

Handedness and Scale Orientation Effects on Consumer Usage of Sensory Scaling

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## **Abstract**

Sensory evaluation is integral to the understanding of individuals' perceptions of products and how the creation of those goods meet their needs. Sensory scaling systems allow researchers to translate consumer perceptions into quantitative data that can more effectively relate the story of a product. However, in some cases, biases linked to the study or the participant can taint the validity of sensory studies, causing researchers to get the wrong message from consumers. This thesis evaluates whether participants of a consumer study have biases related to their handedness and the orientation of commonly used sensory scales. This research was comprised of three studies with varying products including breakfast sandwiches, sponges, and dry pet food requiring different senses to be engaged. Each of the individual studies utilized questions formatted in the 9-point hedonic, 5-point just-about-right, and 5-point expectation and purchase intent scales. Participants were placed in one of four groups based on their handedness, right or left, and the scale they received, standard or reversed, unbeknownst to them. The data was then analyzed using an analysis of variance test to determine if the differences between the four groups mean scores were significant (CI = 95%) and a chi-squared test to determine if the distribution of selection for right- and left-handed individuals was significant. The results showed that when individuals use a 9-point hedonic scale the orientation of the scale and the handedness of the individuals have little effect on the scores given. Across all the studies there were only three out of twenty-three attributes that displayed a significant difference between two of the groups. Interestingly, for the breakfast sandwich study and sponge study there was a consistent trend that left-handed participants rated products more highly when using the standard scale. Across all three studies, right-handed individuals rated products more highly when

receiving the reversed scale. The results from the 5-point just-about-right questions were similar in that a few attribute mean scores were significantly different between the four groups, though no trend could be verified from the data. The chi-square test found few instances where the rate of liking was significantly different based on the scale orientation or handedness of the individuals. Overall, there is little effect of an individual's handedness and the orientation on the scale on the responses by the consumer, yet the trend of how each handedness group scores based off the scale orientation which they are given should be further examined with larger sample sizes.

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# **Chapter 1 - Literature Review**

## **Introduction**

The 9-point hedonic scale is an effective tool to understand the acceptances and preferences of individuals regarding a certain product. The scale is widely used to measure consumer liking in a wide range of industries including human and pet foods, cosmetics, and even cleaning products. Since its inception, the scale has remained relatively unchanged while it still consistently provides significant data that researchers, in both academia and industry, can use to improve products and services. However, knowledge regarding body-specific abstract concepts could prove to invoke differences in the way participants rate products using the scale. Individuals perceive positive traits to be correlated to the side of their body that corresponds with their dominant hand (Casasanto, 2009). The hedonic scale is structured with a spectrum of right is positive and left is negative. The introduction of scales designed for both left- and right-handed individuals may provide more accurate responses that eliminate any body-specific concept bias.

## **Sensory Analysis**

Sensory evaluation is a tool used by both academia and industry to gain an in-depth understanding of how consumers perceive products. Better put, “sensory evaluation is a scientific discipline used to evoke, measure, analyze, and interpret reaction to those characteristics of foods and materials as they are perceived by the senses of sight, smell, taste, touch, and hearing” (Stone and Sidel, 2004). This tool is used in many different areas spanning quality control, research and development, and even determining consumer insights and trends. Products that are used in testing range far beyond typical foods and include such things as furniture polish, personal care products, fabrics, lipsticks, etc. (Stone and Sidel, 2004).

Sensory evaluation is unique in the fact that it relies heavily on the human subject in order to evaluate products and thus precautions should be taken to understand individual bias to achieve clear and accurate results. Individuals selected for evaluating products who receive no training can be quite variable over periods of time, prone to bias, and vary in their perceptions of the product (Meilgaard et al., 2007). For this reason, it is important to ensure that the evaluations minimize bias through the use of multiple evaluation replications, appropriate number of participants, and identifying possible hazards prior to the initiation of the test (Meilgaard et al., 2007).

Sensory analysis is divided into three main subcategories that are used to measure responses based on the goal of the study. The methods that are used include discriminative, descriptive, and affective methods which each have distinctive purposes for evaluation (Lawless and Heymann, 2010). The discriminative methods are primarily used to determine whether individuals can successfully identify if products are different from one another. This may be utilized when a producer wants to change an ingredient for a lower-cost substitute or may have changed the production process and wants to know if a noticeable difference can be detected by consumers (Lawless and Heymann, 2010). Descriptive methods are used to gain detailed understanding of products through their attributes and intensities when evaluated by highly trained individuals. These evaluations can be used to understand how a company's goods may differ from competitors as well as indicate shelf-life deterioration of products (Lawless and Heymann, 2010). The last major type of sensory evaluation is affective methods and is used to understand how well individuals like or dislike certain products. This type of testing is commonly used to gain understanding of how well the population may like a new product or determine if a competitor's goods contain attributes that impact liking. These three methods

form the backbone of sensory analysis and have proven to be useful tools for understanding consumers.

Ability to measure the response that individuals have towards an item is vital in reaching conclusions about the item itself. Each method uses a different type of ballot to obtain consumers perceptions and to understand the individual's perception about the product. The ballots used in discrimination tests simply ask the participant to identify a certain product (Meilgaard et al., 2007). Generally, individuals try to determine if the product is different, as is the case with the triangle test, or if the product is similar to a reference, as is the case with the duo-trio test. These are not the only types of discrimination tests. There have been recent investigations to determine whether or not the tetrad test is a better option than triangle testing for discrimination testing (Zhang, 2013). Tetrad testing involves the use of two products making up four samples and asks participants to match the two products in sets. Descriptive ballots measure trained panelists responses through two main principles, character notes and intensities. The attributes indicate the sensation being perceived while the intensity indicates how strongly that sensation is experienced. The Spectrum Method, developed by Muñoz and Civille, uses a ballot containing attributes that are present within a product and asks trained panelists to indicate the intensity of those attributes on a 15-point scale (Muñoz and Civille, 1992). There are a number of other descriptive methods that use different types of scales but all focus around the main principles of character notes and intensities. Affective methodology uses many different scales within the ballot to understand how well individuals like a product. Two scales commonly used when evaluating products for consumer acceptance and preference are the 9-point hedonic scale and 5-point just-about-right scale. The hedonic scale allows individuals to indicate how well they like or dislike the product overall or certain aspects of the product, such as appearance,

texture, etc. The just-about-right scale measures how the product can be changed to increase consumer liking. Additional scale types that have been frequently utilized are the line scale and labeled affective magnitude scale. These scales do not show significant differences in how well participants like products (Hein et al., 2008).

Testing using either central location tests or descriptive tests should be performed in a controlled environment where possible biases are limited. Descriptive testing uses highly trained panelists whereas central location testing engages the average consumer. Both types of testing use the sensory receptors of individuals and it is important to inhibit any type of environmental effects which might influence participants' perceptions. When performing evaluations, it is important to use a room free of lingering odors in order not to influence the assessors' judgements (Kemp et al., 2009). The booths should be an off-white color and a constant temperature that is comfortable for the individuals of that culture should be maintained. Lighting can also play a role in how individuals perceive products; thus it is necessary to have lights between 755 and 1070 lux without shadows (Kemp et al., 2009). Descriptive testing takes place in a laboratory setting, whereas affective testing can take place in one of three environments. Affective testing can use laboratory settings, central-location-tests (CLT), or home-use-tests (HUT) (Stone and Sidel, 2004). The most frequently used method is the CLT due to the fact that the test can be controlled more easily than home use tests and uses the general public to produce conclusions (Stone and Sidel, 2004). Affective methods may also include speaking with individuals to gain an understanding of the product through one-on-one interviews or even focus groups. The rooms used for these interviews should be as bias proof as possible, although it is not critical, as individuals do not commonly evaluate any products during interviews.

## **History and Use of Hedonic Scale**

The 9-point hedonic scale has had a long history of being used by industry not only in human food settings, but also in areas of cosmetics, fabrics, pet food, and even service reviews. While many versions of the scale have been generated, the 9-point scale still proves to generate the most reliable data while being simple for participants to use and understand. The reliability of the scale was based on the ability to produce similar results when the same food was evaluated multiple times using this scale. The scale was first developed by the Quartermaster Food and Container Institute for the Armed Forces and was aimed at determining the most liked meal items for soldiers (Jones, Peryam, and Thurstone, 1955). The original scale had been carefully crafted to accurately measure the acceptance and preferences of soldiers and thus allow more highly liked foods to be selected. Researchers believed that the foods with a greater sense of satiety and nourishment would increase concentration and motivation. For this reason, it was imperative to create a scale that produced accurate and reliable results that could be used in the aftermath of World War II.

Researchers studied many different variations of the scales to determine if one generated higher reliability or more meaningful data. Doing so, they evaluated various wordings that could be used to correlate individuals' feelings towards the food products they evaluated. Upon completion, they selected phrases that indicated levels of liking with low ambiguity wording. In the creation of scales, significant consideration was paid to factors that would make the scale successful, including time needed to complete, reliability, and transmitted information. The researchers created nine scales of varying length, balance, and wording to evaluate liking of 20 different traditional Army meals. The scale lengths included five to nine anchored values. Some of the scales were unbalanced meaning there were more liking or disliking values, while

others did not contain a neutral point of “neither like nor dislike.” After the assessment, researchers determined that the time needed to evaluate the meals did increase with the length of the scales used although not enough to warrant discontinuation of longer scales. The reliability of the scales was high among the different lengths and balances, yet no scale was considered to have significantly higher reliability. The amount of transmitted information differed slightly among the scales, however, the reproducibility of results stayed constant indicating the scales had good reliability (Jones, Peryam, and Thurstone, 1955). Previous research indicated that scales with greater numbers of selection possibilities allowed for greater discrimination of samples (Bendig and Hume, 1953). Although there are many possible scaling options for determining liking of military meals, researchers determined that scales with greater lengths increased the transmitted information, institutionalizing the use the 9-point hedonic scale historically (Jones, Peryam, Thurstone, 1955).

Since the original success of the hedonic scale, further testing has been conducted to maximize its reliability and assess how to best analyze the output data. In the paper “Hedonic Scale Method of Measuring Food Preferences,” Peryam and Pilgrim discuss the final version of the scale and how it can be a reliable tool for understanding consumers perceptions (Peryam and Pilgrim, 1957). This final version is once again a scale consisting of nine points anchored by wordings that express the responses a person may have towards the food. The scale consists of a dichotomic continuum where liking increases toward one end. These simplicities in the scale are necessary for initial impression responses as the consumer must be considered naïve (Peryam and Pilgrim, 1957).

One aspect discussed by the authors is the orientation of the scale and the lack of effect it has on the consumers participating in the tests. They concluded that the scale orientation does

not play an effect on the judgements of the participants. The researchers evaluated horizontal and vertical versions of the scales and noted that neither presented significantly more reliable results. Likewise, scales were presented with the like to dislike continuum ranging from left-to-right as well as right-to-left and still no significant change in the results existed (Peryam and Pilgrim, 1957). The conclusion of the authors is important as it conveys the strength of the scale even when the orientation of the scale is altered.

Data consistency is important to achieve meaningful results and therefore the authors discuss the importance of the three main variances that can affect results. The first is the judgement-treatment interaction and refers to the differences in preference among individuals. This type of variance will always be present within studies, although with a significant number of individuals tested in the study, this variance can be nearly eliminated, and a consistent trend can be obtained. The second type of variance is due to the differences among individuals and how they rate products overall. Individuals differ in their usage of the scale, as some may be more willing to use the extreme ends of the scale while others may stay reserved towards the middle. The last type of variance, which can have the largest impact on results, is the session effect. This effect results when the environmental situations or population types significantly differ. Examples of this would be if individuals tested soup in a hot room compared to a cold room, or if Mexicans evaluated spicy tacos compared to Canadians. Each of these groups may elicit significantly different results due to the environs of the session or intrinsic factors of the subjects, and because of this it is important to maintain consistency among tests and subjects. These variances should be considered, and precautions should be taken to best avoid them before testing is initiated to obtain accurate and reliable data (Peryam and Pilgrim, 1957).

The perceptions of individuals toward the tested products are only one small portion of the complete test. There are both extrinsic and intrinsic factors that play upon the individual and are sometimes impossible to foresee. Extrinsic factors tend to affect intrinsic factors of individuals. Color is one example of this as certain colors can elicit positive or negative emotions toward products being evaluated (Hanada, 2017; Ismael and Ploeger, 2019). As discussed previously, environment can also affect judgement and increase or decrease desired attribute intensities (Stelick et al., 2018). The extrinsic factors are easier to control, as is the case for all white testing facilities, while intrinsic factors are challenging to anticipate as it is impossible to understand every participants' internal concepts.

Special effects must also be taken into consideration as noted by the Peryam and Pilgrim as they can also influence the evaluations of the samples (Peryam and Pilgrim, 1957). The contrast effect is noted as the effect that occurs when a sample is evaluated after a predecessor. Kamenetzy noted this effect in his study, finding that poor quality foods were rated lower when led by good quality foods (Kamenetzy, 1959). The contamination effect is another noted issue and occurs when average rated samples are tested adjacent to samples of high or low quality. The average sample will be rated more highly if it appears with high quality products and rated lower if with low quality products. The last-mentioned effect in the paper is the position effect and indicates that the product that is served in the first position receives higher ratings as compared to the rest of the samples. The preferential method to remedy this effect is by randomizing the order of samples and for each item to appear in the first position an equal number of times to the participants (Lawless and Heymann, 2010). The special effects discussed in the paper are a confounder in many studies and without proper consideration can be detrimental to obtaining accurate results.

The original paper by Peryam and Pilgrim outlining the hedonic scale, details how it should be used and summarizes some of the pitfalls that should be avoided. Because of the incredible initial success of the hedonic scale, many researchers overlooked that fact that some of the intervals were not perceived equally by the participants (Jones and Thurston, 1955; Moskowitz, 1977). Even with this drawback, the scale remained unchanged due in part to the familiarity that individuals felt with the scale. The scales are now used for a multitude of studies including products in food industry, fabrics and textiles (Pearce et al., 1986), and even pet foods (Hempanpairoh, 2020; Di Donfrancesco et al., 2014).

With the realization that the nine-point hedonic scale could be used as a fundamental tool for sensory scientists, subsequent studies aimed at altering the scale to be more amenable to a wider audience. One of the groups for which the scale needed adaptation was children and younger individuals who cannot read. Researchers determined that children were capable of using the scale effectively, but the length and anchors must be adjusted appropriately (Chen et al., 1996). The scale developed for children is a visual facial scale, showing a range of happy and sad faces with descriptive anchors of “Super Good” to “Super Bad” (Chen et al., 1996). The length of the scale also varies depending on the age group, with children between 36-47 months using a three-point scale, 48-59 months using a five-point scale, and 60-71 months using a seven-point scale. A more recent study used emojis as a substitute of the descriptive anchors in both American and Chinese children, demonstrating complete understanding by both nationalities for use of the scale (Deubler, 2019).

Additional modifications of the scale were needed to reach groups further outside of the United States and English-speaking countries. When the scale was translated into Spanish for individuals in Argentina, the literal translation of the wordings proved to be confusing (Curia et

al., 2001). Thus, it is recommended that translation of the scale should be handled with extreme caution as perceptions and meanings vary based on different cultures. Versions of the scale have been translated for many Asian speaking countries which allows researchers to identify variations in the way each Asian culture uses the scale. Participants identifying as Chinese, Korean, Japanese, and Thai did not use as wide a range when evaluating food items when compared to Americans (Yeh et al., 1998; Yao et al., 2003). When translated correctly into various languages, the hedonic scale becomes a staple of effective testing allowing researchers to understand perception of individuals toward products as well as to compare psychological factors across cultures.

