Taste Perception: More than Meets the Tongue

JOANDREA HOEGG
JOSEPH W. ALBA*

Perceptual discrimination is fundamental to rational choice in many product categories yet rarely examined in consumer research. The present research investigates discrimination as it pertains to consumers' ability to identify differences—or the lack thereof—among gustatory stimuli. Three experiments reveal systematic bias resulting from the presence of common visual and verbal product cues. Particularly noteworthy is the finding that the amount of bias induced by a subtle, nonevaluative cue can far exceed the bias induced by overt and well-established evaluative cues. In addition, the effects these cues have on perceptual discrimination diverge from the effects they have on preference.

It has been argued that, at its essence, decision making is the task of distinguishing one option as superior to others in overall value (Russo and Carlson 2002). As such, decision making becomes onerous when differences in overall utility are subtle and identification of the superior option requires complicated or unpleasant trade-offs (Hammond, Keeney, and Raiffa 1998; Luce, Payne, and Bettman 2001). Although it is generally accepted that the goal of nonperverse decision makers is to obtain the greatest overall utility, a considerable amount of decision research has been devoted to showing how suboptimal decisions may result from inherent human bias. A bias that is particularly noteworthy from the perspective of value discrimination is the propensity to exaggerate the true difference in performance across options—a propensity that itself is prompted by a variety of cognitive and motivational biases (Brownstein 2003).

The present research is likewise concerned with discrimination among alternatives but differs from the main body of research in three significant but related respects. First, the emphasis is on discrimination at the level of an individual attribute rather than overall utility. Thus, decision difficulty obtains from discerning differences, or the lack thereof, among alternatives on a single product dimension rather than from making trade-offs across different dimensions (Hoch 2002). Second, discrimination is considered in its fundamental role as a precursor to decision making rather than as the decision itself. Thus, we largely examine nonevaluative responses to stimuli that contain no objectively superior option. In so doing, we negate many—but not all—of the biases that lead to errors of discrimination. Our focus is on biases that remain when the individual is motivated to recognize the true level of similarity that exists across alternatives. Third, unlike the vast majority of research that presents decision makers with alternatives characterized by verbally describable features, we explore sensory discrimination.

Although it is possible to assess sensory discrimination from a psychophysical perspective by mapping differences in sensation to purely physical differences in the stimulus, consumers rarely experience products under such pristine conditions. The existence of meaning-laden cues in the environment may lead not only to degradation in discrimination but also to distortion. The present research resides at the interface of perception and cognition by examining the potential biasing effects of commonplace visual and verbal cues as they apply to taste discrimination.

COMPETING CUES

It appears that consumers are neither adept at taste discrimination nor cognizant of the extent of their ineptitude (Lau, Post, and Kagan 1995). Anecdotal evidence suggests that even experts can fail to discriminate between red and white wine in blind tests that control for temperature (Matthews 1996). It may be argued that wine constitutes a particularly complex and subtle discrimination problem. However, consumers rarely conduct blind taste tests. The presence of competing visual and verbal cues may hinder discrimination of truly differentiated options.

This problem can be cast in terms of cue diagnosticity. An influential model suggests that consumers base decisions on accessible and diagnostic information (Lynch, Marmorstein, and Weigold 1988). Our use of a stimulus-based par-

*JoAndrea Hoegg is assistant professor of marketing, University of British Columbia, Vancouver, BC, V6T 1Z2 (joey.hoegg@sauder.ubc.ca). Joseph W. Alba is distinguished professor of marketing, University of Florida, Gainesville, FL, 32611 (joe.alba@cba.ufl.edu). Correspondence: JoAndrea Hoegg. The authors express their gratitude to the reviewers for their helpful suggestions and to the editor for his encouragement.

John Deighton served as editor and Joseph Priester served as associate editor for this article.

Electronically published December 5, 2006

adigm neutralizes the role of accessibility. The effect of diagnosticity should be similarly straightforward because we ask consumers not for an evaluative decision about superiority but rather for a nonevaluative judgment of difference along the single dimension of taste. Taste is the most "diagnostic" cue, inasmuch as it is isomorphic with the judgment.

Verbal Cues. The diagnosticity of taste notwithstanding, nontaste cues such as brand labels have been shown to exert a large influence on preference (Allison and Uhl 1964; Hoyer and Brown 1990). However, the extent to which such influence extends to discrimination tasks is not entirely clear for two reasons. First, research on perceptual learning suggests that labels affect perceptual discrimination only after an initial learning phase in which the labels have been clearly associated with specific sensory values (Goldstone 1994; Hoegg and Alba 2007). Consumer contexts are rarely characterized by such directed learning. Second, the influence that labels have been shown to exert on preference may reflect cognitive or social responses to promotional efforts rather than true perceptual distortion.

