# UNDERSTANDING THE EFFECT OF SEAL SIZE IN NON-GMO FOOD ADVERTISEMENTS AND MEASURING CONSUMER ATTITUDES TOWARD GMOS

By

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UNDERSTANDING THE EFFECT OF SEAL SIZE IN

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MEASURING CONSUMER ATTITUDES

TOWARD GMOS

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Abstract: Today, genetically modified organisms have an increased presence in the American food supply. GMOs are a topic of controversy, so it is important to know how consumers feel about them. Attitudes toward GMOs have been studied across the globe, but few studies focus on attitudes toward GMOs in the United States. This study consists of two manuscripts: the first manuscript measured attitudes toward GMOs using a semantic differential scale, and the second manuscript measured the effect a certified non-GMO seal has on the way consumers view food advertisements when the size of the seal is manipulated. This study consisted of 100 faculty and staff members from Oklahoma State University. Attitudes toward GMOs were found to be primarily neutral, potentially revealing participants' lack of knowledge of GMOs. The size of the non-GMO seal was found to be significant for time to first fixation and fixation count, but it was not significant for fixation duration.

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# CHAPTER I

## INTRODUCTION

Genetically modified organisms (GMOs) – three words that have sparked controversy in food culture (Costa-Font, Gil, & Traill, 2008). Genetically modified food products play an increasingly prominent role in U.S. agriculture, but many consumers are not sold on the idea of GMOs used in food products (Lusk et al., 2002). Many studies have examined consumer understanding of GMOs, and the result is low; many consumers even recognize and acknowledge they do not have a good understanding of GMOs (Hallman, Hebden, Cuite, Aquino, & Lang, 2004, as cited in Wunderlich & Gatto, 2015). Aleksjeva (as cited by Wunderlich & Gatto, 2015, p. 845) found "Latvian consumers demonstrated limited understanding of genetics and food, with one-half of the respondents believing that 'an ordinary tomato does not contain genes, but a GM tomato does.'"

In his Diffusion of Innovation theory, Rogers (1995) explores the innovation-decision process for new technologies. Consumers of a technology or innovation must first develop some knowledge of the product before beginning to develop attitudes about the product, make a decision and implement the innovation (Rogers, 1995). According to Costa-Font et al. (2008), "it is worthwhile to differentiate between the 'objective knowledge,' which can be defined as the real knowledge people have about GM food, and 'subjective knowledge,' which refers essentially to what consumers think they know about GM food. Subjective knowledge is clearly related to general attitudes and values" (p. 103). A study conducted by House et al. (2004) found participants with a higher subjective knowledge of GM foods were more likely to consume the

GM food products (as cited in Aertsens, Mondelaers, Verbeke, Buysse, & Van Huylenbroeck, 2011). Aertsens et al. (2011) found a similar result with participants' likelihood to consume organic food products.

With the controversy usually surrounding genetically modified foods (Costa-Font et al., 2008), it is important to understand consumer attitudes toward GMOs to help scientists and food manufacturing companies best communicate their products. Wunderlich and Gatto (2015) stress the importance of educating consumers about genetically modified products to help them make the best food purchasing decisions for themselves or their families. This starts with ensuring GMO messaging gets all the way from the scientist to the consumer (Wunderlich & Gatto, 2015).

In addition to measuring attitudes toward GMOs, this research looked at the way consumers view non-GMO food advertisements. Jeong and Lundy (2015) studied the effectiveness of food advertisements featuring non-GMO products and gauged consumer attitudes after viewing the advertisements, but their study did not focus on the non-GMO seal specifically. To date, no eye-tracking research has been found studying certified non-GMO seals. However, Wedel and Pieters (2000) and Rayner, Rotello, Stewart, Keir, and Duffy (2001) studied brand elements in magazine advertisements, which is similar to the non-GMO seal examined in this study. Both studies found the brand elements to be important (Rayner et al., 2001; Wedel & Pieters, 2000).

In this study, we measure both the attitudes of consumers toward GMOs as well as the way they look at certified non-GMO seals in food advertisements. The eye-tracking portion of this study is one of the first of its kind; therefore, much of the prior research supporting this study comes from both general advertising and nutrition label eye-tracking research.

## Statement of the Problem

Of all the attitude research regarding GMOs, little if any research has examined consumers' attitudes using a semantic differential scale. Additionally, eye patterns on food

packaging and nutrition labels have been studied frequently as have eye patterns on magazine advertisements; however, little research looks at food advertising. This study explored consumer attitudes toward GMOs as well as consumers' eye patterns when viewing food advertisements with certified non-GMO seals of different sizes to better understand the relationship of GMO message size on consumers' visual attention behaviors when viewing advertisements.

## Purpose and Objectives

This thesis consists of two research manuscripts. The purpose of the first manuscript was to examine consumers' attitudes toward genetically modified organisms and see if attitudes changed based on selected demographic characteristics. The purpose of the second manuscript was to determine if the size of a certified non-GMO seal impacted the way consumers view food advertisements.

**Objectives for Manuscript I**

1. Determine participants' selected demographic characteristics (sex, race, age, education, prior 4-H or FFA experience, and family members who live on a farm).
2. Determine participants' attitudes toward genetically modified organisms through a semantic differential scale about GMOs.
3. Describe attitudes toward GMOs based on selected demographic characteristics.

**Objectives for Manuscript II**

1. Determine the amount of time it takes participants to look at specific areas of the advertisement with the small non-GMO seal.
2. Determine the amount of time it takes participants to look at specific areas of the advertisement with the large non-GMO seal.
3. Determine the amount of time participants spend looking at specific areas of the advertisement with the small non-GMO seal.

4. Determine the amount of time participants spend looking at specific areas of the advertisement with the large non-GMO seal.
5. Determine the number of times participants look at specific areas of the advertisement with the small non-GMO seal.
6. Determine the number of times participants look at specific areas of the advertisement with the large non-GMO seal.
7. Determine the effect seal size has on time to first fixation, fixation duration, and fixation count.

## Review of Literature

### Attitudes Toward GMOs

Despite popular belief, GMOs are not a new technology. People have selectively bred plants and animals for thousands of years, creating new breeds and lines of plants and animals (Gurau & Ranchhod, 2016). Historically, humans had certain needs to fulfill, whether it be a certain nutrient in the diet or a certain type of dog to assist with hunting and daily life. It took several thousand years for humans to breed dogs and develop plants to be the way they are today. These practices, though many don't realize, were some of the first occurrences of modifying genetics to fit a need (Gurau & Ranchhod, 2016).

The first modern genetically modified products to enter the market made their debut in the early 1990s (Gurau & Ranchhod, 2016). The World Health Organization defines genetically modified foods as "foods derived from organisms whose genetic material (DNA) has been modified in a way that does not occur naturally, e.g. through the introduction of a gene from a different organism" ("Food," 2017, para. 1). This occurs when scientists take a gene from a plant or animal and place it into another plant or animal to achieve a desired outcome, like increased pest resistance or higher yields (Gurau & Ranchhod, 2016).

However, genetically modified foods are only successful if they are accepted by consumers (Bredahl, 1999). Acceptance of genetically modified foods often varies in different countries (Bredahl, 1999). According to Bredahl (1999):

> Consumers' attitudes may be influenced both by beliefs about the production process and by beliefs about the quality of the resulting product and consequences of consuming it, reflecting the fact that genetic modification is sometimes used in food processing without changing the product and without genetically modified material being present in the final product (p. 344).

In Bredahl's (1999) study of consumer acceptance of GMOs across four countries, participants tended to believe genetic modification turned a product like yogurt "into an unwholesome and unnatural product" (p. 350) and consuming the yogurt would be unhealthy and could lead to long-term issues.

Research studying consumer attitudes toward GMOs has been conducted in several parts of the world (Bredahl, 1999; Costa-Font et al., 2008; Lusk et al., 2002; Saher, Lindeman, & Koivisto Hursti, 2006). Many consumers in Europe have negative attitudes toward GMOs, and many view GMOs as unhealthy or wrong (Bredahl, 1999). Trust is also a contributing factor when it comes to consumers' attitudes toward genetically modified foods (Bredahl, 1999; Costa-Font et al., 2008). Many consumers in Europe do not trust the information about GMOs and, therefore, fear long-term effects of consuming a genetically modified product (Bredahl, 1999).

Saher et al. (2006) found consumer attitudes towards GMOs to be predominantly negative. However, Lusk et al. (2002) argued consumers' attitudes might be better if genetically modified products provided some benefit or utility to consumers. The current study aims to assess the attitudes of Oklahoma State University faculty and staff toward GMOs after they view food advertisements containing non-GMO products and certified non-GMO seals.

The current study measures attitudes using the semantic differential scale developed by Charles Osgood in 1957. In his book, Osgood states the primary goal of written and spoken

language is to communicate a meaning (Osgood, Suci, & Tannenbaum, 1957). According to Osgood, "since the affective reactions people make to symbols and events are important determiners of their overt behaviors with respect to these symbols and events, having comparable means of measuring affective meanings assumes some importance in a world that is rapidly shrinking psychologically, socially, and politically" (Osgood, 1964, p. 171). Osgood et al. (1957) said the meaning of words is highly influenced by an individual's experience with it. Affective meanings and reactions have been studied by semanticists such as S.I. Hayakawa (1990) who noted in his book, *Language in Thought and Action*, reactions could be "the result of miseducation, bad training, frightening experiences in childhood, obsolete traditional beliefs, propaganda, and other influences in our lives" (p. 118). He goes on to say "we are at the mercy of ingrained, inappropriate semantic reactions" (p. 118).

**Eye Tracking**

Today, consumers are exposed to dozens of advertisements and marketing efforts of all kinds as they carry out their everyday lives (Wedel & Pieters, 2008). Whether it is a sponsored Facebook post, a magazine advertisement or a sign on the side of the road, consumers are bombarded with advertising messages (Wedel & Pieters, 2008). Wedel and Pieters (2008) refer to this realm of advertising as visual marketing. They define visual marketing as "the strategic utilization by firms of commercial and non-commercial visual signs and symbols to communicate with consumers in order to establish and maintain mutually profitable relationships" (Wedel & Pieters, 2008, p. 1). As highly visual creatures, it is important for advertising companies to pay attention to what consumers see in their advertisements and use this information to achieve high profits (Wedel & Pieters, 2008).

In today's fast-paced society, causing a person to stop and pay attention to the advertisement is difficult (Wedel & Pieters, 2000). What makes a person stop and take a second look? Which elements do consumers see? What is the most effective way to lay out an advertisement design? These questions can be examined closely through eye tracking, a

technology whose popularity is growing quickly in the United States and other countries (Wedel & Pieters, 2008). According to Hooge and Camps (2013), "the goal of visual communication material (e.g. ads, road signs, warnings) is to transfer a message effectively" (p. 1). Eye tracking technology allows researchers to analyze the way people look at different designs to help determine the best layout for good message transfer (Hooge & Camps, 2013).

One of the places where consumers are bombarded with advertisement messaging is in the grocery store (Bialkova & van Trijp, 2011). Much of this advertising comes in the form of food packages and labels. In recent years, consumers are becoming more interested in the food they buy and consume (Jeong & Lundy, 2015). Steenkamp (1990) said "the information contained in the packaging design provides a potentially rich source of knowledge on what the product is and what it can be expected to deliver" (as cited in Bialkova & van Trijp, 2011, p. 592).

Eye-tracking research has been conducted on food packaging, traditional nutrition labels and front-of-package nutrition labels over the years (Bialkova & van Trijp, 2011; Graham, Orquin, & Visschers, 2012; Oliveira et al., 2016). Bialkova and van Trijp (2011) looked at the difference between front-of-package Guideline Daily Amount (GDA) nutrition labeling in Dannon Activia yogurt packages. They compared package features like brand name, GDA label, etc. with consumers' shopping goal of health or preference (Bialkova & van Trijp, 2011). They found consumers' shopping goals or motivation influenced which elements they looked at on the package (Bialkova & van Trijp, 2011).

Oliveira et al. (2016) studied milk labels for both traditional milk and probiotic milk. They defined several areas of interest for the eye-tracking study, including "brand, type of product, manufacturer, best before date, net content, nutritional label, recommendation, and health claim" (Oliveira et al., 2016, p. 163). They found subjects looked at brand information and type of product first, and areas of interest like brand and health claim were viewed more often than other elements (Oliviera et al., 2016).

Though much research has been done on nutrition labels and package design, little if any eye-tracking research has been conducted on food advertisements in magazines, and more specifically, certified non-genetically modified organism (non-GMO) food advertisements. This study aims to bridge the gap between food nutrition label research and advertisement research with an emphasis in foods certified as non-GMO.

**Surface Size**

In this study, size of the non-GMO seal was manipulated to determine if participants demonstrate increased salience effects when controlling for non-GMO message size when viewing advertisements. The word salient is defined as, "standing out conspicuously: prominent; especially: of notable significance" (Salient, 2018). By increasing the size of the non-GMO seal, it becomes more salient to viewers. Pieters, Wedel, and Zhang (2007) noted that an increase in surface size of feature advertisement elements contributes "to the pop-out of an ad" (p. 1822). Orquin, Scholderer, and Jeppersen (as cited in Graham et al., 2012) studied visual salience in nutrition labels and found a notable difference in how quickly viewers fixated on a label when the size was increased.

In their study of magazine advertisements, Pieters and Wedel (2004) stated, "the general belief underlying print advertising tactics is that size matters: larger advertisements attract and retain more attention, and the larger an advertisement's brand, pictorial, and text elements, the more attention they should capture" (p. 36). However, Pieters and Wedel (2004) tested surface size increases in text, brand and pictorial areas of magazine advertisements and found an effect in text size but not in the brand element. The pictorial element drew attention regardless of its size (Pieters & Wedel, 2004).

## Framework

This study is conceptualized around Rogers' Diffusion of Innovations theory and Mehrabian and Russell's Stimulus Organism Response theory.

**Diffusion of Innovations Theory**

The Diffusion of Innovations theory was originally posed by Everett M. Rogers in his 1962 book *Diffusion of Innovations*. In his theory, Rogers defines an innovation as "an idea, practice or object that is perceived as new by an individual or other unit of adoption" (Rogers, 1995, p. 11). Contrary to popular belief, an innovation is not classified as new solely based on the amount of time it has been around; it is about the "perceived newness" of the innovation to the individual or entity (Rogers, 1995, p. 11). Rogers (1995) stated it is often difficult to get individuals or entities to accept a new idea or innovation.

In this study, genetically modified organisms represent the innovation to be adopted. According to Rogers (1995), a new innovation, more specifically a new technology, has both hardware and software components. Rogers (1995) defines hardware to be "the tool that embodies the technology as a material or physical object" (p. 12) and the software as "the information base for the tool" (p. 12).

For an innovation to be adopted and put into use, the individual or entity goes through an innovation-decision process. This process consists of five steps, including knowledge, persuasion, decision, implementation and confirmation (Rogers, 1995, p. 20). This study focuses on the persuasion stage of the innovation-decision process, which Rogers (1995) defines as the stage "when an individual forms a favorable or unfavorable attitude toward the innovation" (p. 20).

