CRUNCH! – The Impact of Texture on Food Perception and Preference

With each eating experience, there is an understanding of expected quality and enjoyment. The quality of the food that a person eats can be determined based on four important factors: appearance, flavor, texture, and nutrition. However, cost, convenience, and packaging also have a role. Together, these factors make up the multi-sensory experience of eating (Malcom, 2002). From conception until adulthood, consumers build preferences and identify their favorite foods based on these characteristics (Forestell, 2016). Specifically, in recent years, awareness has increased regarding the importance of texture in preference building (Decker, 2017, Endo, 2016, Kumari, 2015, Ordonez, 2001). Due to raising awareness, the food industry has been challenged with accurately portraying their products to appeal to consumers. The purpose of this research is to see which textures are preferred among consumers as well as how the food industry currently conveys these characteristics.

From the time somebody picks up food – with their hands or a fork – their tactile sense is used to assess the texture qualities of the product. Additionally, the sound and sight of food items provide valuable observations regarding the food quality and contribute to a person’s evaluation of the texture. Importantly, texture cannot be characterized simply from the first bite, but rather from the entire experience including the first bite and after swallowing (Le Reverend, 2016). Mastication, the process of breaking down food into smaller particles by chewing, grinding, or crushing with teeth, prepares food to be swallowed/digested. Depending on not only the physical texture of the products, but also on an individual’s development of productive teeth, lips, cheeks, tongue, etc. impacts how the texture might be perceived (Malcom, 2002).

Starting eight weeks after conception, a person’s taste buds begin to form – picking up on rich flavors through amniotic fluid. While there is a trend for infants to prefer sweet tastes,
preferences are developed biologically and can be altered through early exposure to flavors. If a child is exposed to foods, especially fruit and vegetables, they are more likely to develop likability as their taste buds and senses mature (Forestell, 2016).

Furthermore, in a study determining factors that cause “picky eating” in kids, yogurt was manipulated in three trials looking at changes in taste, color, and texture. In the texture trial, children ages 2.5 – 4 were less likely to accept the yogurt after the texture had become lumpier as well as when the number of fruit chunks decreased. The change in texture affected the consumption most out of the three factors, in fact, children were still willing to consume the product after the taste and color had been changed (Werthmann, 2015). Tactile sensitivity greatly impacted the children’s picky eating, similarly to how the texture of products can impact consumers when making purchasing decisions.

While one “right” food is not expected for all foods, there are certain expectations for specific products (Malcom, 2002). When it comes to frankfurters, researchers are trying to manufacture low-fat products without a change in texture to meet consumer expectations as much as possible. The texture (hardness and juiciness) was found to be dependent on the percent of protein and the fat/protein ratio – in which water was added to replace fat and maintain juiciness. Consumers preferred products that had medium to high levels of juiciness and medium levels of hardness (Ordonez, 2001). Outside of overall food quality and a “pleasant” taste, including texture preferability, consumers often preference their food according to health benefits, vitamins, and environmental impact (Kraus, 2015). The learned impact of texture on consumers’ preferences has opened a window in the food industry to better understand their consumers and their purchasing habits.

By gaining a better understanding of how texture can impact consumers’ perceptions and
preference, this study seeks to increase and identify the opportunities of advertising within the food industry. The first part of the research consists of a survey - intended to reach a mass audience and collect information regarding which food items consumers prefer. Some food items that are compared in this portion are Lays Chips, Chips Ahoy Cookies and Rold Gold Pretzels. The second portion of this research will utilize the same foods, except this time will involve consumers in a focus group. This setting will allow more detail to be observed regarding consumers’ preferences.

This study looks at not only specific food items and their pre-existing expectations, but will also compare different appeals used in advertisements and packaging. This information is crucial for the food industry to learn more about because there may be better ways to market each food item to build stronger consumer preferences based upon the factors that influence their perceptions most. It is predicted that food items with clear descriptions of texture (if the texture is preferred) is more likely to be desired. Where texture is not specified, the crunchier food item will be preferred as it provides a more stimulating sensory experience.

**Literature Review**

**Texture**

As one of the four factors that contribute to overall food quality, texture appeals primarily to the tactile sense – using physical touch to assess. However, sight, sound, and movement are also used to make observations and evaluations of texture characteristics. Texture ranges in importance from critical to minor depending on the food item that is being consumed, but overall it influences the perception of the product throughout the entire process of mastication.
Common words to describe texture include chewy, crispy, smooth, tough, etc. (Appendix B).