Since its original conception, as an evaluation tool for soldiers liking of particular military meals, the hedonic scale has remained mainly unchanged, yet it still provides reliable results. The scale provides useful information including understanding whether new products will be accepted by the market, evaluating how shelf-life affects liking, or when paired with other analytics can tell what attributes may result in mass liking. Today the scale is a fundamental tool for nearly every sensory laboratory in the evaluation of acceptance and liking of food products by individuals.

### **Right- and Left-Handed Individuals Perceptions of the World**

The development of human bodies within the womb of their mothers is a highly complicated process that is not completely understood. Among the mysteries yet to be unraveled is what causes individuals to become right- or left-handed. Researchers are also investigating how handedness alters an individual's perceptions of the world, especially towards positive and negative spatial constructs. This continued research could prove to be influential in creating

products and processes that are more accommodating to individuals of both dominant hand types.

Indication of dominant handedness can first be seen during pregnancy when the fetus demonstrates tendencies toward one side or the other. The first sign of handedness that can be identified is which thumb that the fetus sucks inside the womb. Fetuses are more inclined to suck on the thumb that is attached to the dominant hand (Hepper et al., 1991). Whether this is an environmental aspect of the womb, or a specific genetic influence is still debated. Even though most people would consider the body to have a symmetric form, when viewing at the chest cavity there are asymmetries. The heart and stomach are situated toward the left side of the abdomen whereas the liver is predominantly on the right. The question then becomes, “Is there a normal way in which fetuses grow in the womb that gives the right arm more space, causing greater use of it?” On the flip side, is there a genetic component that predisposes handedness resulting in similar dominant handedness in some families? One study indicates that this is likely the case, as adopted children were more likely to share the same dominant hand with their biological parents rather than their adopted parents (Carter-Saltzman, 1980). Other attributions to handedness involve the months in which a child was born (Jones and Martin, 2008) and even the testosterone levels during fetal development (Witelson and Nowakowski, 1991; Medland et al., 2005).

One primary focus in understanding the source of an individual’s handedness starts in the brain, specifically the cerebral hemispheres. Although the two hemispheres easily communicate with one another across the corpus callosum, their purposes are completely different. For right-handed individuals, the main location for speech functions is in the left-hemisphere, but this is only the case for 60% of left-handed individuals (Gutwinski, 2011).

Another striking difference between the two groups is the size of the motor cortex located in the opposite hemisphere of the dominant hand. In right-handed individuals the motor cortex was larger in the left-hemisphere and in left-handed individuals it was larger in the right-hemisphere (Germann et al., 2019). These physiological and anatomical differences correlate to the differences in right- and left-handed individuals, but the personalities of these two groups does not appear to be significantly different.

Left-handed individuals may also be more creative than their counterparts, especially in males, as they have higher divergent thinking scores (Coren, 1995). Overall, there are some inferences that can be made about right- and left-handed personalities, and many internet articles try to do so, yet it is an extremely complicated matter with multitude of factors playing upon it.

Throughout the long history of man there has always been a construct of social hierarchy stipulating the appearance of the “ideal” human, This ideal has been enforced in both positive and negative manners. Some societies have favored certain physical traits and attempted to breed out other “undesirable” traits. Others used genetic malformity identification to help stop severe disabilities from occurring (Mitchell et al., 1996). Among the conventions held by individuals and societies, one of the most baffling is the way cultures viewed the left-handed. These people were often considered sinful, cursed or odd.

Some early foundations for discrimination against left-handed individuals can be found in religious texts. For Christians the Bible contains many verses identifying the right as being the side of power or good, as is the case with the Hebrews 1:3, where Jesus ascended into heaven and sits at the right hand of the Father (New Living Translation, Hebrews 1:3, 2015). There are also verses that show the contempt for the left as Ecclesiastes states “A wise man’s heart inclines him to the right, but a fool’s heart to the left” (ESV, Ecclesiastes 10:2, 2021). Many ancient

civilizations also attributed the right as being the side of honor as the case with Egyptians, Greeks, and Romans who used their right hands to bless individuals (Valentin, 2020). Fast forward to the Middle Ages, left-handed individuals were accused of being associated with witchcraft and other devilish acts (Rothman, 2015). Even the roots of the words left and right show favoritism toward the sides they portray. The root for left, sinister, means evil or presence of ill fortune. The root for right, dexter, refers to being skillful (Casasanto, 2011). Because left-handedness is rarer, prejudice towards this less dominant culture is not uncommon. Bias against those who are left-handed has spanned the centuries and still affects some conceptions today, i.e., using right hands to salute, to shake someone's hand when greeting them or making a deal.

Assigning positive and negative idioms toward spatial planes can further indicate the strong preference society has toward specific directions. Daniel Casasanto studied the perceptions of good and bad relating to sides of the body in his paper "Embodiment of Abstract Concepts: Good and Bad in Right- and Left-Handers." The main focus of the paper was to understand if the concepts of good and bad are specific to the body of an individual or rather held constant by a whole society. The first finding from his research proved that both right- and left-handed people could definitively agree on one thing: "Good Is Up" (Casasanto, 2009). The study showed a diagram of a stick figure with two boxes, one above him and one below him, and asked individuals to draw a zebra in the box corresponding with good. Over 80% of both hand types placed the zebra in the box equivalent to the position above the stick figure. This directly correlates with the societal belief that good is up and is proven through the many metaphors including "top tier/top dog," or the belief that God exists toward the sky while the Devil is under the Earth (Meier and Robinson, 2007; Gottwald et al., 2015; So, 2000).

The second part of Casasanto's study focused on the horizontal plane and showed much more variation among the two groups. He again asked participants to place the zebra in the box that most corresponded with good, however the boxes were now placed to the right and left of the stick figure. The results showed that two-thirds of participants placed the zebra in the box that correlated to the dominant side of the person's hand (Casasanto, 2009). Additional observational studies were conducted looking at the 2004 and 2008 presidential election and showed that right-handed candidates associated positive speech with their dominant hand (Casasanto, 2011). In some cases, this goes against each parties' directional metaphors as Conservatives are considered the right whereas Liberals are considered the left. These initial studies further prove that individuals perceive the world reflective of their own body.

Interestingly, this conception of dominant side being correlated with positive traits can be reversed. Casasanto and Chrysikou investigated individuals with both long-term and short-term handicap due to loss of function in their dominant hand. They found that individuals having lost the function of their dominant hand, either permanently or temporarily, began to portray positivity traits with their new dominant hand. The explanation given in the study is that individuals perceive accessibility with positivity. Furthermore, when the ease of their former dominant hand is taken away from an individual, they tend to transfer their perceptions of positivity toward their new dominant hand (Casasanto and Evangelia, 2011).

Overall, there is a strong association between an individual's dominant body side in relation to positive emotions and idioms. These ideas form at a very young age as even children at the age of 5 years old will attribute the positive trait of intelligence with the side of their dominant hand (Casasanto and Tania, 2012). This proves that there is a body-specific component to the way in which people identify positive and negative valence. These perceptions

from individuals proceed in making societal inferences about life overall, thus people believe good is up and good is right. This is a result of a predominance of the population being right-handed thus creating unopposed metaphors and ideas on positivity's directionality. These beliefs were present throughout the long history of suppression of left-handed individuals and were not fully understood until the work of Casasanto. By identifying the differences in perceptions of good and bad in both right- and left-handed individuals' view of spatial valence, the sensory field can create scales better suited for all participants.

## **Research Objectives**

Individuals' perceptions can be greatly affected by the bodies which they inhabit. This could alter the way in which participants who are left-handed read the 9-point hedonic scale due to the continuum that is used. Comparing results of both standard and reversed scales may expose an underlying bias for individuals when using a scale that contradicts their internal stigmas.

The main objective of this study is to understand whether there is a difference in the way right- and left-handed individuals perceive the orientation of the scale affecting their usage of it. The tests will focus on altering the scale's continuum to both agree and disagree with each handedness's positive and negative conceptions of spatial planes. In doing so, clearer understanding will be made as to how significant the effect of scale orientation and handedness is on judgements of individuals.

Products used to evaluate the perceptions of individuals based on handedness included pet food, sponges, and breakfast sandwiches. The product categories for the studies were selected based on the differing modalities of sensory perception. Individuals evaluated the dry dog food based on its appearance and aroma properties. Hand manipulation of the product was evaluated in the sponge study. Lastly, the taste modality was evaluated through the use of breakfast sandwiches. The variation in product categories allowed for better understanding whether the modality plays a role in scoring based on handedness and scale orientation.

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# **Chapter 2 - Handedness and Scale Orientation Effect on Visual Evaluation of Pet Foods**

## **Abstract**

The scaling systems in sensory evaluation play a vital role in understanding how individuals like certain products. The scale follows a logical continuum with increasing attribute liking from left to right. However, in the literature, there is a lack of discussion on whether the orientation of the scale or a participants' handedness influences their conception of the scale. The purpose of this study is to determine whether there is an effect on liking scores based on participants' handedness and/or the orientation of the scale (standard vs. reversed) when evaluating visual stimuli. Seven different commercially available dry dog foods were used to evaluate consumers' liking and preferences. Individuals used a 9-point hedonic scale to record liking for specific attributes in the dog food as well as 5-point just-about-right, expectation, and purchase intent scales. The results of this study showed that there was no clear scale orientation that should be used for right and left-handed individuals. For seven of the nine liking attributes, there was no significant difference based on handedness or interaction with scale orientation ( $p > 0.05$ ). There was, however, a slight trend in scale orientation, as individuals receiving the reversed 9-point scale tended to show higher liking for specific attributes regardless of handedness. This may be due to the way in which they use the top 2 choices. The participants did exhibit differences in liking for each of the samples evaluated, with Sample 1 being most liked. The liking for this sample was mainly based on visual components as it scored highest for appearance, color, and size liking. This study can be used as a basis for additional investigations to determine if sensory scales demonstrate adequate orientation for all people or if embodiment concepts create biases.

## Introduction

Handedness and spatial perceptions play a role when individuals perform tasks although these biases may not be readily apparent. These perceptions create positive and negative valence toward one specific side of the body and thus create biases (Casasanto, 2009). These differences are initiated in the brain, possibly due to the high lateralization or lack of it. Right-handed individuals' brains are more asymmetrical than left-handed individuals, as each hemisphere is highly specialized to perform certain processes (Price, 2009). Although left-handed individuals' brains can be highly lateralized like their right-handed counterparts, they more frequently demonstrate less lateralization allowing the two hemispheres to communicate more easily with one another (Price, 2009). This ready communication in the brain is thought to enhance creative thinking. The more highly lateralized brains are more skilled in arithmetic and memory tasks (Price, 2009; Preti & Vellante, 2007).

These contrasts in brain structure and function may produce varied observational differences within right- and left-handed individuals. Le Bigot and Grosjean (2012) noted that the two groups of handedness show different levels of visual sensitivity when a hand is engaged. Left-handed individuals recorded higher visual sensitivity scores when engaging both dominant and non-dominant hands as compared to right-handed individuals; whereas right-handed individuals had higher visual sensitivity when neither hand was involved. This higher sensitivity in left-handed individuals may be due to the ready communication between hemispheres producing higher sensitivity when either hand is used.

There are various modalities that can be used to evaluate products and how they affect the sensory receptors in the human body. The first modality of sensory perception to be tested was that of visual stimulation. Dry dog food was used to evaluate visual stimulation as

participants were not required to ingest the product, but in-depth analysis could still be performed. This study assessed whether bias would occur based on handedness when visual presentation was the primary form of evaluation.

The objective of this study was to determine if individuals' assign different liking scores based on their handedness as well as the orientation of the scale when the product evaluation involved only visual stimulation. Dry dog foods were used for this evaluation as they are a common product in households of individuals owning a dog and unique variations between samples make it suitable for this assessment. In previous studies, the authors discuss the main preferences for the samples stem from visual stimuli making it an ideal product for this portion of the research.

## **Materials and Methods**

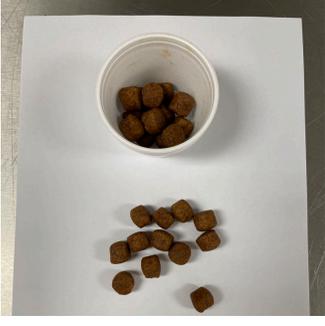
### **Samples**

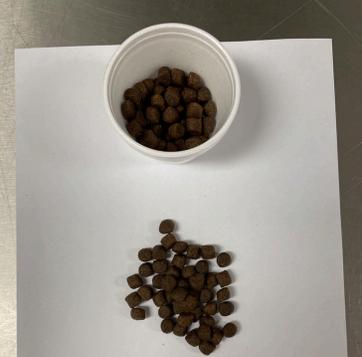
The study used seven different commercially available dry dog foods to evaluate the characteristics for liking. This research was constructed to emulate a previous study by Di Donfrancesco et al. (2014) which used a variety of samples to understand what drives consumer liking. Although in the current study the drivers of liking were not the main purpose of the study, this data can still be used to understand how these trends in consumer liking have changed over time. At the time of the study, there were a few samples from the Di Donfrancesco et al. (2014) study that were no longer produced and thus alternative samples with similar characteristics were used.

All samples were purchased at retail locations in the Kansas City (KS, USA) area (Table 2.1). Samples were purchased at major retailers such as Walmart™, Petco® and PetSmart™ as well as local pet specialty stores. The samples were distinctive from one another and ranged on a

scale of brown coloring, while Sample 1 was quite colorful. The shapes were also unique as some products were squares, triangles, spheres, and star shapes as well as some having mixes of multiple shapes and others containing only a single shape.

**Table 2.1.** Dry Dog Food Samples Used for the Central Location Test

<b>Samples</b>	<b>Shape</b>	<b>Size</b>	<b>Photo</b>
Sample 1	Miscellaneous	Medium	
Sample 2	Square	Small	
Sample 3	Nugget	Large	

Sample 4	Nugget	Small	
Sample 5	Nugget	Small	
Sample 6	Flower Nugget	Medium	
Sample 7	Miscellaneous, Triangular	Small	

After obtaining the products, the samples were stored at room temperature before they were individually packaged for evaluation. The products were all within the best buy date when

the study took place. All samples were distributed into 4 oz insulated foam souffle cups (Dart JCup 4J6, New Castle, Delaware, USA) and covered with a lid (Dart No Vent Lid 6CLR, Madisonville, Kentucky, USA), inhibiting the release of volatile aromatics. Approximately 40 grams ( $\pm 1$  gram) of each sample were weighed out and placed in the Styrofoam souffle cups using Sartorius Practum<sup>®</sup> Precision Balance (Version 1102-1S, Goettingen, Germany).

Styrofoam cups were chosen as they seal in the strong aromas of dog food and were also used in the previous study by Di Donfrancesco et al. (2014). The balance was calibrated prior to the first use and each foam cup that was placed on the scale was tared before addition of dry dog food. Three-digit codes were placed on the lids to keep products identity concealed. The individual samples were then stored in plastic tubs until evaluation.

## **Subjects**

Participants were recruited from around the Kansas City area using the Sensory and Consumer Research Center database at Kansas State University. Individuals were asked to fill out a screener sent via the Compusense Cloud 5.0 (Compusense Inc., Guelph, Ontario, Canada, Version 21.0.7859.31683). To be eligible for participation in the study, participants needed to fit certain requirements of common dog food users. The recruits must own a dog, use dry pet food for feeding, perform the main purchasing of dog food in the household, be older than 18, and cannot work for any animal shelter/hospital as well as advertising/market research companies.

