# THE EFFECTS OF FOOD COLOR ON PERCEIVED FLAVOR

**Lawrence L. Garber, Jr.**
**Appalachian State University**

**Eva M. Hyatt**
**Appalachian State University**

**Richard G. Starr, Jr.**
**University of Auckland**

The authors wish to thank the editor and anonymous reviewers, Scott Armstrong, Unal Boya, Ray Burke, Steve Clopton, Mike Dotson, Joel Huber, Pat Patton and Brian Wansink for their helpful comments on earlier drafts of this paper.

This research investigates the role that food color plays in conferring identity, meaning and liking to those foods and beverages that assume many flavor varieties. In a taste test experiment manipulating food color and label information, 389 undergraduates at a public university (53% male and 47% female; 79% between 18 and 21 years of age) were assigned the task of evaluating a successful brand of powdered fruit drink. Results from this study indicate that food color affects the consumer's ability to correctly identify flavor, to form distinct flavor profiles and preferences, and dominates other flavor information sources, including labeling and taste. Strategic alternatives for the effective deployment of food color for promotional purposes at the point of purchase are recommended.

## INTRODUCTION

Color is a vivid, affect-loaded and memorable visual element (Cheskin 1957, p. 80), and is, as such, an important marketing communications tool. Color carries important symbolic and associative information about the product category and specific brands (Hine 1996, p. 216), making it a powerful visual cue for conferring meaning, contrast or novelty (Garber, Burke and Jones 1999). Thus, marketers should be sensitive to the vital role that color plays in promotion.

A recent store audit conducted by the authors revealed that food color's principal use is for flavor identification, not for strategic marketing communication purposes.[1] This is especially true for food categories where there are many flavors and where color does not indicate condition (i.e., raw, spoiled, etc.). Given the competitive nature of these categories, why is food color not deployed more aggressively?

There has been surprisingly little color research in marketing (Garber, Burke and Jones 2000), and the impact of food color has been completely neglected outside of the food sciences; unfortunate, because marketers understand so little of the powerful yet complex effects of color at the point of purchase (Garber, Burke and Jones 2000; Garber and Hyatt 2000;

[1] The vast majority of food brands evaluated (97%) presented color that consumers typically associate with that food or its flavor.

Garber, Hyatt and Starr 2000). Though food scientists have empirically examined aspects of the effects of food color, research on the topic remains sparse, is not theory-based, and, as a body, is limited (for reviews of this literature, see Cardello 1996; Garber, Hyatt and Starr 2000). Therefore, in this paper we build on prior food color research by proposing a model of food color's effect on flavor perception that explicitly considers its effect on the consumer in a point of purchase context. Specifically, we: (1) review and evaluate the extant research on the effects of color in promotion and on perceived flavor; (2) develop a conceptual framework that considers consumer response to food color at each of three stages in the individual choice process, these being identification, perception and preference; (3) provide a methodology that allows the researcher to decompose and estimate the effects of food color separately at each of the three stages; (4) provide an empirical test of the models' predictions; and (5) discuss managerial implications.

### Research On Color and Food

Many foods today do not display their natural color (Tuorila-Ollikainen 1982). Food producers commonly select, modify, heighten or standardize the colors that we see and come to associate with specific foods. Green for peppermint or brown for cola are examples. The effects of conditioned food color/flavor associations in color-associated foods becomes so ingrained that the unexpected pairing of a given food with a novel color renders it unpalatable. For example, in an early experiment by Moir (1936), as reported in Moskowitz (1978, p. 163),

"Moir prepared a buffet of goods for a dinner with scientific colleagues of the Flavor Group of the Society of Chemistry and Industry in London. Many of the foods were inappropriately colored, and during the dinner several individuals complained about the off-flavor of many of the foods served. Several of the individuals reported feeling ill after eating some of the foods, despite the fact that only the color was varied. The rest of the food was perfectly wholesome, with the requisite taste, smell, and texture."

Though it would be as easy for the food producer to "design in" a food color for strategic marketing communications purposes as it is for flavor identification, novel color in a food context appears incongruous and therefore unacceptable (Heckler and Childers 1992). One such example is Pepsico's early 1990's launch of Crystal Pepsi (c.f., Triplett 1994). Apart from its clear color, Crystal Pepsi was identical to regular Pepsi in all other respects, including flavor. However, Pepsico failed to consider the possibility of a food color/flavor interaction, with dire consequences. To cola drinkers, clearness connoted certain "non-cola" flavor expectations. Consequently, cola drinkers trying Crystal Pepsi for the first time were bowled over by its full flavor. Even most regular Pepsi Cola drinkers didn't like it.

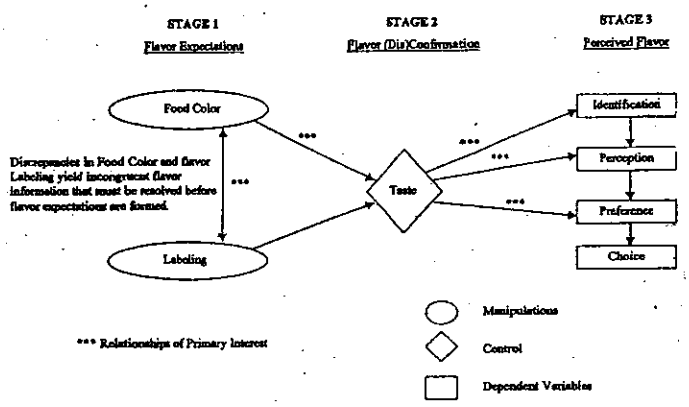
This example raises the question of whether novel food color can ever be viable for strategic marketing communication purposes and, if so, how so, and under what conditions. These are critical questions for food marketers seeking to obtain comparative advantage in the clutter of an ever-more-competitive store environment.

## CONCEPTUAL DEVELOPMENT

### Staged Models of Choice

We conceive of food color as affecting the consumer at each of several stages in the choice process, as shown by the process model in Figure 1.

FIGURE 1
THE RELATIONSHIP BETWEEN THE THREE FORMS OF FLAVOR INFORMATION AND THEIR EFFECTS ON STAGES OF CONSUMER CHOICE




There is much evidence that consumers go through a multistage decision process when making a purchase (Lussier and Olshavsky 1979). Following Roberts (1989), we present individual-level choice as a phased process represented by a series of nested stages where behavior at each stage is conditioned by the events of previous stages. Food color and labeling are proposed to have main and interaction effects on flavor identification, flavor perception and flavor preference formation respectively; though it is food color that is the primary focus of this research.

This specification is supported by theoretical and empirical research from several literatures. For example, Garber, Burke and Jones (2000) empirically test a similar conceptual structure to predict the effects of package color at several stages of individual-level consumer choice. The Garber, Burke and Jones (2000) model draws on brand equity theory (Keller 1993), which specifies several functions for package appearance at the point of purchase (i.e., to provide novelty, contrast and comprehension). We propose that these same roles are played by food color with respect to flavor.

### The Effects of Uncharacteristic Food Color

Several studies from thé food science and sensory literatures have demonstrated empirically, in a laboratory setting, that food color aids correct flavor identification by showing that recognition is diminished when the characteristic colors of food products are altered[2] (c.f., DuBose, Cardello and Maller 1980; Hyman 1983; Stillman 1993). The above theoretical development suggests that these empirical results may be extended to a consumer setting, and we propose a main effect for food color on flavor identification as follows:

H1: Characteristic beverage color aids correct flavor identification, and uncharacteristic beverage color degrades correct flavor identification.