With a variety of texture descriptors now available across different cultures, not only has awareness increased passed the subconscious level for many consumers, but a demand for unique eating experiences has also risen. To combat this, the food industry has begun to find new ways to appeal to consumers and win brand loyalty through their products’ texture (Malcom, 2002).

**Mastication**

To digest food properly, food must be broken down into smaller particles. Through mastication, food particles are mixed with saliva, brought to body temperature, and prepared for swallowing. Additionally, as chewing appeals to the various senses, flavors are released and the overall experience is enhanced all while bringing feelings of satisfaction to consumers. When food is broken down into smaller pieces, digestion is simplified and food can more easily pass through the stomach (Malcom, 2002). The quality of the food items itself impacts how it is processed, fluctuating the rate of mastication/chewing as well as overall enjoyment. Specifically, when comparing hard and soft textured foods, mastication varies because the food particles need to be broken down differently (Le Reverend, 2016).

**Perception & Preference**

The way in which individuals view products impacts how they prefer one brand or product over its competitor.

**Perception** – How a person acts is impacted by their perception of the world around them – including advertisements, products, and packaging produced by the food industry. Often, more important than reality, perceptions are the way in which consumers select, organize and interpret
information. Perceptions are dependent on not only the physical stimuli, but also on individual relationships and experiences with the item – leading many consumers to have different perceptions of the same item or brand (Kotler, 1991).

Preference – During the purchasing decision, consumers express preference of one item over the other based on factors such as culture, socioeconomic status, previous exposure to products, marketing stimuli, texture likability, etc. (Appendix A).

Crunch

While the overall eating experience has been afore defined as multi-sensory, the specific texture characteristic of “crunch,” is multi-sensory in itself. In a study looking at texture-modified diets, for the elderly whose ability to chew and/or swallow has decreased, menu items were perceived as having more ingredients as well as being more thoroughly enjoyed, when a corresponding pseudo-chewing sound was heard despite the lack of physical oral sensation (Endo, 2016).

Additionally, the public has shown a preference for crunch in some situations. For example, after Rold Gold Pretzels lost popularity in the late 1980’s, the product’s packaging, nutritional awareness and texture was modified. When the pretzel was re-branded and was marketed crunchier than ever, sales again began to rise (Lawrence, 1991). Because of this multi-sensational experience, it is predicted, that crunch will be the preferred texture throughout the study.
Consumer Behavior

As a consumer becomes aware of a specific need, in the context of this research - the need for a multi-sensory eating experience, a psychological process takes place (Appendix A). This process leads consumers from being triggered by an internal or external stimuli to making a final physical purchase.

When a purchase is made, consumers go through a 5-step buying process - fulfilling their needs and assessing their overall satisfaction. Each consumer experiences this differently as individual characteristics and traits impact the preferences and perceptions that are developed along the way (Kotler, 1991).

Research Questions

RQ1: Which factors most cause consumers to make preferences regarding their food choices?

RQ2: How can the food industry better advertise these factors?

RQ3: How do expectations of food items relate to the products’ packaging as well as its physical taste?
Methods

The multi-sensory experience of eating explores the impact that flavor, appearance, texture, and nutrition have on an individual’s satisfaction with their food (Malcom, 2002). This research looks specifically at the impact texture has on a person’s preference between two similar food items that have differing texture properties. Additionally, after gaining an understanding of which products are preferred, the focus group will gain insights on how consumers perceive the texture to be conveyed through advertisements and product packaging.

Participants

Survey.

In this study, a survey was distributed among as many individuals as possible. From poster advertisements at Carthage, to social media blasts, word of mouth, and The Bridge (Carthage’s Student News Site), individuals 18 and over, both male and female and of all demographics, voluntarily participated in the survey to learn more about their own food preferences. Demographic data was collected after the completion of the main survey questions - due solely to provide more detailed information – the survey responses remained anonymous.

Focus Group.