**Stimulus-Organism-Response Theory**

The Stimulus-Organism-Response theory was developed by Mehrabian and Russell in 1974. Mehrabian and Russell (as cited in Jang & Namkung, 2009) claim "environmental stimuli (S) lead to an emotional reaction (O) that, in turn, drives consumers' behavioral response (R) based on the stimulus–organism–response (S–O–R) paradigm" (p. 451). The emotional reaction is made up of three areas, including pleasure, arousal, and dominance (Graa & Dani-elKebir, 2011). Pleasure is "a composite of feelings such as happiness, contentment, and satisfaction" (Graa & Dani-elKebir, 2011, p. 56). Arousal is defined as "a measure of how wide awake the

organism is, of how ready it is to act" (Mehrabian & Russell, 1974, p. 287). Graa and Dani-elKebir (2011) define dominance as "a reflection of the extent to which the individual feels in control of or overpowered by his environment" (p. 56).

Buxbaum (2016) stated when people are exposed to a stimulus, they interpret it, and it "influences the emotional state, the motivation to interact and the resulting behavior" (p. 8). In this study, we consider the stimulus to be the non-GMO seal, which is presumed to influence an emotional reaction, which could cause viewers to fixate on the seal or avoid it entirely.

# CHAPTER II

# METHODOLOGY

## Institutional Review Board

Human subjects research is required by Oklahoma State University to go through a review process by the Institutional Review Board. One expedited IRB application was filed for both parts of this study February 14, 2018, and it was approved February 27, 2018. Two modifications were approved March 7, 2018, and March 15, 2018, respectively. Additionally, a request for OSU email addresses was filed February 9, 2018, and it was approved February 13, 2018. This study is identified by AG-18-7. See Appendix A for details.

## Research Design

This study is exploratory in nature. The researcher used a nonprobability convenience sample of OSU faculty and staff to represent a population of food consumers who make food purchasing decisions for themselves and/or their families. The first part of this study used a survey design, and the second part used a two-group exploratory design. No controls were used in either part. Due to the sampling method, results of this study can only be generalized to the participants. This study was analyzed quantitatively.

## Instruments

### Questionnaire – Manuscript I

An online questionnaire was developed for this study using Osgood's semantic differential scale. The semantic differential scale is broken down into three constructs or factors (Osgood, 1964). These three constructs include the evaluative construct, potency construct and

activity construct (Osgood, 1964). This instrument uses the evaluative construct to measure participant attitudes using word pairs modeled after those used in previous literature (Anderson, 2012; Isaac & Michael, 1995; Osgood et al., 1957). Additional word pairs were used to see how participants would respond, but these word pairs did not necessarily fall into the evaluative construct. The evaluative word pairs are reported separately from the additional word pairs. The researcher used Qualtrics to develop the questionnaire for ease of data collection. Participants were asked to rate the concept "Genetically Modified Organisms (GMOs) are…" by selecting a position along the scale for each word pair (see Figure 1).

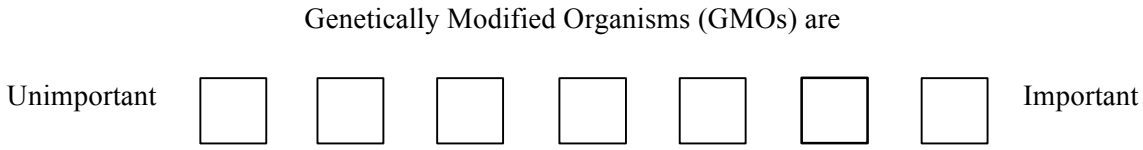



*Figure 1*. Example word pair.

Evaluative word pairs used in the instrument included bad/good, unimportant/important, negative/positive, false/true, unfair/fair, dishonest/honest, and cruel/kind. Additional word pairs included complex/simple, serious/humorous, expensive/cheap, dangerous/safe, conservative/innovative, unhealthy/healthy, unnatural/natural, unnecessary/necessary, low quality/high quality, inconvenient/convenient, unemotional/emotional, unsustainable/sustainable, purposeless/beneficial, confusing/clear, and frightening/cheerful.

In addition to the semantic differential word pairs, a set of demographic questions was included in the questionnaire. The questions were adapted from Anderson's (2012) instrument. These questions included asking participants' sex, race, age, and education as well as their participation in 4-H or FFA and their families' background in agriculture. Participants completed

the questionnaire in person after participating in an eye-tracking data collection exercise used for the second manuscript in this thesis.

**Stimulus Materials – Manuscript II**

A total of four fictional magazine advertisements featuring different kinds of produce were used in each of the two participant groups. Group 1 viewed two tomato advertisements, a strawberry advertisement, and an egg advertisement. The tomato advertisements served as the test advertisements with one containing a small certified non-GMO seal, and the other containing a seal 50% larger. The researcher obtained permission from the Non-GMO Project to use their non-GMO graphic seal (See Appendix F). Group 2 viewed two corn advertisements, a strawberry advertisement, and an egg advertisement. Like Group 1, the two corn advertisements were the test advertisements containing one small and one large certified non-GMO seal. For both groups, the strawberry and egg advertisements served as dummy advertisements. No areas of interest were defined on the dummy advertisements. Thumbnail images of each advertisement are presented in Figure 2.

**Eye Tracking**

The advertisements were displayed on a computer screen at a resolution of 835 pixels by 1080 pixels, which was as close to letter size as the screen would allow. A Tobii T60 eye-tracker was used to measure participants' eye movements on each of the advertisements. Areas of interest (AOIs) were drawn around specific locations in each advertisement, including the headline, subtext, and logo. Additionally, the non-GMO seal was included as an AOI on the tomato and corn advertisements. A full rendering of the AOIs is presented in Figure 3.

## Data Collection

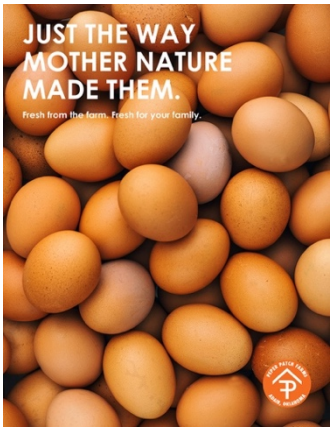
Participants in the study were recruited through a listserv of Oklahoma State University faculty and staff on the OSU-Stillwater campus. The researcher received a sample of email addresses from OSU Research Communications. Faculty and staff were chosen because they


Tomato advertisement with small non-GMO seal


Tomato advertisement with large non-GMO seal


Corn advertisement with small non-GMO seal


Corn advertisement with small non-GMO seal




Dummy advertisement


Dummy advertisement

*Figure 2.* Stimulus Materials.


Tomato advertisement with small non-GMO seal


Tomato advertisement with large non-GMO seal


Corn advertisement with small non-GMO seal


Corn advertisement with large non-GMO seal

*Figure 3.* Areas of Interest.

likely make food buying decisions for themselves or their families. A recruitment email was sent to 4,795 faculty and staff members. A maximum sample size of 100 people was used for this study on a first-come, first-served basis. The researcher made the assumption all participants received the email and were faculty or staff members.

A reminder email was sent through the listserv on the first day of data collection. Volunteer participants were asked to come to the OSU Human Sciences Mixed Reality Lab to participate in the study.

**Part One**

When participants arrived, they signed an informed consent form and were handed a number indicating the order in which they would complete the study for organizational purposes. When possible, participants were taken into the eye-tracking lab two at a time. Participants with odd numbers were asked to sit at Computer 1 and participants with even numbers were asked to sit at Computer 2. The researcher verbally explained the process and gave instructions for the eye-tracking calibration process, which included sitting a comfortable distance from the computer screen and following the red dot on the screen with their eyes without moving their head too much. Once the calibration process concluded, the researcher opened the test for each participant. A set of instructions was the first thing participants viewed on the screen. After reading the instructions, participants said, "begin" when they were ready, and the researcher advanced the screen to the first advertisement. Advertisements were counterbalanced to prevent a learning effect. Advertisements were displayed for four seconds each (Pieters & Wedel, 2007). The timings and transitions in the four-image eye-tracking script were completely automated.

**Part Two**

After completing the eye-tracking portion of the study, participants were compensated $10 each. Each participant signed for their compensation. Participants were then directed to the table outside the lab where they were asked to complete the short online questionnaire on a laptop.

### Threats to Validity

In this study, a possible threat to validity is experimental mortality. One participant was unable to complete the eye-tracking exercise, causing Group 1 to have one less participant than Group 2. Since the study was conducted in an eye-tracking lab, ecological settings could potentially threaten validity since most consumers do not view magazines while sitting in computer labs. However, the study aimed to be as realistic as the setting would allow.

### Participants

A total of 100 participants were included in this study. Participants were faculty and staff members on the OSU-Stillwater campus. For the eye-tracking exercise, participants were placed into two equal groups of 50 people. However, Group 1 only had 49 participants as the eye-tracking software was unable to calibrate one participant's eyes. The participant was compensated for his time and was asked to take the questionnaire.

### Participant Confidentiality

Other than seeing participant email addresses from the creation of the listserv, this study was entirely anonymous. Eye-tracking data was stored on the two password-protected computers in the locked eye-tracking lab. Additionally, questionnaire responses were stored on the online Qualtrics platform within a password-protected account.

## Data Analysis

### Questionnaire Data

Data collected in the questionnaire was analyzed using the Statistical Package for Social Sciences (SPSS) Version 21 for Mac. Data was moved from the Qualtrics platform into SPSS to analyze the frequencies and modal values of each word pair. Fourteen word pairs were reverse coded to prevent participants from marking the same boxes throughout the questionnaire. The reverse coded word pairs had the positive word on the left and the negative word on the right. For analysis, the word pairs were switched to have the negative word on the left and the positive word

on the right. A post-hoc Cronbach's Alpha was calculated on the semantic differential word pairs to test for reliability and resulted in a .89 coefficient.

The researcher used the cross-tabulation function within SPSS to analyze the responses to the semantic differential word pairs in relation to selected demographic information. Mean scores were calculated for each demographic/word pair combination, and a grand mean was calculated for each demographic characteristic for comparison.

**Eye-Tracking Data**

Areas of interest (AOIs) were identified in each test advertisement using the Tobii Studio software. The researcher pulled the eye-tracking data for each AOI using three metrics: time to first fixation, fixation duration and fixation count. Data was arranged in an Excel file and was analyzed for means and standard deviations. Any missing data cells were not counted in the calculations.

Once means and standard deviations had been calculated for each metric and AOI, an independent samples t-test was used to compute statistical significance of the means for each metric for the non-GMO seal. The t-tests were used to compare the tomato advertisement with the small non-GMO seal versus the large seal, and the corn advertisement with the small non-GMO seal versus the large seal. Additionally, a 2x2 mixed ANOVA was conducted to test for main effects and interactions between seal size (small, large) and product (tomato, corn).

# CHAPTER III

## MANUSCRIPT I


### ABSTRACT

Of all the research conducted regarding genetically modified organisms (GMOs), little research has measured consumer attitudes towards GMOs using a semantic differential scale. The goal of this study was to gain an understanding of consumer attitudes toward GMOs using a semantic differential scale and see how attitudes changed based on selected demographic characteristics. A total of 100 people participated in this study, and it was discovered that participant attitudes toward GMOs were relatively neutral. Males tended to be slightly more positive than females, and participants with a master's degree were more positive than participants with other educational levels. Participants between the ages of 20-29 were more positive than other age groups. Participants between the ages of 60-69 were the most negative toward GMOs, suggesting the older generations are not as accepting of GMOs than younger generations. Due to the relative neutrality of participants, it was determined participants may not have an adequate knowledge of GMOs to properly form an attitude toward them.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## Introduction

Genetically modified organisms (GMOs) – three words that have sparked controversy in food culture (Costa-Font et al., 2008). Despite popular belief, GMOs are not a new technology (Gurau & Ranchhod, 2016). People have selectively bred plants and animals for thousands of years, creating new breeds and lines of plants and animals (Gurau & Ranchhod, 2016). Historically, humans had certain needs to fulfill, whether it be a certain nutrient in the diet or a certain type of dog to assist with hunting and daily life. It took several thousand years for humans to breed dogs and develop plants to be the way they are today. These practices, though many don't realize, were some of the first occurrences of modifying genetics to fit a need (Gurau & Ranchhod, 2016).

The first genetically modified products to enter the market made their debut in the early 1990s (Gurau & Ranchhod, 2016). The World Health Organization defines genetically modified foods as "foods derived from organisms whose genetic material (DNA) has been modified in a way that does not occur naturally, e.g. through the introduction of a gene from a different organism" ("Food," 2017, para. 1). This occurs when scientists take a gene from a plant or animal and place it into another plant or animal to achieve a desired outcome, like increased pest resistance or higher yields (Gurau & Ranchhod, 2016).

The need for higher yields comes from the population increase happening around the world (Gerry, 2015). The world is expected to reach 9.7 billion people by the year 2050, just more than 30 years away ("World Population," 2015). This exponential increase will cause a drastic increase in food demand as well as a decrease in available farmland (Food and Agriculture Organization of the United Nations, 2009). Farmers and ranchers will have to produce more food than they ever have on substantially less land (Food and Agriculture Organization of the United Nations, 2009). GMO technology allows producers to further increase their yields, often with fewer inputs ("Frequently Asked," 2014).

Genetically modified foods, however, are only successful if they are accepted by consumers (Bredahl, 1999). Acceptance of genetically modified foods often varies in different countries (Bredahl, 1999). According to Bredahl (1999):

> Consumers' attitudes may be influenced both by beliefs about the production process and by beliefs about the quality of the resulting product and consequences of consuming it, reflecting the fact that genetic modification is sometimes used in food processing without changing the product and without genetically modified material being present in the final product (p. 344).

In Bredahl's (1999) study of consumer acceptance of GMOs across four countries, participants tended to believe genetic modification turned a product like yogurt "into an unwholesome and unnatural product" and consuming the yogurt would be unhealthy and could lead to long-term issues (p. 350).

Research studying consumer attitudes toward GMOs has been conducted in several parts of the world (Bredahl, 1999; Costa-Font et al., 2008; Lusk et al., 2002; Saher et al., 2006). Saher et al. (2006) found consumer attitudes towards GMOs to be predominantly negative. However, Lusk et al. (2002) argued consumers' attitudes might be better if genetically modified products provided some benefit or utility to consumers. This study aims to assess the attitudes of Oklahoma State University faculty and staff toward GMOs after they view food advertisements containing non-GMO products and certified non-GMO seals.

