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# The Impact of Supertasters On Taste Test and Marketing Outcomes: How an Innate Characteristic Shapes Taste, Preference, Experience, and Behavior

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**Abstract**
This article introduces advertisers to a new segmentation technique based on an individual's inherited taste sensitivity—that is, the "supertaster." Three studies demonstrate that this inherited supertaster difference can explain blind taste-test anomalies, such as the Pepsi Challenge; heightened brand loyalty; and a reduced sensitivity to peripheral product cues, such as visual variations. These findings underscore a new vein of segmentation that has great promise for explaining variance in lab, expert, and crowd-sourced evaluations involving matters of taste.

**Keywords**
wines, carbonated soft drinks, blind taste test, advertising research

**Disciplines**
Behavioral Economics | Food and Beverage Management | Hospitality Administration and Management

**Comments**
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# The Impact of Supertasters On Taste Test and Marketing Outcomes

## How an Innate Characteristic Shapes Taste, Preference, Experience, and Behavior

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This article introduces advertisers to a new segmentation technique based on an individual's inherited taste sensitivity—that is, the "supertaster." Three studies demonstrate that this inherited supertaster difference can explain blind taste-test anomalies, such as the Pepsi Challenge; heightened brand loyalty; and a reduced sensitivity to peripheral product cues, such as visual variations. These findings underscore a new vein of segmentation that has great promise for explaining variance in lab, expert, and crowd-sourced evaluations involving matters of taste.

### INTRODUCTION

> *One must ask children and birds how cherries and strawberries taste.*
>
> —Johann Wolfgang von Goethe

Understanding what drives consumer taste preference has been one of the foundational marketing questions: To what extent are our preferences and behaviors learned, and to what extent are they innate? The answer can inform both segmentation and marketing strategies (Wansink and Park, 2000; Wansink and Westgren, 2003). If individual innate taste drives choice, then it would be best to focus on developing products that most appeal to these individual taste preferences and highlight those aspects in communication efforts. If preference is based more on culturally learned aspects, then the consumers' taste is less important than the brand messaging they receive. The objective of this research was to determine the role of a specific inheritable trait—sensitivity to bitterness—on shaping consumer preference, taste preference, and behavior.

This research is important because the majority of advertising research is based on the nurture view, as expressed by Goethe, that culture overwhelms taste. Examples such as the Pepsi Challenge and

### Management Slant

- How consumers experience taste is heritable, particularly with regard to bitter and sweet taste sensations, and this can be assessed through a simple paper taste strip.
- Segmentation of consumers by taste sensitivity can explain differences in cola and wine taste tests that cannot be explained by training or cultural influence.
- Supertasters are more sensitive to bitterness, seek sweeter foods, and exhibit more behavioral loyalty than other consumers, which makes them an important segment for food marketers involved in testing and introducing new products.
- Advertisers can attract this supertaster segment by employing language that highlights the sweetness or mellowness of the product's taste.

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the failed New Coke launch often are cited as situations in which consumer performance in blind taste tests does not relate to marketplace behavior, where culturally learned brand associations trump individual sensory taste-based preference (see LaTour, LaTour, and Zinkhan, 2010). Other research shows that even trained experts cannot separate color cues from their tasting. In these instances, even experts described a white wine colored red as having flavor aspects, such as cherry, that are more associated with a red wine (Morrot, Brochet, and Dubourdieu, 2001). Under the nurture view, advertisers should focus on branding and highlight attributes they want the consumer to taste rather than on how individual consumers might experience taste differently.

The recent evidence that some people's taste sensitivity—particularly to bitterness—is markedly different than others provides early evidence of a segment of people who could be considered supertasters and who might hold the key to other unexplained taste anomalies. If supertasters are indeed different—in kind—from other consumers, this has implications for a wide range of experiences and behaviors far beyond supertasters' idiosyncratic preferences for products. It could influence variety seeking; brand loyalty; and one's sensitivity to peripheral cues, such as advertising, packaging, product recommendations, and many of the traditional variables in the marketing mix.

The Background section of this article begins by highlighting marketing research that has found that some consumers are better at differentiation tasks. The authors suggest that this is in part due to an inherited trait, and they introduce the supertaster research from food science to support the nature argument. The applicability of the nature argument to the consumer context is not clear, however, because those results have been mixed, often bound by the context and participant pool.

**The recent evidence that some people's taste sensitivity—particularly to bitterness—is markedly different than others provides early evidence of a segment of people who could be considered supertasters and who might hold the key to other unexplained taste anomalies.**

In that regard, Study 1 investigates a highly salient blind taste test, the Pepsi Challenge, to see whether supertasters react differently than other types of tasters. Study 2 turns to a more nurture-related consumer product—wine—beginning with a field experiment to determine whether supertasters experience wine differently in terms of emotional arousal and whether this translates to their market-loyalty behavior. Study 3 uses the blind wine-taste situation in which two of the same white wines are served, with one colored red, to determine whether supertasters are better at noticing the taste similarities of the wines and whether wine-education training overwhelms any innate sensation detection ability. The article ends with a discussion of the implications of these findings for research and targeting.

## BACKGROUND

### Taste Preference: Nature versus Nurture

The question as to whether some consumers have different taste worlds remains elusive. To get insight into this issue requires differentiating between what constitutes a sensation and a perception. "Sensation" refers to the primary absorption of information from one's sense organs, whereas perception involves active interpretation of the sensory information (Matlin, 1988). Most advertising research has viewed sensations as being relatively similar across individuals, with differences occurring at the point of perception (Hoegg and Alba, 2007). Blind taste tests historically have been used to study matters of consumer taste (Gruber and Lindberg, 1966) to determine perceptual differences or preferences. Overall, such tests find that consumers are not good at differentiation (Raghubir, Tyebjee, and Lin, 2009). Some researchers have claimed that if consumers cannot discriminate in such tests, then there can be no true preference (Irwin, 1958).

Within the history of taste tests, however, it has been found that some people are exceptional at differentiation, and researchers have suggested that this sensitivity could relate to marketplace behavior. Givon and Goldman (1987) pondered, "To what extent is discriminative ability a stable characteristic of the individual rather than a result of situational factors such as mood, health, fatigue, and foods previously eaten? Will those who display a high discriminative ability with one product also discriminate well in other product classes?" (p. 305).