### The Interaction of Food Color and Taste as Sources of Flavor Information

Additionally, the aforementioned empirical results indicate the relative dominance of the food color stimulus over the taste stimulus by showing that, when presented with altered, or uncharacteristic, food color, the tendency is to recognize a flavor which is typically associated with that color, rather than the correct flavor. We therefore posit the following effect of uncharacteristic color on (incorrect) flavor identification:

H2: Uncharacteristic beverage color is a flavor identification cue for a flavor that is normally associated with that color, rather than the correct flavor.

### The Interaction of Food Color and Labeling as Sources of Flavor Information

Food color is typically not the only source of flavor information available to the consumer in the store.[3] In particular, flavor information is provided as text on the label, particularly in product categories where there is more than one flavor. As indicated in Figure 1, we expect labeling to have main effects on flavor perception similar to food color, as well as an interaction effect with food color. Since the subject of our study is food color, we only examine labeling's interaction with food color, leaving the study of its main effects to future research.

Since we can expect that flavor information on labels is always correct, labeling and characteristic food color are always consistent, or congruent, and mutually reinforce specific flavor expectations in color-associated foods. Given label constancy, uncharacteristic food color presents the shopper with discrepant, or incongruent, flavor information in color-associated foods. Unlike the relationship between food color and taste, where we expect that relatively vivid and primary color sensations dominate the relatively hard to categorize and secondary taste sensations that discrepancies between the two will tend to go unnoticed, we believe that discrepancies between food color and labeling will be apparent, creating a tension that the shopper must then resolve in order to form satisfactory flavor expectations (Petty and Cacioppo 1981).

Incongruent information is commonly employed in advertising as a means of penetrating the "perceptual screen of the audience" (Heckler and Childers 1992, p. 475), and, as such, has been studied at length. Much of this research examines effects on memory recall, where incongruent stimuli have been shown to force more elaborated processing on the consumer to resolve apparent conflicts, thereby aiding the encoding of the information into long term memory and its later recall (c.f., see Heckler and Childers 1992; Goodstein 1993). Advertising's concern with memory recall is sensible since there is usually a time separation between ad exposure and the purchase decision. In point of purchase promotion, however, exposure and purchase consideration and choice are virtually simultaneous, and the role of food color should therefore be motivational (Garber, Burke and Jones 2000). In this research, therefore, we test the effects of food color on flavor perception and liking rather than on recall.

### Incongruent Food Color and Flavor Information

With respect to food color and labeling, we predict that discrepancies are resolved in favor of food color, for two reasons. First, color is the more vivid, affect-loaded and memorable stimulus (Cheskin 1957) which the consumer will therefore find more compelling. And, secondly, in a store setting, food color can resolved at a greater physical distance than labeling, and is therefore processed sooner; namely, as the shopper enters the grocery aisle and is still proceeding toward the target food product (Garber, Burke and Jones 2000):

H3: When incongruent food color and labeling are presented, the discrepancy will be resolved in favor of food color.

#### Effect on Flavor Perception

The aforementioned hypothesized dominance of food color as a source of flavor information over labeling and taste suggest that food color predominates in the formation of flavor perceptions. Therefore, we predict that flavor expectations are indicated by food color, even in the presence of discrepant labeling, and are confirmed by tasting, even if the flavor indicated by the food color is incorrect:

H4: Differently colored versions of otherwise identical beverages will evoke distinct flavor profiles.

#### Effect on Flavor Preference

Of those models predicting the effects of food color on flavor identification, perception and preference respectively, of

[2] However, the strength of the food identification results varies significantly across studies, likely due to differences in the nature of the subject task (Oram et al. 1995).

[3] The inclusion of multiple flavor information sources, and measuring their effects separately, is an aspect that distinguishes this research from prior food science and sensory research.

greatest concern to the marketer would be those predicting preference (Huber 1975), yet this is the stage that has been least studied. There is no available theory of the effects of food color on flavor preference, and the few available empirical studies show conflicting results (i.e., see Johnson and Clydesdale 1982; Compeau, Grewal and Monroe 1989; Baeyens et al. 1996). As with models of identifiability and perception, these studies are also limited in their applicability to a consumer context.[4]

There is abundant evidence showing that prototypical (Loken and Ward 1990), expected (Lee and Mason 1999) or congruent stimuli (Meyers-Levy and Tybout 1989; Garber Burke and Jones 1999) tend to be favorably evaluated. But there is also evidence to support the favorable evaluation of unexpected (Lee and Mason 1999) or incongruent (Meyers-Levy and Tybout 1989) stimuli, though the processes leading to their favorable evaluation are distinct (Dichter 1975). Garber, Burke and Jones (2000, p. 1), "...demonstrate that manufacturers can stimulate consumer purchase consideration by making either subtle or major color changes to their brands' existing packages. Small changes ensure that existing customers will continue to be able to recognize and routinely purchase the brand. Large changes can increase the likelihood that new customers will consider and choose the product, but only when the meaning conveyed by package color is consistent with the brand's original positioning." And, Lee and Mason (1999, p. 1) demonstrate that, "Although ads with unexpected-relevant information elicited more favorable attitudes than did ads with expected-relevant information, ads with unexpected-irrelevant information yielded less favorable attitudes than did ads with expected-relevant information."

We consider incongruent and uncharacteristic color in these contexts. With respect to the former, we propose that incongruent food color and labeling are unusual, blatantly discrepant stimuli when viewed by the consumer in a store context. As such, they would always be viewed as highly rather than slightly incongruent, as well as inconsistent and irrelevant in flavor meaning, and would therefore tend to be unfavorably evaluated relative to foods presented with congruent food color and labeling.

With respect to uncharacteristic color, given food color's dominance over taste as a source of flavor information, we propose that congruent-uncharacteristic food color will be equally preferred to congruent-characteristic food color. We therefore predict that:

H5: The flavors of foods presenting congruent food color and labeling are preferred to those presenting incongruent food color and labeling, regardless of whether the congruent flavor information is a correct or an incorrect signal of true flavor.

## A TEST OF THE EFFECTS OF FOOD COLOR AND LABELING LEVELS ON PERCEIVED FLAVOR

### Experimental Design

The experimental design is illustrated in Figure 2. Beverage color at three levels (orange represents characteristic color, purple represents uncharacteristic color, and clear is the base level) and labeling at three levels (orange drink represents correct information, grape drink represents incorrect information, and fruit drink is the base level) were operationalized as between subjects variables. Flavor was not manipulated for control purposes and for parsimony. All beverage samples were orange flavored.

The hypothesized effects were tested at three stages in the consumer choice process, namely, flavor identification, perception and preference. Since the flavor identification task by its nature requires the withholding of other forms of flavor information, a nested design was used. In other words, to test effects on flavor identification, the orange drink and grape drink levels of the labeling manipulation were omitted from the otherwise full 3x3 factorial design. The full factorial design was used to test flavor perception and preference.

### Stimulus Development

We selected uncarbonated fruit beverages for our empirical research for six reasons: 1) fruit beverages present no issues concerning condition (i.e., color is not an important indicator of freshness, rancidness, spoilage, etc); 2) they come in many flavors; 3) fruit beverages are a ubiquitous and familiar product easily evaluated by most American consumers; 4) there is a simple and well-known relationship between fruit colors and the fruit flavors they represent; 5) fruit beverages are uniform in texture and mouthfeel across flavors; and, 6) a clear form was commercially available.

All subjects in all treatments tasted the same orange flavor served in plain white cups at the same refrigerator temperature. Each batch of fruit drink was prepared uniformly according to package instructions, tasted to assure consistency, and was pretested by several subjects who did not participate in the experiment itself. They were asked if the drink tasted similarly to the powdered orange drinks to which they were accustomed. Without exception, they said yes.