The study also focused on recruiting an equal number of right- and left-handed individuals, but as seen in previous research (Casasanto, 2009), there are a limited number of left-handed individuals in the population. This limit, along with the screener criteria, significantly reduced the number of left-handed consumers that were eligible for the study. In total, 60 right-handed participants and 44 left-handed participants were recruited for the

evaluation of the dry pet foods. This number far exceeds the percentage ratio of left-handed individuals in the general population of the world (10%) as well as the number of individuals examined in previous studies evaluating handedness (Casasanto, 2009; Casasanto & Tania, 2012).

The research was approved by the Institutional Review Board for Protection of Human Subjects (IRB # 10347).

### **Central Location Test**

The test was conducted at the Sensory and Consumer Research Center at Kansas State University- Olathe Campus, Kansas. The participants were asked to select one of five sessions to attend, each lasting 50 minutes. Two rooms were set up for the study, each holding a total of 12 individuals. Tables were arranged with paper placemats, water bottles, and iPads with the Compusense software downloaded. The placemats were used to encourage participants to feel the product and to pour it out on the table.

Upon arrival, participants signed in at the front desk and were instructed to take a seat at one of the tables. They signed into their specific account and waited for the session moderator to begin the test. The moderator described their tasks during the study and then instructed the individuals to initiate the test. Following instructions, the first round of samples were provided to the participants.

Samples were served in a sequential monadic manner and all seven samples were evaluated by all participants in the 50-minute session. The order was completely randomized for each participant and all possible permutations were used to ensure an even distribution of sample orders.

## Questionnaire

The questions used during the evaluation mirrored those asked during the original study by Di Donfrancesco et al. (2014) as individuals in that study could clearly understand the wording used. The questions included perceptions of both appearance and aroma of each sample. The 9-point hedonic scale was used for evaluating the liking of the overall product, appearance, aroma, color, size, shape, uniformity, oily appearance, and expected animal perception. These scales were constructed of nine individual points that included a spectrum of both like and dislike. The scale followed the same format as the original works by Peryam and Pilgrim (1957) where 1 indicated “dislike extremely,” 9 indicated “like extremely,” and 5 indicated “neither like nor dislike.” The scale increased in intensity for both like and dislike away from the center point.

The questionnaire used a 5-point just-about-right scale to indicate how the product can be changed to increase liking. The scale consisted of five points where 1 indicated the attribute was “much too weak,” 3 indicated “just about right,” and 5 indicated “much too strong.” This scale helped to clarify if shorter scales demonstrate differences between the two groups of individuals in the study. The just-about-right scale was used to determine improvements in the product for aroma, color (too light/too dark), size (too small/too large), and oily appearance (not oily enough/too oily).

Purchase intent and expectation of the dry dog foods were also evaluated using a 5-point scale. The purchase intent scale indicated how willing individuals would be to purchase the product if it was easily available with 1 indicating “definitely will not buy,” 5 indicating “definitely will buy,” and 3 indicating “might or might not buy.” Likewise, expectation asked how well the sample met the individual’s expectation for dry dog food with 1 indicating “much

worse than expected,” 5 indicating “much better than expected,” and 3 indicating “meets expectations.”

Demographic questions were also included at the end of the study once all samples had been evaluated (Table 2.2). The purpose of these questions was to understand the composition of the pool of participants as well as verifying that they met the requirements for the study. The questions queried individuals about their gender, age, annual income, handedness, number of dogs owned, dog size(s), who the pet food buyer is, brands purchased and location of purchase, and type of foods purchased (wet, dry, homemade etc.).

**Table 2.2.** Demographics of Dry Dog Food Consumers for CLT

<b>Owner Characteristics</b>	<b>Categories</b>	<b>Frequency</b>	<b>%</b>
Gender	Male	44	42%
	Female	60	58%
Age	17 years or younger	0	0%
	18-24 years	3	3%
	25-34 years	14	13%
	35-44 years	28	27%
	45-54 years	35	34%
	55-64 years	16	15%
	65 years or older	8	8%
Annual Income	Below \$25,000	0	0%
	\$25,001-\$49,999	5	5%
	\$50,000-\$74,999	15	14%
	\$75,000-\$99,999	27	26%
	\$100,000 or more	57	55%
Handedness	Right	60	58%
	Left	44	42%
# of Dogs in Household	1	55	53%
	2	41	39%

	3	3	3%
	4 or more	5	5%
Dog size(s)	Extra small (less than 16 lbs.)	21	20%
	Small (16-35 lbs.)	32	31%
	Medium (36-55 lbs.)	44	42%
	Large (more than 55 lbs.)	31	31%

The questionnaire was also modified based on whether the person was right- or left-handed. Two versions of the questionnaire were created, a standard form which had traditional scaling, where numbers and liking increase from left to right, and a reversed scale, where numbers and liking increase from right to left. Four groups were created for the sessions and each consisted of right-handed participants receiving the standard scale, right-handed participants receiving the reversed scale, left-handed participants receiving the standard scale, and left-handed participants receiving the reversed scale.

The scheduler and screener were used to determine how many right- and left-handed individuals were present during each session. These individuals were then manually placed into groups and given either the standard or reversed questionnaire. The groups were divided evenly among the right- and left-handed individuals to ensure an identical number of individuals within each of the handedness groups evaluated the scales. Individuals were also split evenly for scale orientation in each individual session to prevent any session effect from occurring.

### **Data Analysis**

The data was downloaded from the Compusense software and copied into an Excel spreadsheet (Excel, Microsoft Office 2021, Version 16.47.1). This software was used to determine means, percentages, standard deviations, and sums of various data. For further data manipulation, XLSTAT by Addinsoft (Version 21.1.1) was used to determine multivariate

analysis of variance (MANOVA) and analysis of variance (ANOVA) using the Tukey’s Post Hoc test. Lastly, the chi-squared test was used to determine if the distributions of selections for right- and left-handed individuals were significantly different as well as the distributions of selections for standard and reversed scale usage. All tests were performed at a confidence level of 95%.

## Results and Discussion

### Handedness Evaluation

The first test that was performed was the multivariate analysis of variance (MANOVA) to determine if handedness, scale orientation and their interaction cause a significant effect on the scoring of individuals. The test found that there was no significant effect related to the scale orientation, however handedness displayed an effect on individuals scoring ( $p < 0.05$ ). Further analysis using the analysis of variance aims to understand if these differences in handedness of individuals is true for all 9-point hedonic results. The MANOVA test also detected differences among samples when combining all of the attributes. The interactions did not contribute any significant effect. All of the 9-point attributes were used as factors in the MANOVA test including overall, aroma, appearance, color, size, shape, uniformity, oily and dog liking.

**Table 2.3.** P-Values for MANOVA Testing of Handedness and Scale Orientation of Dry Dog Food When Using the 9-Point Hedonic Scale.

	Handedness	Scale Orientation	Sample	Handedness *Scale	Handedness *Sample	Scale Orientation* Sample
Lambda	0.965	0.984	0.608	0.976	0.934	0.930
F (Observed values)	2.783	1.248	6.757	1.889	0.888	0.951
DF1	9	9	54	9	54	54
DF2	698	698	3564	698	3564	3564
F (Critical value)	1.893	1.893	1.340	1.893	1.340	1.340
p-value	0.003	0.262	0.000	0.051	0.704	0.577

\*Values in red display significance ( $p < 0.05$ ).

Analysis of variance was also performed to determine which factors caused significant differences. The ANOVA model was performed with three factors including handedness, scale orientation and the pet food sample. Interactions for these three factors were also accounted. The model found significant differences ( $p < 0.05$ ) for all of the hedonic attributes evaluated, however this is due to the individuals' evaluations of the pet food. For aroma liking the mean scores between right- and left-handed individuals was significantly different ( $p < 0.05$ ) as left-handed participants scored higher. The scale orientation had different mean scores ( $p < 0.05$ ) for the oily liking while the interaction between handedness and scale orientation had differences for expected dog liking. Table 2.4 shows the p-values for the ANOVA model, the factors, and their interactions.

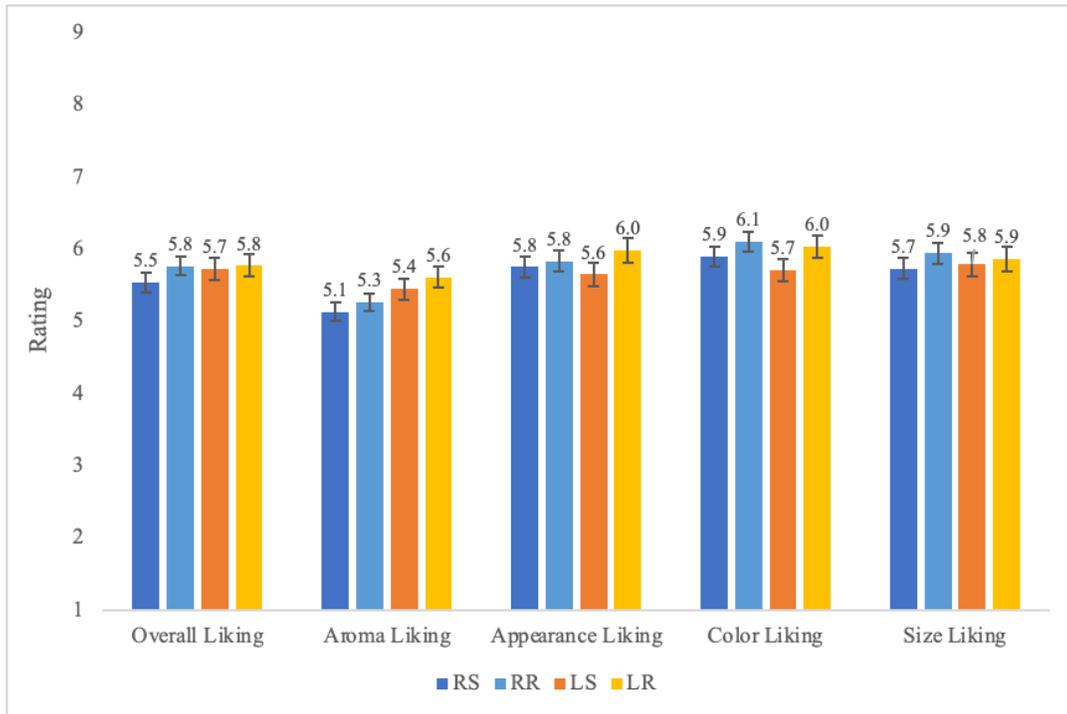
**Table 2.4.** P-Values of ANOVA Model and Factors for Dry Dog Food Using a 9-Point Scale.

	Overall Liking	Aroma Liking	Appearance Liking	Color Liking	Size Liking	Shape Liking	Uniformity Liking	Oily Liking	Dog Liking
Model	0.004	0.002	0.000	<0.0001	<0.0001	<0.0001	<0.0001	0.026	0.028
Handedness	0.470	0.013	0.875	0.353	0.936	0.155	0.776	0.685	0.128
Scale	0.346	0.261	0.177	0.056	0.338	0.193	0.235	0.009	0.700
Sample	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.044	0.004
Handedness*Scale	0.504	0.915	0.405	0.652	0.653	0.850	0.564	0.409	0.028
Handedness*Sample	0.395	0.957	0.312	0.189	0.629	0.434	0.520	0.852	0.920
Scale*Sample	0.960	0.795	0.488	0.970	0.223	0.725	0.558	0.106	0.424

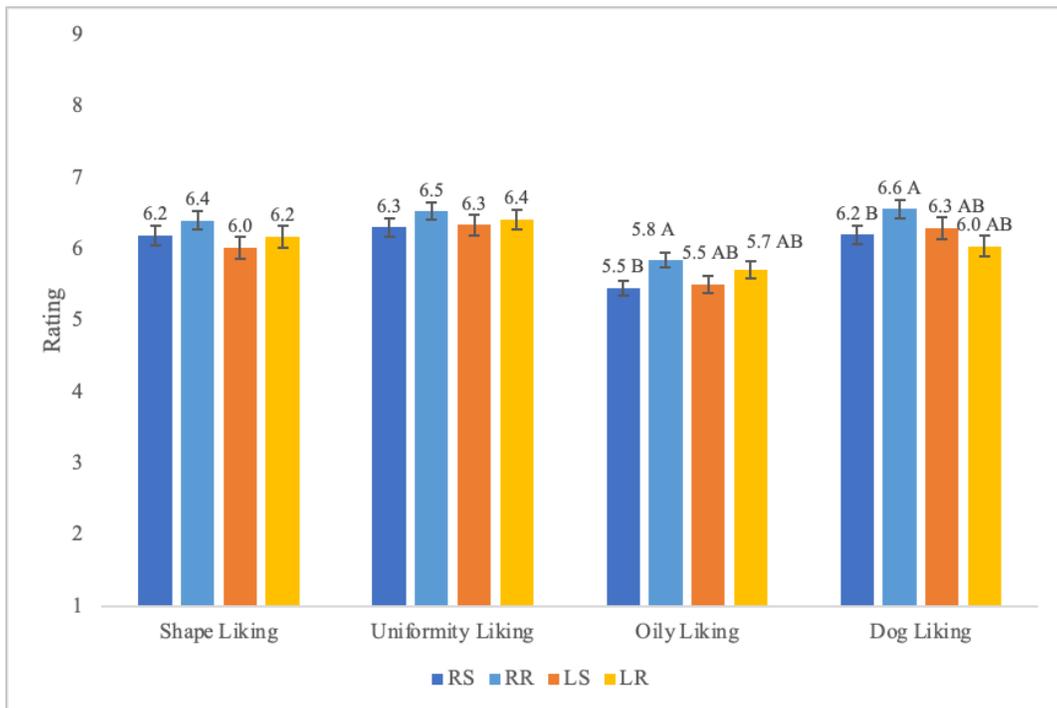
\*Values in red display significance ( $p < 0.05$ ).

Multiple liking questions showed no significant differences in individuals scoring based on their handedness and the orientation of scale. Aroma, appearance, color, size, shape, uniformity, and overall liking were found to have no difference for right- and left-handed groups and the orientation of scale ( $p > 0.05$ ). Although these scores proved no significant difference between groups, some trends were identified showing variations in the way individuals use the standard and reversed scales.

**Figure 2.1A** Bar Graphs Comparing Mean Values for Handedness Groups and Scale Types on a 9-Point Scale for Dry Dog Good.



**Figure 2.1B** Bar Graphs Comparing Mean Values for Handedness Groups and Scale Types on a 9-Point Scale for Dry Dog Good.



\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

\*\* Groups included right-handed standard scaling (RS) n = 29, right-handed reversed scaling (RR) n = 31, left-handed standard scaling (LS) n = 22, and left-handed reversed scaling (LR) n = 22.

\*\*\*The overall liking scores were based on a 9-point scale -1 (extremely dislike) to 9 (extremely like).

One of the trends identified was that left-handed individuals tended to give higher scores when recording on a reversed scale. This was true for all categories except expected dog liking where the standard scale showed greater liking. Although it was not significant, this could indicate that the reversed scale more closely matches the spatial perception of left-handed individuals. Still, the difference is small, which may be in part due to the small sample size. On the other hand, right-handed individuals also scored liking questions higher, on average, when the reversed scale was presented. Further analysis of how individuals use the scale was investigated through frequency graphs and % top 2 and bottom 2 box table.

The oily liking and expected dog liking showed some significant differences among the handedness and scale types used. For oily appearance liking, right-handed individuals receiving the reversed scale rated products significantly higher than right-handed individuals receiving the standard scale ( $p < 0.05$ ). In addition, right-handed individuals who received the reversed scale rated products higher for expected dog liking than did left-handed individuals receiving the reversed scale ( $p < 0.05$ ).

Analysis of the top 2 and bottom 2 boxes were also evaluated to determine if certain scales or handedness type elicited usage of the extreme ends of the scale. The top 2 box evaluates the percentage of individuals who used the top 2 choices, eight and nine, to rate the samples whereas the bottom 2 box evaluates the percentage of individuals using the lowest 2 choices, one and two. Table 2.3 shows the percentages of the top 2 and bottom 2 box for each of the groups.