Until recently, little research has focused on the nature side of consumer-preference

development. An exception is the work of Simonson and Sela (2011), who proposed that heredity may most affect global-prudence views, as represented by the distinction between "living on the edge" and "living mainstream," but does not extend generally to specific decision-making tasks. According to Simonson and Sela, things such as decisions about variety-seeking behavior or perceptual problem-solving tasks less likely are influenced by genetics. They did not consider the role of an inherited trait that drives sensation, perception, and potential downstream variables of behavior.

The research presented here focuses on an individual hereditable trait—sensitivity to detect and experience the sensation of bitterness, which is characterized as a being a supertaster. Although research in this area of food science has been conducted for the past 20 years (see Hayes and Keast, 2011, for a review of that research and, more recently, Zaraska, 2015), it has not made its way to the advertising literature. Food science research initially focused on those who are more sensitive to bitter compounds and how that relates to food preference in general. More recently, however, researchers have found that this sensitivity represents a general acuity in taste perception and also extends to emotional, hedonic responses to stimuli. Such sensitivity potentially is linked to sensation-seeking or avoidance behavior, as well.

For these reasons, it seems clear that advertising researchers ought to be aware of the essential role this innate trait may play not only in food preference but also in consumers' decision-making and market behavior. These innate differences in heredity also could be markers that explain the sometimes curiously wide variation in the hedonic evaluations that take place in blind taste tests, expert panels, and crowd-sourced evaluations.

## Innate Taste Preferences: The Supertaster

Sensitivity for bitter taste sensation differs interindividually. Early research in this area found that some consumers find a chemical called propylthiouracil (PTC) noticeably bitter, whereas some others find it tasteless (Blakeslee and Fox, 1932). Linda Bartoshuk (1991) used a similar compound (6-n-propylthiouracil [PROP]) to classify consumers into three groups: nontasters (roughly 25 percent of the population), tasters (50 percent of the population), and supertasters (25 percent of the population).

This supertaster category represents those who have a particular sensitivity to react negatively to a narrow group of compounds, represented by PTC and PROP. Supertasters seem to have a greater than normal number of taste-bud papillae on their tongue, which allows them to experience all flavors more intensely, not just bitterness (Delwiche, Vucetic, and Breslin, 2001). There has been a gene identified in supertasters, TAS2R38, that is associated with ability to taste PROP and PTC (Hwang *et al.*, 2016; Timpson *et al.*, 2007).

Most food-science research considers how supertasters are different from other types of tasters. Supertasters, for example, are found to dislike dark chocolate, chili peppers, and bitter vegetables such as Brussels sprouts, and they tend to avoid broccoli, turnips, and even alcohol (Catanzaro, Chesbro, and Velkey, 2013). Supertasters in general do not like black coffee (Glanville and Kaplan, 1965) and therefore are associated with a low preference or low consumption of caffeine solutions (Ly and Drewnowski, 2001). Some research shows that supertasters have issues of body fat and prefer creamy and fatty foods, whereas other research has found that supertasters less likely have weight issues compared to nontasters. Other research has found that the relationship between PROP and food preferences also is influenced by cultural factors (Catanzaro *et al.*, 2013) and has found little association for college students between sensitivity and stated food choices.

Researchers believe this taste sensitivity may serve an evolutionary purpose, to protect people from ingesting potentially poisonous substances (Bartoshuk, Duffy, and Miller, 1994). Supertasters are more sensitive to changes in food composition (Prescott, Soo, Campbell, and Roberts, 2004). Researchers have suggested that the sensitivity might be related not to food intake *per se* but to individual differences in defensiveness and emotional reactivity (Herbert *et al.*, 2014), whereby supertasters broadly are thought to experience their world more intensely (Duffy, Peterson, and Bartoshuk, 2004).

The biology of taste is key. Taste sensations are processed in the brain to become perceptions. As with other sensory receptors, taste signals are projected via afferent nerve fibers to several brain regions, including the insula, which play a critical role in neurovisceral integration and the experience of emotions (Kringelbach, de Araujo, and Rolls, 2004).

Early animal research showed a relationship between bitter taste sensitivity and emotional reactivity, finding more stress-related responses from rats with higher taste sensitivities. In humans, the link has been shown between taste sensitivity and (negative) affect, although this relationship is not entirely clear. One study presented negative-mood movie clips to participants screened for PROP sensitivity and found that supertasters experienced more intense emotions, particularly fear and tension (Mach and Mueller, 2007).

Another study found that supertasters experienced faster startle responses in reaction to emotional stimuli, compared to nontasters (Herbert *et al.*, 2014). This startle reflex is thought to underlie motivational processing (Herbert *et al.*, 2014). Lang and

Davis (2006) described the neurobiology and psychology of emotion as relating to appetitive (reward) and aversive motivations, so having taste sensitivity drive emotional reactions in this way is quite remarkable.

The present study looked at whether supertasters experience heightened emotions when they consume hedonic products. This research additionally explored how supertasters' heightened taste sensitivity might influence how they navigate the world. Some researchers, for instance, have suggested that because nontasters have a higher threshold for detecting bitterness and sweetness, they are reported to be more adventurous, less picky eaters who like more highly seasoned and stronger-flavored foods (Stuckey, 2012). In that connection, the Exploratory Buying Behavior Tendencies Scale has been used by marketers to measure an individual's likelihood to seek out sensory stimulation through risky and innovative product choices (Baumgartner and Steenkamp, 1996). The authors suspect that supertasters are narrower in their choices, and once they have found a style or brand they enjoy and can tolerate, likely tend to stick with it.

### Preference Development: Nurture Argument

The nurture argument suggests that preferences are driven by cultural forces. Researchers on preference development generally have looked at repetition and frequency as precursors to preference development, thus implicitly supporting the nurture argument (Krugman, 1962) and the importance of learning to brand loyalty (Sheth, 1968). The nurturing can come from early-childhood influences, including parents (Braun-LaTour, LaTour, and Zinkhan, 2008). Most often, however, advertisers use this view to justify marketing expenditures as a means to frame how consumers learn about their brand from product experiences (Hoch and Deighton, 1989). Brand loyalty, under this view, is more about advertising and packaging than consumers' reactions to sensory aspects of the product, such as flavor or style (Almenberg, Dreber, and Goldstein, 2014).

