

# The Effect of Mood on Visual Gaze Patterns on Healthy and Unhealthy foods

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## ABSTRACT

One's mood deviates from day to day, and different stressors can cause one to have a positive or negative mood. While one's mood can help determine various decisions in one's life, it also can determine which foods are more interesting to eat. Using eye-tracking techniques and methodology, we explore what type of foods people tend to fixate on and compare that to a positive or negative mood.

## KEYWORDS

Eye tracking, visual attention, mood, packaging, food, PANAS

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## 1 INTRODUCTION

When shopping for groceries, there's always one aisle that garners the customer's attention the most: the snack aisle. Whether one goes down that aisle and grabs a snack item can depend on a lot of different factors: budget, dieting restrictions, food allergies, doctor recommendations, and even fitness or weight loss goals of the customer. Not to mention, some snacks are healthier than others, such as fruit cups, especially compared to what is commonly referred to as "junk food" (i.e. potato chips, cookies, and candy). The questions proposed by the study are: how much does a customer's mood affect their choice when shopping? And is there a correlation between mood and what a customer focuses their eye gaze on, especially when given the choice between healthy or unhealthy food options? The proposed hypothesis in this study is that users with lower mood levels will choose unhealthier food options, and users with higher mood levels will choose healthier food options.

## 2 BACKGROUND

A study conducted researching the effect of mood on participants' food choice found that those with a lower mood tended to gravitate more towards unhealthier food options, while those correlated with

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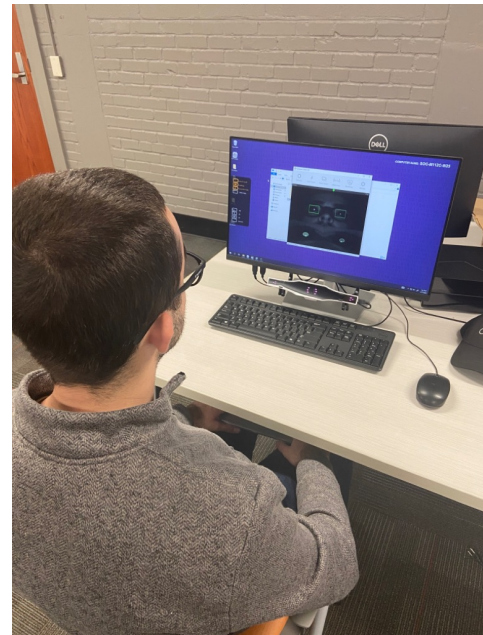


Figure 1: Subject sitting in-front of computer with the Gaze-point Control running.

a higher mood were bound to choose healthier food options Gardner et al. [2014]. Visual attention is an important area of research which Schupp et al. [2007] found that emotion was tied to visual attention. This was suggested to be linked to survival, reproduction, and procreation Schupp et al. [2007]. Bartkiene et al. [2019] found that during stressful periods, people tend to have unhealthier food choice habits and suggest that mood has a direct link to the choice of foods that people are inclined to eat. In order to find out if visual attention is a good enough measure for cognitive preference, Evans et al. [2011] found that visual attention is a process which requires multiple parts of the brain for a process of selection. Other previous research also suggest that mood can elicit a response that focuses more on a rewarding stimuli Tamir and Robinson [2007]. These connections between emotion and visual attention provide a solid foundation for which to build upon.

## 3 EMPIRICAL VALIDATION

We conducted experiments to evaluate the effectiveness of packaging on swaying the user to choose healthy or unhealthy food options, as stated in our hypothesis.



Figure 2: Experimental design screen from Figure 2.

### 3.1 Experimental Design

In summary, this experiment will implement a 2 (negative and positive affect) x 3 (healthy and unhealthy food and neutral stimuli) within subjects design with food products that have had their logos and markings removed to reduce bias toward brand. The experimental design has been broken down into three main parts: the participants involved, the experimental procedure, and the apparatus involved in order to conduct the experiment.

### 3.2 Participants

The number of subjects participating in this experiment will be approximately 10-20 people, with an age range of such participants being between 18-30 years old. The participants will not receive any incentive, their identities will remain anonymous, and the researchers guided them through the procedure steps. At the end of the experiment, a determination will be made whether or not the data collection supported the hypothesis.

### 3.3 Procedure

At the beginning of the experiment, the researchers will have the computer setup and ready to go. The test subject user will be instructed to complete a pre-experiment survey before beginning the experiment, containing questions about the user's age and gender demographic, as well as questions regarding the user's current mood using the PANAS technique, and more. The researcher will assign a participant number to the user to keep their identity anonymous.

