Tasting with our eyes: How color can influence the taste of food and drinks.

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INTRODUCTION

The special senses have been described in the past as independently functioning units of the cerebrum. There is an increasing amount of evidence, however, to suggest that there is substantial overlap between sensory pathways, and multiple senses are used in the perception of various stimuli.

The senses of sight and taste offer a good example of this overlap in processing. The term "taste" refers to the physical sensations felt whilst prompting responses from the gustatory receptors of the mouth, while "flavor" is deemed to be the subjective analysis of one's perception of taste (Spence, 2013). Flavor can be impacted by not only genetic differences in the number of taste buds on the tongue, but also by the perception of visual stimuli associated with the food or drink; this perception relies heavily on the strength of the association that an individual has made between a stimulus and a certain outcome (Spence, 2013, Delwiche, 2012). This is because the brain utilizes top-down processing methods to generate predictions on outcomes (Kveraga et al., 2007). The emergent phenomenon also impacts stimuli processing, and occurs when "one's perception as a whole does not necessarily reflect the physical reality of its parts"; that is, because visual input heavily impacts the perception of stimuli, disruptions in vision often lead to misidentifying gustatory stimulations (Spence, 2013).

The aim of this experiment was to study the strength of correlation between the senses of sight and taste in a group of students at Florida Gulf Coast University.

METHODS

Our study used 107 students enrolled in the lab section of Anatomy and Physiology I at FGCU as the test subjects. Strawberry- and grape-flavored water was used in the experiment, as well as apple juice. Each drink was colored red, blue, orange, or left colorless, yielding 12 different drink samples for subjects to try in both parts of the experiment. First, participants were blindfolded, asked to sample one of the drinks and to tell us what flavor they thought the drink tasted like. This attempted to isolate each subject's sense of taste, and was used as a point of comparison for the second portion of the experiment, which entailed participants removing the blindfold and tasting the same drinks again. The responses were recorded, and the two sets of data were analyzed for trends in mistaken flavors or overall accuracy.

RESULTS

Eyes Open: Overall Results			
	Apple	Strawberry	Grape
No Color	90.60%	34.60%	38.30%
Red	77.60%	60.70%	19.60%
Blue	60.70%	14%	45.80%
Orange	87.80%	29.90%	20.60%

Table 1: Correct answers during the non-blind portion of the experiment

Eyes Closed: Overall Results			
	Apple	Strawberry	Grape
No Color	88.80%	46.70%	35.50%
Red	88.80%	53.30%	35.50%
Blue	88.80%	51.40%	43%
Orange	86%	49.50%	37.40%

Table 2: Correct answers during the blind portion of the experiment

Blue-Colored Apple Sample

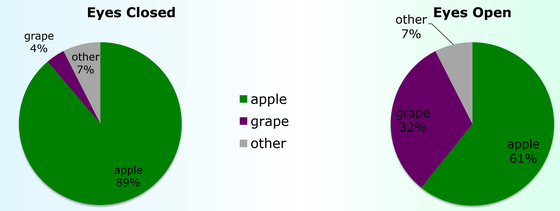

Figure 1: Answers given in both the blind and non-blind portions of the experiment for the apple-flavored, blue-colored drink.

Orange-Colored Strawberry Sample

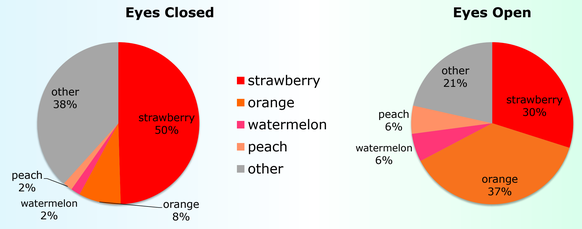

Figure 2: Answers given in both the blind and non-blind portions of the experiment for the strawberry-flavored, orange-colored drink.