A classic study by Allison and Uhl (1964) found that when a set of beers were labeled, consumers were able to discern differences and identify preferences, but there was no such distinction in the absence of labels. In the blind-tasting condition, no beer was judged by its regular drinkers to be significantly better than the other samples. In fact, regular drinkers of two of the five beers scored other beers significantly higher than the brand that they stated was their favorite. In short, top-down expectations altered how the beer tasted (Lee, Frederick, and Ariely, 2006).

This result also has found its way into the wine world, where wines from good vintages, select vineyards, and iconic producers are generally much more expensive than other wines. Despite this, research has found that tasters perform only marginally better at distinguishing vintage, reserve, and special single-vineyard product (Weil, 2005). This finding has led researchers to conclude that brand loyalty and nonblind sensory perception seem to have little to do with the sensory experience—a bottom-up process. Rather, brand cues seem to affect the tasting experience through expectations—a top-down cognitive process.

### Role of Learning and Experience

Traditionally, wine, like coffee and beer, has been portrayed as something consumers are thought to learn to like, because of bitter properties and sensory characteristics that typically are not experienced with other food or beverage products (Rozin, 1996). Rozin, in fact, asserted that most alcoholic beverages are "initially unpalatable," and preferences are thought to develop when the unpleasant sensory experience is outweighed by the positive postdigestive consequences. Allen, Gupta, and Uhl (2008, p. 296) used this to argue the importance of cultural effects on taste-preference development: "Individual preferences are not independent of culture (Fieldhouse, 1995; Rozin, 1996). If innate taste preferences were the sole driving force behind food choice, then few would persevere with unpleasant tastes such as coffee, beer, or chili peppers (Germov and Williams, 1999; Matlin, 1983)." Because beer and wine are embedded in social experiences, these authors argued that the cultural meanings associated with their consumption override any preexisting preferences.

The wine context further allows a differentiation of level of learning on preference and discrimination tasks. Research suggests that experts are more data driven as they process information (Alba and Hutchinson, 1987). Lawless (1984) found that experts were more disciplined than novices when they tasted wines. The experts inspected the visual, olfactory, and taste profiles of a sample, whereas novices generally did not. Solomon (1990) noted that this ability resulted in experts referring to more dimensions during a tasting and using strategies of which novices were unaware to aid their analysis. Although most blind tasting is not blind *per se*—wine is poured in a clear glass—when this visual cue is removed, experts are able to distinguish more taste properties of the wine than novices (Parr, White, and Heatherbell, 2010).

Whether wine experts are innately endowed or have lower absolute thresholds for chemosensory stimuli in general or for detecting wine-related compounds is not clear, with some evidence suggesting there is no special detection ability. Bende and Nordin (1997) looked at experts versus

novices for detecting 1-butanol, an odor related to wine, and found no significant difference. Other evidence suggests some differences due to olfaction, finding that some genes are associated with detecting certain aromas, particularly sensitivity to beta-ionone, a floral violet characteristic found in red wines such as pinot noir (McRae *et al.*, 2013).

The role of taste sensation as an inherited ability is less clear, however. The only academic research directed toward differentiating learning from innate characteristics for taste found that people in the hospitality and wine trade had a higher likelihood of being supertasters than the rest of the population (Hayes and Pickering, 2012). Whether innate sensitivity led them to expertise in this area or whether other external variables caused them to go into that vocation is unknown, given the correlational nature of the study.

### Research Study Overview

This investigation began with the Pepsi Challenge blind taste test to determine whether supertasters perform differently than other tasters with colas varying on sweetness levels, as well as to assess their acuity in tasting. Study 2 features wine, a more complex learned product, to see whether supertasters experience heightened emotional arousal and report different levels of behavioral loyalty. As a means to seek potential boundary effects of this innate supertasting ability, Study 3 looks at high-level experts in a perceptual colored wine task to test nature versus nurture views of taste. See Table 1 for an overview of the research questions addressed in these studies.

**TABLE 1**
Study Overview

| Study 1: Pepsi Challenge redux | Study 2: Supertasters in the field with wine | Study 3: Nature versus nurture |
|---|---|---|
| Do supertasters prefer sweeter colas? Are supertasters better at brand identification? | Do supertasters experience wine differently in terms of emotional arousal? Are supertasters more loyal in their buying behavior? | Does the supertaster discrimination ability persist or dissipate with learning? |

## STUDY 1: PEPSI CHALLENGE REDUX

Food-industry critics have said that the small cola samples served in blind taste tests favor sweeter colas, such as Pepsi. In terms of taste preference, the literature suggests that supertasters might more likely prefer a sweeter-tasting cola. The beverage industry has noted an overall trend with sweet drinks, from the Frappuccinos at Starbucks to the sweet red Apothic wines developed by Gallo. Within the cola industry, Coca-Cola has found a surge of interest in its Mexican Coke, made with pure cane sugar, which is said to be sweeter than the original.[1] For the authors' purposes, the cola context offers an opportunity to test for supertaster status on taste preference across a variety of colas varying on sweetness. The following hypotheses were formulated:

H1: Supertasters will prefer the sweeter Pepsi over others.

H2: With their heightened sensitivity, supertasters will be able to differentiate the colas better (*i.e.*, guess the identity of the samples).

### Method

**Sample.** A total of 142 undergraduates, with a mean age of 20, participated in the blind taste test. This group represents the target population for cola beverages. Taste sensitivity was measured per the method of Zhao, Kirkmeyer, and Tepper (2003), whereby participants put filtered paper strips that had been dipped in PTC solution in their mouth, letting it moisten with their saliva. They then rated the perceived bitterness of the solution. This methodology allowed segmentation of those who noted an extreme bitterness as supertasters (*i.e.*, those who indicated at least 75 on a scale from 0 = barely detectable to 100 = strongest imaginable taste of any kind). Forty individuals in this sample were classified as supertasters. See the Appendix for more detailed descriptions.