**Table 2.5.** Comparison of % Top 2 Box and % Bottom 2 Box Across Handedness and Scale Orientation for Dry Dog Food.

	Overall Liking	Aroma Liking	Appearance Liking	Color Liking	Size Liking	Shape Liking	Uniformity Liking	Oily Liking	Dog Liking
<b>% Top 2 Box</b>									
RS	18%	12%	29%	29%	32%	35%	32%	10%	32%
RR	19%	15%	25%	32%	32%	35%	34%	23%	36%
LS	18%	8%	21%	21%	25%	23%	23%	4%	31%
LR	21%	14%	31%	27%	28%	35%	38%	18%	27%
RR-RS	1%	2%	-4%	3%	1%	0%	2%	13%	4%
LR-LS	3%	6%	10%	6%	3%	12%	15%	14%	-3%
RS-LS	1%	4%	8%	8%	7%	12%	9%	6%	2%
RR-LR	-1%	0%	-6%	6%	4%	0%	-4%	5%	9%
<b>% Bottom 2 Box</b>									
RS	6%	7%	6%	5%	8%	6%	5%	1%	6%
RR	4%	6%	6%	6%	5%	2%	2%	2%	2%
LS	5%	6%	6%	6%	6%	5%	3%	3%	3%
LR	8%	5%	5%	4%	6%	5%	2%	1%	3%
RR-RS	-3%	-1%	0%	1%	-3%	-4%	-4%	1%	-4%
LR-LS	4%	-1%	-1%	-3%	1%	-1%	-1%	-1%	0%
RS-LS	2%	1%	0%	-1%	2%	1%	2%	-2%	3%
RR-LR	-5%	1%	1%	2%	-2%	-2%	0%	1%	-1%

\*\* Groups included right-handed standard scaling (RS) n = 29, right-handed reversed scaling (RR) n = 31, left-handed standard scaling (LS) n = 22, and left-handed reversed scaling (LR) n = 22.

\*\* Values highlighted in red indicate negative numbers as represented by the formula on the left side of the table.

The percent top 2 and bottom 2 boxes were also compared among the groups with the same handedness while scale type alternated and same scale type while handedness alternated. The RR-RS and LR-LS display the differences in percent top 2 and bottom 2 boxes between individuals of the same hand when they receive different scales. A positive number signifies a greater percentage of individuals receiving the reversed scale types used the extreme ends of the scale, whereas a negative number signifies a higher percentage of individuals receiving the standard scale used the extreme ends, for the specific attribute. The table shows that individuals are more likely to use the top two selections when the scale is reversed regardless of their handedness. There were only two instances where the standard scale proved to have a greater percent of individuals using the top two selections, appearance liking for right-handed individuals and dog liking for left-handed individuals. This was not the case for the use of the

low end of the scale, as individuals using the standard scale showed a higher percent usage of the low numbers.

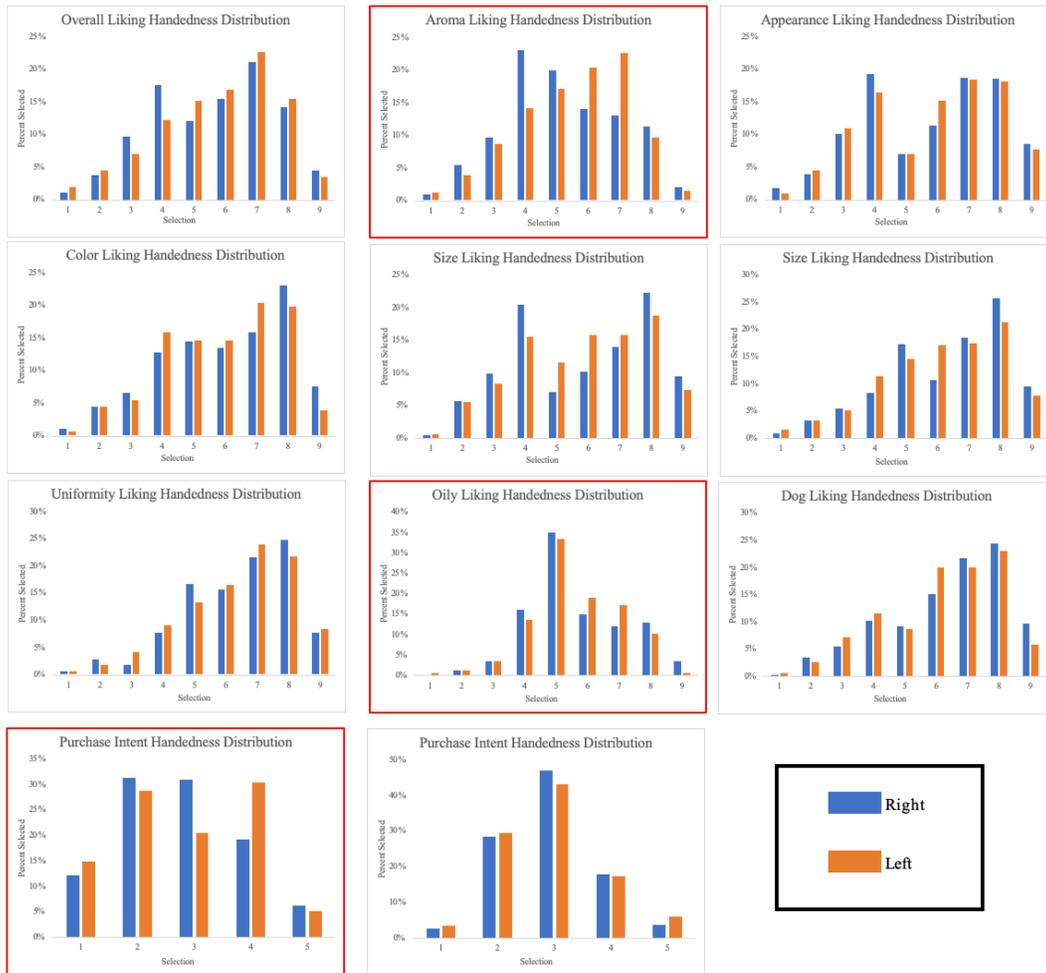
The second factor analyzed was whether there was a difference in the percentage of numbers selected at the ends of the scale when handedness was compared while scale type stayed consistent. Right-handed individuals used a higher percentage of the ends of the scale for both top 2 and bottom 2 box when using the standard scale. This was true for all nine attributes evaluated and possibly indicates that right-handed individuals are more adapted to the traditional scale. When participants use the reversed scale, the left- and right-handed individuals displayed a split in who used the extreme ends more. This split does not appear to be linked with the specific attribute in question, but rather remains random.

Overall, the left-handed individuals displayed a greater percent difference in the top 2 box when evaluating attributes using the standard and reversed scale. Compared to the right-handed individuals, left-handed participants had greater percentages of selections in the top 2 box when using the reversed scale, possibly indicating the tendency to use higher selections when the scale is reversed.

The distributions of selections were also analyzed using a chi-square test to understand if there were significant differences between right- and left-handed participants and the scales used. The data from both scale orientations was combined to determine whether handedness showed influence on rate of liking of the attributes. Conversely, the data from both handedness groups was combined to determine if scale orientation influenced individuals' rate of liking. Using the chi-square to evaluate the distributions across the various characteristics, only three attributes showed significant difference ( $p < 0.05$ ) while eight showed no significant difference ( $p > 0.05$ ).

The three attributes showing significant differences in the distribution were aroma liking, oily liking, and purchase intent and the distributions are shown in Figure 2.2.

**Figure 2.2.** Distributions Spreads Based on Handedness among Attribute Categories for Dry Dog Food.



\*Red border indicates significant difference in the spread of the distribution between the two groups using the chi-squared test ( $p < 0.05$ ).

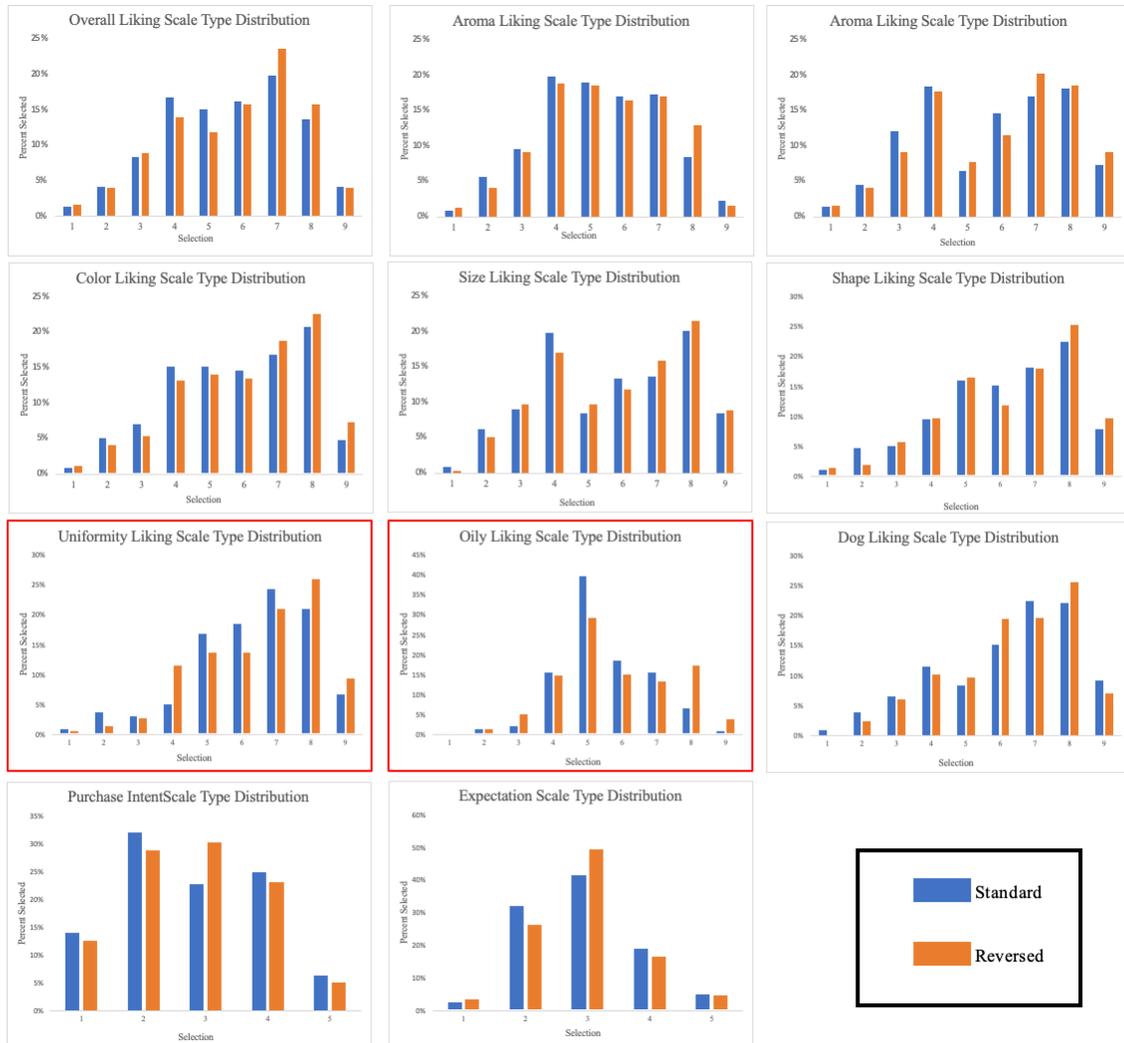
\*\*Groups included right-handed individuals (Right)  $n = 60$ , and left-handed individuals (Left)  $n = 44$ .

The aroma distribution of selection for right- and left-handed individuals shows a unique and interesting spread of selections. The p-value from the chi-square test was 0.002 indicating a significant difference in the spread of the selections among the two groups. The graph gives a clear visualization as the right-handed individuals showed a left-skewed distribution while left-

handed individuals displayed a right-skewed distribution. The purchase intent ( $p < 0.05$ ) also showed this same left-skewed distribution for right-handed individuals, however left-handed individuals presented a bimodal distribution having two peaks at 2 and 4. The oily handedness distribution did not appear to have much difference when assessing the distribution graph even though the chi-square showed a significant difference in the distribution ( $p < 0.05$ ). The right-handed individuals appeared to use higher percentages of selections 4, 5, 8, and 9 compared to left-handed individuals who used a higher percentage of choices 6 and 7. Lastly, the purchase intent distribution displayed a significant difference in the way individuals use the scale based on handedness ( $p < 0.05$ ). Right-handed individuals had a left-skewed distribution indicating that they use points 2 and 3 the most whereas left-handed individuals displayed a bimodal distribution with peaks at 2 and 4.

The chi-squared test was also used to determine if there were significant differences in the distribution spread when the standard and reversed scales were compared regardless of handedness. The test indicated that only two of the eleven attributes had a significant difference in distribution spread among the scale types as the graphs in Figure 2.3 illustrate.

**Figure 2.3.** Distribution Spreads Based on Scale Orientation among Attribute Categories for Dry Dog Food.



\*Red border indicates significant difference in the spread of the distribution between the two groups using the chi-squared test ( $p < 0.05$ ).

\*\* Groups included individuals receiving the standard scale (Standard)  $n = 51$ , and individuals receiving the reversed scale (Reversed)  $n = 53$ .

The two attributes that demonstrated significantly different distribution spreads according to the chi-squared test were the uniformity and oily characteristics ( $p < 0.05$ ). For uniformity liking, the individuals using the standard scale showed a left-skew distribution with a higher

percentage of individuals using selections 5-9 to describe the dog foods. The individuals receiving the reversed scale also had a left-skew to the distribution. The oily attribute had significant differences in the distribution when the chi-squared test was performed for both handedness and scale type. The individuals receiving the standard scale showed a bell curve with almost half of the individuals indicating neither like nor dislike. However, the participants using the reversed scale had a bimodal distribution with peaks on the left side of the scale.

A limitation of this type of evaluation using the chi-squared test is the low number of participants in each of the groupings. Future studies should improve upon this by recruiting larger samples of each of the two handedness types and allow for at least 100 participants to achieve test significance.

An ANOVA test was performed for all the 5-point data to understand which factors are most influential. The model consisted of the same factors as in the 9-point hedonic results, using handedness, scale orientation and sample. The samples provided the main differentiation ( $p < 0.05$ ) in means across the different attributes. For color there was a difference ( $p < 0.05$ ) in the mean scores between right- and left-handed individuals with left-handed individuals scoring higher. The scale orientation displayed significantly different ( $p < 0.05$ ) means for individuals receiving the standard and reversed scale for size and oily just-about-right scoring. Table 2.6 shows the p-values from the ANOVA test.