This study measures attitudes using the semantic differential scale developed by Charles Osgood in 1957. In his book, Osgood stated the primary goal of written and spoken language is to communicate a meaning (Osgood et al., 1957). Osgood et al. (1957) stated the meaning of words is highly influenced by an individual's experience with it. According to Osgood, "since the affective reactions people make to symbols and events are important determiners of their overt behaviors with respect to these symbols and events, having comparable means of measuring affective meanings assumes some importance in a world that is rapidly shrinking psychologically,

socially, and politically" (Osgood, 1964, p. 171). In the case of this study, the meaning of genetically modified organism could vary among participants, based on the individuals.

## Problem Statement

Of all the attitude research conducted regarding GMOs, little, if any, research has examined consumers' attitudes using a semantic differential scale. This study aims to add to the existing knowledge using a method not currently found in the GMO literature base.

## Purpose Statement

The purpose of this study was to examine consumers' attitudes toward genetically modified organisms and see if attitudes varied based on selected demographic characteristics.

## Research Objectives

1. Determine participants' selected demographic characteristics (sex, race, age, education, prior 4-H or FFA experience and family members who live on a farm).
2. Determine participants' attitudes toward genetically modified organisms through a semantic differential scale about GMOs.
3. Describe attitudes toward GMOs based on selected demographic characteristics.

## Theoretical Framework

This study is conceptualized around the Diffusion of Innovations theory originally posed by Everett M. Rogers in his 1962 book "Diffusion of Innovations." In his diffusion theory, Rogers defines an innovation as "an idea, practice or object that is perceived as new by an individual or other unit of adoption" (Rogers, 1995, p. 11). Contrary to popular belief, an innovation is not classified as new solely based on the amount of time it has been around; it is about the "perceived newness" of the innovation to the individual or entity (Rogers, 1995, p. 11). Rogers (1995) stated it's often difficult to get individuals or entities to accept a new idea or innovation.

In this study, genetically modified organisms represent the innovation to be adopted. According to Rogers (1995), a new innovation, more specifically a new technology, has both

hardware and software components. Rogers (1995) defines hardware to be "the tool that embodies the technology as a material or physical object" (p. 12) and the software as "the information base for the tool" (p. 12).

For an innovation to be adopted and put into use, the individual or entity goes through an innovation-decision process. This process consists of five steps, including knowledge, persuasion, decision, implementation and confirmation (Rogers, 1995). This study focuses on the persuasion stage of the innovation-decision process, which Rogers (1995) defines as the stage "when an individual forms a favorable or unfavorable attitude toward the innovation" (p. 20).

## Methodology

### Participants

Participants in the study were recruited through a listserv of Oklahoma State University faculty and staff on the OSU-Stillwater campus. The researcher received a sample of email addresses from OSU Research Communications. Faculty and staff were chosen because they likely make food buying decisions for themselves or their families. A recruitment email was sent to 4,795 faculty and staff members. A maximum sample size of 100 people was used for this study on a first-come, first-served basis. The researcher made the assumption that all participants received the email and were faculty or staff members.

### Questionnaire

An online questionnaire was developed for this study using Osgood's semantic differential scale. The semantic differential scale is broken down into three constructs or factors (Osgood, 1964). These three constructs include the evaluative construct, potency construct and activity construct (Osgood, 1964). This instrument uses the evaluative construct to measure participant attitudes using word pairs modeled after those used in previous literature (Anderson, 2012; Isaac & Michael, 1995; Osgood et al., 1957). Additional word pairs were used to see how participants would respond, but these word pairs did not necessarily fall into the evaluative construct. The evaluative word pairs are reported separately from the additional word pairs. The

researcher used Qualtrics to develop the questionnaire for ease of data collection. Participants were asked to rate the concept "Genetically Modified Organisms (GMOs) are…" by selecting a position along the scale for each word pair (see Figure 4).

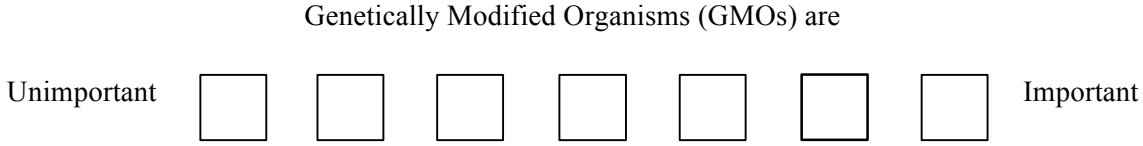



*Figure 4*. Example word pair.

Word pairs used in the instrument included bad/good, unimportant/important, negative/positive, false/true, unfair/fair, dishonest/honest, and cruel/kind. Additional word pairs included complex/simple, serious/humorous, expensive/cheap, dangerous/safe, conservative/innovative, unhealthy/healthy, unnatural/natural, unnecessary/necessary, low quality/high quality, inconvenient/convenient, unemotional/emotional, unsustainable/sustainable, purposeless/beneficial, confusing/clear, and frightening/cheerful.

In addition to the semantic differential word pairs, a set of demographic questions was included in the instrument. The questions were adapted from Anderson's (2012) instrument. These questions included asking participants' sex, race, age, and education as well as their participation in 4-H or FFA, and their families' background in agriculture. Participants completed the instrument in person after participating in an eye-tracking data collection exercise used for the second manuscript in this thesis.

**Procedure**

Participants were asked to complete the questionnaire on a laptop following the eye-tracking exercise. The questionnaire was pre-loaded into the laptop's internet browser.

Participants selected their attitudes toward GMOs using the semantic differential word pairs then completed demographic questions.

To mark their sex, participants could choose male or female. Participants were asked to self-identify their race and age in designated text boxes. For level of education completed, participants chose from high school diploma, associate's degree, bachelor's degree, master's degree or doctoral degree. Participants indicated their participation in 4-H and FFA by marking yes or no for each organization. If participants marked "yes," they were asked to enter the number of years they participated in the organization(s). To indicate their previous agricultural experience, participants could mark "I was raised on a farm," "I have worked on a farm," "I have visited a farm," "I raised livestock," and "I was/am enrolled in a college-level agriculture class." Participants were asked to check all that applied to them. For home residency, participants chose from one of the following: farm, rural area, city/town, suburb, urban area. Finally, participants were asked how their immediate family was involved in agriculture by marking any of the following: "not involved in agriculture," "agricultural government agency employee," "agricultural laborer," "agricultural processing," "livestock production," "crop production" or "other."

Responses to the questionnaire were stored on a password-protected online Qualtrics account. The questionnaire was completely anonymous. No identifiable personal information was collected. The responses were imported into the Statistical Package for Social Sciences (SPSS) for further analysis.

**Data Analysis**

Data was moved from the Qualtrics platform into SPSS to analyze the frequencies and modal values of each word pair. Fourteen word pairs were reverse coded to prevent participants from marking the same boxes throughout the questionnaire. The reverse coded word pairs had the positive word on the left and the negative word on the right. For analysis, the word pairs were switched to have the negative word on the left and the positive word on the right. A post-hoc

Cronbach's Alpha was calculated on the semantic differential word pairs to test for reliability, and resulted in a .89 coefficient.

The researcher used the cross-tabulation function within SPSS to analyze the responses to the semantic differential word pairs in relation to selected demographic information. Mean scores were calculated for each demographic/word pair combination, and a grand mean was calculated for each demographic characteristic for comparison.

## Results

### Findings Related to Objective 1

Of the 100 participants in the questionnaire, 62% were female ($f = 62$). Participants ranged in age with the youngest being 21 years old and the oldest being 73 years old. More than half (53%, $f = 53$) of the participants were between the ages of 21 and 39. One participant chose not to mark his or her age. Full age results are shown in Table 1.

Table 1

*Participant Ages*

| Age Group | *f* | *%* |
|---|---|---|
| 20-29 | 25 | 25% |
| 30-39 | 27 | 27% |
| 40-49 | 17 | 17% |
| 50-59 | 18 | 18% |
| 60-69 | 11 | 11% |
| 70-79 | 1 | 1% |
| No Response | 1 | 1% |

Participants were asked to self-identify their race. Responses then were categorized into the five races recognized by the U.S. Census, which can be found in Table 2 ("Race and Ethnicity," 2017). Seventy-four participants (74%) were white, 11 participants (11%) were Asian, three participants (3%) were Black or African American, and one participant (1%) was American

Indian or Alaska Native. Seven participants (7%) identified as multiple races or another race not falling within the five categories. Four participants (4%) chose not to record their race.

Table 2

*Participant Races*

| U.S.-Census-Identified Race | *f* | % |
|---|---|---|
| White | 74 | 74% |
| Black or African American | 3 | 3% |
| Asian | 11 | 11% |
| American Indian or Alaska Native | 1 | 1% |
| Native Hawaiian or Other Pacific Islander | 0 | 0% |
| Other | 7 | 7% |
| Did Not Respond | 4 | 4% |

A total of 41% (*f* = 41) of participants have completed a master's degree as their highest level of education, and 32% (*f* = 32) have completed a bachelor's degree. Fifteen (15%) participants indicated they had completed a doctoral degree.

Participation in 4-H and FFA was 17% (*f* = 17) and 9% (*f* = 9), respectively. Of those who participated in 4-H, participation time ranged from one year (*f* = 2) to 16 years (*f* = 1). A total of eight participants were involved in 4-H for five or more years. Participation in FFA ranged from two years (*f* = 2) to five years (*f* = 1).

Of the 100 participants who submitted the questionnaire, 18 (18%) marked they were raised on a farm, 29 (29%) marked they had worked on a farm, and 72 (72%) marked they had visited a farm. Fifteen (15%) participants raised livestock, and 13 (13%) participants enrolled in a college-level agriculture class. Results are presented in Table 3.

Sixty-one (61%) participants marked city/town for their home residency. Twenty-one (21%) marked rural area, 12 (12%) marked suburb, five (5%) marked farm, and one (1%) marked urban area. When asked about their families' involvement in agriculture, 63% (*f* = 63) were not involved in agriculture, 10% (*f* = 10) had family members who were agricultural government

agency employees, 12% (*f* = 12) had family members who were agricultural laborers, and 6% (*f* = 6) had family members who were in agricultural processing. A total of 15% (*f* = 15) of

Table 3

*Agricultural Experiences*

| Experience | *f* | % | No Response | % |
|---|---|---|---|---|
| I was raised on a farm. | 18 | 18% | 82 | 82% |
| I have worked on a farm. | 29 | 29% | 71 | 71% |
| I have visited a farm. | 72 | 72% | 28 | 28% |
| I raised livestock. | 15 | 15% | 85 | 85% |
| I was/am enrolled in a college-level agriculture class. | 13 | 13% | 87 | 87% |

participants had family members involved in livestock production, and 13% (*f* = 13) had family members involved in crop production. Five (5%) participants marked "other."

**Findings Related to Objective 2**

A total of 22 semantic differential word pairs were included in the questionnaire administered to participants. All 100 participants responded to each word pair. Of the 22 word pairs, 13 produced a mode of four, or the neutral position. Two word pairs (unimportant/important and conservative/innovative) had a mode of six. One word pair (unnatural/natural) had a mode of one. Full results are presented in Tables 4 and 5.

**Evaluative word pairs.** For the bad/good word pair, 37% of participants marked a space to the left of the neutral spot, which is closer to the word bad. Forty-two percent of participants marked a space to the right of the neutral spot, which is closer to the word good.

For the unimportant/important word pair, nine percent of participants marked a space to the left of the neutral spot, which is closer to the word unimportant. Seventy-four percent of participants marked a space to the right of the neutral spot, which is closer to the word important.

For the negative/positive word pair, 39% of participants marked a space to the left of the neutral spot, which is closer to the word negative. Forty-three percent of participants marked a space to the left of the neutral spot, which is closer to the word positive.

For the false/true word pair, 22% of participants marked a space to the left of the neutral spot, which is closer to the word false. Fifty-one percent of participants marked a space to the right of the neutral spot, which is closer to the word true.

For the unfair/fair word pair, 23% of participants marked a space to the left of the neutral spot, which is closer to the word unfair. Thirty-six percent of participants marked a space to the right of the neutral spot, which is closer to the word fair.

For the dishonest/honest word pair, 31% of participants marked a space to the left of the neutral spot, which is closer to the word dishonest. Thirty-four percent of participants marked a space to the right of the neutral spot, which is closer to the word honest.

For the cruel/kind word pair, 24% of participants marked a space to the left of the neutral spot, which is closer to the word cruel. Thirty-two percent of participants marked a space to the right of the neutral spot, which is closer to the word kind.

**Additional word pairs.** For the complex/simple word pair, 77% of participants marked a space to the left of the neutral spot, which is closer to the word complex. Twelve percent of participants marked a space to the right of the neutral spot, which is closer to the word simple.

For the serious/humorous word pair, 69% of participants marked a space to the left of the neutral spot, which is closer to the word serious. Six percent of participants marked a space to the right of the neutral spot, which is closer to the word humorous.

For the expensive/cheap word pair, 39% of participants marked a space to the left of the neutral spot, which is closer to the word expensive. Thirty-one percent of participants marked a

Table 4

*Semantic Differential Scales – Evaluative Word Pairs*

| Negative Item | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | Positive Item |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | |
| Bad | 18 | 18% | 10 | 10% | 9 | 9% | **21** | **21%** | 9 | 9% | 13 | 13% | 20 | 20% | Good |
| Unimportant | 2 | 2% | 2 | 2% | 5 | 5% | 17 | 17% | 20 | 20% | **34** | **34%** | 20 | 20% | Important |
| Negative | 16 | 16% | 7 | 7% | 16 | 16% | **18** | **18%** | 15 | 15% | 17 | 17% | 11 | 11% | Positive |
| False | 5 | 5% | 7 | 7% | 10 | 10% | **27** | **27%** | 16 | 16% | 21 | 21% | 14 | 14% | True |
| Unfair | 8 | 8% | 6 | 6% | 9 | 9% | **41** | **41%** | 11 | 11% | 15 | 15% | 10 | 10% | Fair |
| Dishonest | 11 | 11% | 12 | 12% | 8 | 8% | **35** | **35%** | 9 | 9% | 18 | 18% | 7 | 7% | Honest |
| Cruel | 6 | 6% | 5 | 5% | 13 | 13% | **44** | **44%** | 15 | 15% | 11 | 11% | 6 | 6% | Kind |

*Note*. Modal responses are bolded.