The purple and orange colored beverages were created by adding flavorless McCormick food dyes to the clear base, according to instructions. To assure that the colors credibly portrayed the fruit drinks that they were intended to represent, several subjects who did not participate in the experiment itself were shown samples of each color of the beverage, in plain

[4] Food scientists seek to understand what distinguishes acceptable foods from unacceptable foods, whereas, marketers seek to understand preference formation from among a set of favorable brand alternatives. Food scientists' empirical studies therefore typically include noxious levels of flavor manipulations (c.f., Johnson and Clydesdale 1982; Baeyens et al. 1990), whereas, marketers' food studies typically should not.

FIGURE 2
ILLUSTRATION OF EXPERIMENTAL DESIGN WITH FOOD COLOR AND LABELING AS BETWEEN-SUBJECTS FACTORS IN THE FORMATION OF FLAVOR EXPECTATIONS

| | | FOOD COLOR | | |
|---|---|---|---|---|
| | | PURPLE (Uncharacteristic) | ORANGE (Characteristic) | CLEAR (None) |
| LABELING | GRAPE DRINK (Incorrect) | Congruent Food Color and Labeling | Incongruent Food Color and Labeling | Incorrect Labeling Only |
| | ORANGE DRINK (Correct) | Incongruent Food Color and Labeling | Congruent Food Color and Labeling | Correct Labeling Only |
| | FRUIT DRINK (None) | Uncharacteristic Food Color Only | Characteristic Food Color Only | No Flavor Information |

NOTES:
- Taste is controlled: all treatment conditions receive an orange flavored beverage.
- Only the "Fruit Drink" level of the "Labeling" manipulation is used to test flavor identification.
- All treatments are used to test the other dependent variables, flavor perception and preference.

white cups that neither identified nor characterized the beverages in any way, and were asked to identify them strictly by their appearance. Without exception, they identified the purple drinks as grape, the orange colored drinks as orange, and the clear drinks as water or lemonade.

### The Experimental Setting

There are three critical elements that must be present to validly measure the effects of food color on perceived flavor perception in a consumer context. They are:

- Flavor information typically comes to the consumer in three forms from the time the food or beverage product is first encountered in the store, through preparation and consumption. They are the aforementioned food color, labeling and taste. All three forms must be represented if a consumer context is to be properly represented.

- The three flavor information forms typically encountered by the consumer come in a particular temporal order. Food color and labeling are first encountered in the store, and tasting occurs sometime thereafter.

- To avoid demand artifacts, the subject cannot know that they are deliberately being presented with masked, atypically colored and mismatched beverages. If they do deduce the real purpose of the experiment, they will then pursue the task of detecting the true flavor of the beverages they sample, rather then the task of evaluating beverages as true product candidates for market introduction.

The researchers took care that all three of the above conditions existed for the experiment that follows.

### Subjects and Procedure

In a taste test experiment, 389 undergraduates at a public university located in the southeastern United States (53% male and 47% female; 79% between 18 and 21 years of age) were assigned the task of evaluating a successful brand of New Zealand powdered fruit drink that they were told was about to be launched in the United States. They were given samples of an actual New Zealand brand of powdered fruit drink mix that pretesting showed tasted similar to common American brands. It was prepared according to package directions using bottled water and served uniformly at refrigerator temperature. Each was given the drink in a 3-oz. white cup, a cracker to cleanse the palate before tasting, and a survey form to be filled out after tasting.

One third of the respondents sampled beverages that were (correctly) labeled orange drink. One third sampled beverages that were (incorrectly) labeled grape drink; and, one-third sampled beverages that were (ambiguously) labeled fruit drink. That the subjects took notice of the food color and labeling was confirmed by post-test debriefing.

The pencil-and-paper survey that the subjects filled out consisted of five parts. Part A asked respondents to answer questions about their knowledge and usage of fruit beverage products. Part B asked respondents to rate the drinks they sampled on each of the thirteen attitudinal statements listed in Table 1. Consumers rated their agreement or disagreement to each statement on a five-point Likert-type scale where "5" indicated strong agreement and "1" indicated strong disagreement. The attribute list was developed from focus groups conducted for this purpose. The list is designed to represent a comprehensive bundle of benefit attributes that collectively define a fruit beverage product, from which an individual beverage profile may be derived, according to the method prescribed by Wilkie and Pessemier (1973).

TABLE 1
FLAVOR PERFORMANCE ATTRIBUTE RATINGS RANKED BY MEAN RESPONSE ACROSS ALL SUBJECTS AND CONDITIONS

| | | Mean Ratings[a] |
|---|---|---|
| 1. | Is inexpensive | 3.54 |
| 2. | Is Very Sweet | 3.53 |
| 3. | Has a lot of flavor | 3.48 |
| 4. | Is Very Cooling | 3.38 |
| 5. | Has a Very clean taste | 3.30 |
| 6. | Is Very Refreshing | 3.26 |
| 7. | Is very thirst-quenching | 3.08 |
| 8. | Has a Very crisp taste | 2.95 |
| 9. | Is Very good served with food | 2.84 |
| 10. | Is Very Tart | 2.66 |
| 11. | Is very good for me | 2.61 |
| 12. | Is very wholesome | 2.48 |
| 13. | Contains all-natural ingredients | 2.26 |

[a] As measured on a 5-point scale, where "5" means "Strongly Agree, ""1" means "Strongly Disagree," and "3" means "Indifferent" or "Don't Know."

The PROC FACTOR procedure (SAS Institute 1989, SAS/STAT User's Guide, p. 449-492) was applied to the beverage attribute ratings in order to derive orthogonal flavor factors for use in tests of Hypotheses 3-5. Varimax rotation was used to derive the three factors retained by the MINEIGEN (minimum eigenvalue) criterion. Factor loadings are shown in Table 2. Twelve of thirteen flavor attributes load cleanly onto one of these factors, while the attribute "Is very tart" loads relatively highly onto both factors 1 and 3. We interpret this double loading to mean that "Is very tart" is qualitatively distinct from both factors, and therefore specify it as a freestanding variable in subsequent analyses.

TABLE 2
FACTOR ANALYSIS OF THIRTEEN BEVERAGE PERFORMANCE ATTRIBUTES AND THEIR LOADINGS INTO A THREE FACTOR SOLUTION[a]

| | Rotated Factor Loadings (Varimax Rotation) | | |
|---|---|---|---|
| Beverage Attributes[b] | Factor 1: Refreshing | Factor 2: Natural, Expensive | Factor 3: Flavorful, Sweet |
| Is Very Refreshing | 81 | 9 | 28 |
| Is Very Cooling | 78 | -3 | 26 |
| Is Very Thirst Quenching | 72 | 20 | 9 |
| Is Very Good Served with Food | 66 | 13 | 17 |
| Has a Very Clean Taste | 64 | 23 | 17 |
| Is Very Good For Me | 61 | 31 | 15 |
| Is Very Tart | -57 | 5 | 47 |
| Contains All Natural Ingredients | 33 | 72 | -5 |
| Is Very Wholesome | 37 | 62 | 10 |
| Is Inexpensive | 7 | -70 | -5 |
| Has a Lot of Flavor | 18 | 11 | 76 |
| Has a Crisp Taste | 25 | 24 | 64 |
| Is Very Sweet | 18 | -21 | 51 |

[a] Printed values are multiplied by 100 and rounded to the nearest integer.
[b] Performance attributes are rank ordered by their loading on the factor with which they are most highly associated.

The flavor attribute "Is inexpensive" is highly negatively associated with factor 2 and is otherwise. not strongly associated with another factor. We therefore reverse-scored it to obtain the converse flavor attribute, "Is expensive," and incorporated it into factor 2. Factor variables were created by taking the simple mean of all component flavor attributes across subjects.