**Procedure.** Participants were given three 1.5-oz. samples of Coke, Pepsi, and Mexican Coke in similar plastic cups. They were told to drink them in any order and to indicate their preferred sample. They rated the samples on a number of scales, with the target being sweetness (1= not at all sweet, 10 = extremely sweet). They were asked also to guess which cola was in each cup.

### Results

In most Pepsi Challenge taste tests, Pepsi wins. In this challenge, in which there was a third option that was also sweet, there was no clear-cut winner. Each cola got about a third of the vote—Pepsi 30 percent, Coke 32 percent, and Mexican Coke 37 percent. It does, therefore, seem as if Mexican

[1] *E. Geiger-Smith, "An Imported Soda That Comes with Buzz,"* The New York Times, *October 5, 2014, p. 8 (Style section).*

Coke appealed to those who might otherwise have opted for the sweeter Pepsi, taking some of the preference share from Pepsi.

As a manipulation check, each participant rated the sweetness of the colas, and, indeed, Pepsi was, overall, rated as the sweetest ($M_{Pepsi}$ = 6.5), Coke as least sweet ($M_{Coke}$ = 5.4), and Mexican Coke in the middle ($M_{Mexican\ Coke}$ = 5.8). Each cola, moreover, was found to be significantly different from the others on sweetness: Coke versus Pepsi, $t$ = 6.0, $p < 0.0001$; Coke versus Mexican Coke, $t$ = 2.0 $p$ = 0.04; Pepsi versus Mexican Coke, $t$ = 3.4 $p < 0.0001$.

These distinctions aside, however, the purpose here was to determine whether supertasters would more likely than others prefer the sweeter Pepsi sample. That was, in fact, the case, with 50 percent of supertasters, compared to 22 percent of other tasters, preferring the Pepsi sample. In comparison, 38 percent of the other tasters preferred the Coke sample, compared to 18 percent of supertasters. Thirty-nine percent of the other tasters, compared to 33 percent of supertasters, preferred Mexican Coke. A chi-square test indicated that the overall proportions of cola choices differed among these groups—a difference significant at $\chi^2(2, N = 142) = 11.3$ $p$ = 0.003—which suggests that supertasters did have different taste preferences than other consumers, being more likely to prefer the sweeter Pepsi sample in particular. Hypothesis 1 thus was supported.

Because research suggests that supertasters might be more acute and aware of their taste experiences, the study additionally looked at supertasters' ability to identify the brands used in the blind test, by coding the number of colas the participant correctly identified. On average, supertasters got 2.0 out of 3 correct, compared to 0.9 for other tasters, significantly different at $t(140) = 5.6$, $p < 0.0001$. Hypothesis 2 thus also was supported.

**This blind test revealed that supertasters preferred sweeter products over other tastes. They also seemed to have more discrimination in terms of knowing which taste sensation was associated with which brand.**

#### Discussion

This blind test revealed that supertasters preferred sweeter products over other tastes. They also seemed to have more discrimination in terms of knowing which taste sensation was associated with which brand. One of the concerns with blind taste tests is whether consumers are lucky or good in their taste identifications (Morrison, 1981), and this research suggests that supertasters are in the latter category, as they were better able to identify brand taste correctly than other consumers.

Blind tasting does not occur in everyday consumption, however, so although this supertaster advantage is important for laboratory studies, it is not clear how this factor plays out in the actual experience of tasting in the real world. For this reason, the next study was in the context of wine, a consumer product that is more complex and associated with learned preferences. Some research has found that supertasters might prefer white over heavy red wines because, given their sensitivity, they perceive greater discomfort with the mouthfeel of red wine (Pickering and Roberts, 2006). Still, there has been no direct link yet established between supertasters and emotional arousal during the taste experience nor the impact on behavioral loyalty, which are examined in the next study.

### STUDY 2: SUPERTASTERS IN THE FIELD WITH WINE

This study sought to determine whether supertasters actually experience their tasting differently than other consumers, using an emotional arousal scale. The study examined whether supertasters' heightened emotional experiences occur as they taste a pleasurable hedonic product—wine—using the Self-Assessment Manikin (SAM). The SAM has been found to be a valid and reliable measure of emotional response (Bradley and Lang 1994) as a pictorial representation of the original pleasure, arousal, and dominance dimensions (Mehrabian and Russell 1974). It has been vetted thoroughly in applications to the assessment of underlying emotional responses to advertising and has been shown on substantially large amounts of data (Morris, Woo, Geason, and Kim, 2002) to be a stronger predictor of conative attitude than cognitive response to such stimuli.

A further important question is how this innate sensitivity affects supertasters' navigation of their wine world and resulting behavioral loyalty. To answer this question, the researchers used the Exploratory Buying Behavior Tendencies Scale (Baumgartner and Steenkamp, 1996). The following hypotheses were formulated:

H3: Supertasters will experience heightened emotional responses when tasting a pleasurable hedonic product—wine.

H4: Supertasters will exhibit greater loyalty behavior than other types of consumers, because

they more likely will stay with a brand whose taste they know and enjoy, rather than switch to an unknown, potentially bitter or unappealing new brand.

### Method

**Sample.** A total of 110 individuals (70 female, 40 male; age range from 23 to 78 years, average age of 53) at California and Colorado wine events experienced a white wine tasting and completed a survey. All of them were frequent consumers of wine, purchasing and drinking wine at least once a week, and labeled themselves as aficionados. As described below, participants took the PTC strip test to determine taster status. Given space constraints on the survey, participants were asked to self-identify whether they detected any taste or experienced a mild bitter taste or extreme bitterness. Those who reported extreme bitterness ($n$ = 42) were considered as supertasters.

**Procedure.** An oaked sauvignon blanc was served at the start of the survey, and the participants indicated how they felt on the SAM as they tasted that wine. The wine had ripe tropical fruits, was light, and had a soft mouthfeel, so it should have been appealing to the supertasters in particular. Participants then filled out a survey about their background, including gender and age, and took the PTC strip test.

They then indicated their wine buying behavior, on a modified Exploratory Buying Behavior Tendencies Scale (Baumgartner and Steenkamp, 1996). This consisted of 10 items for which participants indicated their agreement on a 7-point scale (1 = "strongly disagree," 7 = "strongly agree") on items such as "I would rather stick to a wine brand I usually buy than try something I am not very sure of" and "I think of myself as a brand-loyal consumer of wines" (See Appendix).