Table 5

*Semantic Differential Scales – Additional Word Pairs*

| Negative Item | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | Positive Item |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | |
| Complex | 14 | 14% | 26 | 26% | **37** | **37%** | 11 | 11% | 4 | 4% | 3 | 3% | 5 | 5% | Simple |
| Serious | 21 | 21% | 22 | 22% | **26** | **26%** | 25 | 25% | 3 | 3% | 1 | 1% | 2 | 2% | Humorous |
| Expensive | 9 | 9% | 14 | 14% | 16 | 16% | **30** | **30%** | 15 | 15% | 12 | 12% | 4 | 4% | Cheap |
| Dangerous | 12 | 12% | 13 | 13% | 17 | 17% | **23** | **23%** | 10 | 10% | 12 | 12% | 13 | 13% | Safe |
| Conservative | 2 | 2% | 3 | 3% | 9 | 9% | 21 | 21% | 21 | 21% | **28** | **28%** | 16 | 16% | Innovative |
| Unhealthy | 14 | 14% | 17 | 17% | 14 | 14% | **22** | **22%** | 10 | 10% | 12 | 12% | 11 | 11% | Healthy |
| Unnatural | **28** | **28%** | 15 | 15% | 17 | 17% | 17 | 17% | 8 | 8% | 9 | 9% | 6 | 6% | Natural |
| Unnecessary | 9 | 9% | 13 | 13% | 10 | 10% | 18 | 18% | **21** | **21%** | 17 | 17% | 12 | 12% | Necessary |
| Low Quality | 8 | 8% | 9 | 9% | 12 | 12% | **27** | **27%** | 24 | 24% | 8 | 8% | 12 | 12% | High Quality |
| Inconvenient | 5 | 5% | 5 | 5% | 7 | 7% | **27** | **27%** | 26 | 26% | 20 | 20% | 10 | 10% | Convenient |
| Unemotional | 6 | 6% | 5 | 5% | 8 | 8% | **44** | **44%** | 16 | 16% | 13 | 13% | 8 | 8% | Emotional |
| Unsustainable | 7 | 7% | 7 | 7% | 9 | 9% | 19 | 19% | **26** | **26%** | 14 | 14% | 18 | 18% | Sustainable |
| Purposeless | 8 | 8% | 5 | 5% | 9 | 9% | 20 | 20% | **24** | **24%** | 19 | 19% | 15 | 15% | Beneficial |
| Confusing | 15 | 15% | 14 | 14% | **24** | **24%** | 18 | 18% | 10 | 10% | 9 | 9% | 10 | 10% | Clear |
| Frightening | 7 | 7% | 16 | 16% | 17 | 17% | **38** | **38%** | 9 | 9% | 8 | 8% | 5 | 5% | Cheerful |

*Note*. Modal responses are bolded.

space to the right of the neutral spot, which is closer to the word cheap.

For the dangerous/safe word pair, 42% of participants marked a space to the left of the neutral spot, which is closer to the word dangerous. Thirty-five percent of participants marked a space to the right of the neutral spot, which is closer to the word safe.

For the conservative/innovative word pair, 14% of participants marked a space to the left of the neutral spot, which is closer to the word conservative. Sixty-five percent of participants marked a space to the right of the neutral spot, which is closer to the word innovative.

For the unhealthy/healthy word pair, 45% of participants marked a space to the left of the neutral spot, which is closer to the word unhealthy. Thirty-three percent of participants marked a space to the right of the neutral spot, which is closer to the word healthy.

For the unnatural/natural word pair, 60% of participants marked a space to the left of the neutral spot, which is closer to the word unnatural. Twenty-three percent of participants marked a space to the right of the neutral spot, which is closer to the word natural.

For the unnecessary/necessary word pair, 32% of participants marked a space to the left of the neutral spot, which is closer to the word unnecessary. Fifty percent of participants marked a space to the right of the neutral spot, which is closer to the word necessary.

For the low quality/high quality word pair, 29% of participants marked a space to the left of the neutral spot, which is closer to the words low quality. Forty-four percent of participants marked a space to the right of the neutral spot, which is closer to the words high quality.

For the inconvenient/convenient word pair, 17% of participants marked a space to the left of the neutral spot, which is closer to the word inconvenient. Fifty-six percent of participants marked a space to the right of the neutral spot, which is closer to the word convenient.

For the unemotional/emotional word pair, 19% of participants marked a space to the left of the neutral spot, which is closer to the word unemotional. Thirty-seven percent of participants marked a space to the right of the neutral spot, which is closer to the word emotional.

For the unsustainable/sustainable word pair, 23% of participants marked a space to the left of the neutral spot, which is closer to the word unsustainable. Fifty-eight percent of participants marked a space to the right of the neutral spot, which is closer to the word sustainable.

For the purposeless/beneficial word pair, 22% of participants marked a space to the left of the neutral spot, which is closer to the word purposeless. Fifty-eight percent of participants marked a space to the right of the neutral spot, which is closer to the word beneficial.

For the confusing/clear word pair, 53% of participants marked a space to the left of the neutral spot, which is closer to the word confusing. Twenty-nine percent of participants marked a space to the right of the neutral spot, which is closer to the word clear.

For the frightening/cheerful word pair, 40% of participants marked a space to the left of the neutral spot, which is closer to the word frightening. Twenty-two percent of participants marked a space to the right of the neutral spot, which is closer to the word cheerful.

**Findings Related to Objective 3**

**Evaluative word pairs.** Data were analyzed for Objective 3 using the cross-tabulation function in SPSS. Full results are recorded in Table 5. On the scale from 1-7, males were slightly more positive ($\bar{X}$ = 4.45) toward GMOs than females ($\bar{X}$ = 4.30). Participants with a master's degree were more positive ($\bar{X}$ = 4.52) than other levels of education. Participants with a bachelor's degree were the second most positive ($\bar{X}$ = 4.38) when compared with other education levels. Participants with an associate's degree were the least positive with a grand mean of 3.96. The youngest age group, participants between the ages of 20 and 29, were the most positive toward GMOs ($\bar{X}$ = 4.86). The sole participant in the 70-79 age group was the second most positive with a grand mean of 4.71. Participants between the ages of 60 and 69 were the least positive ($\bar{X}$ = 3.74) when compared to the other age groups. Full results are presented in Table 6.

**Additional word pairs.** For the additional word pairs, males were more positive ($\bar{X}$ = 4.12) toward GMOs than females ($\bar{X}$ = 3.86). Participants who had a master's degree were the most positive of all education levels ($\bar{X}$ = 4.14), and participants with a bachelor's degree were

Table 6

*Cross-Tabulated Grand Means for Evaluative Word Pairs*

| Demographic Characteristic | *f* | $\bar{X}$ |
|---|---|---|
| Sex (*n*=100) | | |
| Male | 38 | 4.45 |
| Female | 62 | 4.30 |
| Education Level (*n*=100) | | |
| High School | 8 | 4.18 |
| Associate's Degree | 4 | 3.96 |
| Bachelor's Degree | 32 | 4.38 |
| Master's Degree | 41 | 4.52 |
| Doctoral Degree | 15 | 4.07 |
| Age Group (*n*=99) | | |
| 20-29 | 25 | 4.86 |
| 30-39 | 27 | 4.29 |
| 40-49 | 17 | 4.15 |
| 50-59 | 18 | 4.31 |
| 60-69 | 11 | 3.74 |
| 70-79 | 1 | 4.71 |

the second most positive toward GMOs ($\bar{X}$ = 3.89). Participants with an associate's degree were the least positive ($\bar{X}$ = 3.63). The sole participant in the 70-79 age category was the most positive ($\bar{X}$ = 4.33) toward GMOs. Participants between the ages of 20-29 were the second most positive ($\bar{X}$ = 4.32), and participants between the ages of 60-69 were the least positive ($\bar{X}$ = 3.68). Full results are presented in Table 7.

Table 7

*Cross-Tabulated Grand Means for Additional Word Pairs*

| Demographic Characteristic | *n* | $\bar{X}$ |
|---|---|---|
| Sex (*n*=100) | | |
| Male | 38 | 4.12 |
| Female | 62 | 3.86 |
| Education Level (*n*=100) | | |
| High School | 8 | 3.65 |
| Associate's Degree | 4 | 3.63 |
| Bachelor's Degree | 32 | 3.89 |
| Master's Degree | 41 | 4.14 |
| Doctoral Degree | 15 | 3.82 |
| Age Group (*n*=99) | | |
| 20-29 | 25 | 4.32 |
| 30-39 | 27 | 3.89 |
| 40-49 | 17 | 3.76 |
| 50-59 | 18 | 3.93 |
| 60-69 | 11 | 3.68 |
| 70-79 | 1 | 4.33 |

## Conclusions, Discussion, and Recommendations

### Conclusions Related to Objective 1

The average participant in this study was primarily white female. She is a college-educated, young adult and was not involved in 4-H or FFA. She lives in a city/town but has visited a farm. In general, her family was not involved in the agricultural industry.

### Conclusions Related to Objective 2

Participants' attitudes toward GMOs were neutral. Participants thought GMOs to be more important than unimportant, but also more complex than simple. They thought GMOs were serious rather than humorous, and they thought GMOs were more innovative than conservative. Participants thought GMOs were unnatural rather than natural, and more convenient than

inconvenient. They also thought GMOs were beneficial rather than purposeless, sustainable rather than unsustainable and more confusing than clear.

**Conclusions Related to Objective 3**

When participant rankings on the semantic differential scales are broken down by demographic characteristics, an interesting pattern unfolds. Between males and females, males were slightly more positive than females in both the evaluative and additional word pair categories. Participants with a master's degree were the most positive when compared to the other education levels in both categories. For the evaluative word pairs, participants in the 20-29 age group were the most positive, while the participant in the 70-79 age group was the most positive for the additional word pair category. For both categories, the 60-69 age group was the least positive.

**Discussion**

This study yielded surprising responses to the semantic differential word pairs. Despite some interesting pieces, attitudes toward GMOs were mainly neutral. The general neutrality of attitudes conflicts with the findings of Saher et al. (2006), who found attitudes toward GMOs to be negative. However, the findings in this study contribute to Bredahl's (1999) claim about the inconsistency of attitudes toward GMOs across different countries. Participants' belief that GMOs were unnatural coincides with Bredahl's (1999) findings where participants believed GMO yogurt was an unnatural product. With a majority of participants believing GMOs to be beneficial rather than purposeless, their beliefs aligned with predictions Lusk et al. (2002) made that attitudes toward GMOs might be more positive if they found some benefit or use from the product.

Male participants were generally more positive toward GMOs than female participants, and participants with a master's degree were more positive than other education levels, potentially showing a more advanced education could influence attitude toward GMOs. Apart from the one participant in the 70-79 age group, younger participants were generally more

positive toward GMOs than older participants, suggesting younger generations are more accepting of GMOs than older generations.

The general lack of positive or negative attitudes toward GMOs could suggest participants are confused or don't understand GMOs. It is possible the participants in this study are still in the knowledge phase of GMOs as an innovation (Rogers, 1995, p. 162). According to Rogers (1995), "until the individual knows about a new idea, of course, he or she cannot begin to form an attitude toward it" (p. 168). This is not to say all participants had no concept of GMOs before this study, but rather they might not have a working principles-knowledge of how GMOs work (Rogers, 1995). Diminishing uncertainty about an innovation is part of the innovation-decision process, and it is possible that the participants in this study still had a significant amount of uncertainty toward GMOs (Rogers, 1995, p. 165).

**Recommendations for Future Research**

Because the results of this study only can be generalized to the 100 participants, replicating this study with a population at another university or in another state, or with a larger, more representative sample of food consumers in the United States could produce an interesting comparison. Experimenting with different word pairs also could account for a different result. Finally, testing consumer knowledge of GMOs would serve as a good foundation for future research before measuring attitudes.

## Summary

In this study, 100 faculty and staff members on the OSU-Stillwater campus participated in a questionnaire measuring attitudes toward genetically modified organisms. Attitudes were measured using a semantic differential scale where they were asked to rate the concept, "genetically modified organisms are…" on a scale from one to seven.

Attitudes were predominantly neutral toward many word pairs, indicating a lack of opinion or a lack of understanding of the concept of genetically modified organisms. Male participants rated GMOs slightly more positively than females, and participants with master's

degrees rated GMOs the most positively as compared to other educational levels. Younger participants were more positive toward GMOs than older participants.

# CHAPTER IV

## MANUSCRIPT II


### ABSTRACT

Eye patterns on food packaging and nutrition labels have been studied frequently as have eye patterns on magazine advertisements. However, little research looks at food advertising. The purpose of this study was to examine consumer eye patterns on non-GMO food advertisements to determine the effect non-GMO seal size has on the way consumers view food advertisements. In this study, the size of the certified non-GMO seal was manipulated in several food advertisements including a tomato advertisement with a small non-GMO seal, a tomato advertisement with a large non-GMO seal, a corn advertisement with a small non-GMO seal, and a corn advertisement with a large non-GMO seal. This study measured time to first fixation, fixation duration, and fixation count for each area of interest (AOI) in each advertisement. Areas of interest included the headline, subtext, non-GMO seal, and logo. A significant main effect was found for seal size in time to first fixation and fixation count, but a significant main effect was not found for fixation duration.

## Introduction

Today, consumers are exposed to dozens of advertisements and marketing efforts of all kinds as they carry out their everyday lives (Wedel & Pieters, 2008). Whether through a sponsored Facebook post, a magazine advertisement or a sign on the side of the road, consumers are bombarded with advertising messages (Wedel & Pieters, 2008). Wedel and Pieters (2008) refer to this realm of advertising as visual marketing. They define visual marketing as "the strategic utilization by firms of commercial and non-commercial visual signs and symbols to communicate with consumers in order to establish and maintain mutually profitable relationships" (Wedel & Pieters, 2008, p. 1). As highly visual creatures, it is important for advertising companies to pay attention to what consumers see in their advertisements and use that information to achieve high profits (Wedel & Pieters, 2008).

In today's fast-paced society, causing a person to stop and pay attention to an advertisement is difficult (Wedel & Pieters, 2000). What makes a person stop and take a second look? Which elements do consumers see? What is the most effective way to lay out an advertisement design? These questions can be examined closely through eye tracking, a technology whose popularity is growing quickly in the United States and other countries (Wedel & Pieters, 2008). According to Hooge and Camps (2013), "the goal of visual communication material (e.g. ads, road signs, warnings) is to transfer a message effectively" (p. 1). Eye-tracking technology allows researchers to analyze the way people look at different designs to help determine the best layout for good message transfer (Hooge & Camps, 2013).

One of the places where consumers are bombarded with advertisement messaging is in the grocery store (Bialkova & van Trijp, 2011). Much of this advertising comes in the form of food packages and labels. In recent years, consumers are becoming more interested in the food they buy and consume (Jeong & Lundy, 2015). Steenkamp (1990) said "the information contained in the packaging design provides a potentially rich source of knowledge on what the

product is and what it can be expected to deliver" (as cited in Bialkova & van Trijp, 2011, p. 592).

Eye-tracking research has been conducted on food packaging, traditional nutrition labels and front-of-package nutrition labels over the years (Bialkova & van Trijp, 2011; Graham et al., 2012; Oliveira et al., 2016). Bialkova and van Trijp (2011) looked at the difference between front-of-package Guideline Daily Amount (GDA) nutrition labeling in Dannon Activia yogurt packages. They compared package features like brand name, GDA label, etc. with consumers' shopping goal of health or preference (Bialkova & van Trijp, 2011). They found consumers' shopping goal or motivation influenced which elements they looked at on the package (Bialkova & van Trijp, 2011).

Oliveira et al. (2016) studied milk labels for both traditional milk and probiotic milk. They defined several areas of interest for the eye-tracking study, including "brand, type of product, manufacturer, best before date, net content, nutritional label, recommendation and health claim" (Oliveira et al., 2016). They found subjects looked at brand information and type of product first, and AOIs like brand and health claim were viewed more often than other elements (Oliviera et al., 2016).