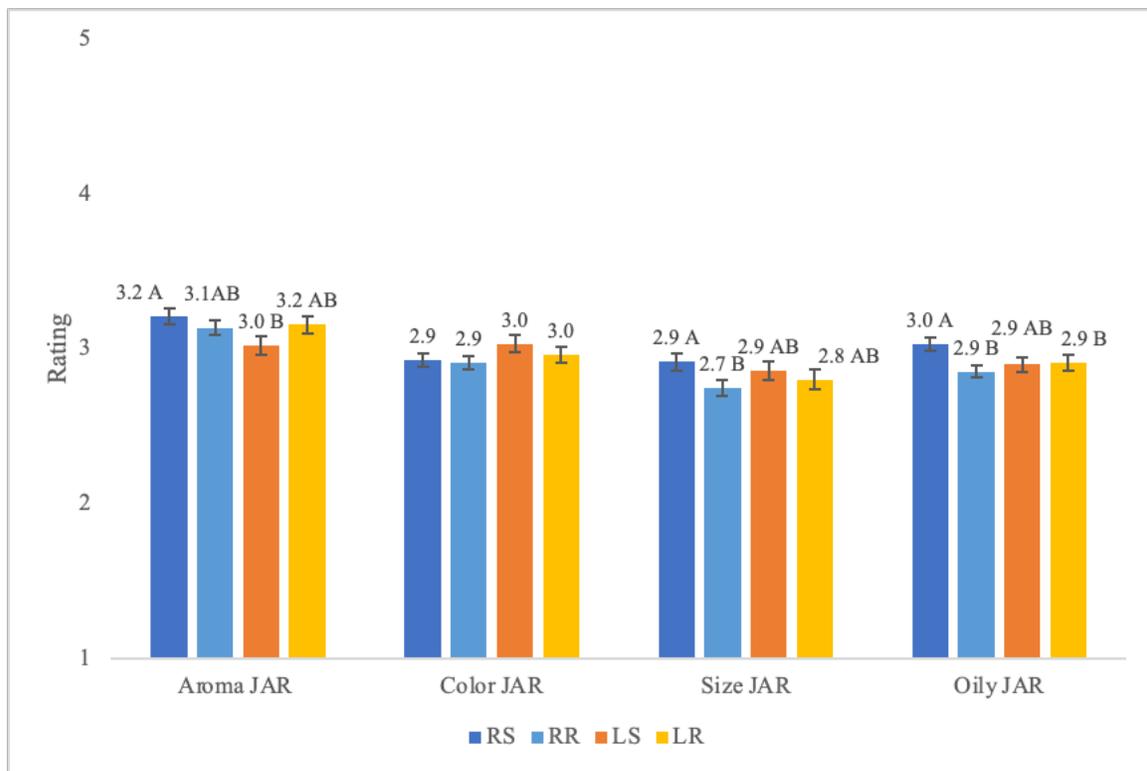
**Table 2.6.** P-Values of ANOVA Model and Factors for Dry Dog Food Using the 5-Point Scale.

	Aroma JAR	Color JAR	Size JAR	Oily JAR	Purchase Intent	Expectation
Model	<0.0001	<0.0001	<0.0001	<0.0001	0.012	0.008
Handedness	0.099	0.047	0.942	0.346	0.452	0.799
Scale	0.528	0.265	0.017	0.045	0.919	0.855
Sample	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Handedness*Scale	0.036	0.509	0.244	0.020	0.623	0.131
Handedness*Sample	0.209	0.122	0.998	0.963	0.409	0.306
Scale*Sample	0.670	0.476	0.928	0.785	0.797	0.915

\*Values in red display significance ( $p < 0.05$ ).

For the just-about-right scoring, three of the four attributes were found to have significant differences. For aroma liking, right-handed individuals receiving the standard scale scored higher ( $p < 0.05$ ) than left-handed individuals receiving the standard scale. The same trend was observed for size and oily just-about-right scoring as right-handed individuals scored significantly higher ( $p < 0.05$ ) when using the standard scale than when using the reversed.

**Figure 2.4.** Bar Graphs Comparing Mean Values for Handedness Groups and Scale Orientation on a 5-Point Just-About-Right Scale for Dry Dog Food.



\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

\*\* Groups included right-handed standard scaling (RS)  $n = 29$ , right-handed reversed scaling (RR)  $n = 31$ , left-handed standard scaling (LS)  $n = 22$ , and left-handed reversed scaling (LR)  $n = 22$ .

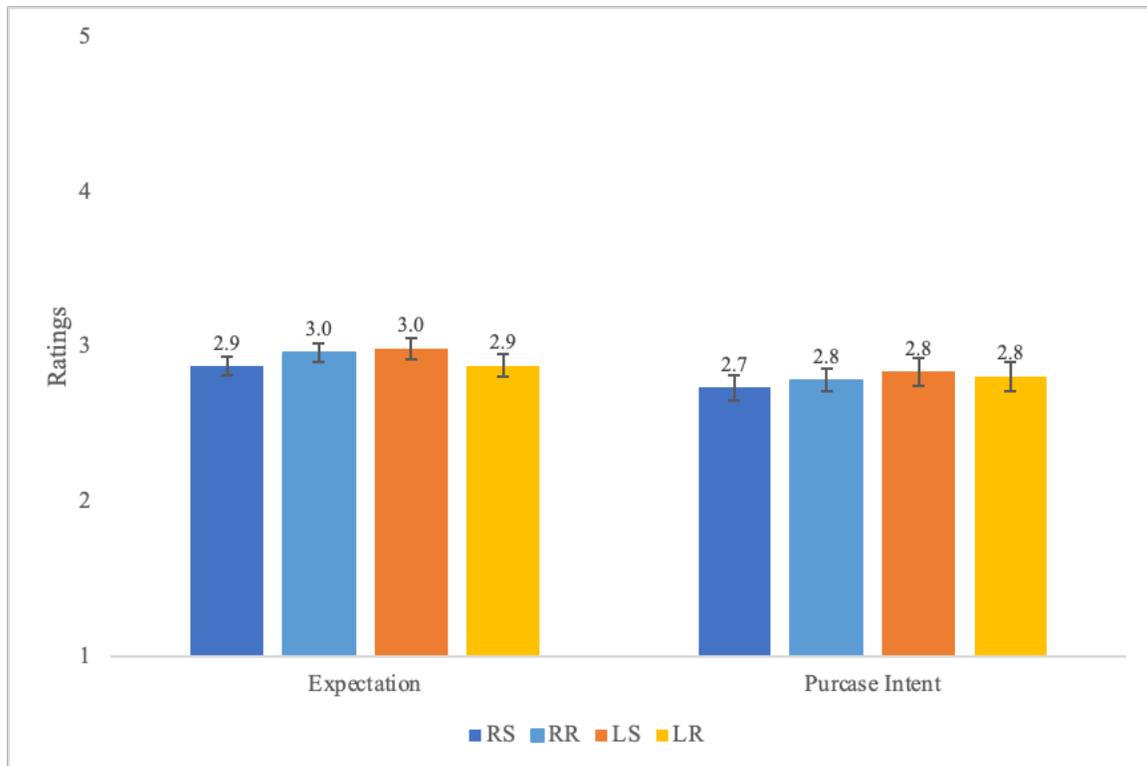
\*\*\*The just-about-right scores were based on a 5-point scale -1 (far too weak) to 5 (far too strong).

There was no group that indicated products needing significant improvement as all of the ratings were around 3 or just-about-right. The deviations from the middle point are minimal (0.3) and do not indicate that any group perceived the stimuli or scale type in a different way.

The just-about-right scale does not show the same results and trends as the 9-point hedonic scales and is most likely due to the intent of the scale. This scale determines product improvement rather than the liking of the product, and thus individuals generally gravitate toward the center of the scale. The distributions of the just-about-right scale do not show any significance between right- and left-handed individuals when using the chi-squared test ( $p > 0.05$ ).

Expectation and purchase intent also employ a 5-point scale to understand how willing individuals would be to purchase the dry pet foods. This scale uses different choices as compared to the just-about-right scale and may produce varied perceptions within the individuals.

**Figure 2.5.** Bar Graphs Comparing Mean Values for Handedness Groups and Scale Orientation on a 5-Point Expectation/Purchase Intent Scale for Dry Dog Food.



\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

\*\* Groups included right-handed standard scaling (RS) n = 29, right-handed reversed scaling (RR) n = 31, left-handed standard scaling (LS) n = 22, and left-handed reversed scaling (LR) n = 22.

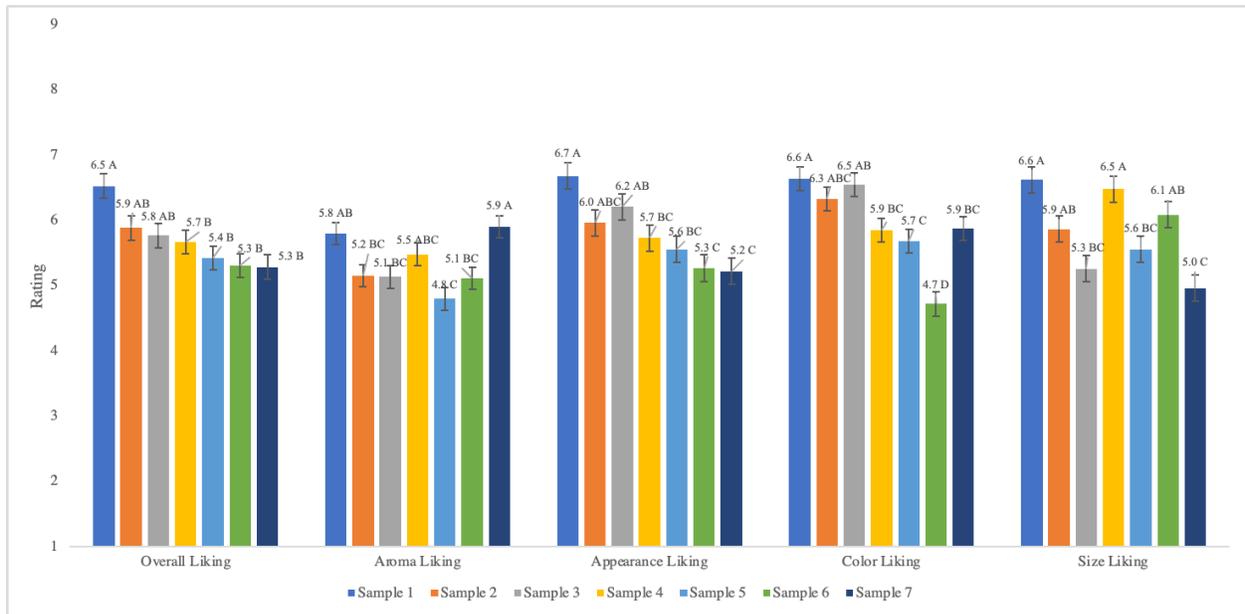
\*\*\*The purchase intent/expectation scores were based on a 5-point scale -1 (definitely will not buy/much worse than expected) to 5 (definitely will buy/much better than expected).

Among the different groups, there was no significant difference ( $p < 0.05$ ) in the scores given for both expectation and purchase intent (Figure 2.5). Interestingly, all of the groups had mean ratings under 3, indicating that the products did not meet expectations and would not be purchased. A trend noted from the mean ratings was that right-handed individuals scored more highly using the reversed graph whereas left-handed individuals scored more highly using the standard scale. This difference was not significant although the purchase intent distribution for right- and left-handed individuals was significantly different ( $p < 0.05$ ) as shown in Figure 2.2.

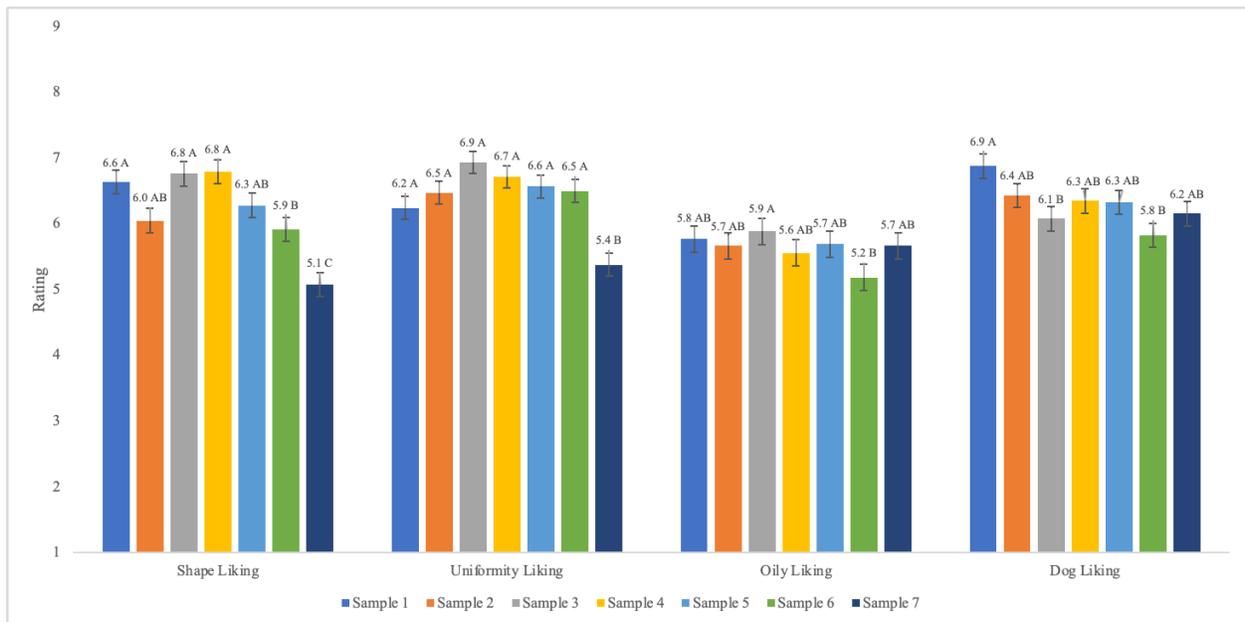
### **Pet Food Evaluations**

When evaluating the pet food there were more differences found between the various pet foods based primarily on their appearance attributes. The first evaluation performed was an ANOVA test to determine if there were differences in liking among the dry pet foods and characteristics evaluated. Upon first observation of the pet foods, all samples were relatively liked by the consumers and no sample received an overall liking score below 5.0. It should also be noted that there was no attribute in which liking was at parity across all samples, indicating the high diversity among products.

**Figure 2.6A** Bar Graphs Comparing Mean Values of Dry Dog Foods on a 9-Point Hedonic Scale.



**Figure 2.6B** Bar Graphs Comparing Mean Values of Dry Dog Foods on a 9-Point Hedonic Scale.



\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

Significant differences existed among the various dry pet food samples for all nine liking categories (Figure 2.6). Sample 1 had the highest overall liking out of all pet foods, with an average score of 6.5 meaning the product was rated in between “Liked Slightly” and “Liked Moderately,” yet was one of the least expensive dog foods used in the study. For overall, appearance, and color liking Sample 1 was significantly more liked than Samples 4,5,6, and 7 ( $p < 0.05$ ). The variation of green, orange and brown colors were more liked in this dog food compared to the very light and very dark brown colors of Samples 6 and 7. This product tended to have high liking characteristics among all of the categories and never had mean scores significantly lower than other products.

Sample 7 was the least liked product and scored lowest for several of liking attributes. This sample had significantly lower liking scores for both shape and uniformity than all other products ( $p < 0.05$ ). This was the only product in the study that had triangular shaped kibbles and may have been the reason for the lower liking. Also, it contained a mix of light-yellow kibbles which were not well liked in Sample 6 as well. The low uniformity liking may have been linked to a combination of yellow kibbles and triangular shaping resulting in an increase in consumer dislike. Size was also a reason for lower scoring as individuals indicated they thought the food would be a choking hazard for medium to larger dogs. This product had the highest liking scores for the aroma liking and was described by participants as being less overpowering and even pleasant. Further studies may consider separating out the yellow and brown kibbles in the samples to understand if the yellow or triangular shape is more disliked by consumers.

Sample 6 was also less liked compared to other products due to its color, shape, and oily characteristics. This product had significantly lower liking for the color ( $p < 0.05$ ) most likely due to the light appearance. This product was baked and did not go through the extrusion

process like all the other samples which may be the reason for the light color. Another result of the baking process is the loss of oily characteristic in the product, which caused lower liking for oiliness compared to all other products. The shape of the product also had lower liking scores compared to the other products and was significantly lower than Samples 3 and 4 ( $p < 0.05$ ). Individuals noted a higher liking for standard nugget shaped kibble, and the unique shape of Sample 6 may have been off putting.