Visual Cues. Humans rely heavily on visual information to navigate the world. Visual cues generally serve us well, particularly when aligned with other sensory cues. However, sensory cues do not always act in concert, such as when visual and kinesthetic cues are intentionally mismatched to produce exaggerated feelings of motion in attractions found at entertainment parks. Evidence suggests that conflicts between visual and other sensory cues tend to be resolved in favor of vision (Posner, Nissen, and Klein 1976). The preponderance of research on such visual dominance has focused on conflicts between visual cues and either kinesthetic or auditory cues. In contrast, the present focus is on the interaction of visual and gustatory cues. Our specific focus is on the conflict between color and taste—an interaction that is not without precedent in marketing research and practice. Color is manipulated by firms to signal freshness and taste and has been shown empirically to be effective at influencing perceptions of flavor intensity (Delwiche 2004). Research has also demonstrated that inappropriate colors (e.g., juice that is grape in flavor but green in color) can influence liking, identification, and perceptions of quality (Garber, Hyatt, and Starr 2000; Stillman 1993). Although affective and evaluative response is clearly important, we focus on how perceptual discrimination is influenced by subtle color differences that are unlikely to produce directional expectations of quality or preference.

At a more general level, our interests are similar in spirit to recent consumer research on visual psychophysics. For example, it has been shown that package shape can bias perceptions of volume—which in turn may influence consumption behavior and satisfaction (Raghubir and Krishna 1999; Wansink and Van Ittersum 2003)—and that such bias is driven in part by inappropriate attention to salient but misleading physical properties of the stimulus (Folkes and Matta 2004; Krider, Raghubir, and Krishna 2001; Raghubir and Krishna 1996). In substance, our research diverges from volume perception in several ways aside from the obvious domain- and task-related differences in the psychophysical judgment (i.e., volume vs. taste and magnitude estimation vs. stimulus discrimination). First, whereas volume is computed from multiple cues by necessity, our taste stimuli vary along a single dimension. Second, we direct consumers to the dimension of interest but provide other cues—both visual and verbal—that are objectively irrelevant to the taste-discrimination task. Moreover, whereas research on volume perception is able to specify the salience of competing cues a priori and then assess the extent to which judgment is biased by salience, a primary objective of the present research is to determine the relative influence of several commonly available cues. Despite the considerable body of research on marketing-related cues, there is no basis on which to anticipate their biasing power vis-à-vis a visual cue.

The present experiments use several procedures that not only allow strong tests of the effects of visual and verbal cues on taste perception but also broaden the question in ways that are pertinent to the consumer context and to related research on preference. With regard to visual cues, we assess consumers' ability to appreciate (*a*) the difference between stimuli that differ in taste but not color and (*b*) the absence of difference between stimuli that differ in color but not taste. Both discriminations are tested against a same-color control. This design enables a test of the effect of visual cues at two levels. At one level is the basic comparison of the color and control conditions. An interpretable effect of color would result in across-color exaggeration and within-color minimization of differences in taste. A stronger test examines whether color dominates taste such that there is greater perceived similarity between two stimuli that share the same color but differ in taste than between two stimuli that share the same taste but differ in color. Experiments 1 and 2 enable both tests. With this design, taste is the only diagnostic cue and, as such, should be the basis for judgment. Color is often diagnostic of taste but not in this instance. Thus, the design allows for assessment of competing cues, one diagnostic and one nondiagnostic. A different but unexplored way to calibrate the effect of color is to compare its influence to the influence of common verbal product-related cues that previously have been shown to exert a strong effect on consumer perceptions and beliefs. Experiment 2 performs such a comparison. Finally, a different but no less important question concerns the extent to which discrimination maps onto preference. Discrimination is a natural precursor to preference, but the relationship between the two has not been investigated. Experiment 3 explores how marketing cues differentially impact discrimination and preference.

EXPERIMENT 1

In all experiments, orange juice served as the stimulus category due to the ease with which its taste and appearance characteristics can be manipulated. In the present experiment

we consider subtle color differences (i.e., similar hues of orange) and variations in sweetness. We examine the influence of color differences against two benchmarks. The first benchmark is a same-color control condition. The second benchmark is a verbal-label condition that should prompt expectations of a taste difference between two samples with different labels. Specifically, we refer to region of origin—California versus Florida—to examine how meaningful labels affect taste discrimination.

Method

Design and Participants. The study employed a 3 (region label, color, control) × 2 (same taste vs. different taste) mixed design, with the former manipulated between participants and the latter within participant. A total of 59 undergraduate students at the University of Florida participated for class credit and were randomly assigned to the three between-subjects conditions.

Stimuli. The test stimuli consisted of two pairs of samples: (*a*) samples with the same taste but different colors or labels and (*b*) samples with different tastes but the same color or label. Testing was limited to these pairs for the combined reason that multiple tastings quickly reduce acuity and the remaining cells of the full factorial (e.g., different taste with a different color) are relatively uninformative with regard to the questions of interest. Thus, we focus on how the critical pairs are affected by the between-subjects manipulation.

The base product was Tropicana pure, pulp-free orange juice. The juice was manipulated to create just-noticeable differences (JNDs) across three levels of sweetness: (1) low sweet, which was the pure orange juice, (2) medium sweet, which was a mixture of 2 grams of Equal Sweetener per 800 milliliters of pure orange juice, and (3) high sweet, which was a mixture of 6 grams of Equal Sweetener per 800 milliliters of pure orange juice. The juice was served in 1.25 ounce Styrofoam cups, filled to the 1 ounce level. In addition, all participants were given a cracker and 5 ounces of water to cleanse their palates between taste opportunities.