Though much research has been done on nutrition labels and package design, little if any eye-tracking research has been conducted on food advertisements in magazines, and more specifically, certified non-genetically modified organism (non-GMO) food advertisements. This study aims to bridge the gap between food nutrition label research and advertisement research with an emphasis in foods certified as non-GMO.

With the controversy usually surrounding genetically modified foods (Costa-Font et al., 2008), it is important to understand what effect a certified non-GMO seal has on the way consumers view food advertisements. In general, consumers have mixed attitudes toward genetically modified foods across different countries (Bredahl, 1999). Many consumers in Europe have negative attitudes toward GMOs, and many view GMOs as unhealthy or wrong (Bredahl,

1999). Trust is also a contributing factor when it comes to consumers' attitudes toward genetically modified foods (Bredahl, 1999; Costa-Font et al., 2008). Many consumers in Europe do not trust the information about GMOs and, therefore, fear long-term effects of consuming a genetically modified product (Bredahl, 1999). This study aims to gain an understanding of the importance of a certified non-GMO seal in a magazine advertisement by examining the way consumers look at an advertisement.

In this study, size of the non-GMO seal was manipulated to determine if increased salience has an impact on the way consumers view magazine advertisements. The word salient is defined as, "standing out conspicuously: prominent; especially: of notable significance" (Salient, 2018). By increasing the size of the non-GMO seal, it becomes more salient to viewers. Orquin, Scholderer, and Jeppersen (as cited in Graham et al., 2012) studied visual salience in nutrition labels and found a notable difference in how quickly viewers fixated on a label when the size was increased.

## Problem Statement

Eye patterns on food packaging and nutrition labels have been studied frequently as have eye patterns on magazine advertisements. However, little research has looked at food advertising. This study aims to take both branches of existing knowledge and combine them to explore eye patterns on food advertisements with certified non-GMO seals of different sizes.

## Purpose Statement

The purpose of this study was to determine the effect the size of a certified non-GMO seal has on the way consumers view food advertisements.

## Research Objectives

1. Determine the amount of time it takes participants to look at specific areas of the advertisement with the small non-GMO seal.
2. Determine the amount of time it takes participants to look at specific areas of the advertisement with the large non-GMO seal.

3. Determine the amount of time participants spend looking at specific areas of the advertisement with the small non-GMO seal.
4. Determine the amount of time participants spend looking at specific areas of the advertisement with the large non-GMO seal.
5. Determine the number of times participants look at specific areas of the advertisement with the small non-GMO seal.
6. Determine the number of times participants look at specific areas of the advertisement with the large non-GMO seal.
7. Determine the effect seal size has on time to first fixation, fixation duration and fixation count.

## Conceptual Framework

A conceptual framework for this study was developed around the stimulus-organism-response theory developed by Mehrabian and Russell in 1974. Mehrabian and Russell (as cited in Jang & Namkung, 2009) claim "environmental stimuli (S) lead to an emotional reaction (O) that, in turn, drives consumers' behavioral response (R) based on the stimulus–organism–response (S–O–R) paradigm" (p. 451). The emotional reaction is made up of three areas, including pleasure, arousal and dominance (Graa & Dani-elKebir, 2012). Pleasure is "a composite of feelings such as happiness, contentment and satisfaction" (Graa & Dani-elKebir, 2012, p. 56). Arousal is defined as "a measure of how wide awake the organism is, of how ready it is to act" (Mehrabian & Russell, 1974, p. 287). Graa and Dani-elKebir (2012) define dominance as "a reflection of the extent to which the individual feels in control of or overpowered by his environment" (p. 56).

Buxbaum (2016) discussed when people are exposed to a stimulus, they interpret it and it "influences the emotional state, the motivation to interact and the resulting behavior" (p. 8). In this study, we considered the stimulus to be the non-GMO seal, which causes an emotional reaction and which could cause viewers to fixate on the seal or avoid it entirely.

## Methodology

### Participants

Participants in the study were recruited through a listserv of Oklahoma State University faculty and staff on the OSU-Stillwater campus. The sample of email addresses was requested from OSU Research Communications. The researcher chose to sample faculty and staff because of their likely role in making food buying decisions for themselves or their families. A recruitment email was sent to 4,795 individuals. The study included 100 people who came on a first-come, first-served basis. Participants were split evenly into two groups for the eye-tracking study. There were 49 participants in Group 1 and 50 participants in Group 2. The eye-tracking software was unable to calibrate one participant's eyes in Group 1.

### Stimulus Materials

A total of four fictional magazine advertisements featuring different kinds of produce were used in each of the two participant groups. Group 1 viewed two tomato advertisements, a strawberry advertisement and an egg advertisement. The tomato advertisements served as the test advertisements with one containing a small certified non-GMO seal and the other containing a seal 50% larger. The researcher obtained permission from the Non-GMO Project to use their non-GMO graphic seal (See Appendix F). Group 2 viewed two corn advertisements, a strawberry advertisement, and an egg advertisement. Like Group 1, the two corn advertisements were the test advertisements containing one small and one large certified non-GMO seal. For both groups, the strawberry and egg advertisements served as dummy advertisements. No data were collected on the dummy advertisements. Thumbnail images of each advertisement are presented in Figure 5.

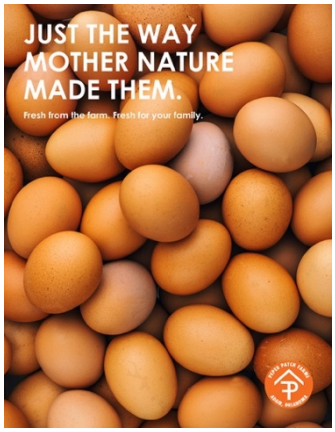
The advertisements were displayed on a computer screen at 835 px by 1080 px, which was as close to letter size as the screen would allow. A Tobii T60 eye-tracker was used to measure participants' eye movements on each of the advertisements. Areas of interest (AOIs) were drawn around specific locations in each advertisement, including the headline, subtext, and


Tomato advertisement with small non-GMO seal


Tomato advertisement with large non-GMO seal


Corn advertisement with small non-GMO seal


Corn advertisement with large non-GMO seal




Dummy advertisement


Dummy advertisement

*Figure 5.* Stimulus Materials


Tomato advertisement with small non-GMO seal


Tomato advertisement with large non-GMO seal


Corn advertisement with small non-GMO seal


Corn advertisement with large non-GMO seal

*Figure 6.* Areas of Interest

logo. Additionally, the non-GMO seal was included as an AOI on the tomato and corn advertisements. A full rendering of the AOIs is shown in Figure 6.

### Procedure

Upon entering the eye-tracking lab, each participant was asked to sit in front of one of two computers. Half of the participants sat at Computer 1 and half sat at Computer 2. Computer 1 contained the tomato advertisements while Computer 2 contained the corn advertisements. The researcher gave each participant the same set of instructions before beginning the calibration process. After the eye-trackers were successfully calibrated, the test began. The system was set up to be hands-free for the participants with the researcher pressing the required key to begin each test. Each advertisement was displayed on the screen for four seconds with a one-second black screen in between. The ads were counterbalanced to prevent an ordering effect (Lierle, 2017).

### Data Analysis

This study was quantitative in nature. Areas of interest (AOIs) were identified in each test advertisement using the Tobii Studio software. The researcher pulled the eye-tracking data for each AOI using three metrics: time to first fixation, fixation duration, and fixation count. Data was arranged in an Excel file and was analyzed for means and standard deviations.

Once means and standard deviations had been calculated for each metric and AOI, an independent samples t-test was used to compute statistical significance of the means for each metric for the non-GMO seal. The t-tests were used to compare the tomato advertisement with the small non-GMO seal versus the large seal, and the corn advertisement with the small non-GMO seal versus the large seal. Additionally, a 2x2 mixed ANOVA was conducted to test for main effects and interactions between seal size (small, large) and product (tomato, corn).

## Results

### Findings Related to Objectives 1 and 2

In participants' time to first fixation, the headline has the shortest mean time; therefore, it was viewed first on average in each advertisement, regardless of seal size. On average, the

subtext, non-GMO seal and logo were viewed second, third and fourth, respectively. Full results for time to first fixation are presented in Table 8.

Table 8

*Time to First Fixation*

| | Time to First Fixation (Seconds) | | |
|---|---|---|---|
| Advertisement | *f* | *M* | *SD* |
| Tomato – Small Seal | | | |
| Headline | 48 | 0.52 | 0.61 |
| Subtext | 29 | 1.68 | 1.03 |
| Non-GMO Seal | 23 | 2.65 | 0.96 |
| Logo | 17 | 2.79 | 0.78 |
| Tomato – Large Seal | | | |
| Headline | 47 | 0.5 | 0.57 |
| Subtext | 33 | 1.9 | 0.99 |
| Non-GMO Seal | 30 | 2.32 | 1.16 |
| Logo | 15 | 2.69 | 0.91 |
| Corn – Small Seal | | | |
| Headline | 45 | 0.48 | 0.51 |
| Subtext | 31 | 1.74 | 0.93 |
| Non-GMO Seal | 23 | 2.69 | 0.94 |
| Logo | 20 | 2.79 | 0.74 |
| Corn – Large Seal | | | |
| Headline | 44 | 0.37 | 0.21 |
| Subtext | 25 | 1.74 | 1.27 |
| Non-GMO Seal | 27 | 2.27 | 0.90 |
| Logo | 19 | 2.81 | 0.82 |

In comparing the two tomato advertisements, the headline was observed slightly quicker in the advertisement with the large seal ($M = 0.50$, $SD = 0.57$) versus the small seal ($M = 0.52$, $SD = 0.61$). The subtext was seen more quickly in the advertisement with the small seal ($M = 1.68$, $SD = 1.03$) versus the large seal ($M = 1.90$, $SD = 0.99$). The non-GMO seal was seen more

quickly in the advertisement with the large seal ($M$ = 2.32, $SD$ = 1.16) versus the small seal ($M$ = 2.65, $SD$ = 0.96). The logo in the advertisement with the large seal was viewed slightly quicker ($M$ = 2.69, $SD$ = 0.91) than in the advertisement with the small seal ($M$ = 2.79, $SD$ = 0.78).

When comparing the two corn advertisements, the headline was observed faster in the advertisement with the large seal ($M$ = 0.37, $SD$ = 0.21) than with the small seal ($M$ = 0.48, $SD$ = 0.51). The subtext had the same average time to first fixation in the corn advertisement with the small seal ($M$ = 1.74, $SD$ = 0.93) and the corn advertisement with the larger seal ($M$ = 1.74, $SD$ = 1.27). Like the tomato advertisements, the non-GMO seal was viewed faster in the corn advertisement with the large seal ($M$ = 2.27, $SD$ = 0.90) than with the small seal ($M$ = 2.69, $SD$ = 0.94). The logo was observed slightly faster in the advertisement with the small seal ($M$ = 2.79, $SD$ = 0.74) than with the large seal ($M$ = 2.81, $SD$ = 0.82).

**Findings Related to Objectives 3 and 4**

For both of the corn advertisements and the tomato advertisement with the large non-GMO seal, the logo was fixated on the longest. Conversely, the non-GMO seal was fixated on the longest in the tomato advertisement with the small non-GMO seal. The headline was fixated on the least amount of time throughout all of the advertisements, regardless of seal size. Full results are presented in Table 9.

When looking at the tomato advertisements, the headline was viewed slightly longer in the advertisement with the small seal ($M$ = 0.19, $SD$ = 0.06) versus the large seal ($M$ = 0.17, $SD$ = 0.06). The subtext had the same average fixation duration across the tomato advertisement with the small seal ($M$ = 0.21, $SD$ = 0.14) and the tomato advertisement with the large seal ($M$ = 0.21, $SD$ = 0.10). The small non-GMO seal was viewed longer ($M$ = 0.33, $SD$ = 0.34) than the large seal ($M$ = 0.23, $SD$ = 0.10). The logo in the advertisement with the small seal was viewed longer ($M$ = 0.29, $SD$ = 0.14) than the advertisement with the large seal ($M$ = 0.24, $SD$ = 0.14).

Table 9

*Fixation Duration*

| | Fixation Duration (Seconds) | | |
|---|---|---|---|
| Advertisement | *f* | *M* | *SD* |
| Tomato – Small Seal | | | |
| Headline | 228 | 0.19 | 0.06 |
| Subtext | 60 | 0.21 | 0.14 |
| Non-GMO Seal | 34 | 0.33 | 0.34 |
| Logo | 26 | 0.29 | 0.14 |
| Tomato – Large Seal | | | |
| Headline | 237 | 0.17 | 0.06 |
| Subtext | 75 | 0.21 | 0.10 |
| Non-GMO Seal | 70 | 0.23 | 0.10 |
| Logo | 20 | 0.24 | 0.14 |
| Corn – Small Seal | | | |
| Headline | 200 | 0.16 | 0.06 |
| Subtext | 81 | 0.22 | 0.08 |
| Non-GMO Seal | 37 | 0.23 | 0.11 |
| Logo | 32 | 0.24 | 0.13 |
| Corn – Large Seal | | | |
| Headline | 187 | 0.17 | 0.06 |
| Subtext | 53 | 0.20 | 0.08 |
| Non-GMO Seal | 63 | 0.25 | 0.31 |
| Logo | 30 | 0.33 | 0.18 |

In the two corn advertisements, the headline was viewed almost the same time in both advertisements; the advertisement with the small seal had an average fixation duration of 0.16 (*SD* = 0.06), and the advertisement with the large seal had an average of 0.17 (*SD* = 0.06). The subtext was viewed slightly longer in the advertisement with the small non-GMO seal (*M* = 0.22, *SD* = 0.08) than with the large seal (*M* = 0.20, *SD* = 0.08). Participants viewed the large non-GMO seal longer (*M* = 0.25, *SD* = 0.31) than the small seal (*M* = 0.23, *SD* = 0.11). The logo was

viewed longer in the advertisement with the large seal ($M$ = 0.33, $SD$ = 0.18) than with the small seal ($M$ = 0.24, $SD$ = 0.13).

**Findings Related to Objectives 5 and 6**

Figure 7 shows a heat map of all fixation counts for each advertisement. The heat map serves as a way to visualize the fixation count data.

In all advertisements, the headline had the most fixations, regardless of seal size. The logo was fixated on the least number of times across all advertisements. The non-GMO seal had the second highest number of fixation counts in the corn advertisement with the large non-GMO seal, compared to the third highest in all other advertisements. Full results are presented in Table 10.