Similarly, participants of the focus group were 18 and over, male or female, a Carthage community member and any demographic. However, there was an additional restriction to reduce risk in which participants should not have any known food allergies. The first 6-10 individuals that expressed interest in participating were selected, given they matched the provided criteria. Individuals with food allergies were directed to participate in the survey only to maximize the research potential. While there were no risks to participating in the focus group
or the survey, assuming participants did not have food allergies, participants were able to end the research at any point for any given reason. Audio and visual recordings were taken solely for further analysis, and everyone was notified and provided consent before agreeing to participate.

Materials

Survey.

The survey for this research was conducted electronically, and included debriefing, providing consent, the survey questions themselves and demographic questions.

Focus Group.

Audio and visual recordings were conducted throughout the focus group, and a signed consent form recognized that the footage was only used for research analysis and that personal information is not included in the final results. The footage has helped gain a better understanding of the group dynamic and discussion while also providing additional insights into how texture correlates to the participants’ perception of and preferences over the food that they sampled.

Procedure

Survey.

Participants became aware of the opportunity to participate in the study through the afore-mentioned advertisement techniques. From there, they provided consent, and if applicable proceeded with the survey completion. The variables used in this experiment are types of textures, food packaging/advertisement techniques, and consumer preferences. The participants were asked to make a preference, or indicate no preference, between food items/categories including: Lay’s Chips, Chips Ahoy! Cookies, PBJ Sandwiches, Nature Valley Granola Bars,
Rold Gold Pretzels, Taco Bell Tacos, Reese’s Peanut Butter Cups, Skippy Peanut Butter, and Cocoa Puffs and Cocoa Pebbles.

After indicating their preference for each food item listed above, participants ranked which factors (Anticipated Texture, Appearance/Packaging, Previous Experience, Flavor, and Nutrition) they thought contributed to their preference formation. Optionally, participants were then asked to provide additional comments on how they made their preferences. Lastly, demographic information was asked.

Focus Group.

While collecting results of the survey, a focus group was conducted (see above for participants and materials). The focus group looked specifically at the consumer’s perceptions and preferences before and after consuming the food item, based on their expectations of texture and their overall eating experience. Unlike the survey, the focus group looked solely at Lay’s Chips, Chips Ahoy! Cookies, Nature Valley Granola Bars, Rold Gold Pretzels, and Cocoa Puffs/Cocoa Pebbles.

At the beginning of the focus group, the study was explained, consent forms were completed, and existing questions were answered. Next, a list of popular adjectives to describe texture –collected from a content analysis of existing literature- was passed out to each participant. Then, the first food samples were distributed, and the package they came from was placed on the table in front of participants. First, participants were asked what expectations they have regarding the food items texture, based off their memories of the food item and the packaging. Next, participants were directed to taste the food samples, making note of the observed texture throughout the process. When everyone was done describing the texture, participants were asked which item they preferred/why. Additionally, they were questioned
regarding what they thought about the overall eating experience and how the texture impacted their enjoyment in comparison to the other factors. The basis for this research is to understand how the food industry can better advertise the texture of their products to increase overall brand preferencing.

Reflection

Two years ago, amidst a bag of stale tortilla chips, a couple friends and I debated whether or not crunchy was a flavor. Of course it was, these chips were not as crunchy as they should have been and they tasted completely different – but others argued confidently; crunchy was a texture, not a flavor. The argument continued into the late night, bringing up examples like crunchy and creamy peanut butter, soggy cereal, hard and soft tacos etc. As days, months, and years flew by, the debate was brought up frequently, with different groups of friends, with family members, classmates, co-workers, professors etc. Everybody had a different opinion, was it a taste? A flavor? An onomatopoeia? A texture? Or just “Part of the experience?”

At one point we had imaginary tasting trials. We gave our friend, an adamant believer that crunch was not a taste, an imaginary peanut and asked him to put it in his mouth and describe the taste. The first word he used to describe the taste - “Crunchy.” We were finally getting somewhere in our argument – somebody who refused to believe that crunchy was a taste had willingly described the taste of something as crunchy. What other ground-breaking strides could we make in the name of research?

Initially, what started as friendly debate, turned into something we passionately discussed. My friends and I shared pictures with each other every time we came across a food item in the store or on the menu of a restaurant that pertained to texture, especially crunchy. We drafted a presentation and PowerPoint that we would use, if we came across “non-believers,” and
hypothesized that maybe being able to make preferences based on texture was similar to how some individuals are “tasters” of PTC while others are “non-tasters” due to the taste receptors that are present (GSLC, 2016). Alas, the conversation continued.