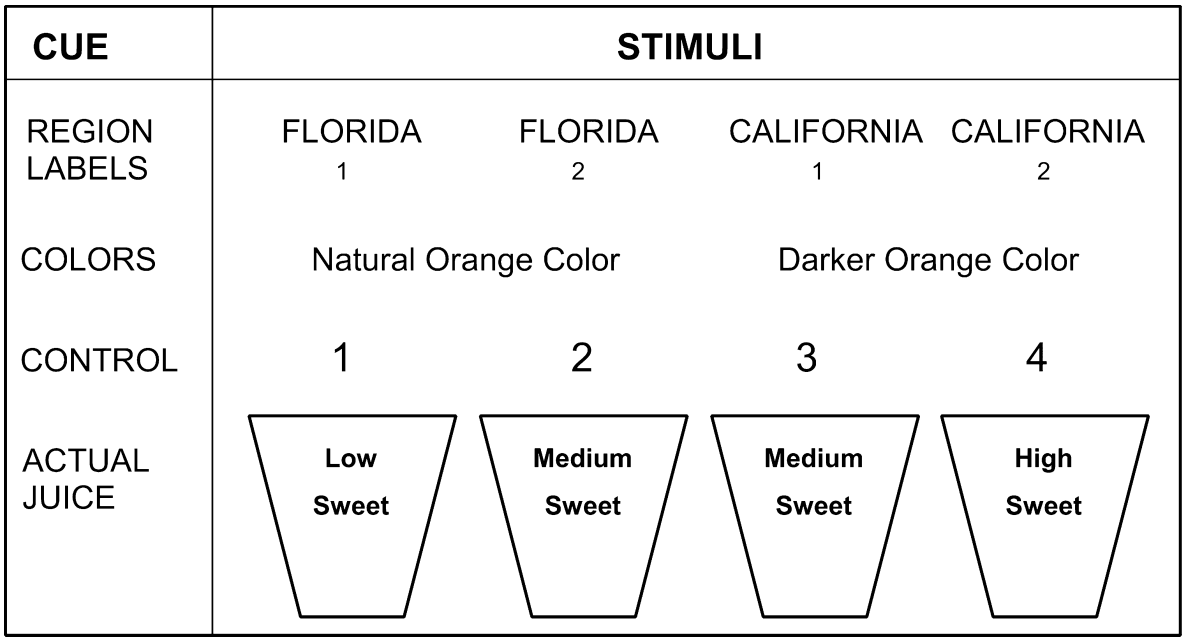
To achieve the desired JNDs, a series of pretests was conducted. Four cups were labeled 1, 2, 3, and 4. Cup 1 was low sweet, cups 2 and 3 were medium sweet, and cup 4 was high sweet. Participants rated the similarities of three critical pairs (1 vs. 2, 2 vs. 3, and 3 vs. 4) on a five-point scale ranging from zero (identical) to four (different). The end result was a desired difference between the similarity rating of pair 1 and pair 2 ($M_{P1} = 2.31$ vs. $M_{P2} = 1.00$, $t(12) = 2.44$, $p < .05$) as well as between pair 2 and pair 3 ($M_{P2} = 1.00$ vs. $M_{P3} = 2.54$, $t(12) = -3.99$, $p < .05$) and a desired lack of difference between pairs 1 and 3 ($t(12) = -.59$, NS). Thus, participants properly perceived the difference between the low-sweet and medium-sweet samples and the difference between the medium-sweet and high-sweet samples as greater than the difference between the two identical samples. The absolute difference between the identical samples was small but nonzero, perhaps reflecting conservatism in scale usage, compliance with instructions to assess "differences," or both. Posttaste protocols support at least the latter. Regardless, the key measures in the main experiment involve differences in perception across conditions, rather than absolute judgments.

The juice stimuli presented to participants in the main experiment consisted of one sample of low-sweet, two samples of medium-sweet, and one sample of high-sweet orange juice. The four samples in the control condition were identical in color and were labeled 1, 2, 3, and 4, with cups 2 and 3 containing medium-sweet juice and cups 1 and 4 containing high- or low-sweet juice (counterbalanced). In the region condition, two samples were identified as originating in California and two in Florida. Within each region, one sample was medium sweet and one was either high or low sweet (counterbalanced). Consequently, one sample of California and one sample of Florida were identical in taste (both medium sweet); within each region, the two items were different in taste (either medium and high or medium and low). In the color condition, different hues of orange substituted for region labels. For purposes of identification, the numerical labels used in the control condition again were applied. Two of the four samples (one medium sweet and one high or one low sweet, counterbalanced) were darkened slightly by adding a drop of flavorless yellow McCormick food dye per 100 milliliters of orange juice. Pretests were conducted to create color differences that were small but just noticeable (i.e., noticeable by at least 90% of participants). Both hues fell within the range of colors of orange juice available in the market.