When comparing both tomato advertisements, the headline was viewed more often in the advertisement with the large seal ($M$ = 4.84, $SD$ = 2.82) than the small seal ($M$ = 4.65, $SD$ = 2.79). The subtext was also viewed longer in the advertisement with the large seal ($M$ = 1.53, $SD$ = 1.72) than the small seal ($M$ = 1.22, $SD$ = 1.50). Participants viewed the large non-GMO seal more often ($M$ = 1.43, $SD$ = 1.54) than the small seal ($M$ = 0.69, $SD$ = 0.89). The logo was viewed more in the advertisement with the small seal ($M$ = 0.53, $SD$ = 0.89) than the large seal ($M$ = 0.41, $SD$ = 0.70).

In the two corn advertisements, the headline was viewed more times in the advertisement with the small seal ($M$ = 4.00, $SD$ = 2.57) than the large seal ($M$ = 3.74, $SD$ = 2.76). The subtext was also viewed longer in the advertisement with the small seal ($M$ = 1.62, $SD$ = 1.65) than the large seal ($M$ = 1.06, $SD$ = 1.48). The large non-GMO seal was viewed the most ($M$ = 1.26, $SD$ = 1.59) when compared to the small non-GMO seal ($M$ = 0.74, $SD$ = 1.03). Finally, the logo was viewed more in the advertisement with the small seal ($M$ = 0.64, $SD$ = 0.88) than with the large seal ($M$ = 0.60, $SD$ = 0.93).

Tomato advertisement with small non-GMO seal

Tomato advertisement with large non-GMO seal

Corn advertisement with small non-GMO seal

Corn advertisement with large non-GMO seal

*Figure 7.* Heat Maps – Fixation Count

Table 10

*Fixation Count*

| | Fixation Count (Views) | | |
|---|---|---|---|
| Advertisement | *f* | *M* | *SD* |
| Tomato – Small Seal | | | |
| Headline | 49 | 4.65 | 2.79 |
| Subtext | 49 | 1.22 | 1.50 |
| Non-GMO Seal | 49 | 0.69 | 0.89 |
| Logo | 49 | 0.53 | 0.89 |
| Tomato – Large Seal | | | |
| Headline | 49 | 4.84 | 2.82 |
| Subtext | 49 | 1.53 | 1.72 |
| Non-GMO Seal | 49 | 1.43 | 1.54 |
| Logo | 49 | 0.41 | 0.70 |
| Corn – Small Seal | | | |
| Headline | 50 | 4.00 | 2.57 |
| Subtext | 50 | 1.62 | 1.65 |
| Non-GMO Seal | 50 | 0.74 | 1.03 |
| Logo | 50 | 0.64 | 0.88 |
| Corn – Large Seal | | | |
| Headline | 50 | 3.74 | 2.76 |
| Subtext | 50 | 1.06 | 1.48 |
| Non-GMO Seal | 50 | 1.26 | 1.59 |
| Logo | 50 | 0.60 | 0.93 |

**Findings Related to Objective 7**

An independent samples t-test was conducted on each advertisement between the small and large non-GMO seal to test for significance. For time to first fixation in the tomato advertisements, no significant difference was found when comparing the small non-GMO seal ($M = 2.65$, $SD = 0.96$) and the large non-GMO seal ($M = 2.32$, $SD = 1.16$), $t(51) = 1.13$, $p = 0.26$. Similarly in the corn advertisements, no significant difference was found when comparing the

small seal ($M$ = 2.69, $SD$ = 0.94) with the large seal ($M$ = 2.27, $SD$ = 0.90), $t(46) = 1.59$, $p = 0.12$. Findings for time to first fixation are presented in Table 11.

Table 11

*Independent T-test Results – Time to First Fixation*

| Seal Size | *n* | *M* | *SD* | *df* | *p* |
|---|---|---|---|---|---|
| Tomato | | | | | |
| Small Seal | 23 | 2.65 | 0.96 | 51 | 0.26 |
| Large Seal | 30 | 2.32 | 1.16 | | |
| Corn | | | | | |
| Small Seal | 23 | 2.69 | 0.94 | 46 | 0.12 |
| Large Seal | 27 | 2.27 | 0.90 | | |

For fixation duration in the two tomato advertisements, no significant difference was found between the small non-GMO seal ($M$ = 0.35, $SD$ = 0.34) and the large non-GMO seal ($M$ = 0.24, $SD$ = 0.10), $t(26) = 1.55$, $p = 0.13$. Similarly, comparing the corn advertisements, no significant difference was found between the small non-GMO seal ($M$ = 0.25, $SD$ = 0.11) and the large non-GMO seal ($M$ = 0.29, $SD$ = 0.31), $t(35) = -0.74$, $p = 0.46$. Results are presented in Table 12.

Table 12

*Independent T-test Results – Fixation Duration*

| Seal Size | *n* | *M* | *SD* | *df* | *p* |
|---|---|---|---|---|---|
| Tomato | | | | | |
| Small Seal | 24 | 0.35 | 0.34 | 26 | 0.13 |
| Large Seal | 31 | 0.24 | 0.10 | | |
| Corn | | | | | |
| Small Seal | 24 | 0.25 | 0.11 | 35 | 0.46 |
| Large Seal | 28 | 0.29 | 0.31 | | |

For fixation count in the two tomato advertisements, a significant difference was found between the small non-GMO seal ($M$ = 0.69, $SD$ = 0.89) and the large non-GMO seal ($M$ = 1.43, $SD$ = 1.54), $t(77) = -2.89$, $p = 0.01$. Conversely, no significant difference was found between the small seal ($M$ = 0.74, $SD$ = 1.03) and the large seal ($M$ = 1.26, $SD$ = 1.59), $t(84) = -1.94$, $p = 0.06$, in the corn advertisements. Findings for fixation count are summarized in Table 13.

Table 13

*Independent T-test Results – Fixation Count*

| Seal Size | *n* | *M* | *SD* | *df* | *p* |
|---|---|---|---|---|---|
| Tomato | | | | | |
| Small Seal | 49 | 0.69 | 0.89 | 77 | 0.01 |
| Large Seal | 49 | 1.43 | 1.54 | | |
| Corn | | | | | |
| Small Seal | 50 | 0.74 | 1.03 | 84 | 0.06 |
| Large Seal | 50 | 1.26 | 1.59 | | |

A 2x2 mixed ANOVA was also conducted for each metric to test main effects and interactions. There was a significant main effect of seal size on time to first fixation ($F(1, 27) = 6.613$, $p = .016$). There was no significant main effect of product on time to first fixation ($F(1, 27) = .052$, $p = .822$). Full results are presented in Table 14.

Table 14

*Mixed ANOVA for Time to First Fixation by Size and Product*

| | Type III Sum of Squares | *df* | Mean Square | *F* | *p* |
|---|---|---|---|---|---|
| Within Groups | 4.170 | 1 | 4.170 | 6.613 | .016 |
| Between Groups | .097 | 1 | .097 | .154 | .698 |
| Interaction | .048 | 1 | .048 | .052 | .822 |

There was no significant main effect of seal size on fixation duration ($F(1, 27) = 1.366$, $p = .253$). There was also no significant main effect of product on fixation duration ($F(1, 27) = .106$, $p = .747$). Full results are presented in Table 15.

Table 15

*Mixed ANOVA for Fixation Duration by Size and Product*

| | Type III Sum of Squares | *df* | Mean Square | *F* | *p* |
|---|---|---|---|---|---|
| Within Groups | 0.030 | 1 | 0.030 | 1.366 | .253 |
| Between Groups | 0.004 | 1 | 0.004 | 0.106 | .747 |
| Interaction | 0.020 | 1 | 0.020 | 0.927 | .344 |

A significant main effect of seal size on fixation count was found ($F(1, 97) = 12.940$, $p = .001$). No significant main effect of product on fixation count was found ($F(1, 97) = .099$, $p = .754$). Full results are presented in Table 16.

Table 16

*Mixed ANOVA for Fixation Count by Size and Product*

| | Type III Sum of Squares | *df* | Mean Square | *F* | *p* |
|---|---|---|---|---|---|
| Within Groups | 19.479 | 1 | 19.479 | 12.940 | .001 |
| Between Groups | 0.186 | 1 | 0.186 | 0.099 | .754 |
| Interaction | 0.570 | 1 | 0.570 | 0.379 | .540 |

## Conclusions, Discussion, and Recommendations

### Conclusions

As a whole, the headline was most dominant when it came to time to first fixation, as it had the lowest time. Participants then generally moved on to fixate on the subtext second, non-GMO seal third and the logo last.

For fixation duration, participants generally looked at the logo for the longest amount of time. The tomato advertisement with the small non-GMO seal was the only exception to this with

the non-GMO seal being viewed the longest. For all other advertisements, the non-GMO seal was the second-most viewed AOI.

When looking at fixation count, it is easy to see the headline was always fixated on the greatest number of times. After the headline, fixation count declined as participants moved to the subtext, non-GMO seal, and logo. The logo was the element viewed the least number of times.

Seal size specifically was compared within the tomato advertisements and the corn advertisements. Although the mean scores for each pair of data were different, only one pair was found to be statistically significant in the independent *t* tests. This data pair occurred in the tomato advertisements for fixation count. In this set, participants looked at the large non-GMO seal a significantly greater number of times than the small non-GMO seal, on average.

Through the ANOVA tests, seal size was found to be significant in time to first fixation and fixation count. Participants looked at the large seal more quickly and for a greater number of times than the small seal. However, seal size was not significant in fixation duration. Finally, there was no significant difference between the tomato and corn advertisements.

**Discussion**

When looking at time to first fixation for all of the elements, some interesting findings appeared. On average, the advertisements were viewed similarly to a z-pattern, beginning with the headline, then moving to the subtext, non-GMO seal, and finally, the logo (Eldesouky, 2013). The eye begins in the top left, moves across to the top right, then travels down diagonally to the bottom left and ends at the bottom right.

Participants generally did not look at the non-GMO seal first. In every advertisement, it was usually the third AOI fixated upon when considering time to first fixation. This could be because it wasn't noticeable right away, or simply because the headline, which was always viewed first, was too overpowering. The headline was the biggest AOI and was placed in the top left corner of every advertisement. This could have contributed to the fact that it was always viewed first. Additionally, the frequencies for time to first fixation declined after viewing the first

AOI, possibly meaning participants did not get to the bottom of the advertisement before it changed.

In all of the advertisements except the tomato advertisement with the small non-GMO seal, participants viewed the logo for the longest period of time, on average. This is an interesting finding as the logo was the last item viewed in each advertisement, as mentioned in the previous section. This coincides with findings from Wedel and Pieters (2000), where they emphasize the importance of a logo or brand in an advertising. They go as far as saying it is the most important piece of an advertisement (Wedel & Pieters, 2000). In the tomato advertisement with the small non-GMO seal, participants viewed the seal for the longest amount of time. Although the logo was the longest-viewed AOI in the other three advertisements, the seal was the second-most viewed AOI. Another interesting finding was that although the headline was viewed first in every advertisement, participants fixated on it for the shortest amount of time.

The fixation count for the headline is again an interesting finding, considering all three metrics together; the headline was fixated on first, it was fixated on the greatest number of times, but it was fixated on the least amount of time. This data suggests participants gave the headline several quick fixations over the course of the four seconds in which each advertisement was displayed.

According to Wedel and Pieters (2000), "the number of fixations, not their duration, is related to the amount of information a consumer extracts from an ad." Although the independent *t* tests comparing the non-GMO seal data within the tomato and corn advertisements yielded only one significant comparison, it is possible that this sole significant metric has some underlying importance, based on the findings of Wedel and Pieters (2000). This could mean participants gathered a lot of information from the larger non-GMO seal as they fixated on it a greater number of times.

In a study conducted with front-of-pack nutrition labeling, Bialkova and vanTrijp (2011) claimed consumers pay attention to elements that they are looking for. They go on to say

consumers' motivations also influence what they pay attention to (Bialkova & vanTrijp, 2011). The significant difference in time to first fixation between the two non-GMO seals is similar the findings of Orquin et al. (as cited in Graham et al., 2012) in their study of nutrition labels. They found a quicker time to first fixation when visual salience of the label was increased – one of the ways to do this is through changing the size of the label (as cited in Graham et al., 2012).

The lack of significant difference in fixation duration could have been because participants had already seen one seal or the other, reducing the need to fixate on it for a length of time on second view. The advertisements were counterbalanced to prevent an order effect, but each participant saw two seals, regardless of the order.

Based on the findings in this study, it can be concluded that manipulating the size of the non-GMO seal in the magazine advertisements generally had an effect how quickly participants viewed the seal and how many times they viewed the seal. It did not have an effect on how long participants looked at the seal.

**Recommendations for Future Research**

The results of this study can only be generalized to the participants. However, this study could be replicated with a different population in a different location to see if similar results occur. This study used a convenience sample of faculty and staff at Oklahoma State University to represent a population of food consumers who are likely to make food purchasing decisions for themselves or their families. A similar study conducted at a local grocery store where participants are recruited as they enter the store could provide an interesting addition to this study.

Additional eye-tracking research also could be conducted focusing on specific areas of the non-GMO seal, including the text and the small graphic elements within the seal. A study also could be conducted to test whether the location of the non-GMO seal has an effect on the way consumers view the advertisements. Fixation count and fixation duration could be further explored to determine if either metric can predict attitudes toward the object as Mele, Federici,

and Dennis (2014) examined in their study. Finally, a similar study could be conducted where the background image is identified as an AOI in addition to the AOIs identified in this study.

## Summary

Certified non-GMO seals were observed on food advertisements in different sizes. Two sets of advertisements, one featuring non-GMO tomatoes and one featuring non-GMO corn were used to compare a small seal versus a seal that was 50% larger. Although differences were observed when comparing the small and large seal, statistical significance was only found on the time it took participants to view the seal and the number of times the seal was viewed. No significant difference was found in the amount of time participants fixated on the seal. It can be concluded that the size of the seal does have an effect on the way consumers look at food advertisements in magazines.

# CHAPTER V

# CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

## Conclusions for Manuscript I

### Objective One

The average participant in this study was primarily white female. She is a college-educated, young adult and was not involved in 4-H or FFA. She lives in a city/town but has visited a farm. In general, her family was not involved in the agricultural industry.

### Objective Two

Participants' attitudes toward GMOs were neutral. Participants thought GMOs to be more important than unimportant, but also more complex than simple. They thought GMOs were serious rather than humorous, and they thought GMOs were more innovative than conservative. Participants thought GMOs were unnatural rather than natural, and more convenient than inconvenient. They also thought GMOs were beneficial rather than purposeless, sustainable rather than unsustainable, and more confusing than clear.

### Objective Three

When participant rankings on the semantic differential scales are broken down by demographic characteristics, an interesting pattern unfolds. Between males and females, males were slightly more positive than females in both the evaluative and additional word pair categories. Participants with a master's degree were the most positive when compared to the other

education levels in both categories. For the evaluative word pairs, participants in the 20-29 age group were the most positive, while the participant in the 70-79 age group was the most positive for the additional word pair category. For both categories, the 60-69 age group were the least positive.

## Conclusions for Manuscript II

As a whole, the headline was most dominant when it came to time to first fixation, as it had the lowest time. Participants then moved on to fixate on the subtext second, non-GMO seal third and the logo last.