I had thought that I had heard it all, but when somebody told me, “Well your jeans have a texture, but you can’t taste those, can you?” I had to draw the line. I thought to myself, “there must be some research regarding the crunchiness of our foods—” that is when I came across a couple articles that set the groundwork for this research. Not only was I exposed to the idea that the variety of textures found in our food cause different oral processing, but also to the fact that yes, eating is a multi-sensory experience, and yes, texture does impact how we perceive our foods (Spence, 2015 & Jourden, 2016).

From there, I noticed that in many studies (Ordonez, 2001, Werthmann, 2015, Decker, 2017, Endo, 2016) the texture of a specific food impacted its likability and acceptance, leading to the idea that texture impacts our perception and preferences. I was excited to have found a possible topic that I was highly interested in, and I was even more excited to be able to bring it to light through research within the Carthage community. Personally, I think this is the kind of learning classes should emphasize. Being able to choose a topic that I was interested in made it easier and more motivating to accomplish deadlines and conduct research. I was genuinely excited to read the articles that I found, and I was even more excited to turn what I read into my thesis. Up until right after Spring Break, everything seemed to be coming along quite nicely.

Despite enthusiasm for the project, there were a few road blocks that prevented the completion of this research project in its entirety. To begin, I set-off establishing my own due dates and expectations for the semester. I set a very hopeful goal of wanting to work on thesis for an hour every day. After last semester’s near nightmare of having to overload on projects and
assignments, I thought this would help me to avoid all-nighters as I got closer to final deadlines. Having never completed a research project before (outside of last semester’s thesis), the process of going through IRB was completely new and I was not sure what to expect. I heard that it took around 2 weeks for proposals to receive feedback, so I allotted time to make deadlines feasible. What I was not expecting was to be declined, with corrections to make, and having to submit hard copies once again with my professor’s and the department head’s signatures. While this should have been possible if I was more aware of this process, the unexpected time that it took ultimately prevented me from being able to complete the planned focus group and survey.

I completely understand why the IRB is in place, but I don’t think the system is perfect. Initially I had thought that maybe there should be different processes depending on the scale and purpose of your research. For example, a student conducting a sleep study to be presented at a conference would have harsher or more precise guidelines than a simple survey used for a communication thesis. However, after I thought about this more, every student researcher really should have the same expectations when it comes down to it. There is no reason why one should be more harshly looked at, when both students are needed to put forward quality, ethical work. This is what brought me to my next idea that students need to be made more aware of the processes and expectations of thesis.

Sure, since I started at Carthage I knew that eventually the day would come – essentially, I would have to find a topic, write the world’s largest research paper, and afterwards present my findings to the student body. That is about all I knew about thesis, and it was an obviously exaggerated and incorrect understanding. What I did not know about writing a thesis is that by the end of it, you become truly passionate about what you have written and learned, that when you present, you hope others are inspired by what you have to share, that when you pick up your
bounded copy from the mailroom, a huge weight is lifted off of your shoulders. I dreaded thesis because not only did I not know much regarding the expectations, but also because I had only heard about how monstrous it could be, instead of hearing about how valuable the experience finishing a semester-long research paper can be. I think that with an increase in awareness regarding the procedures and expectations early on, the process of writing a thesis could become much more manageable.

One way that I think IRB could make writing a thesis within a single semester more doable is by updating the revision process. When I received my revisions, they were as follows:

1. Your proposal indicates that no compensation will be given, but your consent form indicates they will receive a $5 gift card. Please clarify. (Also, if you haven't paid participants in this way in the past, let me know. The College has some guidelines on how to do this.)

2. In different parts of the proposal you cite different methods of recruiting. Please clarify the recruiting techniques you plan to use. Is it possible that you will be testing people who are not part of the Carthage College community?

3. Is videotaping the focus group necessary?*** If so, could you please reconsider how you will store the data? They should remain in your faculty member's office to maintain confidentiality.

4. Can you please clarify the use of Appendix B? Part of it is written about what will be asked of participants and some sentences sound like they are written to the participants (e.g., "you will be asked..."). There should be uniformity in who is being addressed, if you see what I mean.