Procedure. The four samples of juice were presented in pairs. The positions of the samples within each pair, as well as the pairs themselves, were counterbalanced. Participants in the region condition saw that two samples were labeled Florida, and two were labeled California (see fig. 1). They were told that they would taste and rate four samples of orange juice, two from Florida and two from California. They were not given any other information about the juices. Participants in the control and color conditions received the same instructions but without mention of region of origin. After tasting all four samples prior to answering any questions, participants were asked to express difference judgments via a seven-point scale (where 1 = identical taste) for three randomly presented comparisons: (1) low sweet versus medium sweet, (2) medium sweet versus medium sweet, and (3) medium sweet versus high sweet. Participants were permitted to taste the samples again both during and after making their ratings. Pairs 1 and 3 are variants of a taste test in which the two samples have different taste characteristics. A follow-up test showed that, as expected, ratings given to these pairs did not differ from each other (paired *t*-test, $p > .50$); for simplicity, responses to these pairs were collapsed to create a single rating for pairs with different tastes. Proper discrimination, of course, would be reflected in lower numerical scores (because 1 = identical taste) for pairs that have the same taste than for pairs that have dif-

FIGURE 1

STIMULI PRESENTATION FOR EXPERIMENT 1



NOTE.—Sweetness and cues were counterbalanced.

ferent tastes. Inasmuch as these are critical test pairs, however, it is important to keep in mind that pairs that possess identical tastes also were characterized by different colors or regions of origin; likewise, pairs with different tastes were identical in color and reputed region of origin. Only the control condition rendered taste judgments in the absence of any other cues.

Results

Across all experiments, a total of 13 participants failed to complete the task or follow instructions and were removed from the analysis. In addition, outlier analysis at the 95% level resulted in the deletion of an additional eight participants across the three studies. The removal of the outliers did not materially affect the pattern of results in any of the studies. A 3 (region label, color, control) × 2 (same vs. different taste) mixed ANOVA revealed a significant interaction, $F(2, 54) = 8.71$, $p < .01$. There was no main effect of the nontaste cue ($F(2, 54) = 1.24$, $p > .25$) and no effect of stimuli ($F < 1$). Figure 2 graphically depicts the interaction. The control group fared well, with participants appropriately perceiving less similarity in pairs with different tastes than pairs with identical tastes ($M_{DIFF} = 4.63$ vs. $M_{SAME} = 3.05$; $F(1, 18) = 10.98$, $p < .01$). Participants in the region condition perceived equal degrees of similarity, regardless of the true taste difference between samples within a pair ($M_{DIFF} = 4.33$ vs. $M_{SAME} = 4.39$; $F < 1$). In contrast, the color condition exhibited a pattern opposite to that of the control, such that participants perceived a significantly greater difference in the taste of two identical samples than in the taste of two different samples ($M_{DIFF} = 3.40$ vs. $M_{SAME} = 4.70$; $F(1, 19) = 6.57$, $p < .05$). That is, the visual cue dominated the taste cue.

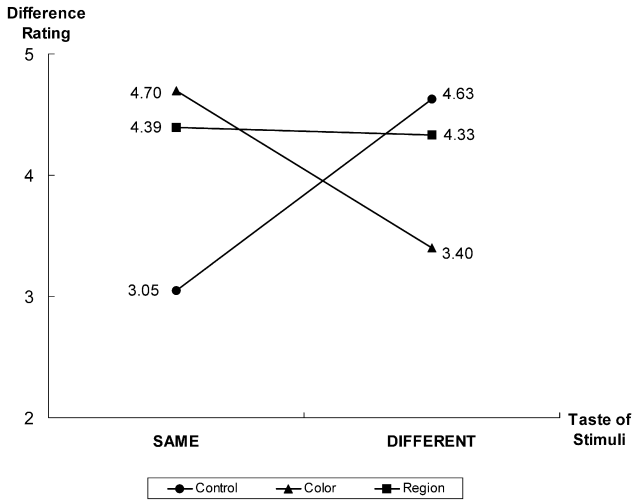
Discussion

The control condition indicates that the taste manipulations fell within participants' ability to discriminate. Relative to the control, the region condition showed an effect of label. We made no predictions regarding the biasing effect of labels, and the present result is open to interpretation. An uninteresting explanation invokes experimental demand. Experiment 2 renders this explanation unlikely. It is also possible that the labels created an expectation-based bias. As noted, prior research on taste that has focused on affective response has shown that prior beliefs can influence aesthetic reaction and preference (Hoyer and Brown 1990). In the present case, the strength of prior beliefs regarding an orange's region of origin is difficult to calibrate against the prior beliefs associated with familiar brands used in previous research. It is generally known that Florida oranges are cultivated primarily for their superior juice-making ability, and therefore our participants' discrimination ratings may have been driven by affective expectations. However, rather than speculate, experiment 2 includes label conditions that help interpret the present result.

Regardless, the condition of focal interest in the present

FIGURE 2

EXPERIMENT 1: DIFFERENCE RATINGS BY CONDITION



experiment is the color condition. Participants in this condition showed a different pattern from those in the control condition, thereby satisfying the minimal criterion for an effect of color. Moreover, differentiation via a color cue led to exaggeration of differences across color boundaries and homogenization of tastes within a single color. In fact, the color condition showed a pattern opposite to that of the control condition. Conflict between color and taste was resolved in favor of color. Because the color differences were subtle and counterbalanced, it is unlikely that perception was driven by expectations of superior taste by one hue versus another.

The strength of the visual dominance effect in the present experiment can only be measured against the control condition and the relatively weak semantic effect of region. We next compare the effect of color to the influence of semantic manipulations known from consumer research to induce strong prior beliefs.