### Results

**Emotional Response.** The SAM scale consists of three measures: pleasure, activation, and dominance (see the Appendix). On all aspects, the supertasters differed from the other tasters: Supertasters experienced more pleasure ($M_{\text{Supertasters}}$ = 6.5 versus $M_{\text{Nonsupertasters}}$ = 5.8), $t(108) = 2.2$ $p = 0.03$; more activation during tasting ($M_{\text{Supertasters}}$ = 5.9 versus $M_{\text{Nonsupertasters}}$ = 4.3), $t(108) = 3.9$ $p < 0.0001$; and less feeling of control, indicated by less dominance, ($M_{\text{Supertasters}}$ = 3.7 versus $M_{\text{Nonsupertasters}}$ = 2.6), $t(108) = 1.7$ $p < 0.0001$. Hypothesis 3 thus was supported.

**Loyalty Behavior.** The next question was whether this more active feeling during tasting had an effect on how supertasters approached wine buying and their loyalty behavior. Three items were reverse scored, and then all items were summed, with higher values indicating more loyalty behavior and less variety seeking. Supertasters were significantly less likely to seek variety or try new wines, preferring to stick with styles and brands they were comfortable with ($M_{\text{Supertasters}}$ = 35.1 versus $M_{\text{Nonsupertasters}}$ = 31.1), $t(108) = 2.3$ $p = 0.02$. Hypothesis 4 therefore was supported also.

### Discussion

This field study found that supertasters experienced wine differently than other tasters, exhibiting more activation and feeling less in control (less dominance) during their taste experience. Given the criticality of arousal response in a consumptive context, as demonstrated repeatedly over decades of research (*e.g.*, Di Muro and Murray, 2012; Dunn and Hoegg, 2014), and how substantially idiosyncratic psychophysiological responses typically are (LaTour and Rotfeld, 1997), these results provide unique, theoretically grounded elucidation. This translates to supertasters' comfort-zone marketplace behavior, where they more likely will stick with a brand or wine they like than to seek variety.

It is still not clear, however, whether learning might overwhelm these effects, because this sample of aficionados had not gone through extensive wine training. Might the supertasting advantage disappear when consumers have had extreme training? After all, Chase and Simon (1973) suggested that approximately ten years of practice are required to develop world-class performance ability in chess, and other research suggests a similar level of practice is necessary across a wide variety of domains (Ericsson and Crutcher, 1990). Currently, there are only about 300 Masters of Wines, and only a couple hundred others have achieved the necessary expertise even to be considered to test for that title. The next study thus considered whether years of learning lead to more accurate perceptual judgments or whether this innate sensitivity in supertasters continues to dominate discrimination.

## STUDY 3: NURTURE VERSUS NATURE

This study involved pouring participants two glasses of the same wine, identical except that one was colored a light red, in a procedure similar to that used by Morrot *et al.* (2001). Those researchers found that midlevel experts used the red color to set expectations of the wine, so that they experienced the wine in ways more similar to its color, mentioning cherry and raspberry flavors and rating it as if it were a red wine with tannins because of their learned associations. If participants are processing in a bottom-up manner that relies on taste sensations, however, they should be able to notice that the wines are the same and be able to overcome such learned associations between color and taste.

The results from the first study suggested that supertasters might have greater acuity toward recognizing the similarities in the wines and thus be able to withstand

the perceptual color bias. Morrot *et al.*'s (2001) study used midlevel experts and did not consider how learning might mitigate these effects (LaTour and LaTour, 2010) or the role of innate supertasting ability. Given the research on learning and expertise suggesting that experts should be able to use bottom-up processes in this task (nurture), one would predict that high-level experts would exhibit little bias in the task. If innate ability is involved and sensory acuity drives the taste test results, however, one contrarily would expect the supertasters to perform better on this discrimination task. The following research question thus was posed:

RQ1: Are wine experts or supertasters better able to overcome color bias?

## Method

**Sample.** The experts consisted of second-year Master of Wine students and international wine judges. All had undergone extensive training and testing as to their wine-identification ability. This group consisted of wine makers, wine growers, wine educators, wine writers, and other wine-trade-oriented individuals.

The aficionados consisted of students who had taken a wine-appreciation course and were interested in furthering their knowledge of wine. As a means to differentiate the nurturing effects of training, it was important that this group have some familiarity with and interest in wine for them to be able to approach the task, but no more than one year of experience tasting wine. As one might expect, the aspiring wine students were younger than the experts (average age = 24 versus 45 years), but no other overt differences, such as gender, differentiated the groups.

**Procedure.** Participants were instructed to sample the flight of two wines served side by side in clear glasses at the same temperature. Both glasses contained a slightly oaked sauvignon blanc–semillon blend similar to that used by Morrot *et al.* (2001). The colored wine had red and blue natural food coloring added, so that it looked like a light red wine. This food coloring had no flavor impact on the wine. The wines were presented in the same manner to all participants.

Participants were told to spend about five minutes analyzing and writing their tasting notes for each wine. The important point here was to avoid being overly leading at this point, given that the key issue was how they would approach these similar but differently colored wines. They could taste and retaste each wine. Participants then rated the wines comparatively on seven dimensions (flavor, acid, tannin, body, alcohol, finish, and quality), where 1 = not at all similar and 7 = very similar. They filled out some background demographic material and indicated what varietal they thought the wines were. Taste-sensitivity response was determined as in the earlier studies with the PTC strip, and, as in Study 2, participants were asked to self-report whether they tasted nothing, tasted something slightly bitter, or tasted something extremely bitter.

## Results

**Supertaster Status.** Again, those who indicated that they had tasted something extremely bitter were identified as the supertaster group. The first question of interest was whether experts consisted of a greater percentage of supertasters, given the suggestion from prior research of a self-selection bias in going into that field. This sample, overall, was higher than researchers have found in the general population, but the difference was not significant between the two groups; 55.6 percent of experts and 43.5 percent of aspiring wine aficionados were found to be supertasters, $\chi^2 = 0.15$.

