L. Brown, and Stephen J. Hoch (1996), "Consumption Vocabulary and Preference Formation," *Journal of Consumer Research*, 23 (September), 120-35.

Yeomans, Martin R. (1996), "Palatability and the Micro-Structure of Feeding in Humans: The Appetizer Effect," *Appetite*, 27 (October), 119-33.