Once the pre-experiment survey has completed, the user will be walked through the calibration steps with the Gazepoint eye-tracker's "Gazepoint Control" software, seen in Figure 1. The user will be instructed to look directly at the screen, and should be able to see their eyes show up in two separate panels, along with a gauge that moves from left to right as the user moves further or closer towards the eye-tracker respectively. The user will need to ensure that their distance, corresponding to the moving circle on the gauge, is as close to the center as possible. This will allow for an effective and appropriate distance between the user and the eye-tracker for proper experimentation setup and data collection. Note that the user should not look into the eye-tracker, but rather, directly at the computer screen.

Once Gazepoint Control is open and running, the researcher will walk the user through PsychoPy to run the overall experiment. Once the experiment is running, there will be calibration steps that the

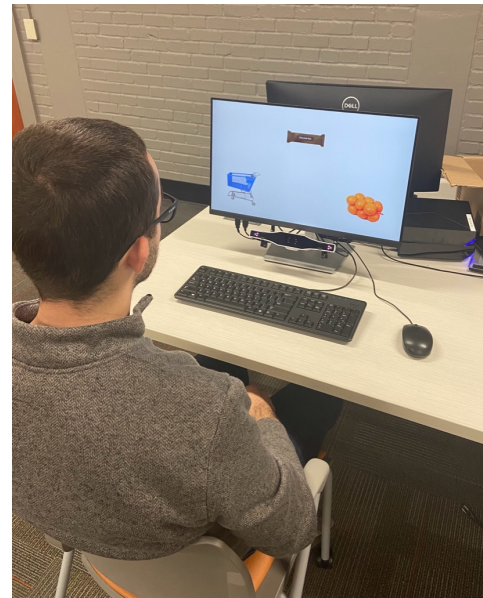


Figure 3: Subject sitting in-front of computer with eye-tracking experiment running.

user completes in order to ensure proper eye-tracking functionality for smooth operation of the experiment. The researcher will ensure that the eye-tracker is calibrated with an average error of less than 50, according to the calibration screen output that the user receives back. After calibration, the user will follow the on-screen instructions to begin the experiment. First, a set of three images - a healthy food option, unhealthy food option, and a random image - will all appear on the screen as shown in Figure 2 and Figure 3. These slides will have a randomized orientation for each experiment and the order of the images will also be randomized. The participant is to look at the items on the screen that are most interesting or appealing to them. There is no right or wrong image to focus one's gaze upon. The program will randomly shift after 10 seconds to the next set of three images, and will keep running until all possibilities of image arrangements have been exhausted.

At the end, there will be text prompting the user that the experiment has ended. Once this step has been reached, the user is to complete a post-experiment survey provided by the researchers, containing questions about their mood and how this influenced their item selection. This will provide data for the researchers to use to determine whether or not the hypothesis was supported.

### 3.4 Apparatus

The experimental design incorporated a Gazepoint GP3 Eyetracker with a 60 Hz sampling rate, installed properly onto a Alienware desktop computer running Microsoft Windows 10 Enterprise with "Gazepoint Control" and "PsychoPy" installed. The monitor used for the computer in this experiment was a Dell monitor with a resolution of 1920 x 1080 pixels, and a diagonal screen size of 60 centimeters (23.62 inches). The computer setup was placed onto a desk as seen in Figure 1 and Figure 3.

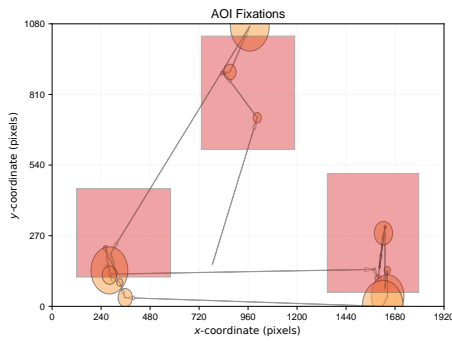


Figure 4: Example of a participant's scan-path for one of the stimuli.

It is also implied that there will be a human user voluntarily participating in the experiment, as well as at least one human researcher guiding the user through any steps of the experiment. Therefore, chairs for both the participant and researcher to sit in during the experiment were used. A Pre-Experiment, PANAS Form, and Post-Experiment survey was handed to the user in paper form, as well as a writing utensil for the participant to select their desired answers to the questions asked. All three of the forms collected the user's three-digit participant number for the researchers to analyze and keep track of their data anonymously. The Pre-Experiment survey simply collected the user's authorization of participation, age range, gender, and asked them if they wear corrective lenses. The PANAS Form is a standardized form used for psychological evaluation across various industries, and allowed the user to rank their moods from either very slightly or not at all, a little, moderately, quite a bit, or extremely. The number of moods on the list was 20. The Post-Experiment survey asked the user which category of foods appealed the most to them (healthy or unhealthy), and which food item from the eight items included in the experimental design slides they would like to eat in that present moment. Finally, the survey asked the user to rank on a scale of one to four how important the following attributes were to packaging in terms of making a purchasing decision in the grocery store: Font Type/Size, Logo/Branding, Photos of Product, Product Visibility, Current Food Cravings, Sustainability, and Nutritional Information.