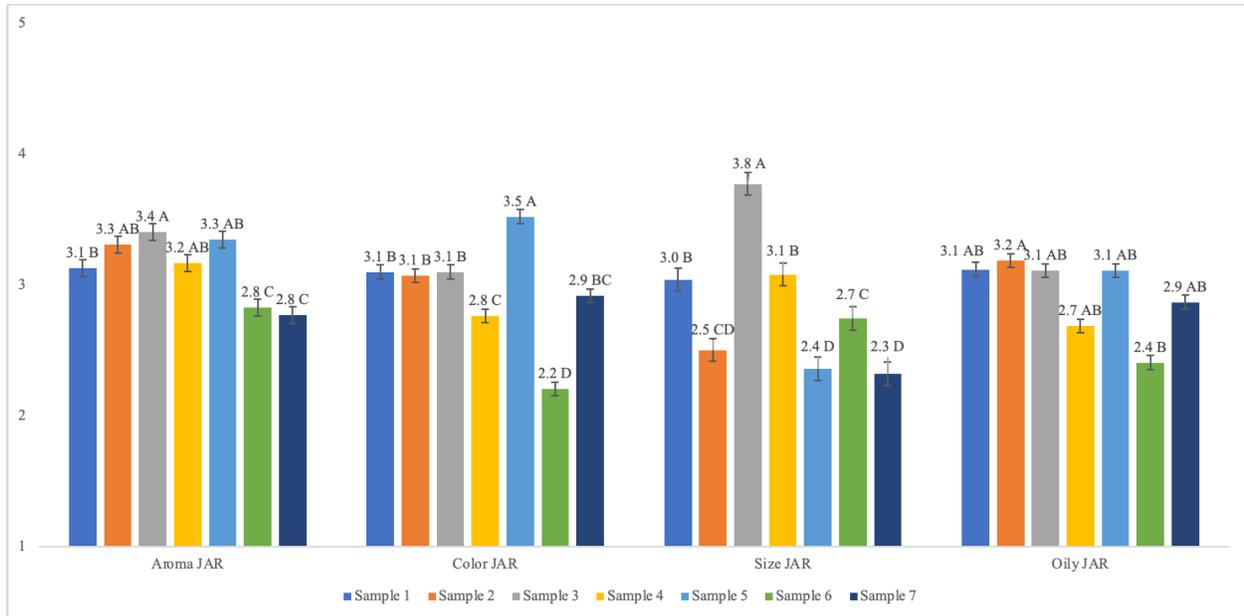
Sample 2 was found to be better liked than most of the other products but not as much as Sample 1. The factor most negatively affecting liking in this product was the aroma which was noted as being strong and, for some individuals, rancid. As with Sample 7, individuals noted that the small pieces may be a choking hazard for larger dogs, although Sample 2 was significantly more liked for this attribute ( $p < 0.05$ ). The shape and width of the kibble emulated Sample 7 although the shape was square as opposed to triangular. The square kibbles received significantly higher liking scores ( $p < 0.05$ ) for shape compared to the triangular kibble, further indicating that the triangular form is not an ideal shape in dry dog food.

Products that did not specifically stand out as being the best or worst included Sample 3, 4, and 5. However, there were certain characteristics that differentiated them from other samples. Sample 3 was more highly liked for its dark color, nugget shape, and uniformity but was less liked for its large size and strong aroma. Sample 4 was also highly liked for its shape in addition to its medium size and mild aroma but was scored lower for its appearance and color liking. Sample 5 had the lowest aroma liking in addition to low appearance, color, and size liking. The primary complaint from consumers about this product was related to the strong smell and small kibble size.

The liking characteristics for consumers were based heavily on the appearance of the product. Products that received greater liking for appearance, shape, color, and size tended to have greater overall liking scores. This evaluation for pet foods based on their appearance is common and has been studied across individuals of different nationalities (Di Donfrancesco, 2014; Chanadang et al., 2016; Gomez et al., 2018; Koppel et al., 2018). Although kibble appearance is used by individuals to determine liking in each of the different countries, the characteristics that are preferred vary.

The just-about-right analysis also demonstrated difference among the products, including areas in which they could be improved. Figure 2.7 shows the mean scores for the just-about-right scale for each of the pet foods selected, allowing for further comparison to be made regarding the scoring for each of the handedness groups. It is also important to note that the most ideal score for this type of analysis is 3 as it indicates “just-about-right” whereas 1 indicates “too little” and 5 indicates “too much.”

**Figure 2.7.** Bar Graphs Comparing Mean Values of Dry Dog Foods on a 5-Point Just-About-Right Scale.

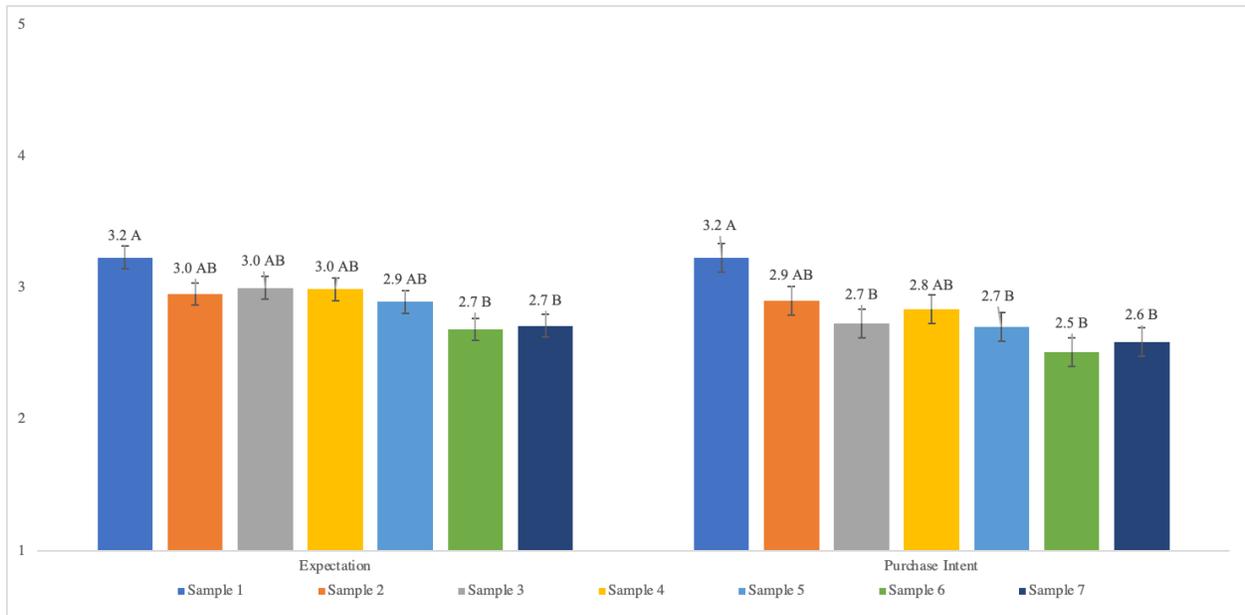


\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

The 5-point scores comparing mean values show a sizeable difference compared to those seen during the handedness evaluation. There are significant differences for every just-about-right category, which were rarely seen when handedness was evaluated. This indicates that the participants handedness and scale orientation did not have a substantial effect on the way individuals used the 5-point just-about-right scale. The mean values and ANOVA are not the traditional method used evaluate data using a 5-point just-about-right scale, however it was employed here to show the significant differences that were found during the pet food evaluation that was not present in the handedness evaluation.

The participants were also asked to indicate their purchase intent and expectation of dry pet foods. Figure 2.8 shows these metrics as they appear to share the same trend as the overall liking measurements.

**Figure 2.8.** Bar Graphs Comparing Mean Values for Dry Dog Food on a 5-Point Expectation/Purchase Intent Scale.



\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

\*\*The purchase intent/expectation scores were based on a 5-point scale -1 (definitely will not buy/much worse than expected) to 5 (definitely will buy/much better than expected).

Sample 1 was the only one to exceed expectations (3.2). Individuals also noted they would be likely to purchase this dog food (3.2). Sample 3 met the consumers expectations for dry dog food (3.0), but the purchase intent was a bit lower (2.7). This higher expectation may be due to the sample resembling traditional nugget shaped dog food but being larger than preferred for medium sized dogs, which constituted a significant portion of participants. The lowest scoring dry dog foods were Samples 6 and 7 which were also scored lowest for the overall liking. These two samples were still close to the midpoint of both scales, meaning they met expectations for dry dog food and individuals may or may not purchase the product. Compared to the results from Di Donfrancesco (2014), there was a much smaller range in scores for purchase intent. In

the previous study some dry dog foods scored as high as 3.4 and as low as 2.2 creating five different segments in purchase intent, whereas the current study only found two.

### **Limitations**

The present study used dry dog food as a means to evaluate the consumer perceptions of right- and left-handed individuals and their uses of the scaling. This evaluation mirrored a previous study by Di Donfrancesco (2014) which found preferences in individuals for specific liking characteristics of the pet foods. Some of the kibble used for evaluation was slightly different than those in the original study but still maintained specific key attributes. The new samples emulated properties such as shape, color, and uniformity that were experienced in the original study. In addition, the samples used in the current study had characteristics that allowed individuals to easily differentiate between samples as seen in the original study. Overall, this minor difference from the original study should not cause a meaningful difference in the results as the replacement samples were carefully selected for the specific key attributes and intended to emulate the previous study. The sample selection should not affect the way in which right- and left-handed individuals use the scales as well.

A second limitation of this study is that the number of right-handed individuals outweighed their left-handed counterparts. Since only about 10% of people in the general population are left-handed, it is difficult to recruit a substantial number of these individuals. With the added layer of requiring that individuals in the study be pet food purchasers many possible left-handed applicants may have been excluded from the study. In total left-handed individuals made up a bit under half (42%) of the entire number of participants in the study. Even though the left vs. right handedness of individuals in the study was not an even split, the proportions of left-handed participants was much greater than that seen in other studies

performed by Casasanto (2009; 2011) and Casasanto and Chrysikou (2011). In fact, the high number of left-handed individuals used in this study serves as a baseline allowing further testing to be conducted to determine if right- and left-handed individuals show preferences for spatial continuums.

The last major limitation of the study the size of each of the four groups. To perform adequate statistical analysis, such as the chi-squared test, each group should have at least 100 individuals. This was not the case in this study and an increase in the number of participants may show clearer trends in their distribution of selections. This allows for future opportunities to investigate right- and left-handed individuals perceptions of scale orientation.

## **Conclusion**

In the current study, both handedness type and scale orientation were tested to see if scale orientation and handedness affect the way in which people score products along a 9-point hedonic scale, 5-point just-about-right scale, and 5-point expectation and purchase intent scales. Upon reviewing the data from the handedness portion of the study, no clear trend emerges showing how individuals use the scale and only a few attributes showed significant differences within the four groups.

The panelists were able to indicate a difference between the dry dog foods and showed acceptance and preferences for certain samples, such as Sample 1. This preference was shown throughout a number of different attribute liking questions where this sample was rated highest, such as appearance, color, and size liking. Even though participants were easily able to give conscious perceptions toward the product, their subconscious bias toward the dominant side of their body was not seen. Individuals did not record significantly different scores based on their handedness nor was there an interaction with the scale type ( $p > 0.05$ ). The MANOVA test

showed differences based on handedness, however when looking at the specific attributes from the ANOVA test there was only one of nine attributes display different mean scores from right- and left-handed individuals.

The length of the scale did not play a role on the conceptions of spatial continuum bias and participants handedness. The 9-point hedonic scale and 5-point just-about-right scale did not show drastically different results in how consumers used the scale based on their handedness. This would indicate that individuals thoroughly read through the scale and understand the continuum of answers before making their selection, regardless of orientation.

However, the scale orientation itself may have a slight effect on the individuals regardless of their hand type. When evaluating attribute liking on the 9-point hedonic scale, individuals receiving the reversed scale had higher scores than those receiving the standard scale, even though this trend did not reach the level of significance. There was only one instance where this was not the case, the left-handed individuals receiving the standard scale rated dog liking higher than individuals using the reversed scale. These trends were not seen in the 5-point just-about-right data nor the 5-point expectation/purchase intent scales, where neither scale indicated apparent higher scores and only differed by about 0.3. This trend of higher ratings when using the reversed 9-point hedonic scale may be due to a lack of familiarity with the reversed scale, but further testing is required to determine if other factors are at play. Although mean scores were higher for the groups using the reversed scale, the distribution of selections did not show many significant differences in the distribution using the chi-squared test across attributes. The following studies in this thesis will further prove if the reversed scale elicits higher scores.

This study found that although there is a slight difference between the way in which right- and left-handed individuals score dry dog food the difference is small. The trend of how

right- and left-handed individuals have higher mean scores when using a reversed scale did not show significant differences across the majority of attributes. Also, few attributes displayed a significant difference in the distribution of selection for handedness and scale orientation, further emphasizing that these factors have little effect overall. Further testing is required with larger samples sizes to understand if there is a significant difference in the way individuals use the scale, but this test has shown that from a small scale the difference is negligible.

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## **Chapter 3 - Handedness and Scale Orientation Effect on Tactile Manipulation of Sponges**

### **Abstract**

The purpose of this study was to understand how right- and left- handed individuals perceive sensory scaling during tactile evaluation of five different products. Participants (n = 107) were asked to assess the products (sponges) in a central location test format for both appearance and usefulness characteristics and were presented with standard or reversed scales. The ANOVA results found that there was no significant difference in the way individuals rate the products based on their handedness or the orientation of the scale. There was however a consistent trend showing right-handed individuals rating products more highly when using a reversed 9-point scale and left-handed individuals rating more highly on the standard 9-point scale. This trend was not found in the data for the 5-point just-about-right scale. The lack of trend in the 5-point just-about-right scale is most likely due to the design of the scale which measures product improvement and not have positive and negative valence associated with the continuum. The sponge products on the other hand did show significant differences as Sample 2 had the highest overall liking followed by Samples 1 and 3. Sponge liking was characterized by familiar color, mainly vibrant yellow and green, low thickness, and moderate stiffness. This study provides a basis for understanding the conceptions of right-and left-handed individuals when using sensory scaling techniques as well as a preliminary assessment of consumer preferences of sponge liking.

## Introduction

Brain lateralization and hand dominance play a key role in how individuals interact with their surroundings and perform specific tasks. Even though society has focused on right-handed individuals as the dominant hand type, there is value in understanding how left-handed individuals experience the world. Left-handed individuals may acquire negative attitudes toward the right spatial spectrum as certain physical activities neglect left-handed individuals. An interview with students at the University of Kansas identifying as left-handed revealed that such tasks as sewing and using scissors can be more challenging as the tools are mainly designed for right-handed individuals (Pihan, 2020). These tools designed for right-handed individuals may generate a negative consciousness in left-handed individuals and result in spatial biases. Certain companies have designed products specifically for left-handed individuals including keyboards, scissors, and even can openers, but at an increased price and reduced availability (Lefty's the Left Hand Store, 2021; Jelly Comb, 2021).

Even though left-handed individuals may be more uncommon, when it comes to sports their physical differences are desired to gain a competitive edge. Baseball is one sport where left-handed individuals have an advantage as their physical differences allow them to perform more proficiently at first base and pitching. They utilize a distinctive pitching mechanic which results in a unique rotation of the ball which is difficult for batters to track and hit (Molyneux and Birnbaum, 2020). This is not the only sport in which left-handed individuals have an advantage. Loffing et al. described the benefits these individuals have on the volleyball court (2012). It is more difficult for individuals to track where a volleyball will be hit when left-handed individuals perform the strike. These physical differences may increase the positive spatial bias for left-handed individuals as they are considered more valuable in sports.