5. On the consent form (this is a legal document, so it needs to be free of errors):
   i. The first sentence is very long and difficult to parse. Moreover, there a noun-verb agreement issue at the end of the sentence.
   ii. Is it really going to take 2 hours to conduct the focus group? Please reconsider. That is a lot to ask for $5!
   iii. I can't parse the first sentence of the third paragraph.
   iv. The second sentence of the third paragraph should simply indicate that anyone with a food allergy is not eligible to participate.
   v. In the sentence "Do not have known food allergies or have spoken with the student researcher about restrictions", it would be clearer if you included the word "dietary" between "about" and "restrictions."

At this point, my advisor, Kim Kulovitz, and the head of the department, Laura Huaracha, had already signed off on my research proposal, and when the revisions were sent out, they too were made aware of the changes that I needed to make. Because of this, I think that there should be different levels of oversight after the IRB has initially overviewed the proposal. Specifically, what was requested of me did not require any drastic changes to my experiment or methods, but rather were minor technicalities that could be easily clarified and re-established. It seems as if I
could have easily made the corrections and gotten departmental approval within a few days instead of having to wait almost another two weeks until I was notified of approval. If there were different classifications for necessary revisions, I think IRB could include in their e-mail whether the proposal must re-circulate through IRB or if the department could approve of the corrections.

Additionally, I think that it was impractical for IRB to approve my research and expect me to be able to complete an entire focus group and survey along with proper data analysis with almost two weeks until graduation. On top of that, I do not recall ever having to analyze data like this research would have required. I would have had to take time to learn and understand not only how to analyze the data but also how to write about what I had found – things that I was more than willing to do with the previous expectation that I would have had more than two weeks to complete it. I was even looking forward to being able to receive results; it is kind of disappointing to not be able to complete the research.

At the beginning of the semester, when my friends and family asked me what I would be focusing on this semester, I was over ecstatic to see their reactions when I revealed that I would be studying crunch and the impact that texture has on our food preferences and perceptions. I got mixed reviews – some people thought it was hilarious, others were curious, and some even a little confused. I may be bias, but I do think some people were looking forward to participating in anyway that they could, and it is unfortunate that not only will they not have this opportunity but also that we will not receive the answers that we were expecting.

However, despite not completing the full research I had intended, I am still proud of the research and writing that I have completed thus far on the topic. It was interesting and a beneficial experience to have to read and write about a more science-based topic, even though it was just about food. Overall, I am still passionate and curious about this topic, and I may still
consider ways in which I can complete the focus group and survey just to gain the additional experience and insights. Carthage has helped me to develop a certain level of curiosity and drive, and I hope that this leads me to complete fun yet impactful projects in the future.

References


mechanics and eating behavior to small differences in food texture. Physiology & Behavior 165, pp. 136-145.


Appendix A

Consumer Behavior Model in Relation to Food Consumption and Texture Acceptance

**Need Identification**
Consumer feels a need for a “pleasure” experience (Kraus, 2015). Multi-Sensory Stimulation (Spencer, 2015), or Texture Likability (Werthman, 2015).

**Information Search**
Consumer finds available options that could satisfy needs - getting information from advertisements and packaging/labels (Aday, 2014).

**Alternative Assessment**
Determine available options based on beliefs, attitudes and values while forming reasonable judgments (Kotler, 1991).

**Purchase Decision**
Consumer forms preferences and is aware of which textures and quality characteristics create a personal enjoyable eating experience.

**Postpurchase Evaluation**
Was the eating experience enjoyed? How did food quality compare to expectations and perceptions?

**Stimulation**
External and internal stimuli begin moving consumers through purchase-making. Stimuli include marketing, advertising, packaging, and need for high quality.

**Consumer**
Individual motivation, perception, memories, culture, and physioeconomic characteristics impact behavior, decisions and purchasing.

**Buying Decision Process**
The 5-step process magnified above brings consumer from need to purchase while developing preferences.

**Purchase Experience**
The actual purchase is made - considering which product and brand was chosen, when and where it is bought, how many and for how much.

**Appendix A:** When a consumer makes a purchase, a psychological process takes place - starting with stimulation of a need and ending with the physical purchase experience. During this process, buyers form preferences and act on them based on needs and alternatives (Kotler, 1991). Depending on a person’s acceptance and preference of various textures (Forestell, 2016), previous exposures (Werthman, 2015), and their perceptions of available products, different buying habits are observed. (Unless otherwise stated, information is developed from Kotler, 1991).