**Taste Differentiation.** The key issue investigated for this study was that if learning overcame nature, then experts would be able to identify the bias and see similarities as they tasted the wines. Conversely, if innate sensitivity were associated with differentiation ability in blind tasting, then such additional learning would not matter. The researchers used two measures to test these issues. First, they analyzed the tasting notes to see whether the participant had noticed that the wines were the same (any differences between judges were resolved in discussion). Second, the researchers summed the comparative judgments of the two wines on the wine-evaluative dimensions. Because the wines were exactly the same except for the color, a higher rating of similarity would show less effect of the perceptual bias on evaluation of the seven measures (*i.e.*, flavor, acid, tannin, body, alcohol, finish, and quality).

In terms of detection, there was no significant difference between experts and aspiring students in noticing the bias (54% versus 44%), $\chi^2 < 1$. There was a supertasting difference, however; the supertasters more likely would identify the bias than other tasters (65% versus 29%), $\chi^2(1, N = 62) = 7.9$, $p = 0.004$. The answer to Research Question 1 thus was that supertasters were more able to overcome color bias.

For similarity judgments, a general linear model was run with level of expertise, supertasting status, and the interaction as factors. The overall model was significant, $F(3, 58) = 4.6$, $p = 0.006$, and the only significant factor was supertaster status, $F(1, 58) = 13.2$, $p = 0.006$. Supertasters, overall, noticed more similarities in the wines ($M_{\text{Supertasters}} = 34.1$ versus $M_{\text{Nonsupertasters}} = 25.5$), $F$s < 1 for both level of expertise and the interaction. Where the experts fared better than the aspiring students was in their

ability to correctly identify the varietal of the untampered wine, with 54 percent of experts compared to 29 percent of students writing that the wine was sauvignon blanc, $\chi^2(1, N = 62) = 3.8$ $p = 0.05$.

#### Discussion

This study suggests that there is an innate ability for taste-differentiation tasks that cannot be explained by training alone. Supertasters were more able to notice the similarities in the wines and less likely would experience a perceptual bias on flavor ratings, which shows that sensation can drive choice decisions even in the presence of extreme learning and experience. The effect of training also was evident, however, in the fact that the experts more likely were able to identify and name the correct varietal associated with the wine.

## GENERAL DISCUSSION

The findings reported here support the contention that the role of nature has been diminished inappropriately in taste tests, as indicated by the well-worn phrase "*De gustibus non est disputandum*"—or, "There is no accounting for taste." Most advertising research has focused on the nurturing effect of various environmental factors that can affect consumption, such as through advertising (Wansink and Ray, 1996), packaging (Wansink, 1996), stockpiling promotions (Ailawadi and Neslin, 1998), and mood-inducing events (Garg, Wansink, and Inman, 2007). In these cases and others, it has been shown that culturally learned symbolic meaning affects behavior in a top-down process (Allen *et al.*, 2008), so that well-known brands and higher prices "taste" better (Allison and Uhl, 1964; Plassman, O'Doherty, Shiv, and Rangel, 2008).

The current research focused on how preexisting innate preferences—such as bitterness sensitivity—better can be understood and addressed to understand consumer preferences. By focusing on one's heritable ability to perceive bitterness in certain compounds, the taste tests outlined here show that supertasters not only preferred sweeter tasting products but also were more discriminating in perceptual taste tasks. Even in the case of a culturally learned and complex product—namely, wine—supertasters exhibited differences in the actual taste experience (more activation, less control) and were associated with greater loyalty behavior. This comparison of taste-differentiation abilities with more learned consumers—wine experts versus wine aficionados—demonstrates that even with extreme learning, this innate supertaster characteristic was associated with enhanced bottom-up perceptual-discrimination judgments.

**This research demonstrates not only how an innate sensory predisposition can make consumers more sensitive to incongruent sensory messages exhibited when tasting a white wine colored red, but also how that drives their taste-discrimination judgments.**

#### Insights for Taste-Test Research

With respect to theory, evidence of the influence that innate taste sensations impart on reactions to a perceptual bias has implications for research on perception and, more practically, how taste-test studies are interpreted and taste segments defined. Perceptual decision-making research makes an implicit assumption that consumers perceive sensory material in similar ways and that only at the point of higher-level decision making might judgments differ. This research demonstrates not only how an innate sensory predisposition can make consumers more sensitive to incongruent sensory messages exhibited when tasting a white wine colored red, but also how that drives their taste-discrimination judgments.

This individual taste acuity offers interesting future research opportunities. Some researchers have speculated that supertasters overall might be less influenced by environmental factors than ordinary tasters, so a whole new variable comes into play for advertising researchers.[2] For instance, given that research in consumer behavior has noted that consumers perceive a deeper color of orange juice as being sweeter (Hoegg and Alba, 2007), might supertasters less likely be influenced by coloring, because they more likely will note the sensory properties of the juice?

In terms of preference development, this research demonstrates how one's innate characteristics might overcome some cultural symbolic messaging. Although Study 2 found that supertasters were less adventurous than other tasters, there may be higher-level interactions in terms of personality and culture that future research could consider (Ulrich, Touger-Decker, O'Sullivan-Maillet, and Tepper, 2004). Given that bitter sensations have been found to be the opposite of the mellow taste one associates with home and comfort (Mukherjee, 1965), knowing that

*2 Lucy Shaw, "Theory of Five Basic Tastes 'Outdated,'"* Drinks Business, *May 7, 2014. Retrieved June 13, 2014, from https://www.thedrinksbusiness.com/2014/05/theory-of-five-basic-tastes-outdated/*

certain consumers may experience this taste sensation more often may affect how it is discussed in communications. Taster status more broadly might be considered as an important variable for new-product development, in a similar way that other metrics have been used for product-design research.

Future research ought to investigate cross-cultural differences on supertasting status across a variety of products. Cultural variation in taste sensitivity mainly has considered the proportion of nontasters to tasters, because the identification of supertaster had not yet occurred. That research has found that 30 percent of Caucasians, 10 percent of Asians, and 5 percent of Africans fall into this low-discrimination group (Parr, 1934). In general, there is an inverse relationship between the nontaster and supertaster segments, with cultures that have more nontasters reporting fewer supertasters, and vice versa (Bell and Song, 2004). Researchers also have reported further ethnic differences in terms of the proportion of supertasters (Bell and Song, 2004). More recent research suggests that those who follow what has been called a Western diet, high in fat and sugar, have a higher likelihood of being supertasters (Stevenson *et al.*, 2016), but there are many future studies that can and should be done in this area.