The purpose of this study was to analyze whether handedness and scale orientation have an effect on individuals when evaluating products through physical manipulation. Physical manipulation uses the individuals' hands, firing electrical impulses between the hand and the motor cortex in the brain (*Introduction to Psychology*; Nielsen, 2013). This stimulation may increase the likelihood of individuals to prefer the scale which associates with the dominant side of their body.

## **Materials And Methods**

### **Samples**

Five commercially available sponges were purchased for use in this study to evaluate whether physical manipulation of products leads to spatial orientation bias. The sponges used for the study were purchased around the Kansas City (KS, USA) area, although one sample was ordered through the Walmart™ website. All of the other samples were obtained in-person at Walmart™ stores in the local area except for Sample 4 which was purchased at Target®. These sponges had appreciably different characteristics and could be easily distinguished from one another, with the exception of Samples 1 and 2 which had similar characteristics and were selected to determine if the name brand performed better than the store brand.

The sponges used in the study had similar shape and thickness, although the color, scrubbing pads, and purpose varied among samples. The shape of all of the sponges were rectangular as Samples 1, 3 and 4 measured 3 x 6 x 1 inches, Sample 2 measured 5" x 3" x 1" (length x width x height), and Sample 5 measured 6" x 4" x 1". Sample 1-4 had wavy edges to them, causing them to not be perfectly square like the unbranded cellulose sponges. The addition of a scrubbing pad was present on all sponges except for the unbranded cellulose sponge which only contained soft sponge. The colors of the sponges were significantly different from

each other. Samples 1 and 2 were a vibrant neon yellow with a green scrubbing pad, Sample 3 was a light pink with a dark pink scrubbing pad, Sample 4 was light grey with a dark grey scrubbing pad, and Sample 5 was a standard yellow. Table 3.1 shows pictures of the products used during the study.

The samples were carefully prepared and stored prior to evaluation in order to maintain the same textures and moisture as intended by the manufacturer. The sponges were unwrapped and cut in half to be an appropriate size for the plate used in this evaluation as well as to provide additional samples and save on costs. The size of the cut sponges stayed consistent for all of the samples. The sponges were then placed in gallon-size Ziploc® (Bay City, MI, USA) bags as to preserve the moisture in the samples. Sponges are packaged water moisture to maintain their soft texture during shipping from manufacturer to consumer. Without this moisture, the sponges become brittle and break during transportation. For this reason, it was imperative that the samples were not left out exposed to the air and were placed on the plates only 5 minutes prior to evaluation. Samples were placed on 10” plates and coded with a random 3-digit code for identification and kept in ambient temperature.

**Table 3.1.** Sponge Samples and Packaging Used in the Central Location Test

Samples	Sponge Dimensions (Inches)	Sample Photo
Sample 1	3 x 6 x 1	

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Sample 2

5 x 3 x 1



---

Sample 3

3 x 6 x 1



---

Sample 4

3 x 6 x 1



---

Sample 5

6 x 4 x 1



## **Subjects**

The participants recruited for this study were individuals from the Kansas City metro area and recruited from the Kansas State Center for Sensory and Consumer Science database. These individuals were recruited based on their answers to screener questions which were issued using the Compusense software (Compusense Inc., Guelph, Ontario, Canada) and distributed to potential participants via email. To qualify for the study, individuals needed to indicate that they cleaned dishes as part of their chores on a monthly basis. They also needed to clean the dishes by hand rather than using a dishwasher and use a sponge as opposed to a scrubbing wand. The purpose of these questions was to eliminate individuals who do not use sponges and thus are not as familiar with the product.

The research was approved by the Institutional Review Board for Protection of Human Subjects (IRB # 10347).

## **Central Location Test**

Study was conducted at the Center for Sensory and Consumer Research at Kansas State University in Olathe, Kansas. Participants attended one of 5 sessions each lasting one hour. Two rooms were prepared for the study, each consisting of 12 tables separated by at least 6 feet from one another due to Covid-19 restrictions. Each table had a silver wash pan, a 1000-mL glass Pyrex measuring cup, a 200-mL plastic bowl, paper towels, and iPads with the Compusense questionnaire software to record their responses. Figure 3.1 shows an image of the setup for the study.

After arriving individuals signed in for the study at the front desk and were asked to give proof of identification. They were then directed to one of the two rooms and given a desk at

which to sit. The individuals would then sign into their specific Compusense account and await further instructions from the session moderator. Once a room was entirely filled or all participants for that session had arrived, the moderator would then instruct participants through the use of the moderator guide as shown in Figure 3.1.

**Figure 3.1.** Detailed Instruction Example from Moderator Guide and Questionnaire.

### MODERATOR GUIDE (Read in Serving Room)

#### CLAIRVOYANT 3/2

- **WELCOME** and **THANK YOU**. TURN OFF **CELL PHONES** and any other **ELECTRONICS**
- **DO NOT REMOVE** your mask throughout the evaluation process.
- You will be testing **5 different sponges** today and will answer questions about each. Questions will involve the appearance and functionality.
- **NO TALKING** to those around you.
- **If you have a question or need any help, RAISE your HAND** and ask the server.
- When you get your sample, you will be asked about the appearance first. Be sure to answer those questions before dipping it in the water. Once instructed to do so, you may dip the sponge into the water to evaluate absorbency. When told to do so use the sponge to clean the plate, **YOU DO NOT NEED TO CLEAN THE ENTIRE PLATE**, but just enough to form an opinion.
- Clean the plate over the steel bin used to collect the water.
- The substance that is used on the plate is standard cooking **MOLASSES**.
- **There is a 3 DIGIT CODE** on each sample. Please be sure that the code on the computer matches the code on the plate. If NOT, please notify the server.
- When you reach the **RED STOP SIGN** please **discard the sponge in the trash can as well as empty the soap dish in the Pyrex bowl**. The server will come around and refill the soap dish when they bring the next sample.
- Please **RAISE your HAND** when you have **COMPLETED** the study. The **server will excuse you, paying close attention to social distancing rules** for checking out and collecting your payment.

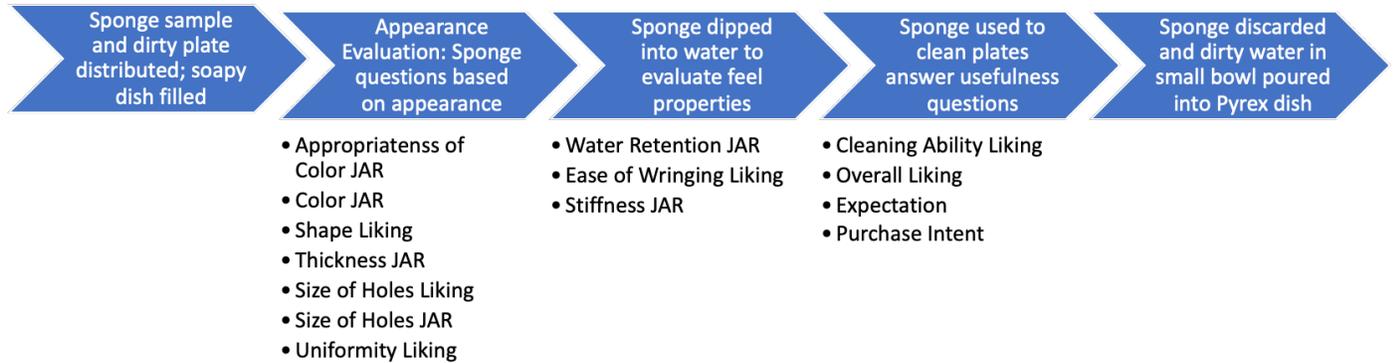
There is no prior literature describing the use of sponges in sensory evaluations and thus careful consideration was used to determine how individuals could thoroughly evaluate the samples. Instructions were present in the Compusense questionnaire as well as given by the moderator at the beginning of the study. The following sections provide details on the arrangement of the table followed by the instructions.

Prior to the initiation of the study participants were given several tools to aid them in their evaluation of the sponges and reduce messiness. The first item in the center of the station was a large silver wash pan. Individuals were asked to wash the plates within these wash pans to keep tables clean. The pans were processed through a dishwasher during the intermission between sessions. Participants were also provided with a small plastic bowl that was used for holding soapy water to clean plates. A large concentrate of soapy water was prepared before each session and consisted of 20 liters of water mixed with  $\frac{3}{4}$  cups of Dawn Ultra Original Dish Soap. The container of soapy water was placed on a wheeled cart and servers used a  $\frac{1}{2}$  cup ladle to fill the plastic bowls. The soapy water was prepared 30 minutes prior to each session in order to acclimate to room temperature and was routinely stirred before and during the sessions. The last object that was placed on the tables was a Pyrex measuring cup allowing individuals to dump their dirty water into the Pyrex dish. This allowed for fresh soapy water to be provided before each new sample.

Each Individual was also provided with a 10" ceramic plates that was smeared with one teaspoon of Grandma's Original Molasses. The molasses was spread on the plates using a spatula creating a thin layer of sticky grime. They were distributed at the same time as the sponges so individuals received a "dirty" plate for each sponge. These plates acted as a dish cleaning simulation allowing participants to evaluate the cleaning ability of the sponges.

The sponges were then evaluated for different characteristics including appearance and usefulness attributes. To ensure that all participants evaluated the products in the same way, instructions were given throughout the questionnaire for guidance. The following flowchart shows the steps of the study.

**Figure 3.2.** Flowchart of Steps for Sponge Evaluation.



**Figure 3.3.** Table Configuration for Sponge Study and Molasses Plate Presentation.



All of the specific instructions were clearly laid out for the participants prior to beginning the evaluation. Instructions were given both orally by the session moderators as well as in written form on the questionnaire.

## Questionnaire

The questionnaire was constructed around various qualities and tested claims for the products specific use. The participants evaluated for appearance, product liking, and usefulness among the samples.

The 9-point hedonic scale was used to understand how well each of the samples was liked by the participants. The questions using this scale included shape, size of holes, uniformity, ease of wringing, cleaning ability and overall liking. Overall liking was asked last because it allowed for participants to evaluate all the sponge attributes for appearance and usefulness before making their overall decision. As with general 9-point scale usage, the scale consisted of a dichotomic continuum where specific numbers were linked to anchor wordings to describe the products. The word anchoring's for the scale consisted of 1 indicating "dislike extremely," 5 indicating "neither like nor dislike" and 9 indicating "like extremely." The intensity for both liking and disliking increased the further away from the center point.

The 5-point just-about-right scale was also used to determine how products can be manipulated to increase the liking of consumers. The scale also contains anchored points with 1 indicating the attribute in question is "much too weak," 3 indicating "just-about-right" and 5 indicating "much too strong." These just-about-right questions were asked for both appearance and usefulness characteristics including color appropriateness, color brightness, thickness, size of holes, absorbency, and stiffness.

A 5-point scale was also used to determine purchase intent and expectation for the sponges. For the purchase intent 1 indicated "definitely would not purchase," 3 indicated "may or may not purchase" and 5 indicated "definitely would purchase." The expectation was measured on a scale where 1 indicated "performed much worse than expected," 3 indicated

“performance meets expectations” and 5 indicated “performed much better than expected.”

These 5-point scales allow for further comparison of the scale length on consumer conceptions.

Half of the scales were reversed within each of the right- and left-handed groups. These scales still consisted of the same numbers contributing to the descriptive anchors, although the orientation of the scales was altered. The reversed scale had the continuum altered to have the positive likings on the left while the negative likings were on the right. Due to the numberings being the same in the questionnaire, analysis did not require the scores to be altered to match the data from the standard scale.

Upon completing the evaluation of all the sponge samples, consumers were asked to answer questions regarding their specific demographics. The questions helped to understand what type of consumers were being recruited and how well each segment liked the individual sponges. The demographic questions asked about individuals’ gender, age, annual income, handedness, cleaning product purchase location(s), cleaning brands purchased, and dish cleaning methods used. Table 3.2 shows the demographics for the individuals participating in the study.

**Table 3.2.** Demographics of Sponge Consumers for CLT.

<b>Characteristics</b>	<b>Categories</b>	<b>Frequency</b>	<b>%</b>
Gender	Male	34	32%
	Female	73	68%
Age	17 years or younger	0	0%
	18-24 years	1	1%
	25-34 years	8	8%
	35-44 years	25	23%
	45-54 years	30	28%
	55-64 years	30	28%

	65 years or older	13	12%
Annual Income	Below \$25,000	0	0%
	\$25,001-\$49,999	14	13%
	\$50,000-\$74,999	18	17%
	\$75,000-\$99,999	25	23%
	\$100,000 or more	50	47%
Handedness	Right	39	36%
	Left	68	64%
Purchasing Locations	Grocery Stores	96	90%
	Wholesale Clubs (Sam's)	65	61%
	Online Stores (Amazon)	35	33%
	Other	22	21%
Brands Purchased (Cleaning Brands)	Dawn	93	87%
	Clorox	90	84%
	Cascade	75	70%
	Lysol	75	70%
	Swiffer	59	55%
	Mr. Clean	59	55%
	Scrubbing Bubbles	58	54%
	Pledge	57	53%
	Scotch-Brite	57	53%
	Finish	48	45%
	Oxi Clean	43	40%
	Resolve	42	39%
Pine-Sol	34	32%	
Meyer's	24	22%	

	Easy Off	20	19%
	Libman	14	13%
	Fabuloso	11	10%
	Other	7	7%
<hr/>			
	Scrubbing with Sponge	80	75%
Plate Cleaning	Scrubbing with Scrubbing Brush	40	35%
Method	Using a Dishwasher	76	71%
	Other	8	7%
<hr/>			

### **Data Analysis**

The data for the study was collected using Compusense Cloud 5.0 (Compusense Inc., Guelph, Ontario, Canada, Version 21.0.7859.31683) and extracted at the end of the test. It was then copied into a Microsoft Excel spreadsheet (Excel, Microsoft Office 2021, Version 16.47.1) for further analysis using XLSTAT by Addinsoft (Version 21.1.1). Functions within the Excel file were used for examining the data for mean, standard deviations, percentages, and sums while the XLSTAT was used for in-depth statistical analysis. XLSTAT was used to run a MANOVA and ANOVA tests using a Tukey's Post-Hoc test to determine the differences in means, for both 9- and 5-point scales, among each of the sponges. The panelists selections were also analyzed using a chi-squared test to understand if there was a difference in distributions between right- and left-handed individuals as well as if the scale type used. To determine how the sponges could be improved based on their characteristics, penalty analysis was run on the just-about-right scores. All tests were performed at a confidence level of 95%.

## Results and Discussion

### Handedness Evaluation

The first evaluation performed on the data was the MANOVA test to determine if there was effect caused by the handedness of the participants of the scale orientation. From the MANOVA test, scale orientation did not have a significant effect ( $p > 0.05$ ) how individuals score samples. However, it was found that handedness has an association ( $p < 0.05$ ) with individuals scoring along the scale. The MANOVA test also detected differences among samples when combining all of the attributes. The interactions did not contribute any significant effect. All of the 9-point attributes were used as factors in the MANOVA test including overall, size of holes, shape, uniformity, ease of ringing, and cleaning ability liking.

**Table 3.3.** P-Values for MANOVA Testing of Handedness and Scale Orientation of Sponges When Using the 9-Point Hedonic Scale.

	Handedness	Scale Orientation	Sample Name	Handedness *Scale Orientation	Handedness *Sample Name	Scale Orientation* Sample Name
Lambda	0.964	0.989	0.700	0.982	0.949	0.972
F (Observed values)	3.217	0.996	8.040	1.556	1.120	0.608
DF1	6	6	24	6	24	24
DF2	514	514	1794	514	1794	1794
F (Critical value)	2.116	2.116	1.523	2.116	1.523	1.523
p-value	0.004	0.427	0.000	0.158	0.312	0.932

\*Values in red display significance ( $p < 0.05$ ).