For fixation duration, participants generally looked at the logo for the longest amount of time. The tomato advertisement with the small non-GMO seal was the only exception to this with the non-GMO seal being viewed the longest. For all other advertisements, the non-GMO seal was the second-most viewed AOI.

When looking at fixation count, it's easy to see the headline was usually fixated on the greatest number of times. After the headline, fixation count declined as participants moved to the subtext, non-GMO seal and logo. The logo was the element viewed the least number of times.

Seal size specifically was compared within the tomato advertisements and the corn advertisements. Although the mean scores for each pair of data were different, only one pair was found to be statistically significant in the independent *t* tests. This data pair occurred in the tomato advertisements for fixation count. In this set, participants looked at the large non-GMO seal a greater number of times than the small non-GMO seal, on average.

Through the ANOVA tests, seal size was found to be significant in time to first fixation and fixation count. Participants looked at the large seal more quickly and for a greater number of times than the small seal. However, seal size was not significant in fixation duration. Finally, there was no significant difference between the tomato and corn advertisements.

## Discussion

### Manuscript I

The general neutrality of attitudes conflicts with the findings of Saher et al. (2006), who found attitudes toward GMOs to be negative. However, the findings in this study contribute to Bredahl's (1999) claim about the inconsistency of attitudes toward GMOs across different countries. Participants' belief that GMOs were unnatural coincides with Bredahl's (1999) findings where participants believed GMO yogurt was an unnatural product. With a majority of participants believing GMOs to be beneficial rather than purposeless, their beliefs aligned with predictions Lusk et al. (2002) made that attitudes toward GMOs might be more positive if they found some benefit or use from the product.

The lack of positive or negative attitudes toward GMOs could suggest participants are confused or don't understand GMOs. It is possible the participants in this study are still in the knowledge phase of GMOs as an innovation (Rogers, 1995, p. 162). According to Rogers (1995), "until the individual knows about a new idea, of course, he or she cannot begin to form an attitude toward it" (p. 168). This is not to say all participants had no concept of GMOs before this study, but rather they might not have a working principles-knowledge of how GMOs work (Rogers, 1995, p. 166). Diminishing uncertainty about an innovation is part of the innovation-decision process, and it is possible that the participants in this study still had a significant amount of uncertainty toward GMOs (Rogers, 1995, p. 165).

### Manuscript II

Participants generally did not look at the non-GMO seal first. In every advertisement, it was usually the third AOI fixated upon when considering time to first fixation. This could be because it wasn't noticeable right away, or simply because the headline, which was always viewed first, was too overpowering. The headline was the biggest AOI and was placed in the top left corner of every advertisement. This could have contributed to the fact that it was always viewed first. Additionally, the frequencies for time to first fixation declined after viewing the first

AOI, possibly meaning participants did not get to the bottom of the advertisement before it changed.

According to Wedel and Pieters (2000), "the number of fixations, not their duration, is related to the amount of information a consumer extracts from an ad." Although the significance tests comparing the non-GMO seal data within the tomato and corn advertisements yielded only one significant comparison, it is possible that this sole significant metric has some underlying importance, based on the findings of Wedel and Pieters (2000).

In a study conducted with front-of-pack nutrition labeling, Bialkova and vanTrijp (2011) claimed consumers pay attention to elements that they are looking for. They go on to say consumers' motivations also influence what they pay attention to (Bialkova & vanTrijp, 2011). The significant difference in time to first fixation between the two non-GMO seals is similar the findings of Orquin et al. (as cited in Graham et al., 2012) in their study of nutrition labels. They found a quicker time to first fixation when visual salience of the label was increased – one of the ways to do this is through changing the size of the label (as cited in Graham et al., 2012).

The lack of significant difference in fixation duration could have been due to the fact that participants had already seen one seal or the other, reducing the need to fixate on it for a length of time on second view. The advertisements were counterbalanced to prevent an order effect, but each participant saw two seals, regardless of the order.

Based on the findings in this study, it can be concluded that manipulating the size of the non-GMO seal in the magazine advertisements generally had an effect how quickly participants viewed the seal and how many times they viewed the seal. It did not have an effect on how long participants looked at the seal.

## Recommendations for Future Research

### Manuscript I

Because the results of this study only can be generalized to the 100 participants, replicating this study with a population at another university or in another state, or with a larger,

more representative sample of food consumers in the United States could produce an interesting comparison. Experimenting with different word pairs also could account for a different result. Finally, testing consumer knowledge of GMOs would serve as a good foundation for future research before measuring attitudes.

**Manuscript II**

This study used a convenience sample of faculty and staff at Oklahoma State University to represent a population of food consumers who are likely to make food purchasing decisions for themselves or their families. A similar study conducted at a local grocery store where participants are recruited as they enter the store could provide an interesting addition to this study.

Additional eye-tracking research also could be conducted focusing on specific areas of the non-GMO seal, including the text and the small graphic elements within the seal. A study also could be conducted to test whether the location of the non-GMO seal has an effect on the way consumers view the advertisements. Fixation count and fixation duration could be further explored to determine if either metric can predict attitudes toward the object as Mele, Federici, and Dennis (2014) examined in their study. Finally, a similar study could be conducted where the background image is identified as an AOI in addition to the AOIs identified in this study.

**General**

In hindsight, several complications arose in the study's design. First, the initial recruitment email did not indicate the study was on a first-come, first-serve basis. The researcher received numerous emails from potential participants wanting to sign up for a time slot to participate. Adding a first-come, first-serve message to the initial email would have reduced some confusion among potential participants. Second, if similar studies are conducted, the researcher recommends having participants bring a printed copy of the recruitment email with them to the study to serve as their "ticket." Doing so would reduce the number of participants outside the target population from unknowingly participating in the study.

Additionally, the researcher would have connected the questionnaire data to the eye-tracking data. In digging deeper into the Stimulus-Organism-Response theory, the researcher realized the theory uses Osgood's semantic differential scales to measure the organism response. If the researcher had linked the questionnaire responses to the eye-tracking data, deeper analyses and conclusions could have been made in regards to the theory.

## Summary

In this study, 100 faculty and staff members on the OSU-Stillwater campus participated in a questionnaire measuring attitudes toward genetically modified organisms. Attitudes were measured using a semantic differential scale where they were asked to rate the concept, "genetically modified organisms are…" on a scale from one to seven.

Attitudes were predominantly neutral toward many word pairs, indicating a lack of opinion or a lack of understanding of the concept of genetically modified organisms. Male participants rated GMOs slightly more positively than females, and participants with master's degrees rated GMOs the most positively as compared to other educational levels. Younger participants were more positive toward GMOs than older participants.

Certified non-GMO seals were also observed on food advertisements in different sizes. Two sets of advertisements, one featuring non-GMO tomatoes and one featuring non-GMO corn were used to compare a small seal versus a seal that was 50% larger. Although differences were observed when comparing the small and large seal, statistical significance was only found on the time it took participants to view the seal and the number of times the seal was viewed. No significant difference was found in the amount of time participants fixated on the seal. It can be concluded that the size of the seal does have an effect on the way consumers look at food advertisements in magazines.

# REFERENCES


Aertsens, J., Mondelaers, K., Verbeke, W., Buysse, J., and Van Huylenbroeck, G. (2011). The influence of subjective and objective knowledge on attitude, motivations, and consumption of organic food. *British Food Journal, 113*(11), 1353-1378.

Anderson, K.L. (2012). *Fairgoers' attitudes toward youth livestock exhibits at the California State Fair* (unpublished master's thesis). Oklahoma State University, Stillwater, Oklahoma.

Bialkova, S., & van Trijp, H. (2011). An efficient methodology for assessing attention to and effect of nutrition information displayed front-of-pack. *Food Quality and Preference, 22,* 592-601. doi:10.1016/j.foodqual.2011.03.010

Bredahl, L. (1999). Consumers' cognitions with regard to genetically modified foods. Results of a qualitative study in four countries. *Appetite, 33,* 343-360. https://doi.org/10.1006/appe.1999.0267

Buxbaum, O. (2016). *Key insights into basic mechanisms of mental activity.* Switzerland. Springer International Publishing.

Costa-Font, M., Gil, J., & Traill W. (2008). Consumer acceptance, valuation of and attitudes towards genetically modified food: Review and implications for food policy. *Food Policy, 33,* 99-111. doi:10.1016/j.foodpol.2007.07.002

Eldesouky, D. (2013). Visual hierarchy and mind motion in advertising design. *Journal of Arts and Humanities, 2*(2), 148-162. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1000.2943&rep=rep1&type=pdf

Food and Agriculture Organization of the United Nations. (2009, October). *How to feed the world in 2050*. Retrieved from http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf

Food, Genetically modified. (2017) Retrieved from http://www.who.int/topics/food_genetically_modified/en/

Frequently Asked Questions on Genetically Modified Foods. (2014). Retrieved from http://www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified-food/en/

Gerry, C. (2015). Feeding the world one genetically modified tomato at a time: A scientific perspective. [Web log]. Retrieved from http://sitn.hms.harvard.edu/flash/2015/feeding-the-world/

Graa, A., & Dani-elKebir, M. (2012). Application of stimulus & response model to impulse buying behavior of Algerian consumers. *Serbian Journal of Management, 7*(1), 53-64. DOI:10.5937/sjm1201053G

Graham D., Orquin, J., & Visschers, V. (2012). Eye tracking and nutrition label use: A review of the literature and recommendations for label enhancement. *Food Policy, 37,* 378-382. http://dx.doi.org/10.1016/j.foodpol.2012.03.004

Gurau, C., & Ranchhod, A. (2016). The futures of genetically-modified foods: Global threat or panacea? *Futures, 83*, 24-36. Retrieved from http://www.sciencedirect.com/science/article/pii/S0016328716301859

Hayakawa, S.I. (1990). *Language in Thought and Action* (5th ed.). Orlando, Florida: Harcourt Brace and Company.

Hooge, I., & Camps, G. (2013). Scanpath entropy and arrow plots: Capturing scanning behavior of multiple observers. *Frontiers in Psychology, 4,* 1-10. doi:10.3389/fpsyg.2013.00996

Isaac, S., & Michael, W.B. (1995). *Handbook in Research and Evaluation* (3rd ed). San Diego, California: Educational and Industrial Testing Services.

Jang, S., & Namkung, Y. (2009). Perceived quality, emotions, and behavioral intentions: Application of an extended Mehrabian–Russell model to restaurants. *Journal of Business Research, 62,* 451–460. doi:10.1016/j.jbusres.2008.01.038

Jeong, Y., & Lundy, L.K. (2015). Evaluating food labels and food messages: An experimental study of the impact of message format and product type on evaluations of magazine food advertisements. *Journal of Applied Communications, 99*(1), 52-66. Retrieved from http://journalofappliedcommunications.org/2015/24-volume-99-no-1.html

Lierle, A. (2017). *The view: An eye-tracking study of print advertisements* (unpublished master's thesis). Oklahoma State University. Stillwater, Oklahoma.

Lusk, J.L., Moore, M., House, L.O., & Morrow, B. (2002). Influence of brand name and type of modification on consumer acceptance of genetically engineered corn chips: a preliminary analysis. *International Food and Agribusiness Management Review, 4,* 373-383. https://doi.org/10.1016/S1096-7508(02)00065-4

Mehrabian, A., & Russell J.A. (1974). The basic emotional impact of environments. *Perceptual and Motor Skills, 38,* 283-301.

Mele, M.L., Federici, S., & Dennis, J.L. (2014). Believing is seeing: Fixation duration predicts implicit negative attitudes. *Plos One, 9*(8), 1-6.

Oliveira, D., Machin, L., Deliza, R., Rosenthal, A., Walter, E., Giminez, A., & Ares, G. (2016). Consumers' attention to functional food labels: Insights from eye-tracking and change detection in a case study with probiotic milk. *LWT – Food Science and Technology, 68,* 160-167. http://dx.doi.org/10.1016/j.lwt.2015.11.066

Osgood, C.E. (1964). Semantic differential technique in the comparative study of cultures. *American Anthropologist, 66,* 171-200. doi:10.1525/aa.1964.66.3.02a00880

Osgood, C.E., & Suci, G.J., Tannenbaum, P.H. (1957). *The Measurement of Meaning*. Urbana, Illinois: Univesity of Illinois Press.

Pieters, R., & Wedel, M. (2004). Attention capture and transfer in advertising: Brand, pictorial, and text-size effects. *Journal of Marketing, 68,* 36-50. Retrieved from http://www.jstor.org/stable/30161988

Pieters, R. & Wedel, M. (2007). Goal control of attention to advertising: The Yarbus implication. *Journal of Consumer Research, 34(2)*, 224-233. Retrieved from http://www.jstor.org/stable/10.1086/519150

Pieters, R., & Wedel, M. Zhang, J. (2007). Optimal feature advertising design under competitive clutter. *Management Science, 53*(11), 1815-1828. https://doi.org/10.1287/mnsc.1070.0732

Race and Ethnicity. (2017). U.S. Census Bureau. Retrieved from https://www.census.gov/mso/www/training/pdf/race-ethnicity-onepager.pdf

Rayner, K., Rotello, C.M., Stewart, A.J., Keir, J., Duffy, S.A. (2001). Integrating text and pictorial information: Eye movements when looking at print advertisements. *Journal of Experimental Psychology, 7*(3), 219-226. DOI: 10.1037//1076-898X.7.3.219

Rogers, E.M. (1995). *Diffusion of Innovations* (4th ed.). New York, New York: The Free Press.

Saher, M., Lindeman, M., & Koivisto Hursti, U.K. (2006). Attitudes towards genetically modified and organic foods. *Appetite, 46,* 324-331. doi:10.1016/j.appet.2006.01.015

Salient. (2018). In *Merriam-Webster's online dictionary*. Retrieved from https://www.merriam-webster.com/dictionary/salient

Wedel, M., & Pieters, R. (2000). Eye fixations on advertisements and memory for brands: A model and findings. *Marketing Science, 19*(4), 297-312. http://argo.library.okstate.edu/login?url=https://search-proquest-com.argo.library.okstate.edu/docview/212279258?accountid=4117

Wedel M., & Pieters, R. (2008). Eye tracking for visual marketing. *Foundations and Trends in Marketing, 1*(4), 231-320. http://dx.doi.org/10.1561/1700000011

World Population Projected to Reach 9.7 Billion by 2050. (2015, July 29). United Nations Department of Economic and Social Affairs. Retrieved from http://www.un.org/en/development/desa/news/population/2015-report.html

Wunderlich, S., & Gatto, K.A. (2015). Consumer perception of genetically modified organisms and sources of information. *Adv. Nutr., 6,* 842-851. doi:10.3945/an.115.008870.