Blue-Colored Strawberry Sample

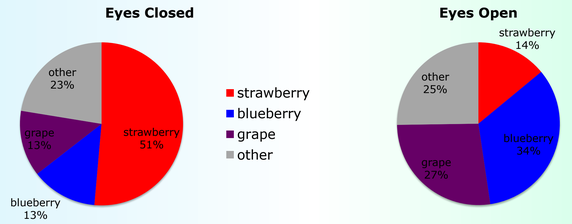

Figure 3: Answers given in both the blind and non-blind portions of the experiment for the strawberry-flavored, blue-colored drink.

Red-Colored Grape Sample

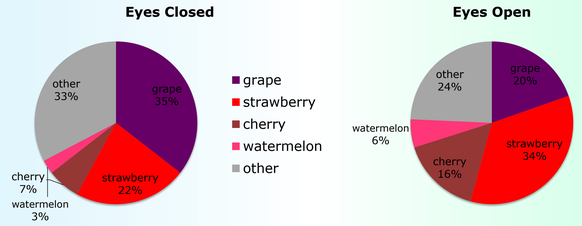

Figure 4: Answers given in both the blind and non-blind portions of the experiment for the grape-flavored, red-colored drink.

DISCUSSION

The closed-eyes portion of this experiment served as a control group, as well as indicated the strength of the samples used, i.e., how discernable the flavors were on their own. Despite the lower rates of recognition in the closed-eye section of the experiment, the rate of correct identification of appropriately colored drinks increased, leading to the notion that, although the flavor was shown to be ambiguous, the presence of a color aided many subjects in identification. For example, we saw an increase from 53.3% correct answers to 60.7% in the identification of red-colored strawberry drinks between the two tests.

During the open-eyes portion of the experiment, there were a few color-flavor combinations that seemed to fool test subjects more frequently. For example, while attempting to identify the flavor of the blue-colored apple sample, we saw a 28% increase in participants reporting a grape flavor from the blind trials. Similarly, for the orange-colored strawberry drink, the correct number of answers dropped from 50% to 30%, and the percentage of people who misidentified the drink as having an orange taste rose by 29%. Additionally, the red-grape sample saw a 15% decrease in correct answers, with a rise in strawberry/cherry answers of 21%.

One of the most striking occurrences appeared in the case of the blue-strawberry sample. In the blind trials, 51% of subjects correctly identified this drink. However, this figure dropped to 14% in the non-blind portion of the study, while grape and blueberry flavors accounted for 61% of the responses given.

Though the study yielded interesting data, some problems in the experimental design may have impacted the results. Firstly, using real fruit juice would yield more reliable flavors than artificial ones, which often rely on marketing and labeling to achieve their flavors for real consumers. The apple flavored drink seemed to be the most obvious of the flavors used, while the grape juice was most commonly misidentified in the control test. The apple-flavored sample was pure apple juice, while both the strawberry and grape samples were flavored waters. This artificial flavoring appeared to make discerning their flavors more difficult for subjects, and therefore may have impacted the quality of the control group. Because both the grape and strawberry flavors were hard for subjects to recognize without seeing color, natural fruit juices should be used in further experiments in hopes of receiving figures similar to those of the apple-flavored samples. Furthermore, the sense of smell of the participants was not taken into consideration while testing, which may have skewed results. This is especially true for the apple-flavored samples, as the real fruit juice had a much stronger smell than the other flavors used in the testing. In future experimentation, subjects should have their sense of smell cut off or blocked via nose plugs for both portions of the experiment to solely isolate taste and vision.

CONCLUSION

There is an increasing amount of evidence to support the claim that, contrary to previous beliefs, there is significant overlap between the senses of the brain in the perception of a stimulus. In this experiment, the correlation between sight and taste was tested using 107 college students as subjects and colored, flavored drinks as samples. The blind test showed that the samples used were not always clearly identifiable to participants, and for future experimentation, all natural fruit juices should be used instead of artificial flavoring. For the non-blind portion of the experiment, some flavor-color matches proved more difficult for subjects to identify than others. However, the sense of smell was not isolated from the tests, and this could have impacted the collected data. This problem could be fixed in future trials by having subjects plug their noses so that taste and vision are truly isolated.