Part C asked the students to evaluate their overall liking of the drink itself, and their liking of the "particular flavor" of the drink, on respective 7-point valence scales ranging from "+3" ("Like it very much") to "–3" ("dislike it very much"), with a response of "0" indicating indifference or uncertainty. Part D asked subjects to identify the fruit flavor they tasted by checking the boxes associated with the correct answers from respective closed-form lists of fifteen fruit flavor alternatives, including all the usual fruit flavors represented in the category plus "Mixed fruit flavors" and "Other." In a similar manner, subjects were subsequently asked in Part D what fruit flavor they *expected* prior to tasting. Finally, Part E asked subjects to supply demographic information including age and gender.

## RESULTS

Food color and labeling are between-subjects factors in a full factorial design (see Figure 2). Subjects assigned to all treatments sampled the same orange flavored beverage. The uncharacteristic food color level is represented by a purple colored beverage, the characteristic food color level is represented by an orange colored beverage, and the base "no flavor information" level is represented by a clear beverage. The Incorrect labeling level is represented by a "Grape Drink" appellation, the correct labeling level is represented by an "Orange Drink" appellation, and the base "no flavor information" level is represented by the relatively unspecific "Fruit Drink" appellation. Incongruent flavor information is represented by two treatments, Purple-Orange and Orange-Grape. Congruent flavor information is represented by Purple-Grape and Orange-Orange. Table 3 reports the simple means and standard deviations of those dependent measures used to test flavor perception (H4) and preference (H5). The dependent variables used to test flavor identification are binary in nature and are therefore not reported in Table 3, and there was no dependent variable associated with the exploration of H3. Two covariates, gender and age, are also specified, because we believed a priori that their respective effects on flavor may be confounded with the effects of food color.

### Results for Flavor Identification

Hypotheses 1 and 2 were tested by comparing the differently colored versions of the beverages nested within the "Fruit Drink" level of the Labeling manipulation. This was done with the expectation that, among those subjects deprived of label information, the orange colored drink would more often be correctly identified as orange in flavor than would the clear

**TABLE 3**
**LEAST SQUARES MEANS FOR FLAVOR PERCEPTION AND PREFERENCE TESTS[a,b]**

| Treatment Cells Color-Labeling | Performance Factors[c] | | | | |
|---|---|---|---|---|---|
| | Refreshing | Tart | Natural, Expensive | Flavorful, Sweet | Preference Liking[d] |
| Orange-Orange | 3.46 | 3.00 | 2.87 | 3.44 | 0.87 |
| Orange-Fruit | 3.62 | 2.94 | 2.72 | 3.66 | 1.36 |
| Orange-Grape | 3.33 | 3.27 | 2.70 | 3.28 | 0.64 |
| Clear-Orange | 2.88 | 3.62 | 2.52 | 3.46 | 0.07 |
| Clear-Fruit | 3.17 | 3.29 | 2.66 | 3.30 | 0.85 |
| Clear-Grape | 3.33 | 3.53 | 2.80 | 3.40 | 0.79 |
| Purple-Orange | 3.40 | 3.29 | 2.80 | 3.42 | 0.67 |
| Purple-Fruit | 3.45 | 2.94 | 2.94 | 3.35 | 1.04 |
| Purple-Grape | 3.27 | 3.54 | 2.80 | 3.36 | 0.3 |

[a] Least squares means are reported here and used in subsequent analyses to control for unequal cell sizes.
[b] Test of hypotheses concerning flavor identification employ binary dependent variables and are not reported here.
[c] Each treatment cell is rated on each performance factor on a five-point scale, where a "5" indicates the highest rating.
[d] Liking for each treatment cell is rated on a seven-point scale, where a "3" indicates "Like very much," a "-3" indicated "Very much dislike," and a "0" indicates uncertainty or indifference.

form, which in turn would be correctly identified more often than the purple form. Conversely, we expected that the purple beverage would more often be identified as grape, a fruit flavor commonly associated with purple color, than would beverages colored orange or clear.

We operationalized flavor identification as a binary dependent variable (i.e., correctly or incorrectly identifying the beverage's true flavor), and a generalized logit model was performed using the SAS CATMOD procedure (SAS Institute 1989). We tested the significance of the differences between individual cells in the design using Kanji's Test #5, "Z-test for Two Population Proportions, Variances Known and Unequal" (Kanji 1993, p.25).

The beverage color manipulation had a significant main effect on consumers' abilities to correctly identify fruit flavor ($\chi^2 = 4.06$, $p = 0.044$, $df = 2$), confirming the important role beverage color plays in consumers' abilities to correctly identify beverage flavors.

Figure 3a graphically shows the proportions of respondents exposed to differently colored beverages respectively who correctly identified the true orange flavor of the beverage they sampled. As predicted, those respondents exposed to the characteristic orange colored beverage correctly identified its flavor significantly more often than those exposed to its neutral clear form (66.1% *vs.* 24.4%, $Z_{56,45} = 4.171$, $p < .0001$) or its uncharacteristic purple form (66.1% *vs.* 5.4%, $Z_{45,37} = 5.806$, $p < .0001$); and, those exposed to the clear form identified the correct flavor a significantly greater proportion of the time than those exposed to the purple form (24.4% *vs.* 5.4%, $Z_{45,37} = 2.346$, $P = .0194$). As posited in Hypothesis 1, in comparison with the neutral color level, characteristic color aided correct flavor identification, and uncharacteristic color degraded it.

Figure 3b shows the proportion of respondents, by color, who incorrectly identified the flavor as grape, the uncharacteristic beverage color in this experiment. These results reveal that a significantly greater proportion of respondents exposed to the purple colored beverage identified its flavor as grape, than did those exposed to the neutral clear form (75.7% versus 2.2%, $Z_{37,45} = 6.927$, $p < .00001$) or the characteristic orange form (75.7% to 0.0%, $Z_{37,56} = 7.940$, $p < .00001$). The proportion of subjects exposed to the clear form who identified grape flavor is greater than the proportion exposed to orange color who identified grape flavor, to a degree that approaches significance (2.2% to 0.0%, $Z_{45,56} = 1.115$, $p = .1251$). These results show that those respondents exposed to the purple beverage tend to identify it as grape flavored rather than as its true orange flavor. This result indicates that food color tends to dominate taste as a flavor information source, in support of Hypothesis 2.

**Results of the Comparison of the Relative Strength of Food Color and Labeling**

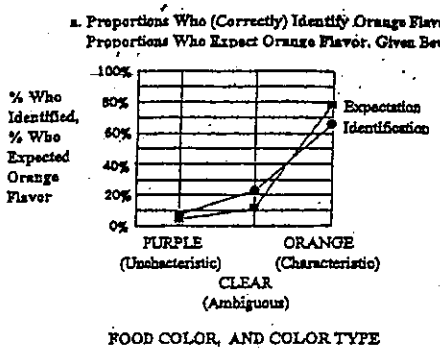
The use of compensatory multi-attribute attitude models have long been used in marketing to profile competitor brands according to how they are perceived by the consumer (c.f., Hauser and Koppelman 1979). In this research we take a similar decompositional approach to compare and contrast the relative flavor profiles of differently colored beverages across the flavor factors. Specifically, Hypothesis 3 was explored by mapping the frequencies with which the flavor factors were associated with different levels of food color and labeling onto a common, multidimensional space using the SIMCA correspondence analysis package (Greenacre 1993) and inspecting their relative positions.[5]

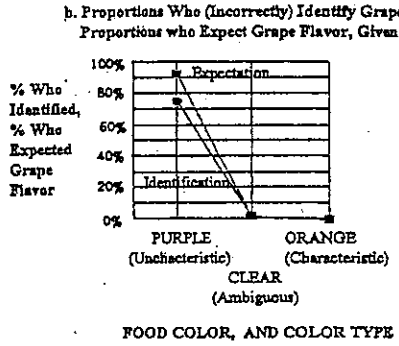
By this method, we can explore the hypothesis that food color dominates labeling by examining the relative positions of the incongruent food color/labeling treatments. Specifically, we would expect that, if food color is dominant, then the orange-grape treatment's flavor profile would tend to cluster with the orange color treatments rather than the purple color treatments. Conversely, we would expect that the purple-orange treatment's flavor profile would tend to cluster with the purple color treatments rather than the orange treatments.