EXPERIMENT 2

In the present experiment we created stronger label manipulations to assess the relative ability of color cues to influence taste discrimination. A large body of research documents the biasing effects of brand names and prices on consumer perceptions of, and beliefs about, product quality. Brand names and prices are often viewed as reliable signals of quality, sometimes to the extent that they dominate strong and more valid counterevidence (Broniarczyk and Alba 1994; Hoyer and Brown 1990). The question posed in the present experiment concerns how the visual cue manipulated in the preceding experiment compares to these more familiar cues in a taste-discrimination context.

Method

Design and Participants. The color and control conditions were retained from experiment 1. Two additional conditions presumed to induce stronger expectation replaced the region condition: a brand condition and a price condition. Two familiar brands were used in the brand condition: Tropicana 100% Pure Premium and Winn-Dixie (an every-day-low-price store), the latter described as being made from concentrate. In the price condition, no brand was identified, but the true local prices for a 2 liter container of these two brands, \$3.29 and \$1.89, were used to label the samples. Thus, the design was a 4 (brand priors, price priors, color, control) × 2 (same taste vs. different taste) mixed design, with the first factor manipulated between participants and taste manipulated within participant. A total of 152 undergraduate students at the University of Florida were randomly assigned to the four between-subjects conditions.

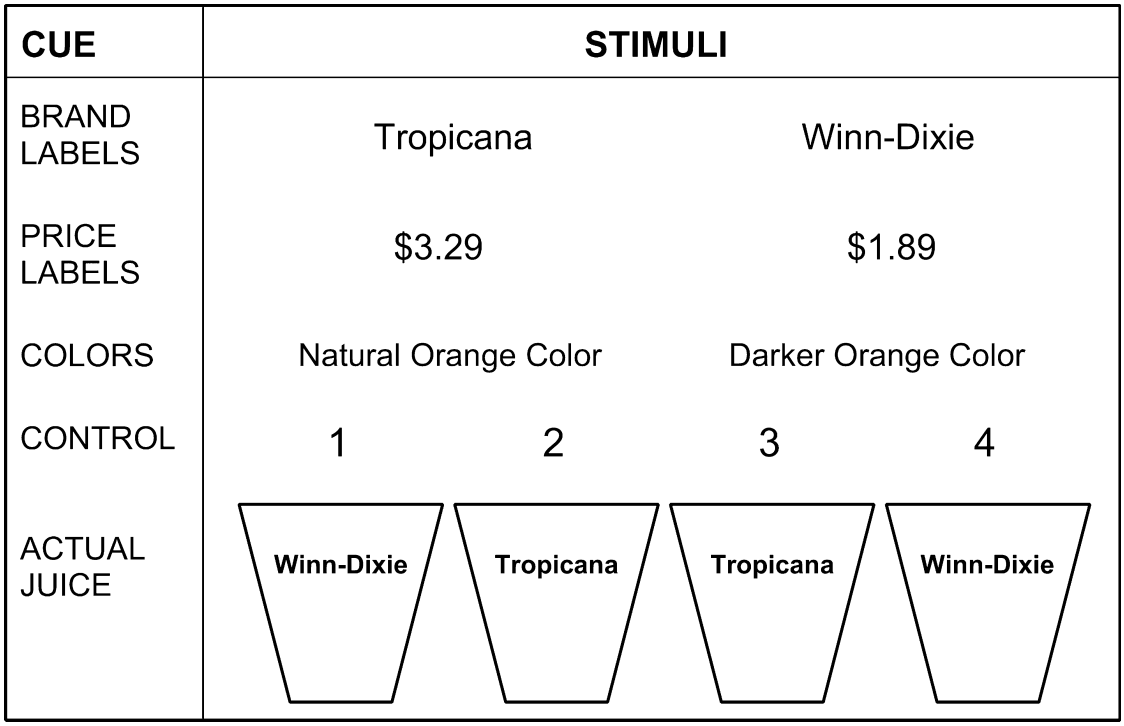
Stimuli and Procedure. Unlike the preceding experiment, a natural manipulation of taste was achieved by using actual Tropicana and Winn-Dixie products. Participants in the brand condition were (correctly) told that both brands consisted of pure unsweetened Florida orange juice that differed in manufacturer and whether they were fresh squeezed (Tropicana) or from concentrate (Winn-Dixie). Although only two taste levels were used, the test still consisted of four samples (see fig. 3). In the control condition the samples were labeled 1, 2, 3, and 4. For all other conditions the samples were divided into two pairs, each consisting of one true sample of Tropicana and one true sample of Winn-Dixie juice. The between-participants factor was crossed with the true taste. For example, in the brand condition, both samples in one mixed-taste pair were labeled Tropicana, and both samples in the other mixed-taste pair were labeled Winn-Dixie. The design therefore enabled construction of critical comparisons involving pairs with the same taste but different brand names and pairs with different tastes (i.e., from different manufacturers) but the same brand name. Corresponding stimuli were created for the other conditions. In the price condition, the brand names were replaced by \$3.29 and \$1.89; in the color condition, one pair (cups 1 and 2 or cups 3 and 4) was slightly darker than the other. The procedure was similar to the one described for experiment 1, with the exception that participants in the brand and price conditions were told that they would be sampling juices from different brands or with different retail prices.