# APPENDICES

# APPENDIX A

## INSTITUTIONAL REVIEW BOARD APPROVAL

**Oklahoma State University Institutional Review Board**

| | |
|---|---|
| Date: | 02/27/2018 |
| Application Number: | AG-18-7 |
| Proposal Title: | Understanding the Effect of Seal Size in Non-GMO Food Advertisements |
| Principal Investigator: | Rachel Metzger |
| Co-Investigator(s): | |
| Faculty Adviser: | DWAYNE CARTMELL |
| Project Coordinator: | |
| Research Assistant(s): | |
| Processed as: | Expedited |

**Status Recommended by Reviewer(s): Approved**
**Approval Date: 02/27/2018**
**Expiration Date: 02/26/2019**

---

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

The final versions of any recruitment, consent and assent documents bearing the IRB approval stamp are available for download from IRBManager. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be approved by the IRB. Protocol modifications requiring approval may include changes to the title, PI, adviser, other research personnel, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3. Report any unanticipated and/or adverse events to the IRB Office promptly.
4. Notify the IRB office when your research project is complete or when you are no longer affiliated with Oklahoma State University.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact the IRB Office at 223 Scott Hall (phone: 405-744-3377, irb@okstate.edu).

Sincerely,

Hugh Crethar, Chair Institutional Review Board

# APPENDIX B

## INSTITUTIONAL REVIEW BOARD MODIFICATIONS

**Oklahoma State University Institutional Review Board**

| | |
|---|---|
| Date: | 03/07/2018 |
| Application Number: | AG-18-7 |
| Proposal Title: | Understanding the Effect of Seal Size in Non-GMO Food Advertisements |
| Principal Investigator: | Rachel Metzger |
| Co-Investigator(s): | |
| Faculty Adviser: | DWAYNE CARTMELL |
| Project Coordinator: | |
| Research Assistant(s): | |

**Status Recommended by Reviewer(s): Approved**
**Approval Date:** **02/27/2018**
**Expiration Date:** **02/26/2019**

---

The requested modification to this IRB protocol has been approved. Please note that the original expiration date of the protocol has not changed.

Modifications Approved:
Modifications Approved: Modifications were made to the dummy advertisements to make them more consistent with the test advertisements to ensure eye patterns are not affected by different text and advertisement layout.

The IRB office MUST be notified when a project is complete or you are no longer affiliated with Oklahoma State University.

All approved projects are subject to monitoring by the IRB.

The final versions of any recruitment, consent and assent documents bearing the IRB approval stamp are attached. These are the versions that must be used during the study.

Sincerely,

Hugh Crethar, Chair
Institutional Review Board

**Oklahoma State University Institutional Review Board**

| | |
|---|---|
| Date: | 03/15/2018 |
| Application Number: | AG-18-7 |
| Proposal Title: | Understanding the Effect of Seal Size in Non-GMO Food Advertisements |
| Principal Investigator: | Rachel Metzger |
| Co-Investigator(s): | |
| Faculty Adviser: | DWAYNE CARTMELL |
| Project Coordinator: | |
| Research Assistant(s): | |

**Status Recommended by Reviewer(s): Approved**
**Approval Date:** **02/27/2018**
**Expiration Date:** **02/26/2019**

---

The requested modification to this IRB protocol has been approved. Please note that the original expiration date of the protocol has not changed.

Modifications Approved:
Modifications Approved: add email recruitment

The IRB office MUST be notified when a project is complete or you are no longer affiliated with Oklahoma State University.

All approved projects are subject to monitoring by the IRB.

The final versions of any recruitment, consent and assent documents bearing the IRB approval stamp are attached. These are the versions that must be used during the study.

Sincerely,

Hugh Crethar, Chair
Institutional Review Board

# APPENDIX C

# QUESTIONNAIRE

**Default Question Block**

Please rate the concept "Genetically Modified Organisms (GMOs) are ..." according to how you feel about GMOs by selecting a dot along the scale for each word pair:

| | | |
|---|---|---|
| Good | ○ ○ ○ ○ ○ ○ ○ | Bad |
| Complex | ○ ○ ○ ○ ○ ○ ○ | Simple |
| Unimportant | ○ ○ ○ ○ ○ ○ ○ | Important |
| Humorous | ○ ○ ○ ○ ○ ○ ○ | Serious |
| Positive | ○ ○ ○ ○ ○ ○ ○ | Negative |
| True | ○ ○ ○ ○ ○ ○ ○ | False |
| Cheap | ○ ○ ○ ○ ○ ○ ○ | Expensive |
| Safe | ○ ○ ○ ○ ○ ○ ○ | Dangerous |
| Fair | ○ ○ ○ ○ ○ ○ ○ | Unfair |
| Conservative | ○ ○ ○ ○ ○ ○ ○ | Innovative |
| Unhealthy | ○ ○ ○ ○ ○ ○ ○ | Healthy |
| Natural | ○ ○ ○ ○ ○ ○ ○ | Unnnatural |
| Necessary | ○ ○ ○ ○ ○ ○ ○ | Unnecessary |
| Low Quality | ○ ○ ○ ○ ○ ○ ○ | High Quality |
| Convenient | ○ ○ ○ ○ ○ ○ ○ | Inconvenient |
| Honest | ○ ○ ○ ○ ○ ○ ○ | Dishonest |
| Unemotional | ○ ○ ○ ○ ○ ○ ○ | Emotional |
| Kind | ○ ○ ○ ○ ○ ○ ○ | Cruel |
| Sustainable | ○ ○ ○ ○ ○ ○ ○ | Unsustainable |
| Puposeless | ○ ○ ○ ○ ○ ○ ○ | Beneficial |
| Confusing | ○ ○ ○ ○ ○ ○ ○ | Clear |
| Cheerful | ○ ○ ○ ○ ○ ○ ○ | Frightening |

What is your sex (check one):

- ◯ Male
- ◯ Female

Please describe your race/ethnicity: (fill in the blank)

What is your age?

Choose the highest level of education you have earned:

- ◯ Did not complete high school
- ◯ High school diploma
- ◯ Associate's degree
- ◯ Bachelor's degree
- ◯ Master's degree
- ◯ Doctoral degree

Did you participate in 4-H? (check one)

- ◯ Yes (how many years?)
- ◯ No

Did you participate in FFA? (check one)

- ◯ Yes (how many years)
- ◯ No

Which of the following have you experienced? (check all that apply to you)

- [ ] I was raised on a farm.
- [ ] I have worked on a farm.
- [ ] I have visited a farm.
- [ ] I raised livestock.
- [ ] I was/am enrolled in a college-level agriculture class.

Which best describes your home residency? (check one)

- ○ Farm
- ○ Rural area
- ○ City/Town
- ○ Suburb
- ○ Urban area

How is your immediate family associated with agriculture? *Select all that apply.*

- [ ] Not involved in agriculture
- [ ] Agricultural government agency employee
- [ ] Agricultural laborer
- [ ] Agricultural processing
- [ ] Livestock production
- [ ] Crop production
- [ ] Other (please specify):


We thank you for your time spent taking this survey.
Your response has been recorded.

Powered by Qualtrics

# APPENDIX D

## RECRUITMENT AND REMINDER EMAILS

TO: <Subject>
FROM: Rachel Metzger <rachel.metzger@okstate.edu>

SUBJECT: Your Assistance is Needed for OSU Eye-Tracking Study!

My name is Rachel Metzger, and I am a master's student in the OSU Department of Agricultural Education, Communications and Leadership. I am pursuing my master's degree in agricultural communications, and I am conducting an eye-tracking study to look at the way people view magazine advertisements.

I am emailing to request your participation in my study. Each participant, up to 100 people, will be compensated $10 for his or her time. There are no known risks in participating in this study. The study will consist of an eye-tracking portion as well as a questionnaire. Participation is completely voluntary and your answers will remain anonymous.

This study will be conducted in the User Experience Laboratory located in the new wing of Human Sciences. To find the lab, take the elevator in the new wing of Human Sciences to the fourth floor. The lab is located just off the elevator in 463 Human Sciences. Expected participation time is 20 minutes. Data collection will occur on Tuesday March 27 and Wednesday March 28 from 10 a.m. to 5 p.m.

If you have any questions, please do not hesitate to contact me at rachel.metzger@okstate.edu.

Best,
Rachel Metzger
Graduate Teaching Assistant
College of Agricultural Sciences and Natural Resources

02/26/2019
AG-18-7

TO: <Subject>
FROM: Rachel Metzger <rachel.metzger@okstate.edu>

SUBJECT: Reminder: Your Assistance is Needed for OSU Eye-Tracking Study this Week!

As a reminder, I am conducting an eye-tracking study of magazine advertisements on Tuesday March 27 and Wednesday March 28. Your participation is requested for this study. Each participant, up to 100 people, will be compensated $10 for his or her time.

We are collecting data in the User Experience Laboratory located in the new wing of Human Sciences. To participate, please come to the lab between 10 a.m. and 5 p.m. To find the lab, take the elevator in the new wing of Human Sciences to the fourth floor. The lab is located just off the elevator in 463 Human Sciences.

Best,
Rachel Metzger
Graduate Teaching Assistant
College of Agricultural Sciences and Natural Resources

02/26/2019
AG-18-7

# APPENDIX E

# CONSENT FORM

**Investigators:** Rachel Metzger and Dr. Dwayne Cartmell, Agricultural Communications

**Purpose:** The purpose of this study is to understand how people view magazine advertisements through an eye-tracking study. You must be 18 years or older to participate.

**What to Expect:** This study is administered in the User Experience Laboratory in the Human Sciences building on the OSU-Stillwater campus. By participating in this study, you will complete an eye-tracking exercise as well as an online questionnaire. You will only complete each portion of the study once. The eye-tracking and questionnaire should only take you about 20 minutes to complete.

**Risks:** There are no known risks associated with this study. Your answers will remain anonymous to protect your privacy.

**Benefits:** This study will expose you to innovative eye-tracking technology.

**Compensation:** Participants will be compensated $10 cash for their participation in this study.

**Your Rights:** Participation in this study is completely voluntary. There is no penalty for choosing not to participate, and you may withdraw your consent and participation at any time.

**Confidentiality:** Your eye-tracking data and survey answers are completely anonymous. Results will be written in aggregate, and no identifying information will be included. Research data will be stored on password-protected computers in a locked lab or within a password-protected online account. Access to your records will be limited to the researchers.

**Contacts:** If you have any questions, you may contact Rachel Metzger (Rachel.metzger@okstate.edu) or Dwayne Cartmell (Dwayne.cartmell@okstate.edu). If you have any questions about your rights as a research volunteer, you may contact the IRB Office at 223 Scott Hall, Stillwater, OK 74078, 405-744-3377, or irb@okstate.edu.

**Participant Agreement:** I have read the procedures described above. I voluntarily agree to participate and understand that by signing below, I am consenting to participate in this study and am at least 18 years of age.

Participant Signature Date

02/27/2018
02/26/2019
AG-18-7

# APPENDIX F

## NON-GMO PROJECT SEAL USE APPROVAL

# Re: Contact Us [#2709]

Marketing Team <marketing@nongmoproject.org>

Tue 2/6/2018 11:41 PM

To:Metzger, Rachel Lauren <rachel.metzger@okstate.edu>;

1 attachments (720 KB)

NGPV RGB.eps;

Hi Rachel,

This request is approved. However, please completely fictionalize the brand and the product, and include a disclaimer somewhere in your report that the brands/products are fictional.

Correct artwork is attached.

Can you please send us a copy of the report when it's complete?

Please let me know if you have any questions–thank you!

Best,
Erin

On Sat, Feb 3, 2018 at 3:52 PM, Metzger, Rachel Lauren <rachel.metzger@okstate.edu> wrote:

> Good evening,
>
> I just wanted to touch base on the conversation below regarding permission to use the non-GMO seal in a master's thesis.
>
> Please let me know if you have any questions or if there is any additional information I can provide.
>
> Best,
>
> **Rachel Metzger**
> *Student Development & Communications Graduate Asst.*
> College of Agricultural Sciences and Natural Resources
>
> 143 Agriculture North | Stillwater, Oklahoma 74078
> rachel.metzger@okstate.edu | 405.744.8061
>
> ***Expanding*** Minds, ***Inspiring*** Purpose
>
> ---
>
> **From:** Metzger, Rachel Lauren
> **Sent:** Monday, January 29, 2018 5:52:11 PM
> **To:** Marketing Team
>
> **Subject:** Re: Contact Us [#2709]
>
> Erin,

It is our intent to have the research published as it would be part of my master's thesis. However, we are not aiming to look at consumer attitudes toward the non-GMO label - we are simply looking at whether or not the size of the label has an effect on the scan path, or the way people look at the ad. We would like to use the label because it is likely the most recognizable and realistic.

I designed my own advertisement for use in the study, which I have attached. There is a placeholder where the non-GMO label would appear. The advertisement is for a partially fictional brand. Peper Patch Farms is a real entity, but they don't actually grow or sell corn to my knowledge.

Please let me know if you have any additional questions!

**Rachel Metzger**
*Student Development & Communications Graduate Asst.*
College of Agricultural Sciences and Natural Resources

143 Agriculture North | Stillwater, Oklahoma 74078
rachel.metzger@okstate.edu | 405.744.8061

***Expanding*** Minds, ***Inspiring*** Purpose

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**From:** Marketing Team <marketing@nongmoproject.org>
**Sent:** Thursday, January 25, 2018 8:38:47 PM
**To:** Metzger, Rachel Lauren
**Subject:** Re: Contact Us [#2709]

Hi Rachel,

Will this study be published, or is this just an assignment? Would you use existing advertisements, or will you be creating your own?

Thank you,
Erin

On Wed, Jan 24, 2018 at 2:05 PM, Wufoo <no-reply@wufoo.com> wrote:

| | |
|---|---|
| **Name** * | Rachel Metzger |
| **Email** * | rachel.metzger@okstate.edu |
| **What can we help you with?** * | Artwork Request |
| **Company Name** * | Oklahoma State University |
| **What questions do you have?** * | My name is Rachel Metzger and I am a master's student at Oklahoma State University. I am hoping to conduct an eye-tracking study of magazine advertisements featuring food with the non-GMO label. I am looking into the effects that label size has on the way consumers look at advertisements and what they fixate on. I am reaching out to request permission to use the Non-GMO Project label as it is likely the most commonly seen non-GMO label in stores. Please feel free to contact me with any questions. Thank you! |

VITA

Rachel Lauren Metzger

Candidate for the Degree of

Master of Science

Thesis: UNDERSTANDING THE EFFECT OF SEAL SIZE IN NON-GMO FOOD ADVERTISEMENTS AND MEASURING CONSUMER ATTITUDES TOWARD GMOS

Major Field: Agricultural Communications

Biographical:

Education:

Completed the requirements for the Master of Science/Arts in Agricultural Communications at Oklahoma State University, Stillwater, Oklahoma in May, 2018.

Completed the requirements for the Bachelor of Science/Arts in Animal Science at Oklahoma State University, Stillwater, Oklahoma in 2016.

Experience:

Served as the Student Development and Communications graduate teaching assistant in the College of Agricultural Sciences and Natural Resources at Oklahoma State University in Stillwater, Oklahoma, from June 2016 – May 2018.