For instance, cross-cultural failures, such Krispy Kreme donuts in the United Kingdom, have been explained by cultural differences in sweetness preference of American and U.K. consumers, with the former growing up on sweet colas and the latter on tea. Within the U.K. market, though, supertasters who are born to prefer sweeter foods exist, so capturing their attention and interest for these sweet-expansion efforts is important. As the world has become more global and uniform via social media communications, furthermore, finding variables that exist in spite of cultural differences is important. Although the focus to date has been on altering taste expectations through labeling, advertising, menus, and so forth, a new frontier is to better target people on the basis of their taste sensitivities.

#### Limitations and Future Research

The research on supertasters in food science has been mixed, and many geneticists have questioned whether the term "supertaster" even should be used, given that this innate ability does not really translate to a better tasting experience. In fact, some might argue that supertasters have lesser enjoyment of foods, given their acute sensitivities. As with any new research area introduced to advertisers, research regarding supertasters needs to develop fully over time. There are, however, important insights and messages for advertising researchers based on new converging evidence from biophysiological research. This innate predisposition might account for the early marketing taste results, wherein a segment was more discriminatory as well as more consistent with its evaluations (Givon and Goldman, 1987). The PTC strip test is certainly more efficient than the traditional triangular taste tests and repeated testing that have been used by marketers in the past to determine sensitivity and reliability (Gruber and Lindberg, 1966).

The present research findings provide initial confidence for moving forward in using this indicator of sensitivity as a segmentation device for other foods. For instance, supertasters' heightened sense of taste also might lead them to be candidates for healthier foods that other people might find too tasteless, such as tofu (Wansink and Park, 2002).

There are limitations to these studies, on the basis of context as well as participant factors. The Pepsi Challenge traditionally features just two products, Coke and Pepsi; adding a third cola altered the preference distribution. The wine festival study focused on consumers in a fun, hedonic setting. It also only featured one wine, which would be appealing not only to supertasters, because it was white, light, and soft on the palate, but also to other tasters. Future research might vary the product as well as the setting.

**The present research findings provide initial confidence for moving forward in using this indicator of sensitivity as a segmentation device for other foods.**

The third study featured both experts and aficionados and found that the supertaster status was most important in this task for differentiation. Other researchers, however, have found that experts can learn in spite of their taster status (Hanni, 2013), so there is more to wine expertise than not falling for the perceptual illusion of color. In fact, other research has found that experts might be more subject to such illusions when their knowledge gets in the way of their perceptions (LaTour, LaTour, and Brainerd, 2014).

#### Managerial Implications

Starbucks developed its "blonde" line to appeal to those who like a lighter roast coffee,[3] Coca-Cola has seen a surge of popularity in its sweeter Mexican Coke within

*3 Amy McKeever, "Starbucks Will Not Tolerate Jokes About Its Blonde Roast," Eater, January 13, 2012. Retrieved November 20, 2014, from http://www.eater.com/2012/1/13/6622843/starbucks-will-not-tolerate-jokes-about-its-blonde-roast.*

the United States,[4] and Gallo has developed products based on different taste profiles.[5] Its sweet red Apothic has become one of the best-selling wines and has carved out a niche in the predominately dry U.S. wine market. Even in these situations, however, it is not clear whether the products succeed because they are a better match to consumers' preferred innate taste or whether the companies are finding the right means to communicate benefits to consumers and shape what they desire.

One potential reason for the effectiveness of these new products is that companies are recognizing that consumers have different taste sensitivities. At least 25 percent of the population are supertasters. Many supertasters, however, do not realize their status. Even experts in the studies presented here were unaware of their tasting status. These consumers likely will stick to products they know do not upset their taste sensitivities, even if they do not know why they do so.

For companies such as Starbucks to get these sensitive palates to try new products, a different type of promotion campaign is warranted, one that both plays up the product features that are appealing to the supertaster, such as lighter and sweeter, and makes the product available in a risk-averse manner, such as sampling, similar to the wine-by-the-glass concept. Future research might seek other factors that appeal to this segment of the market. In other research, the authors have found supertasters to react positively to advertising that contains "sweet" in the message, so employing the right terms for positioning to this group should be explored.

The risk-averse and low-variety-seeking traits of supertasters have important implications for advertisers as well as for public policy makers involved in healthy-eating campaigns. This is especially the case because many young children exhibit taste sensitivities similar to those of the supertasters studied here—for example, reacting negatively to bitter greens. Some children outgrow this tendency; others stay supertasters (Hanni, 2013; Mennella, Bobowski, and Reed, 2016). Advertising messages that play up sweeter vegetables might be more effective in getting children to consume healthy vegetables. That message also might resonate with adults, given that one of the risks for older supertasters is colon cancer, because their diets are often devoid of healthy greens. The sweet campaign might thus have broader consequences.

Although this research investigates one form of innate marker in one sensory domain, the authors hope that it opens a much broader and more serious investigation with other markers in other domains. In one world, a powerful contribution to public health could be made if genetic markers of predisposition to sugar, salt, fat, or alcohol consumption could be identified. In another world, genetic markers of risky behavior or careless variety seeking could be used to target important environmental interventions. JAR

*4 E. Geiger-Smith, "An Imported Soda That Comes with Buzz."*

*5 J. Siegel. (2012, May 31). "How Sweet It Is." Retrieved November 24, 2014, from the Beverage Media Group website: http://www.beveragemedia.com/index.php/2012/05/how-sweet-it-is/.*

## ABOUT THE AUTHORS

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**Mike LaTour** was a professor of marketing and law at Ithaca College at the time of his death in 2015. He was a nationally ranked scholar in advertising and marketing communications. His research focused on consumer responses to promotional stimuli and spanned a range of topics, including the portrayal of women and sex in advertisements as well as memory and the effect of marketing information on consumer decision making. He served as a member of the editorial boards of several journals, including the *Journal of Advertising*, *Journal of Current Issues and Research in Advertising*, and *Industrial Marketing Management*. From 2013 to 2015 he was the editor of the *Cornell Hospitality Quarterly*.