The perceptual map shown in Figure 4 displays the 9 food color/labeling treatments as points projected onto a two-

[5] Correspondence analysis is commonly used for positioning studies in marketing research to create perceptual maps in which competitor brands and a set of flavor attributes are presented as points in a joint, low-dimensional brand attribute space. The relative positions of the competitor brands along primary axes are interpreted to generate relative brand image or performance profiles, useful for competitive strategy purposes. For reference to their application in marketing research, see Hoffman and Franke (1986, pp. 213-217).

FIGURE 3
FLAVOR IDENTIFICATION AND EXPECTATION AMONG THOSE NOT TOLD FLAVOR, BY BEVERAGE COLOR




dimensional flavor performance space.[6] The two-dimensional solution was selected because the first two dimensions collectively account for 96% of explained variance. The primary (horizontal) axis accounts for 48% of explained variance, and, based upon the positions of the beverage flavor factors, its anchors are interpreted to be "Tart," on the left hand side of the map, and "Flavorful, Sweet and Refreshing" on the right. The secondary (vertical) axis accounts for another 48% of explained variance, and its anchors are interpreted to be "Natural and Expensive," at the top of the map, and its opposite, "Unnatural and Inexpensive," at the bottom.

It can be seen by visual inspection that all three levels of the purple color manipulation are positioned on the left-hand side of the map, along with the clear-grape treatment, indicating that purple and grape are perceived to be relatively "Tart" in flavor. In contrast, all three levels of the orange color manipulation are positioned to the right hand side of the map, along with the clear-orange and clear-fruit treatments, indicating that orange color and orange labeling are perceived to be relatively "Flavorful, Sweet and Refreshing." Not surprisingly, the two incongruent conditions, orange-grape and purple-orange, conflicted in image as they are, fall further toward the center of the horizontal axis. However, the purple-orange condition falls slightly more to the left of the orange-grape condition, towards the purple-grape-like "Tart" anchor, and the orange-grape condition falls slightly more to the right, towards the orange-orange-like "Flavorful, Sweet, Refreshing" anchor, as one would expect if food color information were dominating labeling, supporting H3.

**Results for Perception**

To test the effects of beverage color, labeling and their interaction on perceptions of flavor, a regression and planned comparisons were performed for each dependent variable (refreshing, tart, natural and expensive, flavorful and sweet), using the SAS GLM procedure (SAS Institute 1989, SAS/STAT User's Guide, p. 549-640). The significance of all main effects are shown in Table 4.[7]

Food color had significant main effects on the flavor factors "Refreshing" ($F_{2,343} = 7.35$, $p = .0007$), "Tart" ($F_{2,344} = 4.00$, $p = .0192$) and "Natural, Expensive" ($F_{2,353} = 3.93$, $p = .0205$), indicating the importance of food color in determining distinctive flavor profiles. With respect to food color, we also found significant differences between the least squares means of the orange and purple levels of the food color manipulation for two factors ("Refreshing" = 3.47 *vs.* 3.12, $t_{345} = 3.70$, $p = .0002$; "Tart" = 3.07 *vs.* 3.48, $t_{344} = -2.82$, $p = .0050$) and a difference that approaches significance for a third ("Natural, Expensive" = 2.76 *vs.* 2.66, $t_{343} = 1.60$, $p = .1115$). These results indicate that differently colored versions of identically flavored beverages evoke distinct flavor profiles. Purple is perceived to be relatively more tart, and orange is perceived to be relatively more refreshing, more natural and more expensive, in support of H4. There was no significant main effect for the remaining factor, "Flavorful, Sweet" ($F_{2,344}=0.56$, $p=.5711$), indicating that all food color levels are perceived to be relatively equally flavorful and sweet.

The effect of the interaction of food color and labeling is significant for only "Natural, Expensive" flavor performance ($F_{2,344} = 2.42$, $p = .0479$). With respect to "Natural, Expensive," we also found significant differences between the least squares means of two pairs of treatments, orange-orange *vs.* purple-orange ("Natural, Expensive" = 2.51 *vs.* 2.33, $t_{343} = 2.18$, $p = .0295$) and purple-grape *vs.* purple-orange ("Natural, Expensive" = 2.52 *vs.* 2.23, $t_{343} = 2.10$, $p = .0365$). These

[6] Input for correspondence maps are contingency data. Data for this analysis were created by transforming the ratings data provided by the respondents into categorical data using a "top box" approach. Specifically, each cell of the 9x4frequency table that served as input to the correspondence analysis procedure contained the number of respondents who positively associated a particular flavor factor/attribute with a particular color-labeling condition. A positive association is defined as an average rating of "4.0" or more on a five-point scale where a "5" indicates a strong association. The four columns of the frequency table represent the three flavor factors and the one freestanding flavor attribute respectively. Its nine rows represented the nine food color-labeling conditions respectively.

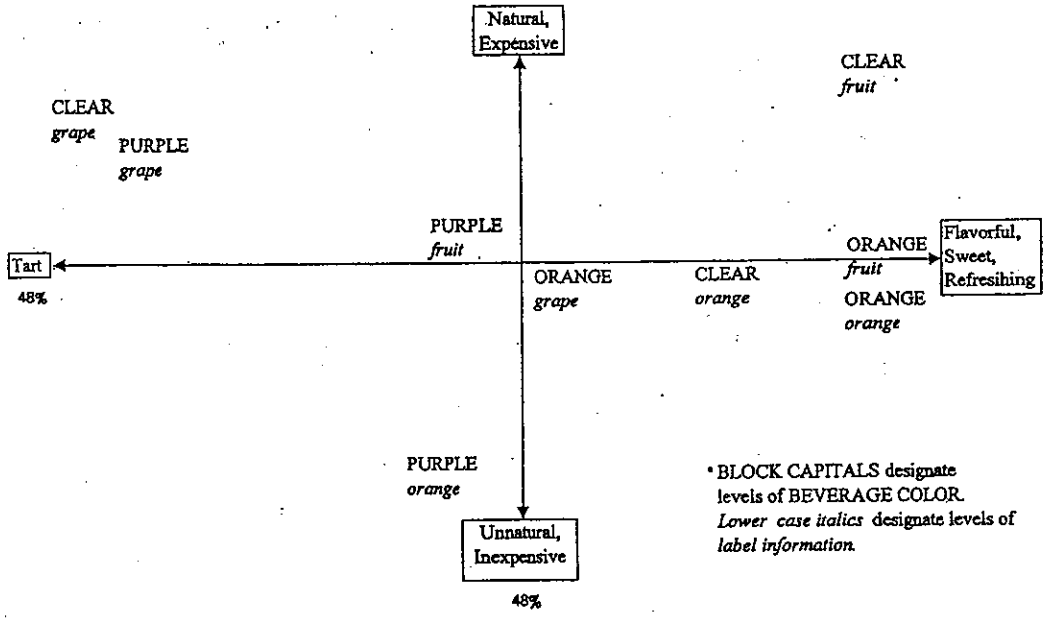
[7] Table 4 also includes a fifth dependent variable, liking, discussed in the next section.

TABLE 4
RESULTS FOR FLAVOR PERCEPTION AND PREFERENCE

| INDEPENDENT VARIABLES | DEPENDENT VARIABLES: MEASURES OF PERCEPTION AND PREFERENCE<br>Performance Factors (H4) | | | | Preference (H5) |
|---|---|---|---|---|---|
| | Refreshing | Tart | Natural, Expensive | Flavorful, Sweet | Liking |
| **Manipulations** | | | | | |
| Food Color | F2,345=7.35, p=.0007**** | F2,344=4.00, p=.0192*** | F2,343= 3.93, p=.0205*** | F2,344= 0.56, p=.5711 | F2,344=4.00, p=.0192*** |
| Labeling | F2,345= 1.57, p=.2090 | F2,344=3.92, p=.0207*** | F2,343= 0.23, p=.7925 | F2,344= 0.64, p=.5305 | F2,344=3.92, p=.0207*** |
| Food Color*Labeling | F4,345= 2.24, p=.0698** | F4,344=0.55, p=.7005 | F4,343= 2.42, p=.0479*** | F4,344= 1.61, p=.1708 | F4,344=0.055, p=.7005 |
| **Covariates** | | | | | |
| Gender | F1,345= 1.91, p=.1673 | F1,344=2.68, p=.1085 | F1,343= 3.44, p=.0644** | F1,344= 0.04, p=.8384 | F1,344=2.68, p=.1025 |
| Age | F1,345= 9.04, p=.0025**** | F1,344=0.97, p=.3265 | F1,343= 0.40, p=.5255 | F1,344= 0.36, p=.5714 | F2,344=0.97, p=.3265 |

**** p < .0100
*** p < .0500
** p < .10 (approaches significance)

FIGURE 4
PERCEPTUAL MAP SHOWING THE NINE FOOD COLOR/LABELING TREATMENT CELLS AS POINTS IN FLAVOR PERFORMANCE SPACE*



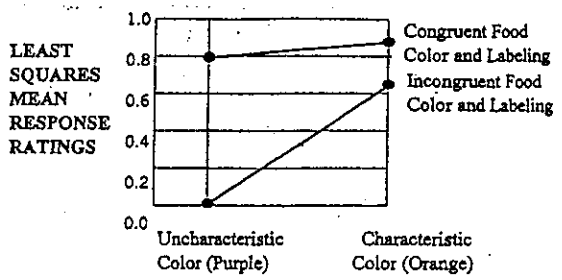

results are interesting, because they show the congruent food color/labeling conditions to be perceived as significantly more natural and expensive than the incongruent food color/labeling conditions, regardless of whether the color of the congruent condition is characteristic (Orange-Orange) or uncharacteristic (Purple-Grape). These results further support H1 and H2, and the notion that food color dominates taste as a source of flavor information.

Labeling had a significant main effect only on "Tart" ($F_{2,344}$ = 3.92, p = .0207), perhaps suggesting labeling's lesser effect on the drawing of distinctive flavor profiles relative to food color, in further support of Hypothesis 3.

**Results for Flavor Preference**

To test the effects of beverage color, labeling, their interaction, and two covariates, gender and age, on preference, an ANCOVA was performed using the SAS GLM procedure (SAS Institute 1989, SAS/STAT User's Guide, p. 549-640). Subjects rated their liking of the beverage they sampled on two separate liking scales, overall flavor liking and overall beverage liking. These proved to be highly correlated (ρ = .79), indicating that both questions measure the same underlying construct. Therefore, a composite liking measure was created by taking a simple mean of the two, which served as the dependent variable in an ANCOVA that was performed to test H5. The significance of all main effects on liking is shown in the last column of Table 4. Comparisons pertinent to the test of Hypothesis 5 are shown in Figure 5.

FIGURE 5
A COMPARISON OF THE EFFECTS OF (IN)CONGRUENT FOOD COLOR AND LABELING ON LIKING, BY CHARACTERISTIC VS. UNCHARACTERISTIC FOOD COLOR




FOOD COLOR AS A SIGNAL OF TRUE (ORANGE) FLAVOR

NOTES: Liking was rated on a seven-point scale where "+3" means "Like Very Much," and "-3" means "Dislike Very Much." Least squares means, rather than simple means, are reported to control for differences in cell size.

Food color had a marginally significant main effect on liking ($F_{2,344} = 2.40$, $p = .0921$), indicating that food color affects the favorable evaluation of foods. Figure 5 shows that the mean response ratings for the congruent food color/labeling treatments were greater than those for the incongruent treatments. This result holds true even for those congruent treatments where food color is uncharacteristic of the true flavor, in support of Hypothesis 5. However, this support is qualified by the fact that, though directionally correct, only one of these two pair-wise differences in response mean is statistically significant, that being the congruent-uncharacteristic *vs.* the incongruent-incorrect treatment condition (purple-grape liking = 4.79 *vs.* purple-orange liking = 4.07, $t_{344} = 2.0365$, $p = .0458$).

In addition, labeling also has a significant main effect on liking ($F_{2,344} = 5.25$, $p = .0057$), indicating that the flavor designation on the label also affects food or flavor preference. In particular, the Fruit Label Information level is significantly more liked than either the "Orange Flavor" (liking = 5.08 *vs.* 4.54, $t_{344} = 2.81$, $p = .0053$) or the Grape Label Information (liking = 5.08 *vs.* 4.61, $t_{344} = 2.71$, $p = .0071$) levels. The response means for the Orange Label Information and the Grape Label Information levels are not significantly different (liking = 4.54 *vs.* 4.61, $t_{344} = 0.34$, $p = .7303$). Contrary to these results, we expected that the labeling levels that specified the fruit flavor would be preferred to the level that did not; these results will be discussed the next section.

## MANAGERIAL IMPLICATIONS

Results from this study indicate that food color affects the consumer's ability to correctly identify flavor, to form distinct flavor profiles and preferences, and dominates other flavor information sources, including labeling and taste. Further, these results support the notion that food color is inextricably linked to expected flavor in the minds of consumers, making the selection of uncharacteristic food color problematical. In the following, we present three possible strategies for making the introduction of a novel food color viable for marketing communications purposes. The first is to teach consumers to accept a novel color as characteristic, or emblematic, of a particular food, as green is for peppermint of or brown is for cola. This is a strategy that is self-defeating in some respects, but is useful under certain circumstances, as we shall discuss. The second strategy is to celebrate the very incongruity of a novel food color, to announce to the consumer that its novelty is there to surprise and delight, and the proper response is to have fun and enjoy it. The third strategy for the introduction of novel food color is to sever the food color and flavor expectations connection, making it impossible for the consumer to connect the two. Concerning the latter strategy, we suggest several means for severing this connection.

A drawback to rendering a novel color no longer novel is that it loses its ability to surprise the consumer into attention, which was the prime reason for utilizing novel color in the first place. But, we mention this strategy here because it does serve a purpose in the case of food products that are nondescript in color or appearance. When the appearance of a food product is nondescript, then associating it with a new, more vibrant color can enhance its noticeability, its distinctiveness and its appeal. Such as been the case with green for peppermint or yellow for Mountain Dew and all its me-too competition (a me-too color strategy).

A problem with rendering a novel food color characteristic is that it will likely be a lengthy and expensive process, requiring as it does the conditioning of consumers to accept the accept a new color as characteristic of a particular food product. Another obstacle is the sheer diversity and multiplicity of food products (and their packages) on display. This makes it hard for the marketer to find an empty visual niche, when compared to the days when peppermint was made green or cola was made brown.

A second strategy for the effective implementation of novel food color is to make a virtue of its incongruence. This is done by featuring novel color and its very incongruence in the shelf presentation. The consumer therefore knows that the incongruence is intended, is meant to be amusing, and is therefore made to feel welcome to share in the fun. An example of this is Gatorade's Blue Raspberry drink, an uncharacteristically blue-colored beverage whose name calls attention to the incongruence of the drink's color and flavor. This packaging ploy assures the consumer that the discrepancy is intentional, is for their entertainment, and cues feelings of pleasure and enjoyment. As an example of this approach, it is interesting to note that blue foods, once considered by food manufacturers to be unpalatable and unacceptable to the consumer (Hine 1996) have in recent years been utilized in this manner as a means of creating novelty and excitement, especially in categories aimed at children.

A third approach to novel food color is to sever the food color/ labeling connection by making it impossible for the consumer

to connect the two. If color and flavor cannot be connected, then novel food color cannot be incongruent. Given the ingrained nature of the food color/expected flavor association, how is such an uncoupling made possible? First, the natural tendency of the consumer to connect color and flavor must be deliberately blocked, to permit the introduction of other color themes and associations to distinguish and contrast the brand, and lend it meaning.

The most straightforward means of unlinking food color and labeling is to mask food color. The focus of the product can then be shifted to a more thematic association. Several drink brands have elected this approach by packaging their drinks in opaque bottles or plastic labels that cover the outside of the package, thus hiding the view of the actual product. Cans, of course, have by their nature always masked their contents, but the deliberate painting of bottles, whose virtue has always been to permit the consumer to view its contents, is a new and contrary wrinkle.

A recent example of this approach is an iced coffee beverage line by Havana, which has covered the bottles in plastic and placed eye-catching graphics on the package. The Havana "Mocha Iced Cappuccino" package has a sexual appeal, with an exotic woman on a pink background surrounded by floating coffee beans. This color/graphic combination is sure to stand out among beverage competitors. This strategy makes novel use of color while masking the dull brown color of the coffee-based beverage. With this motif, flavor expectations formed in the store derive solely from label information (including package color, which, itself, may or may not be congruent or characteristic) or, of course, from prior experience. Exposure to food color is postponed until the time of preparation and consumption, which grants the designer and marketer greater promotional latitude.

A more subtle approach to the disconnection of the food color/expected flavor relationship is the selection or creation of food colors and flavors that are not flavor- or color-associated. In denying the consumer the ability to readily categorize the flavor cues that food color and labeling present, the consumer may be induced into a mode of more elaborated information processing in order to understand and evaluate the product. This opens an opportunity for the presentation of promotional ideas, symbols, meanings and associations through the medium of novel food color.

For example, Gatorade sought to extend their product line, but was limited by the fact that there are a finite number of fruit flavors, all of which can be found in competitor product lines. The Frost series solved this problem by replacing the usual flavor references on the package with references to themes of winter, with colors and names that evoked images of cold, ice and snow; images that are not inconsistent with themes normally positively associated with fruit beverages, but which are normally evoked in advertising and not by food color and flavor names. For example, Gatorade's Frost series includes "Glacier Freeze," which comes in a clear strong blue color not unlike mouthwash, "Whitewater Splash," which comes in a clear strong green, and one called "Alpine Snow," which comes in a semi-translucent white.

A key to consumer acceptance of such a thematic approach, along with its innate vividness and appeal, is to deny the consumer ready access to any flavor cues, which, if obtained, would likely preempt further search and evaluation. Therefore, Gatorade goes so far as to withhold specific flavor information in its "Nutritional Facts" label, citing only "natural flavors." The consumer is therefore blocked from falling back on old flavor habits, and can have none of the usual flavor expectations prior to tasting. The consumer is therefore forced to consider and evaluate the Frost line of drinks in an entirely new context.

A related but somewhat different approach seeks an alternative appeal that is cognitive in nature. For example, Snapple and SoBe offer beverage lines whose names and body text offer symbolic and spiritual references not normally associated with beverages, and whose colors are designed to be consistent with those themes rather than with flavor. For example, Snapple's "Rain" is clear like water and contains ginseng, astragalus and agave, whose flavors most consumers would find unfamiliar. SoBe's "Drive" comes in a glass bottle which describes it as a "Beach Brew," and whose label features two green lizards. Its herbal additives include epimedium, ginseng and muria puama, which, as with "Rain," offer little recognizable flavor information to the consumer. By uncoupling color from flavor, SoBe has given themselves the promotional opportunity to associate color with meaning, namely "healthy." They added value for the health-conscious consumer by including herbal ingredients without affecting flavor expectations.

## Extensions

Valuable future research would include generalizing on the results of this experiment by manipulating actual food flavor and food category along with food color and label information. With respect to food flavor, this research implicitly assumes that flavors differ purely on the basis of how well they are liked, and may therefore be compared directly. However, flavors as complex multidimensional stimuli each have their own particular character. By replicating this study while manipulating flavor along with food color and label information, we may account for any flavor-specific effects. Similarly, food category may also be manipulated in order to account for any food-category-specific effects.

We find that beverage color dominates other flavor information forms in a typical consumer context, and speculate that this is likely due to a combination of two conditions whose effects we do not disentangle here. The first is the vividness and salience of beverage color relative to labeling or taste. The second is the primacy of beverage color in the sense

that it is the first flavor information perceived and processed by the consumer in the store (Oram et al. 1995). Further research is required to measure these effects separately, and determine their relative importance in the formation of flavor expectations.

A distinct preference was observed for the beverages carrying Fruit Label Information than for the more specifically identified beverages carrying the Orange or Grape labels. These contrary results suggest to us that the more general label identifier, "Fruit," did not represent to the consumer an absence or a reduction in specific flavor information, as we had intended. Rather, Fruit Label Information seems to have evoked an image and set of associations as vivid and distinct as those associated with the more specific label identifiers, Orange and Grape (i.e., note the position of the Clear-Fruit treatment condition in the upper right hand corner of the perceptual map in Figure 4). Perhaps, too, the more general "Fruit" designator evokes a favorable response due its very generality, permitting the consumer to exercise her or his imagination in a pleasant and satisfying manner, resulting in a more ideal or more personal flavor profile than when a more specific fruit image is delivered fully formed. Further research is necessary to understand this effect.

It also appears that the clear level of the labeling manipulation, also intended as a neutral and relatively informationless base level, served in this capacity no better than did the "Orange Flavor" level of the labeling manipulation. Results indicate that clear color has equal color identity to orange and purple, complete with meanings and associations and flavor expectations of its own. Upon post hoc review, it is apparent that this possibility was suggested by the aforementioned Crystal Pepsi example. Future research should examine the specific meanings and associations that consumers have concerning clear or colorless beverages, as well as the circumstances under which consumers may prefer less complete or less explicit product information.

## REFERENCES


Baeyens, Frank, Paul Eelen, Omer Van DEN Bergh, & Geert Crombez (1990), "Flavor-Flavor and Color-Flavor Conditioning in Humans," *Learning and Motivation*, 21, 434-455.

_____, Deb Vansteenwegen, Jan De Houwer, & Geert Crombez (1996), "Observational Conditioning of Food Valence in Humans," *Appetite*, 27, 235-250.

Cardello, A. V. (1996) The Role of the Human Senses in Food Acceptance. In H.L. Meiselman and H.J.H. McFie, *Food Choice, Acceptance and Consumption* (pp.1-82). New York: Blackie Academic and Professional.

Cheskin, Louis (1957), *How to Predict What People Will Buy*, New York: Liveright.

Compeau, Larry D., Dhruv Grewal, & Kent B. Monroe (1989), "Role of Affect and Sensory Cues on Consumer's Affective and Cognitive Responses and Overall Perceptions of Quality," *Journal of Business Research*, 42, 295-308.

Dichter, Ernest (1975), *Packaging: The Sixth Sense? A Guide to Identifying Consumer Motivation*, Boston: Cahners Books.

DuBose, Cynthia N., Armand V. Cardello, & Owen Maller (1980), "Effects of Colorants and Flavorants on Identification Perceived Flavor Intensity, and Hedonic Quality of Fruit-Flavored Beverages and Cakes," *Journal of Food Science*, 45, 1393-1399, 1415.

G. & C. Merriam & Co., Publishers (1959), *Webster's New Collegiate Dictionary*, Springfield, Ma.: G. & C. Merriam and Co., Publishers.

Garber, L. L., Jr., R.R. Burke, & J.M. Jones (2000) *The Role of Package Appearance in Consumer Purchase Consideration and Choice*. Boston: Marketing Science Institute Working Paper Series.

_____, & E.M. Hyatt (2000) Color as a Tool for Visual Persuasion, In R. Batra, & Scott, L., *Visual Persuasion*, Hillsdale, NJ: Lawrence Erlbaum Associates.

_____, E.M. Hyatt, & R.R. Starr, Jr. (2000), Placing Food Color ExperimentationInto a Valid Consumer Context," *working paper*.

Goodstein, Ronald C. (1993), "Category-Based Applications and Extensions in Advertising: Motivating More Extensive Ad Processing," *Journal of Consumer Research*, 20 (June), 87-99.

Greenacre, Michael J. (1993), *Correspondence Analysis in Practice*, New York: Academic Press.

Hauser, John R. & Frank S. Koppelman (1979), "Alternate Perceptual Mapping Techniques: Relative Accuracy and Usefulness," *Journal of Marketing Research*, XVI (November), 495-506.

Heckler, Susan E., & Terry L. Childers (1992), "The Role of Expectancy and Relevancy in Memory for Verbal and Visual Information: What is Incongruency?" *Journal of Consumer Research*, 18 (March), 475-492.

Hine, Thomas (1996), *The Total Package*, New York: Little, Brown and Company.Hoffman, Donna L., & George R. Franke (1986), "Correspondence Analysis: Graphical Representation of Categorical Data," *Journal of Marketing Research*, XXIII (August) 213-227.

Huber, Joel (1975), "Predicting Preferences on Experimental Bundles of Attributes: A Comparison of Models," *Journal of Marketing Research*, XII (August), 290-297.

Hyman, Arnold, (1983), "The Influence of Color on the Taste Perception of Carbonated Water Preparations," *Bulletin of the Psychonomic Society*, 21(2), 145-148.

Johnson, J., & F.M. Clydesdale (1982), "Perceived Sweetness and Redness in Colored Sucrose Solutions," *Journal of Food Science*, 47, 747-752.

Kanji, Gopal K. (1993), *100 Statistical Tests*, London: Sage Publications Ltd.

Keller, Kevin Lane (1993), "Conceptualizing, Measuring, and Managing Customer-Based Brand Equity," *Journal of Marketing*, 57 (January), 1-22.

Lee, Yih Hwai, & Charlotte Mason (1999), "Responses to Information Incongruency in Advertising: The Role of Expectancy, Relevancy, and Humor," *Journal of Consumer Research*, 26 (September), 156-169.

Loken, Barbara, & James Ward (1990), "Alternative Approaches to Understanding the Determinants of Typicality," *Journal of Consumer Research*, 17 (September), 111-126.

Lussier, Dennis A., & Richard W. Olshavsky (1979), "Task Complexity and Contingent Processing in Brand Choice," *Journal of Consumer Research*, 6 (September), 154-165.

Maga, J.A. (1974), "Influence of Color on Taste Thresholds," *Chemical Senses, Flavor*, 1, 115-119.

Mandler, George (1982), "The Structure of Value: Accounting for Taste," in *Affect and Cognition: The 17th Annual Carnegie Symposium*, eds. Margaret S. Clark and Susan T. Fiske, Hillsdale, NJ: Lawrence Erlbaum Associates, 3-36.

McCullough, James M., Charlene S. Martinsen, & Reza Moinpour (1978), "Application of Multidimensional Scaling to the Analysis of Sensory Evaluations of Stimuli with Known Attribute Structures," *Journal of Applied Psychology*, 65 (1), 103-109.

Meyers-Levy, Joan, & Alice M. Tybout (1989), "Schema Incongruity as a Basis for Product Evaluation," *Journal of Consumer Research*, 16 (June), 39-54.

Moir, H.C. (1936), "Some Observations on the Appreciation of Flavor in Food Stuffs," *Chemistry and Industry*, 55, 145-148.

Moskowitz, Howard R. (1978), "Taste and Food Technology: Acceptability, Aesthetics, and Preference," *Handbook of Perception*, VIA, 158-193.

Oram, Nicholas, David G. Laing, Ian Hutchinson, Joanne Owen, Greenville Rose, Melanie Freeman, & Graeme Newell (1995), "The Influence of Flavor and Color on Drink Identification among Children and Adults", *Developmental Psychobiology*, 28 (4): 234-246.

Petty, Richard E., & John T. Cacioppo (1981), *Attitudes and Persuasion: Classic and Contemporary Approaches*, Dubuque, Iowa: Wm. C. Brown Company Publishers.

Roberts, John H. (1989), "A Grounded Model of Consideration Set Size and Composition," *Advances in Consumer Research*, 16, 749-757.

SAS Institute Inc. (1989), *SAS/STAT User's Guide, Version 6, Fourth Edition, Volume 1*, Cary, NC: SAS Institute Inc., 405-517.

Stillman, Jennifer A. (1993), "Color Influences Flavor Identification in Fruit-flavored Beverages," *Journal of Food Science*, 58, 810-812.

Triplett, Tim (1994), "Consumers Show Little Taste for Clear Beverages," *Marketing News*, 28 (11), 2.

Tuorila-Ollikainen, H., (1982), "Pleasantness of Colourless and Coloured Soft Drinks and Consumer Attitudes to Artificial Food Colours," *Journal for Intake Research*, 3, 369-376.

Wilkie, William L., & Edgar A. Pessemier (1973), "Issues in Marketing's Use of Multiattribute Attitude Models," *Journal of Marketing Research*, 10 (November) 428-441.

## AUTHOR BIOGRAPJY

Lawrence L. Garber, Jr. (Ph.D., University of North Carolina at Chapel Hill) is associate professor of marketing at the John A. Walker College of Business, Appalachian State University, Boone, NC. His research interests include visual persuasion, the graphical presentation of statistical data, and nonprofit and arts marketing. He has published in the *Journal of Marketing Theory and Practice*, the *Working Paper Series* of the Marketing Science Institute, *Transportation Journal, Journal of Professional Services Marketing*, the *Journal of Nonprofit and Public Sector Marketing, Advances in Consumer Research* and other proceedings.

## AUTHOR BIOGRAPHY

Eva M. Hyatt (Ph.D., University of South Carolina) is associate professor of marketing at the John A. Walker College of Business, Appalachian State University, Boone, NC. Her research interests include the effects of cognitive processes in consumer behavior, product symbolism, demand bias issues, consumer socialization, public policy issues especially with respect to vulnerable populations, and marketing ethics. She has published in the *Journal of Marketing Theory and Practice, Journal of Consumer Research*, the *Journal of Business Research*, the *Journal of Public Policy and Marketing*, and *Consumption, Culture and Markets, Advances in Consumer Research* and other proceedings.

## AUTHOR BIOGRAPHY

Richard W. Starr, Jr.(Doctoral candidate, University of North Carolina at Chapel Hill) is senior lecturer in marketing at the University of Auckland, NZ. His research interests include how firms respond to the required disclosure of nutritional information on packaged foods, the use of color in product marketing, customer perceptions of value, and the use of marketing knowledge for social marketing and environmental improvement. In terms of selected publications, he co-authored several instructors' editions of Kotler and Armstrong's *Principles of Marketing*, and his articles have appeared in the *Journal of Marketing Theory and Practice, Marketing Letters,* and conference proceedings.