Results

A two-way mixed ANOVA revealed neither a main effect of the nontaste cue manipulation, $F < 1$, nor of the taste manipulation, $F(1, 148) = 1.99$, $p > .15$, but did reveal a significant two-way interaction, $F(3, 148) = 4.18$, $p < .01$, as depicted in figure 4. The control group correctly provided higher difference ratings for mixed-taste pairs than for same-taste pairs ($M_{\text{DIFF}} = 4.24$ vs. $M_{\text{SAME}} = 3.34$; $F(1, 37) = 4.47$, $p < .05$). Neither the brand group ($M_{\text{DIFF}} = 4.34$ vs.

FIGURE 3

STIMULI USED IN EXPERIMENT 2



NOTE.—Cues were counterbalanced.

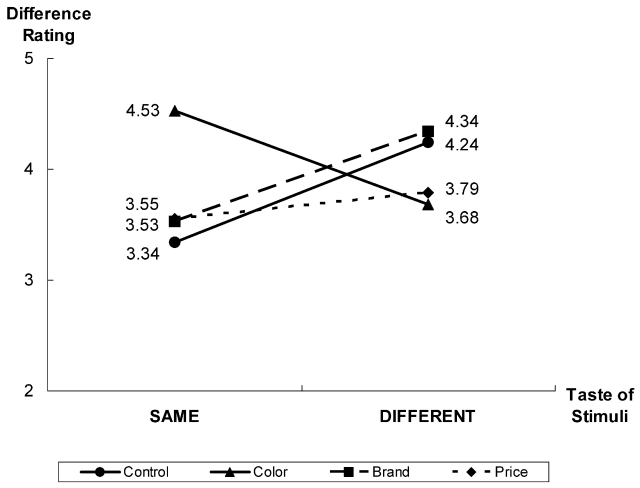
$M_{\text{SAME}} = 3.53$; $F(1, 37) = 3.58$, $p < .07$) nor the price group ($M_{\text{DIFF}} = 3.79$ vs. $M_{\text{SAME}} = 3.55$; $F < 1$) showed a tendency to rate the samples differently, although each group was more closely aligned with the control condition than with the color condition. The color group's perception of taste was dominated by color, with significantly higher difference ratings for same-taste pairs of different hues ($M_{\text{SAME}} = 4.53$) than for mixed-taste pairs of the same hue ($M_{\text{DIFF}} = 3.68$), $F(1, 37) = 5.70$, $p < .05$, consistent with experiment 1.

Discussion

The control group again perceived a significantly greater difference between distinct samples than between identical ones, confirming that the products were distinguishable in the absence of conflicting cues. Surprisingly, and in contrast to the robust effect of prior beliefs reported in other domains, the discrimination pattern observed in the brand condition was almost identical to that of the control condition; the pattern observed in the price condition also was directionally consistent with accurate perception but not statistically so. Any effect of such manipulations, of course, is driven by the strength of the manipulations. We opted for naturally occurring differences in brand image and price and therefore cannot speak to their absolute strength. However, we investigated these conditions not with an eye toward their individual effects but rather as reference points for the effect of color. In terms of relative manipulation strength, it could be argued that the color manipulation was weak, given the JNDs in hue, whereas the brand and price manipulations

FIGURE 4

EXPERIMENT 2: DIFFERENCE RATINGS BY CONDITION



were relatively strong, with the levels of brand and price residing near the end points of their respective real-world ranges. Taken together, these manipulations and results illustrate the strong effect of color in an ecologically valid taste-discrimination task.

The Role of Expectations. Speculation regarding the source of the color effect should be made with some caution. On the one hand, analogous research that has investigated visual-proprioceptive conflict suggests a primarily perceptual process. On the other hand, our use of color as a visual cue and color-taste conflict as the context make it difficult to rule out a more cognitive influence. That is, color may have created expectations. To investigate this possibility we conducted a follow-up experiment using only the brand, price, and color conditions. Participants were asked to indicate the difference in taste they would expect to find between orange juices that differed along each dimension. Specifically, participants in the brand condition were asked, "How much difference would you expect between the taste of Tropicana 100% pure orange juice and Winn-Dixie 100% orange juice from concentrate?" Participants in the price condition were asked, "How much difference would you expect between the taste of orange juice priced at $3.29 for 2 liters and orange juice priced at $1.89 for 2 liters?" Participants in the color condition were shown the two colors and were asked, "How much difference would you expect between the taste of orange juice 1 and orange juice 2?" Eighty-two participants took part in the experiment. On a scale from one (no difference) to seven (a lot of difference), participants indicated an expected taste difference of 4.38, 4.73, and 4.00 for the brand, price, and color conditions, respectively, $F(2, 79) = 1.48, p > .23$. Thus, expectations of difference were equivalent across cues, and, moreover, the lowest absolute expected difference was observed in the color condition. Clearly, the major result from the main experiment cannot be attributed to differential expectations. Indeed, the color manipulation, which produced the greatest deviation from the control condition, is directionally associated with the weakest expectation of difference.

It is noteworthy that the brand and price conditions in the main experiment did not exhibit significant bias. Although both represent powerful purchase cues, neither has been examined in a controlled taste-discrimination setting. We are unfamiliar with any studies that examine the effect of price on taste. Investigations of the effect of branding on taste show dramatic effects but tap preference rather than taste discrimination (Allison and Uhl 1964; Hoyer and Brown 1990). This distinction between preference and perceived similarity offers an interesting and important opportunity for future research. Experiment 3 takes an incipient step in this direction by trying to rule out an uninteresting explanation. One reason for the divergent effects of branding on preference versus discrimination may involve the product context. Insofar as consumers view orange juice as commodity-like, the influence of the brand manipulation may have been suppressed. Thus, to draw conclusions about discrimination versus preference, it is first necessary to confirm that the two operate differently within the chosen product category.

EXPERIMENT 3

Experiment 3 separately examines discrimination and preference in the critical brand and color conditions. To test whether the effect reported in experiments 1 and 2 is limited to complex stimulus contexts, the study was conducted entirely between subjects, focusing only on the perceived difference between two samples of identical-tasting orange juice.

Method

Task (discrimination vs. preference) and cue (brand vs. color) were manipulated between subjects. A total of 184 undergraduate students at the University of Florida were randomly assigned to the four between-subjects conditions.

The study was conducted using Tropicana 100% Pure Premium orange juice. Each participant received two 1.25 ounce cups of juice, each filled to the 1 ounce level. For participants in the brand conditions, one cup was labeled Tropicana and the other was labeled Winn-Dixie (counterbalanced). For participants in the color condition, the cups were simply labeled 1 and 2, but the juice in one of the cups had been darkened in the same manner as earlier studies (counterbalanced).

Participants were provided with two cups of orange juice, a napkin, an unsalted cracker, and 5 ounces of water. They were instructed to taste both samples of juice and, depending on condition, indicate the perceived difference or the extent of their preference for one or the other sample. As in previous studies, participants were permitted to taste and retaste the juices during the rating task. Discrimination was measured on a seven-point scale ranging from "exactly the same" (one) to "completely different" (seven); preference was measured on a seven-point scale ranging from "no preference" (one) to "strong preference" (seven). For those in the preference condition who indicated a preference (i.e., a rating higher than one), a follow-up question probed which of the two samples was preferred.

Results

The discrimination results mirrored those of experiment 2. Participants in the color condition perceived a significantly greater difference between the taste of the two samples than did participants in the brand condition ($M_{\text{COLOR}} = 3.86$ versus $M_{\text{BRAND}} = 3.28, t(97) = 2.41, p < .05$). In contrast, participants in the color condition indicated less preference for one sample or the other than participants in the brand condition ($M_{\text{COLOR}} = 3.08$ versus $M_{\text{BRAND}} = 3.90, t(79) = -2.06, p < .05$). These results cannot be directly compared because of the differences in the scales, but the reversal in direction clearly indicates a dissociation between discrimination and preference. Among those participants who indicated a preference, 67% preferred Tropicana ($p < .07$)—as

anticipated by prior research. There was no difference in preference for color (55% vs. 45% for dark vs. light, respectively).

Overall, the discrimination results illustrate the robustness of our preceding findings in a simpler stimulus environment; the preference results illustrate the robustness of prior research on branding and preference. The combined results show that the discrimination pattern reported in experiments 1 and 2 is not driven by commodity-based reasoning on the part of the participants.

GENERAL DISCUSSION

Consumer research has paid little attention to the important issue of perceptual discrimination. The present research represents an attempt to address the problem. We find a large effect of a subtle color manipulation but, moreover, an effect that far outstrips the effects of less subtle brand and price information. Although we had no strong expectations regarding the relative influence of these competing cues, we did anticipate that visual dominance would result in a nontrivial influence of color on taste discrimination.

A description of the relative contribution of perceptual and cognitive effects in pure taste-discrimination tasks awaits additional research, although a definitive account may prove elusive (Rothbart, Davis-Stitt, and Hill 1997). However, several lines of evidence favor a perceptual over a cognitive account. First, it seems unlikely that our consumers deliberately eschewed taste for color as a basis for discrimination. Moreover, our consumers succumbed to the influence of color but were less influenced by the powerful lure of brand and price information. Our data also show that expectations about the effects of color were no stronger than the expectations associated with brand and price. Finally, parsimony favors a perceptual explanation, given other demonstrations of visual dominance that appear perceptually driven.

We do not claim that labels have no effect on taste discrimination. The results of experiments 1 and 2 indicate at least a small influence of the labels; however, it is possible that the influence of a label over discrimination is dependent on other factors, such as prior product experience (Hoegg and Alba 2007).

The results from experiment 3 suggest that, in contrast, preference may be driven by a different process. Given that the stimulus array was composed solely of identical samples, the different pattern of results for preference versus discrimination is striking. Prior research on preference has not isolated the underlying process, but it is reasonable to hypothesize a more cognitive or even social process. Expectations about a sensory experience may shape the experience through confirmatory processing, particularly when the experience is ambiguous (Hoch and Ha 1986). However, other factors may alter preference alone or in combination with the experience itself. For example, preference for one brand over another—even when the preferred brand has inferior sensory qualities—may reflect preference for familiarity, trust in the manufacturer, a desire for prestige, and other lower- and higher-order processes.

The results from all three experiments can be viewed from the perspective of cue diagnosticity. In the evaluative contexts in which diagnosticity is typically invoked, it is believed that consumers identify those cues that provide the most reliable predictors and differentiators of utility. In the context of discrimination, intuition suggests that taste would provide the most diagnostic cue, whereas analogous preference research suggests that brand and price information would also be heavily weighted. The present results are consistent with neither. Unlike the companion construct of accessibility, the determinants of diagnosticity are not well developed and may, in fact, be task specific.

A deeper understanding of the underlying processes provides an obvious target for future research. So too does the nature of the taste stimulus. The present experiments examined differences along a single taste dimension, but most taste products exhibit far greater complexity. An important question is whether the correspondence between a label and one dimension (e.g., sweetness) interferes with perception of differences among samples on other dimensions.

REFERENCES

Allison, Ralph I. and Kenneth P. Uhl (1964), "Influence of Beer Brand Identification on Taste Perception," *Journal of Marketing Research*, 1 (August), 36–39.

Broniarczyk, Susan M. and Joseph W. Alba (1994), "Theory versus Data in Prediction and Correlation Tasks," *Organizational Behavior and Human Decision Processes*, 57 (January), 117–39.

Brownstein, Aaron L. (2003), "Biased Predecision Processing," *Psychological Bulletin*, 129 (July), 545–68.

Delwiche, Judy (2004), "The Impact of Perceptual Interactions on Perceived Flavor," *Food Quality and Preference*, 15 (March), 137–46.

Folkes, Valerie and Shashi Matta (2004), "The Effect of Package Shape on Consumers' Judgments of Product Volume: Attention as a Mental Contaminant," *Journal of Consumer Research*, 31 (September), 390–401.

Garber, Lawrence L., Jr., Eva M. Hyatt, and Richard G. Starr Jr. (2000), "The Effects of Food Color on Perceived Flavor," *Journal of Marketing Theory and Practice*, 8 (Fall), 59–72.

Goldstone, Robert L. (1994), "Influences of Categorization on Perceptual Discrimination," *Journal of Experimental Psychology: General*, 123 (June), 178–200.

Hammond, John S., Ralph L. Keeney, and Howard Raiffa (1998), "The Hidden Traps in Decision Making," *Harvard Business Review*, 76 (September–October), 47–58.

Hoch, Stephen J. (2002), "Product Experience Is Seductive," *Journal of Consumer Research*, 29 (December), 448–54.

Hoch, Stephen J. and Young-Won Ha (1986), "Consumer Learning: Advertising and the Ambiguity of Product Experience," *Journal of Consumer Research*, 13 (September), 221–33.

Hoegg, JoAndrea and Joseph W. Alba (2007), "Linguistic Framing of Sensory Experience: There Is Some Accounting for Taste," in *Psycholinguistic Phenomena in Marketing Communications*, ed. Tina M. Lowrey, Mahwah, NJ: Erlbaum.

Hoyer, Wayne D. and Steven P. Brown (1990), "Effects of Brand

Awareness on Choice for a Common, Repeat-Purchase Product," *Journal of Consumer Research*, 17 (September), 141–48.

Krider, Robert E., Priya Raghubir, and Aradhna Krishna (2001), "Pizzas: Pi or Square? Psychophysical Biases in Area Comparisons," *Marketing Science*, 20 (Fall), 405–25.

Lau, Kin-Nam, Gerald Post, and Albert Kagan (1995), "Using Economic Incentives to Distinguish Perception Bias from Discrimination Ability in Taste Tests," *Journal of Marketing Research*, 32 (May), 140–51.

Luce, Mary Frances, John W. Payne, and James R. Bettman (2001), "The Impact of Emotional Tradeoff Difficulty on Decision Behavior," in *Conflict and Tradeoffs in Decision Making*, ed. Elke Weber and Jonathan Baron, New York: Cambridge, 86–109.

Lynch, John G., Jr., Howard Marmorstein, and Michael F. Weigold (1988), "Choices from Sets including Remembered Brands: Use of Recalled Attributes and Prior Overall Evaluations," *Journal of Consumer Research*, 15 (September), 169–84.

Matthews, Thomas (1996), "The ABC's of Wine Tasting," http://www.winespectator.com.

Posner, Michael I., Mary Jo Nissen, and Raymond M. Klein (1976), "Visual Dominance: An Information-Processing Account of Its Origins and Significance," *Psychological Review*, 83 (March), 157–71.

Raghubir, Priya and Aradhna Krishna (1996), "As the Crow Flies: Bias in Consumers' Map-Based Distance Judgments," *Journal of Consumer Research*, 23 (June), 26–39.

——— (1999), "Vital Dimensions in Volume Perception: Can the Eye Fool the Stomach?" *Journal of Marketing Research*, 36 (August), 313–26.

Rothbart, Myron, Carene Davis-Stitt, and Jonathan Hill (1997), "Effects of Arbitrarily Placed Category Boundaries on Similarity Judgments," *Journal of Experimental Social Psychology*, 33 (March), 122–45.

Russo, J. Edward and Kurt A. Carlson (2002), "Individual Decision Making," in *Handbook of Marketing*, ed. Barton A. Weitz and Robin Wensley, London: Sage, 371–408.

Stillman, Jennifer A. (1993), "Color Influences Flavor Identification in Fruit-Flavored Beverages," *Journal of Food Science*, 58 (July–August), 810–12.

Wansink, Brian and Koert van Ittersum (2003), "Bottoms Up! The Influence of Elongation on Pouring and Consumption Volume," *Journal of Consumer Research*, 30 (December), 455–63.