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## APPENDIX

### Measures

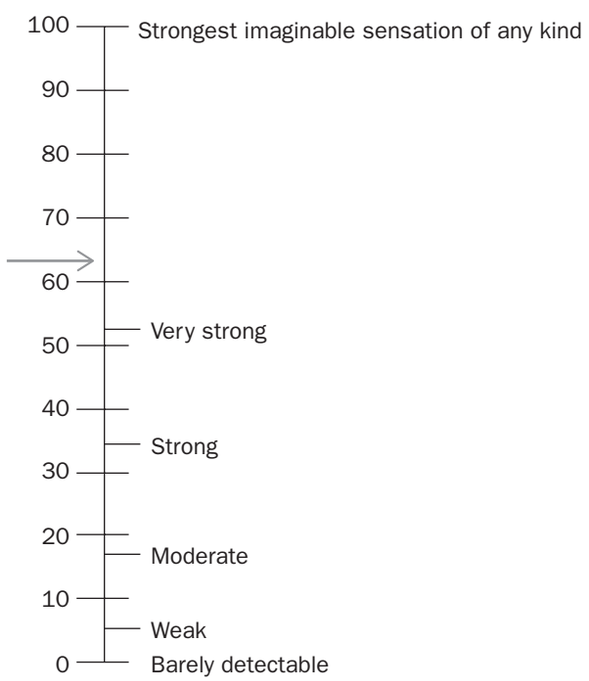
#### TASTER INSTRUCTIONS

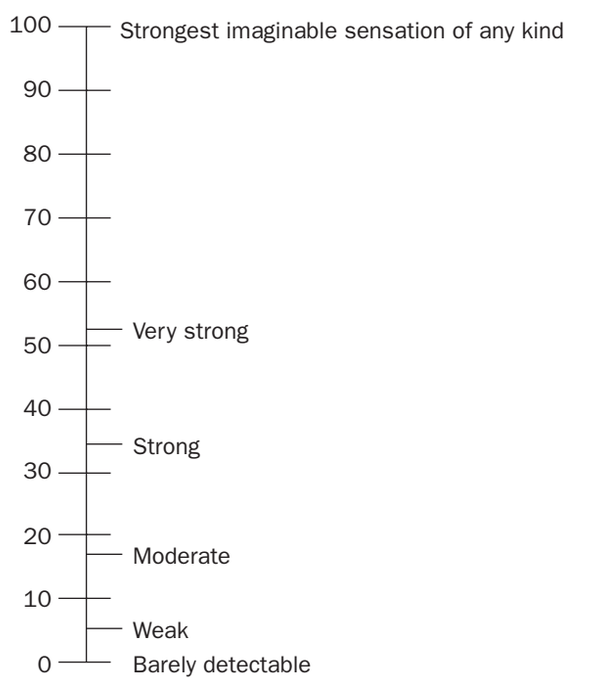
**Taster status:** *On the paper plate, there is a cup of water and a paper strip that used to identify what kind of taster you are. After you get the paper strip, please* ***READ*** *the instruction first:*

**Step 1**: Take a sip of water and swish it around your mouth to clean it

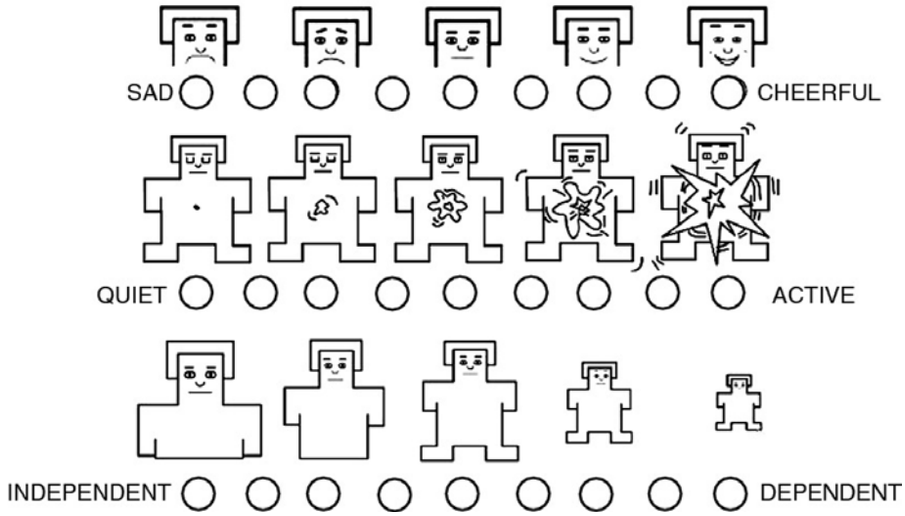
**Step 2**: Take the paper strip and place it on your tongue for 30 seconds or until it is fully wet

**Step 3**: Please rate the intensity of the taste of the paper strip by drawing an arrow on the right graph. **You can put a mark on any place on the scale, not just near the words. The top of the scale is the strongest sensation of any kind, including pain, that you can imagine experiencing**." (The **arrow** on the left graph shows an example)



**SELF-ASSESSMENT MANIKIN**




**EXPLORATORY BUYING BEHAVIOR TENDENCIES SCALE ADAPTED FOR THE WINE CONTEXT**

| **State how much you agree/disagree with the statements below regarding your own personal wine behavior:** | **Strongly disagree** | | | | | | **Strongly agree** |
|---|---|---|---|---|---|---|---|
| 1. Even though wines are available in a number of different styles, I tend to buy the same style. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. I would rather stick to a wine brand I usually buy than try something I am not very sure of. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. I think of myself as a brand-loyal consumer of wines. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. When I see a new wine brand on the shelf, I'm not afraid to give it a try. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. When I go to a restaurant, I feel it is safer to order wines I am familiar with. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. If I like a wine brand, I rarely switch from it just to try something different. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. I am very cautious in trying new or different types of wine. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. I enjoy taking chances in buying unfamiliar wine brands just to get some variety in my purchases. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. I rarely buy brands about which I am uncertain how well they taste. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. I usually drink the same kind of wines on a regular basis. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |