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The effect of wrapper color on candy flavor expectations and perceptions

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ABSTRACT

The color of a product's metallic paper wrapper influences the expectations concerning the flavor of the product. These color-induced expectations are consistent with flavors associated with those colors (e.g., cherry-red) but vary somewhat with the product to be wrapped (e.g., a candy or beverage). Beverages wrapped in green were expected to have a lemon/lime flavor while candies wrapped in the same color were expected to have a mint flavor. Although flavor expectations were affected by the wrapper color there was no effect of the color of the wrapper on the identification of the flavor of a plain white spun sugar candy wrapped in the paper wrapper. The color of the wrapper also did not affect how much subjects liked the flavor of the candy or the rated intensity of the flavor or sweetness. There was also no difference among the colored wrappers in how appropriate they were judged to be for the candy. All colors were seen as, at best, "somewhat" appropriate. Subjects were more likely to report a candy as having a flavor consistent with the color of the candy than with the color of the paper it was wrapped in. This suggests that people's judgments and evaluations of a food stimulus is most strongly influenced by those aspects of the stimulus they perceive as being an integral part of the food (i.e., the color of the food rather than the color of the packaging).

1. Introduction

The color of a food or beverage leads to certain expectations about what sensory experience we will have when we taste the food or beverage. Some of these color-induced expectations might be caused by correspondences between certain colors and sensory characteristics. There are numerous examples of color-odor correspondences. For example, Kemp and Gilbert (1997) found that dark colors correspond to more intense odors. Correspondences have also been found between specific colors and specific odors (Gilbert, Martin, & Kemp, 1996). In their study, subjects indicated that cinnamic aldehyde (which smells like cinnamon) corresponds to the color red while caramel lactone (which smells like caramel) corresponds to the color brown.

Certain colors have also been found to correspond to certain basic tastes (e.g., red with sweet and green with sour, Koch & Koch, 2003; for a review, Spence et al., 2015). Correspondences have also been found between colors and the sensory experience of refreshment. Zellner and Durlach (2002) reported that subjects listed red, orange, and yellow as the most refreshing colors, and black and brown as the least refreshing. However, Clydesdale, Gover, Philipson, and Fugardi (1992) found brown to be a refreshing color.

The fact that the color brown was found to be both refreshing and

not refreshing suggests that some correspondences between colors and sensory aspects of foods are specific to the product being considered. These associations might be learned through experience with a food and drink of a particular color. Zellner and Durlach (2002) asked subjects about the color of foods or beverages whereas Clydesdale et al. (1992) asked subjects about non-alcoholic beverages. Clydesdale et al. suggested that their subjects found brown to be a refreshing color because they were thinking about cola. Because Zellner and Durlach (2002) asked their subjects to think about both food and drink they might have been thinking about foods such as steaks or hot chocolate in that study, which are not refreshing.

The idea that such correspondences are learned through experience is supported by studies demonstrating differences between people from different cultural groups where the colors that correspond to different foods and flavors might differ. For example, Shankar, Levitan, and Spence (2010) found that when their British subjects (70%) were shown a brown beverage they said that they expected it to have a cola flavor whereas none of their Taiwanese subjects expected cola.

In fact, Stevenson, Boakes, and Wilson (2000) demonstrated learned color-taste associations. Their subjects expected that colored solutions previously paired with citric acid would taste sour and that colored solutions previously paired with sucrose would taste sweet. So it

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appears that prior experience with foods of a particular color having certain sensory qualities can lead to those colors causing certain sensory expectations.

The expectations that colors produce can also impact the sensory perception of a food or beverage of that color once the food or drink is consumed. For example, color can affect the perceived intensity of both tastes and odors. In a series of studies it was found that the addition of a red color to beverages enhanced their perceived sweetness (Johnson & Clydesdale, 1982; Johnson, Dzendolet, Damon, Sawyer, & Clydesdale, 1982; Johnson, Dzendolet, & Clydesdale, 1983; Lavin & Lawless, 1998). Dubose, Cardello and Maller (1980) found that the intensity of an orange beverage was enhanced by an orange color and the intensity of a lemon cake was enhanced when colored yellow.

Although enhancement of orthonasal odor (odor smelled through the nostrils) by color of the stimulus that is the source of the odor has been observed consistently (Christensen, 1983; Engen, 1972; Koza, Cilmi, Dolese & Zellner, 2005; Zellner & Kautz, 1990; Zellner & Whitten, 1999) similar color-induced enhancement of retronasal odor (odor smelled when the food is in the mouth) has not been found. Christensen (1983) and Zampini, Sanabria, Phillips, and Spence (2007) found no effect of color on retronasal odor intensity. Others (Koza et al., 2005; Zellner & Durlach, 2003) have found a suppression of retronasal odor intensity by color.

In addition to affecting the perception of the sensory characteristics of foods and drinks, the color of the food or beverage can also influence how much it is liked (Dubose et al., 1980; Zellner, Bartoli, & Eckard, 1991). Zellner et al. (1991) found that the smell of solutions that are appropriately colored (e.g., a grape solution colored purple) is liked more than the smell of the same solution colored inappropriately (e.g., a grape solution colored yellow). This change in odor pleasantness with appropriateness of color seems to be at least partly due to a decrease in the ability to correctly identify an inappropriately colored odorous solution [although see Piqueras-Fiszman & Spence (2012b) and Velasco et al. (2016) for discussions of incongruity being hedonically positive in certain contexts such as a modernist restaurant].

However, this decrease in liking when a food is inappropriately colored might be the result of conditioned changes in the quantity or quality of the taste and smell of the food caused by a learned association with the color (see Zellner, 2013). Such conditioned odor quality changes have been found in odor-odor conditioning (Case, Stevenson, & Dempsey, 2004; Stevenson, 2001a; Stevenson, 2001b; Stevenson, Case, & Boakes, 2003). When subjects are exposed to a mixture of two odors and then presented with only one of the pair they report smelling the other. If a similar thing happens with color-odor pairings it is possible that the color produces the expectation of a particular taste or odor which then produces a percept of that taste or odor (see Zellner, 2013). That could result in a red drink being perceived as sweeter than a clear drink, and as having a cherry or strawberry odor or flavor.

The fact that color might result in such conditioned percepts is suggested by studies finding that when subjects misidentify odorous solutions they often identify them as odors whose objects have the color of the solution they are asked to identify (Blackwell, 1995; Dubose et al., 1980; Morrot, Brochet, & Dubourdieu, 2001; Zellner et al., 1991 – but see Piqueras-Fiszman & Spence, 2015; Shankar et al., 2010; Zellner, 2013 for limitations). For example, a solution with a lemon odor might be identified as “cherry” or “strawberry” if colored red.

Many of the studies investigating the effect of color on liking and sensory characteristics of food have looked at the effect of the color of the actual food (e.g., yellow cake, red beverages). It seems likely that the production of expectations by the color of the food about the sensory properties of the food plays a role (e.g., Cardello & Sawyer, 1992; Shankar et al., 2010), possibly through previous learned associations. That is, we have learned that red foods often have a “red” flavor such as cherry or raspberry.

However, studies have found that not only the color of the food, but the color of service items on which the food is served can alter liking for

and perception of the flavor of the food [e.g., bowls (Harrar, Piqueras-Fiszman & Spence, 2011, plates (Piqueras-Fiszman, Giboreau & Spence, 2013, cups (Piqueras-Fiszman & Spence, 2012a, cutlery (Harrar & Spence, 2013)]. It is difficult to imagine how the color of the service items would result in different flavor expectations of the food served. More likely, these effects are the result of changes in how the food itself looks when presented on different colored backgrounds, both in terms of color (through simultaneous color contrast) and attractiveness (see Zellner, Loss, Zearfoss, & Remolina, 2014) which changes sensory perception and liking.

While the color of the service items (e.g., plates, cups) probably does not produce its effect directly through expectations caused by the color of those items, the color of the packaging of certain foods might (e.g., red cans with coca-cola, brown wrappers for a chocolate candy, e.g. Hershey bar in the US) because they do seem to cause sensory expectations. For example, Huang and Lu (2015) found that people expected foods in red packaging would taste sweeter than foods in blue or green packaging. However, they did not investigate whether those expectations changed perception of the product.

There has also been some research on the effect of the color of packaging on actual flavor perception, identification and liking (e.g., Ares & Deliza, 2010; Deliza & MacFie, 1996; Piqueras-Fiszman & Spence, 2011; Rebollar, Lidon, Serrano, Martin, & Fernandez, 2012; Tijssen, Zandstra, de Graaf, & Jager, 2017). In one study (Piqueras-Fiszman & Spence, 2011) subjects who were given potato chips (crisps) of a particular flavor from a package having a color they associated with a different flavor often misidentified the flavor as the one corresponding to the color of the package (also see Piqueras-Fiszman, Velasco, & Spence, 2012). This finding suggests that package color might also produce expectations which affected the perceived flavor of the packaged food.

What expectations are produced by the color of the packaging can depend upon the food product. For example, a red can might cause an expectation of a cola flavor but a red yogurt container might cause an expectation of a raspberry flavor because of prior associations of those package colors with those product flavors. Piqueras-Fiszman and Spence's (2011) data supports this idea. People seemed to have learned rather arbitrary color-flavor associations of crisps (potato chips) and which associations they learned depended upon the brand of crisp they ate.

In the case of crisps (potato chips) the package color might be the only color setting up a flavor expectation because chips of most flavors are the same color. However, in some cases we expect the actual product to have a color congruent with the flavor of the product. That is true for many beverages. For example, we expect colas to be brown and other colors such as a clear cola are not acceptable. Soon after a clear version of Pepsi-Cola was introduced in 1993 it was discontinued (Triplett, 1994). The can label indicated that the beverage was Pepsi (Crystal Pepsi) but according to anecdotal reports people did not like the cola if they drank it from a glass (where they could see that it was clear) but did like it straight from the can (where they did not see the color of the beverage).

These studies suggest that both the color of the package of a product and the color of the product itself might both set up expectations concerning the flavor of food or beverage which can influence how they are perceived. Here we investigate the odor quality (what we will call flavor) expectations, if any, produced by colored metallic paper wrappers around a beverage container or a piece of candy. After finding out the flavor expectations the paper produced, we then investigate whether these expectations affect the perception of an unflavored sugar candy wrapped in that paper by asking subjects to taste the candy, identify the flavor of the candy, rate how much they like it, rate the flavor and sweetness intensity, and rate how well they thought the color of the paper went with the flavor of the candy.

If the color of a wrapper produces effects through expectations, much as the color of the actual food does, we expected that people

would identify the candy as having a flavor corresponding to the color of the wrapper. They might also report liking a candy in a colored wrapper which they found to be more congruent with the flavor more than one in a colored wrapper that should be perceived as incongruent with the flavor. In addition, candies in a red wrapper might be perceived as sweeter than the candies in wrappers of other colors.

2. Study 1

This study investigates what flavor expectations were produced by metallic paper wrappers if subjects are told that they are used to wrap bottles of beverages or candies. The study was approved by the Montclair State University Institutional Review Board (approval #001321).

2.1. Subjects

Subjects were 24 Montclair State University students (16 females, 7 males, 1 unknown, mean age = 21 years, SD = 3 years) recruited from the Psychology department's subject pool. The subjects did not participate in any other studies reported in this paper.

2.2. Method

Each subject received four 21.6 cm × 27.9 cm sheets of white paper which were stapled together in the upper left-hand corner. Pasted on each sheet was one 5.1 × 5.1 cm piece of foil paper (cut from 10.2 × 10.2 cm sheets from Papermart at www.papermart.com/square-foil-candy-wrappers/id=44280). On each sheet was pasted a different colored paper for a total of four different colors. The colors were red, green, orange, and purple/pink (called "wildberry" by the manufacturer). The sequence of colors was counterbalanced across subjects.

In addition to the piece of foil paper, each sheet contained a series of questions concerning the foil paper. Subjects were first asked if the color of the paper made them think of a particular flavor (yes or no). If they answered "yes" they were asked to report what flavor. They were then asked if the paper was a candy wrapper what flavor they would expect the candy would have. They were then asked if the paper was wrapped around a beverage container what flavor they would expect the beverage would have.

2.3. Results

Most people reported that the colored papers made them think of a particular flavor. People reported that they expected different flavors for the different colored wrappers. What flavors they expected differed somewhat depending upon whether they were just asked for a flavor or asked about a candy or a beverage flavor.

2.3.1 General flavor

When asked if the paper made them think of a particular flavor most of the 24 subjects said "yes" and then gave a flavor response (20 for the red paper, 19 for the green paper, 16 for the orange paper, and 16 for the purple/pink paper). Most of the expected flavor responses were for flavors commonly associated with that color (100% for red, 95% for green, 88% for orange, and 100% for purple/pink). The most common flavor expectation for the red paper was cherry (75%), for the green paper it was mint (74%), for the orange paper it was orange (56%) and for the purple/pink paper it was grape (44%). See Table 1.

2.3.2 Candy flavor

When asked about flavors of candies wrapped in the paper most of the 24 subjects gave a flavor response (21 for the red paper, 21 for the green paper, 21 for the orange paper and 20 for the purple/pink paper). Most of the expected flavor responses were for flavors commonly associated with that color (95% of red, 95% of green, 81% of orange, and

Table 1

Percentage of people reporting flavor expectations induced by the color of the wrappers from Study 1 for products in general (General), candy (Candy) or a beverage (Beverage). Only those flavors reported by 10% or more of subjects are listed.

	General	Candy	Beverage
Red	Cherry (75%) Cinnamon (10%) Spice/hot/red pepper (10%)	Cherry (68%)	Cherry (40%) Cola (25%) Apple (10%)
Green	Mint (74%) Apple (21%)	Mint (57%) Apple (29%)	Lemon/lime (60%) Ginger ale (10%)
Orange	Orange (56%) Honey (19%)	Orange (43%) Caramel (14%) Butterscotch (14%) Chocolate (14%)	Orange (47%)
Purple/pink	Grape (44%) Raspberry (38%) Berry (13%)	Grape (35%) Raspberry (30%) Chocolate (20%) Berry (10%)	Grape (32%) Fruit (26%) Berry (16%)

80% of purple/pink). The most common flavor expectation for the red paper was cherry (68%), for the green paper it was some type of mint (57%), for the orange it was orange (43%) and for purple/pink it was grape (35%). See Table 1.

2.3.3 Beverage flavor

When asked about flavors of beverages whose container would be wrapped in the paper most of the 24 subjects gave a response (20 for the red paper, 20 for the green paper, 19 for the orange paper, and 19 for the purple/pink paper). Most of the expected flavor responses were for flavors commonly associated with that color (75% for red, 80% for green, 89% for orange, and 89% for purple/pink). The most common flavor expectation for the red paper was cherry (40%), for the green paper it was lemon/lime (60%), for the orange paper it was orange (47%) and for the purple/pink paper it was grape (32%). See Table 1.

2.4. Discussion

The colored paper did produce expectations of particular flavors. The flavors expected differed among the colored wrappers and were ON OCCASION different depending upon whether subjects were asked about candies or beverages. The flavor expectations were those often associated with the color of the wrapper for the cultural group we tested (USA college students). However, there were slight differences in expectations depending on whether subjects were asked about a general flavor expectation, one for a candy, or one for a beverage. Specifically, mint was a common response to the green paper when subjects were asked about flavor in general or when asked about a candy flavor. But when subjects were asked about the flavor for a beverage in a green paper lemon/lime was a far more common response. This result is not surprising since many lemon/lime beverages in the United States are sold in green containers (e.g., Sprite and 7-Up). This supports the idea that the color-flavor expectations are learned through experience and are context specific. Mint beverages, other than mint tea, are rare in the United States.

3. Study 2

This study investigated whether the flavor expectations caused by the foil wrappers seen in Study 1 influenced the perception and liking for a candy whose only ingredient was spun sugar. The study was approved by the Montclair State University Institutional Review Board (approval #001322).

3.1. Subjects

Subjects were 60 Montclair State University students (35 females, 25 males, mean age = 20.6 years, SD = 2 years) recruited from the Psychology department's subject pool. The subjects did not participate in any other studies reported in this paper.

3.2. Method

Subjects were each given one spun sugar candy made by Jacques Torres, a master pastry chef and chocolatier located in New York City. Because the candies were hand-made they varied slightly in size but were on average about 3.8 gms. They were wrapped in 10.2×10.2 cm pieces of the foil paper used in Study 1. All four colors (red, green, orange, & purple/pink) were used. A subject received only one candy wrapped in one piece of colored foil (15 subjects for each color).

Before tasting the candy, subjects were told to look at the wrapped candy and answer the first section of a questionnaire on the table in front of them. In the first section of the questionnaire they were asked to write down the color of the wrapper. They were also asked to rate how much they liked the color of the wrapper using a 201-point bipolar hedonic scale. On the scale 100 was labeled "like extremely", -100 was labeled as "dislike extremely", and 0 was labeled as "neither like or dislike". They also reported what flavor they expected the candy to have.

Subjects were then told to unwrap the candy and put it in their mouths. They were then asked to answer the second part of the questionnaire. In the second part of the questionnaire they were asked to write down the flavor of the candy and rate the intensity of both the sweetness and flavor of the candy on a scale ranging from 0 "not at all" to 100 "extremely intense". A final question asked them to rate how well they thought the color of the paper went with (i.e., corresponded to) the flavor of the candy. They answered this question by circling one of the following answers: not at all (1), somewhat (2), pretty well (3), or very well (4).

3.3. Results

Differences in 1) wrapper liking, 2) candy flavor liking, 3) candy sweetness intensity, 4) candy flavor intensity, and 5) appropriateness of the candy to the wrapper, between the four groups of subjects receiving the candy in the four different wrappers were analyzed using 1-way ANOVAs.

3.3.1 Wrapper color identification

All subjects receiving all of the four colored candies correctly identified the color. All 15 people receiving the candy in the red wrapper identified the wrapper color as red and all 15 of those people receiving the candy in the green wrapper identified the wrapper color as green. Thirteen of the people receiving the candy in the orange wrapper identified the color as being orange, one as gold, and one as orange/gold. The purple/pink colored wrapper was identified as purple by six people, pink or dark pink by five people, purple fuchsia by one person, pink fuchsia by one person, magenta by one person, and pink/purple by one person.

3.3.2 Wrapper liking

There was no significant difference in liking ratings for the wrapper between the groups of subjects receiving the candies in a red, green, orange, or purple/pink wrapper, $F(3,56) = 0.59$, $p = .62$. The mean liking rating for all colored papers was 36.6 (SD = 43.3).

3.3.3 Flavor of candy

Most of the 15 subjects in each color wrapper group indicated that the candy had a specific flavor (14 for the red wrapper, 9 for the green, 14 for the orange, and 12 for the purple/pink. In all four groups (60

Table 2

Percentage of people reporting perceived flavor when tasting (Study 2) and expected flavor when looking at of spun sugar candy (Study 3). Only those flavors reported by 10% or more of subjects are listed.

Perceived flavor when tasting (Study 2)	Expected flavor when looking (Study 3)
Vanilla (29%)	Mint (38%)
Butterscotch (14%)	Vanilla (15%)
	Coconut (15%)

subjects total) only four of the subjects responded with flavors that were clearly associated with the color of the wrapper. All were for candies wrapped in the orange paper. Two people indicated that the candy had an orange flavor, one that it had a pumpkin flavor, and one that it had a butterscotch flavor.

All of the other flavors were flavors more commonly associated with the color of the candy itself which was a white to slightly golden-brown color. The most common responses were vanilla (14 responses) and butterscotch (7 responses). See Table 2.

3.3.4 Candy liking

There was no significant difference in liking ratings for the flavor of the candy between the groups of subjects receiving the candies in a red, green, orange, or purple/pink wrapper, $F(3,56) = 0.43$, $p = .71$. The mean liking rating for all candies wrapped in all colored papers was 39.25 (SD = 46.3).

3.3.5 Sweetness intensity

There was no significant difference in sweetness intensity ratings for the candy between the groups of subjects receiving the candies in a red, green, orange, or purple/pink wrapper, $F(3,56) = 1.01$, $p = .39$. The mean sweetness intensity rating for all candies wrapped in all colored papers was 42.7 (SD = 27.3).

3.3.6 Flavor intensity

There was no significant difference in flavor intensity ratings for the candy between the groups of subjects receiving the candies in a red, green, orange, or purple/pink wrapper, $F(3,56) = 0.12$, $p = .95$. The mean flavor intensity rating for all candies wrapped in all colored papers was 45.3 (SD = 29.8).

3.3.7 Appropriateness of paper/candy combination

There was no significant difference in appropriateness ratings for the candy/paper combination between the groups of subjects receiving the candies in a red, green, orange, or purple/pink wrapper, $F(3,56) = 0.68$, $p = .57$. The mean appropriateness rating for all candies wrapped in all colored papers was 1.7 (SD = 0.8).

3.4. Discussion

The paper wrapper had little, if any, effect on the perception of the candy. Although subjects indicated in Study 1 that they expected that candies wrapped in specific colored papers would have flavors associated with those colors (e.g., cherry flavor with a red wrapper), very few subjects reported that they experienced any flavors associated with the wrapper color when they tasted the candy. Instead, they reported flavors that were more typically associated with the white/golden color of the candy such as vanilla or butterscotch. They also indicated that the color of the wrapper was not appropriate for the flavor of the candy. None of the colored wrappers were rated as even "somewhat" appropriate for the flavor of the candy with the mean appropriateness rating being less than 2- "somewhat" appropriate for all colors.

The equal degree of inappropriateness of the color of the wrapper to the candy flavor for all colored wrappers could explain the lack of difference in liking ratings among the candies wrapped in different

colored wrappers. However, it is also possible that the appropriateness of the color of the packaging simply has no influence on the judgment of the product itself. Schifferstein and Howell (2015), for example, found no effect of the appropriateness of the packaging color on buying intentions for perfumes. Instead, subjects' likeliness to buy a perfume was based on the degree to which they liked the perfume's scent. Thus, the color of the packaging of a product seems irrelevant to judgments about the product itself. This certainly appears to be true in the current studies in that most subjects seemed to think of the wrapper color as irrelevant to the flavor of the candy and focused on the color of the candy itself. Focusing on the candy color would also contribute to the failure to see any difference in candy liking among subjects who got candy with different colored wrappers.

The fact that subjects were reporting flavors for the candy that were more congruent with the color of the candy than the color of the paper can explain the fact that the color of the wrapper had no effect on sweetness intensity or flavor intensity of the candy. Although others (Johnson & Clydesdale, 1982; Johnson et al., 1982; Johnson et al., 1983; Lavin & Lawless, 1998) have found that beverages colored red are perceived as sweeter than clear beverages, the red wrappers did not increase the sweetness of the candy. The wrapper color also seemed to have no effect on the flavor intensity of the candy although in previous studies (Zellner & Kautz, 1990; Zellner & Whitten, 1999) the color of beverages did enhance orthonasal odor intensity of the beverage and reduced retronasal odor intensity (Koza et al., 2005) and the color of opaque bottles enhanced the odor intensity of bath soap contained in those bottles (Gatti, Bordegoni & Spence, 2014). However, in our case, unlike in the other studies, the subjects saw both the color of the packaging and the color of the product (i.e., candy), which were not the same. If subjects were paying attention to the candy color rather than the wrapper color, then no effect on sweet or flavor intensity rating would be anticipated since the visual input from the candy itself was always the same. It is also possible that because all of our candies were wrapped that all of the wrapper colors produced equal degrees of odor or sweetness enhancement.

4. Study 3

This study directly examined the flavor expectations caused by viewing the candy alone, rather than with the colored wrappers. We wanted to determine if flavor expectations caused by viewing the candy itself were similar to the experienced flavors that subjects reported when tasting the candies in Study 2. Particularly, were these expectations more similar to the experienced flavor than were the expectations caused by viewing the candy in the wrappers as was done in Study 2? This study was approved by the Montclair State University Institutional Review Board (approval #001322).

4.1. Subjects

Subjects were 26 Montclair State University students (24 females, 2 males, mean age = 19.2 years, SD = 2.3 years) recruited from the Psychology department's subject pool. The subjects did not participate in any other studies reported in this paper.

4.2. Method

Each subject was given a small plastic 0.75 ml soufflé cup (Solo p075) in which was placed one of the spun sugar candies used in Study 2. They were told not to eat the candy but to answer the questions on the sheet of paper based on the candy's appearance. The first question was "Does the color of the candy make you think of a particular flavor?" to which they answered "yes" or "no". If they answered "yes" to that question they were asked what flavor the candy made them think of. The third question asked them what flavor they expected the candy would have.

4.3. Results

Twenty-one of the 26 subjects said that the color of the candy made them think of a particular flavor. Of those subjects, nine reported thinking of mint/peppermint, four of vanilla, four of coconut, two of pineapple, one of lemon, and one of fish. When asked what flavor they would expect the candy would have, all 26 subjects responded. Ten expected mint/peppermint, six vanilla, five coconut, three pineapple, one lemon, and one marshmallow. See Table 2. In all but three of 21 cases did the subjects report that the flavor that the candy made them think of was the one they expected the candy would have.

4.4. Discussion

All of the flavors that subjects reported as coming to mind when looking at the candy or that they expected to experience when tasting it were flavors associated with the color of the candy. However, while the most commonly experienced flavor when subjects tasted the candy in Study 2 was vanilla, the most commonly expected flavor when looking at the candy in this study was mint/peppermint (vanilla was next most common). Nobody in Study 2 reported experiencing a mint flavor. Also, while quite a few subjects reported tasting butterscotch flavor in Study 2, no subjects reported that butterscotch came to mind while looking at the candy or that they would expect the candy to have a butterscotch flavor.

So while the flavors subjects reported tasting in Study 2 and the flavors they expected while looking at the candy in Study 3 were all flavors associated with white/light golden candies, they differed slightly. Most likely the difference is due to the subjects attempting to integrate what they were seeing and "tasting" in Study 2, whereas in Study 3 they did not have to integrate what they were experiencing via their chemical senses. So, for example, although many people expected the candy to have a mint/peppermint flavor while looking at it, when they tasted the candy it was probably immediately apparent that it was not mint/peppermint, which is a rather strong flavor, often with a trigeminal component. They then would have thought of another "white/light golden" flavor which was mild enough to be possible, and many came up with vanilla, which is a flavor that is generally less assertive than mint.

5. General discussion

Viewing the colored papers resulted in flavor expectations (Study 1) that were consistent with flavors associated with the color of the paper viewed but were context-dependent. When subjects were told that the papers were candy wrappers the flavors they reported expecting were different from the flavor they reported expecting when they were told that the papers were wrappers for beverage containers. So flavor expectations were based on multiple factors including color. However, when subjects actually tasted a white/light golden-colored candy wrapped in one of the four colored papers the flavors the subjects reported tasting were not the same as those expected looking at the wrappers. Instead, the flavors they reported experiencing were flavors that were more consistent with the color of the candy.

These studies suggest that while the color of product packaging does impact our expectations of the flavor of the food with that packaging, it appears to have less impact on the flavor experienced than does the color of the food itself when the food color produces competing flavor expectations. There are some findings indicating that the expectations produced by the color of packaging are stronger than the perceptions of the food after it is tasted (Tijssen et al., 2017). In Tijssen et al. (2017) as well as the present study, where the flavor expectations produced by the color of the product (a white color in both cases, L. Zandstra, personal communication, January 31, 2018) differ from the flavor expectations produced by the color of the package, the color of the product itself might exert the stronger effect, overriding the effect of the

color of the package.

It appears that consumers attempt to integrate the various sensory characteristics of the actual product (including color, taste, and odor) into an overall sensory experience that makes sense of those characteristics. However, expectations produced by the packaging, which is not an integral part of the product, can easily be dismissed if information from that source does not agree with the sensory experience of the product.

It might be that the effect of candy packaging color differs from that of many other products. The color of a candy's wrapper might be a less strong predictor of the flavor than is the color of the packaging of another food such as a soft drink or juice. Future research should investigate the strength of the expectations produced by package and product color on overall expectations and flavor perception in other products.

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