#### 4 RESULTS

The results from the eye-tracking method of this experiment are inconclusive. The eye-tracking data for fixation duration was not able to be derived completely, and therefore the only results available were from the Pre-Experiment, PANAS form, Post-Experiment surveys, with some eye tracking data able to be qualitatively analyzed. Approximately 94 percent of the users before the experiment scored higher in positive moods than negative moods, with the remaining 6 percent being one participant, participant "011" specifically (see Figure 5). The highest preference category for purchasing deciding factors based on product packaging was current food cravings, followed by product visibility, photos of the product, and logo/branding attributes of packaging (see Figure 6 for reference).

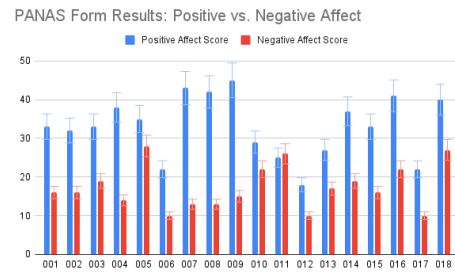


Figure 5: PANAS Form Results: Positive vs. Negative Affect: sum of points for all users' moods from the PANAS method before the experiment started.

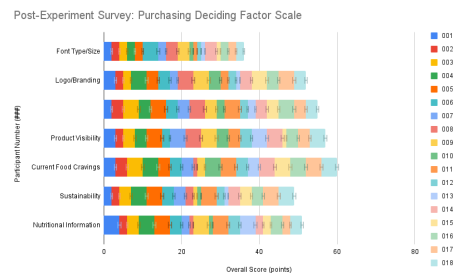


Figure 6: Post-Experiment Survey, Purchasing Deciding Factor Scale: sum of user rankings on scale of 1-4 regarding purchasing deciding factors based on product packaging.

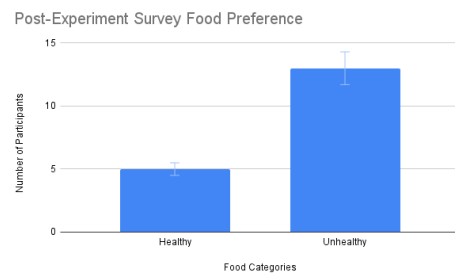


Figure 7: Post-Experiment Survey Food Preference: sum of users who chose unhealthy vs. healthy food choices from a list provided in the Post-Experiment survey.

#### 5 LIMITATIONS & FUTURE WORK

There were some noteworthy limitations in this experiment. Namely the few amount of participants. Future iterations and improvements on this study should include more participants to gain a better and more accurate understanding of the effect of mood on food cravings. The participants in this study were generally of positive affect, which leads to a lack of data for negative affect. Future studies would want to include more individuals of negative affect or design an experiment that introduces stress to include more participants with negative affect. While the PANAS mood assessment was used

to gauge the mood of participants before the experiment started, there was no assessment completed once the experiment ended. A future study could introduce another PANAS form after the experiment is over in order to see if there is any correlation between completing the experiment and changes in mood.

Another variant of this study may consider using a more natural shopping environment to emulate a grocery store, for example, instead of just placing images onto a screen in an effort to place participants into the same mindset for when they go shopping.

The time available to conduct the experiment, analyze results, and write this paper was short and contributed to the lack of extensive quantitative analysis of the eye tracking data. Given more time for debugging and script writing, more analysis of the eye tracking could have been completed.

## 6 DISCUSSION AND CONCLUSION

One's mood can be a factor in whether one chooses to purchase healthy or unhealthy food as suggested by Gardner et al. [2014]. The purpose of this study was to explore if there is a correlation between the general mood of a person and their preference for healthy or unhealthy foods. Eye tracking is a great method to determine

user preference through fixation duration analysis on experimental stimuli. It was intended by the researchers to find user preference based on which category of items (healthy, unhealthy, or neutral) the user fixated upon the longest. Although the results in this study came out to be inconclusive, there is some groundwork that can be built upon to further advance this study, and provide insight to help shoppers be more mindful of their moods and the foods that they eat.

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