The data was further analyzed using an ANOVA test to determine the effect of handedness. The ANOVA test found that when the factor of handedness is evaluated across all six attributes individually there is no significant difference ( $p < 0.05$ ) between mean groups. This findings between the MANOVA and ANOVA are different based on the handedness attribute, however this is mainly due to the measurements of each of the tests. The MANOVA test measures all liking attributes combined whereas the ANOVA focuses on the specific

attributes, so there seems to be an accumulative effect for MANOVA, even though individual liking attributes do not show statistical differences.

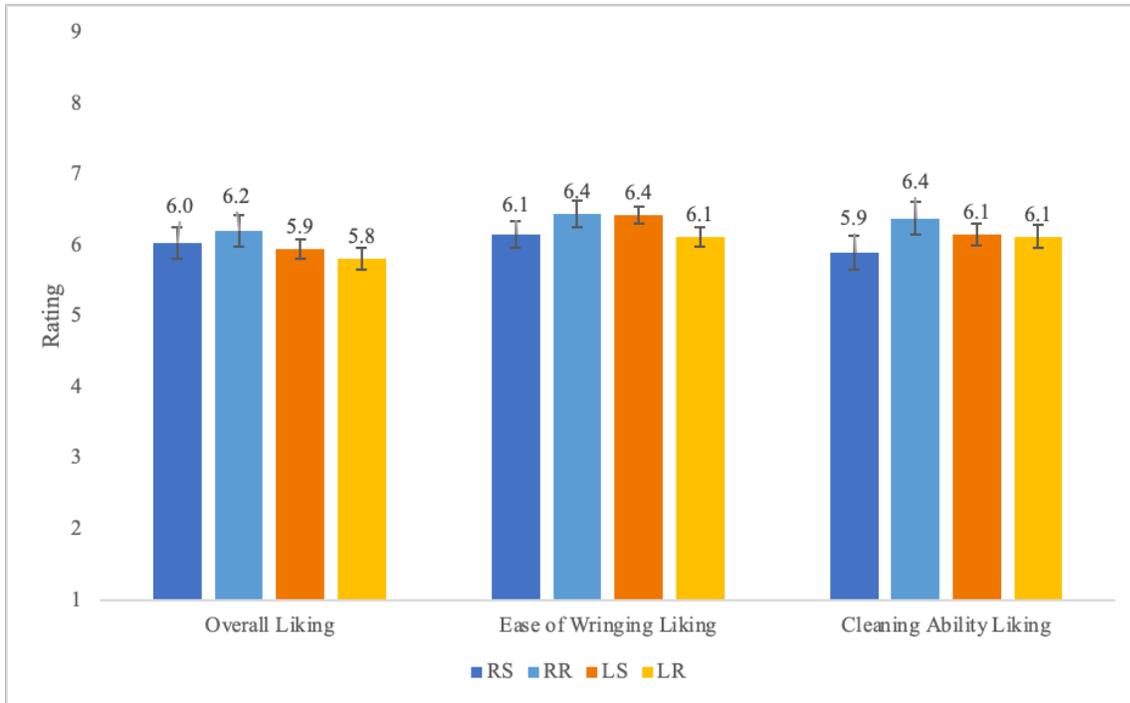
**Table 3.4.** P-Values of ANOVA Model and Factors for Sponges Using a 9-Point Scale.

	Overall Liking	Shape Liking	Size of Holes Liking	Uniformity Liking	Ease of Ringing Liking	Cleaning Ability Liking
Model	0.006	<0.0001	0.541	0.260	0.037	0.131
Handedness	0.210	0.171	0.288	0.062	0.870	0.984
Scale Orientation	0.924	0.058	0.765	0.931	0.944	0.256
Sample	0.001	<0.0001	0.192	0.134	0.008	0.108
Handedness*Scale Orientation	0.406	0.015	0.406	0.354	0.070	0.214
Handedness*Sample	0.677	0.614	0.586	0.073	0.843	0.590
Scale Orientation*Sample	0.257	0.902	0.806	0.929	0.613	0.379

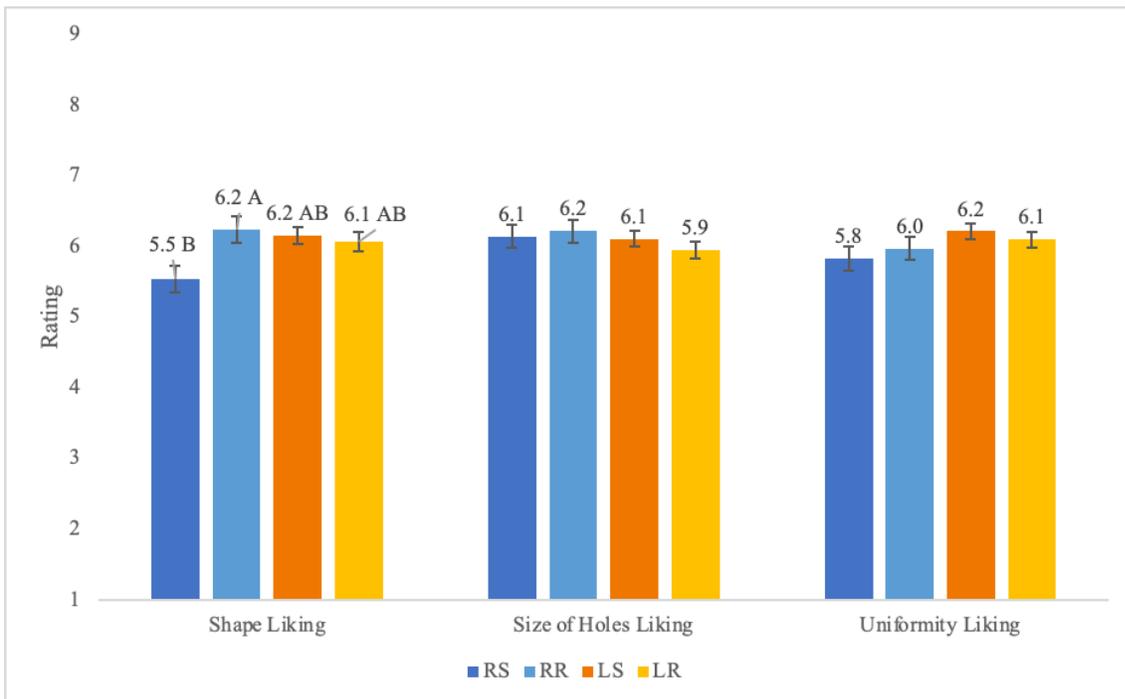
\*Values in red display significance ( $p < 0.05$ ).

The data was further displayed using bar graphs along with the mean scores for each group and lettering when the Tukey’s test showed samples to be different. As with the ANOVA test, handedness was not a factor causing difference in the mean scores based on the Tukey’s Post Hoc test. There was a difference in the way right-handed individuals score based on the orientation of the scale as individuals receiving the reversed scale scored higher, however this was only present in one attribute, shape liking, and was not a major factor across all attributes.

**Figure 3.3A** Bar Graphs Comparing Mean Values for Handedness Groups and Scale Types on a 9-Point Scale for Sponges.



**Figure 3.3B** Bar Graphs Comparing Mean Values for Handedness Groups and Scale Types on a 9-Point Scale for Sponges.



\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

\*\* Groups included right-handed standard scaling (RS)  $n = 16$ , right-handed reversed scaling (RR)  $n = 17$ , left-handed standard scaling (LS)  $n = 40$ , and left-handed reversed scaling (LR)  $n = 34$ .

\*\*\*The overall liking scores were based on a 9-point scale -1 (extremely dislike) to 9 (extremely like).

The trends within each of the handedness groups were completely opposite from one another, in regarding which scale recorded the highest scores. Right-handed individuals assigned higher scores for all attributes when using the reversed scale, as compared to those right-handed individuals receiving the standard scale. This was flipped in the left-handed individuals as they scored attributes more highly when receiving the standard scale as opposed to left-handed individuals who received the reversed scale. Although these differences in mean scores between handedness groups were small, they stayed consistent throughout all 9-point hedonic attributes.

Previous studies of the 9-point hedonic scale do not measure any relation among the handedness traits of individuals or scale orientation when it comes to scaling. The original paper by Peryam and Pilgrim (1957) pertaining to the scale noted that there was no significant difference based on the orientation, whether it was vertical or horizontal and the left to right direction as well. This current study showed that there may be a slight effect on the individuals' usage of the scale based on the discussed factors. Although the effect is slight, it may need to be considered for further product evaluations, and more research is needed to confirm this effect.

The percent of the top 2 and bottom 2 boxes were also evaluated to understand how individuals use the ends of the scales and the link between handedness and scale type (Table 3.5).

**Table 3.5.** Comparison of % Top 2 Box and % Bottom 2 Box Across Handedness and Scale Orientation for Sponges.

	Overall Liking	Shape Liking	Size of Holes Liking	Uniformity Liking	Ease of Ringing Liking	Cleaning Ability Liking	Purchase Intent	Expectation
<b>% Top 2 Box</b>								
RS	29%	20%	29%	23%	36%	33%	39%	29%
RR	34%	39%	28%	25%	40%	46%	44%	33%
LS	26%	29%	23%	24%	33%	34%	38%	31%
LR	28%	31%	18%	21%	26%	34%	36%	29%
RR-RS	5%	19%	-1%	2%	4%	13%	5%	4%
LR-LS	2%	2%	-5%	-3%	-7%	0%	-2%	-1%
RS-LS	3%	-9%	6%	-2%	3%	-2%	1%	-2%
RR-LR	6%	8%	11%	4%	14%	12%	8%	4%
<b>% Bottom 2 Box</b>								
RS	5%	11%	1%	3%	3%	9%	29%	29%
RR	6%	6%	0%	0%	1%	8%	36%	32%
LS	7%	4%	1%	0%	2%	6%	38%	29%
LR	5%	2%	0%	0%	1%	5%	36%	35%
RR-RS	1%	-5%	-1%	-3%	-1%	-1%	8%	3%
LR-LS	-2%	-2%	-1%	0%	-1%	0%	-2%	7%
RS-LS	-2%	8%	1%	3%	1%	3%	-9%	0%
RR-LR	1%	4%	0%	0%	1%	3%	1%	-4%

\* Groups included right-handed standard scaling (RS) n = 16, right-handed reversed scaling (RR) n = 17, left-handed standard scaling (LS) n = 40, and left-handed reversed scaling (LR) n = 34.

\*\* Values highlighted in red indicate negative numbers as represented by the formula on the left side of the table.

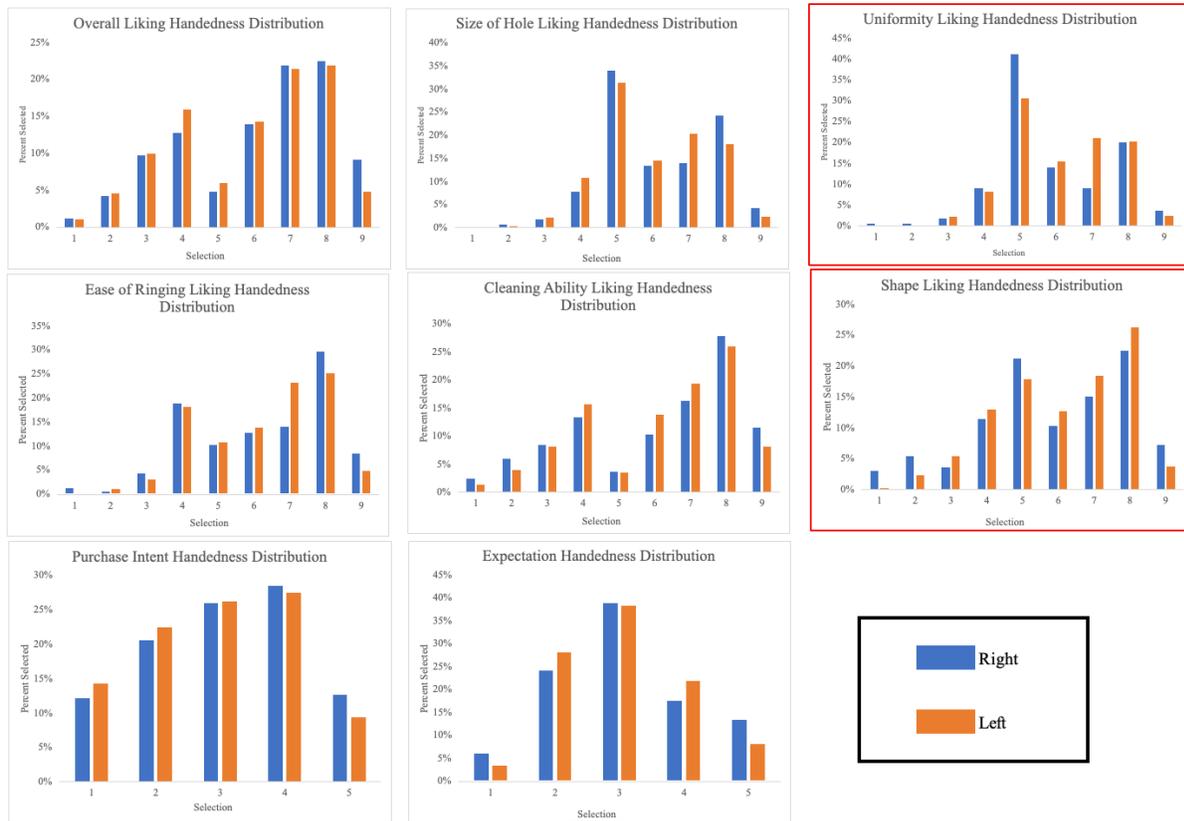
The percent top 2 box displayed trends which aligned with those seen in the ANOVA tests. Right-handed individuals receiving the reversed scale tended to use the more extreme ends of the scale when indicating positive liking for the product. This was true for all of the attributes except size of hole liking, which was only 1% higher for right-handed individuals receiving the standard scale. These higher results correlated with the pet food study in the previous research, however, this was not the case with the left-handed participants. In the previous study using pet food, left-handed individuals used more of the extreme ends when receiving the reversed scale. In fact, left-handed individuals receiving the standard scale in the current study appeared to use the top 2 selections more than those receiving the reversed. In this study, when comparing the

right-handed individuals' usage of the top 2 selections to left-handed individuals, there was an even split when using the standard scale. Using the reversed scale however, right-handed individuals used the extreme ends more frequently for both the top 2 and bottom 2 boxes.

Individuals using the standard scale used the lower scores more often than those who received the reversed scale regardless of handedness. Right-handed individuals appeared to use the low ends of the scale more regularly than left-handed individuals regardless of scale type, although the difference in percent was fairly low for each attribute. The top 2 and bottom 2 box percentages gives researchers a better idea as to how individuals use the ends of the scale.

To further investigate the differences among the groups in the study, the distributions of right- and left-handed individuals were evaluated. A chi-squared test was performed on the distributions to determine if there was a significant difference between the handedness groups. Of the eight attributes dealing with liking, only two had significantly different distributions ( $p < 0.05$ ) among right- and left-handed participants. These distributions are shown in Figure 3.5.

**Figure 3.4.** Distributions Spreads Based on Handedness Among Attribute Categories for Sponges.



\*Red border indicates significant difference in the spread of the distribution between the two groups using the chi-squared test ( $p < 0.05$ ).

\*\* Groups included right-handed individuals (Right)  $n = 33$ , and left-handed individuals (Left)  $n = 74$ .

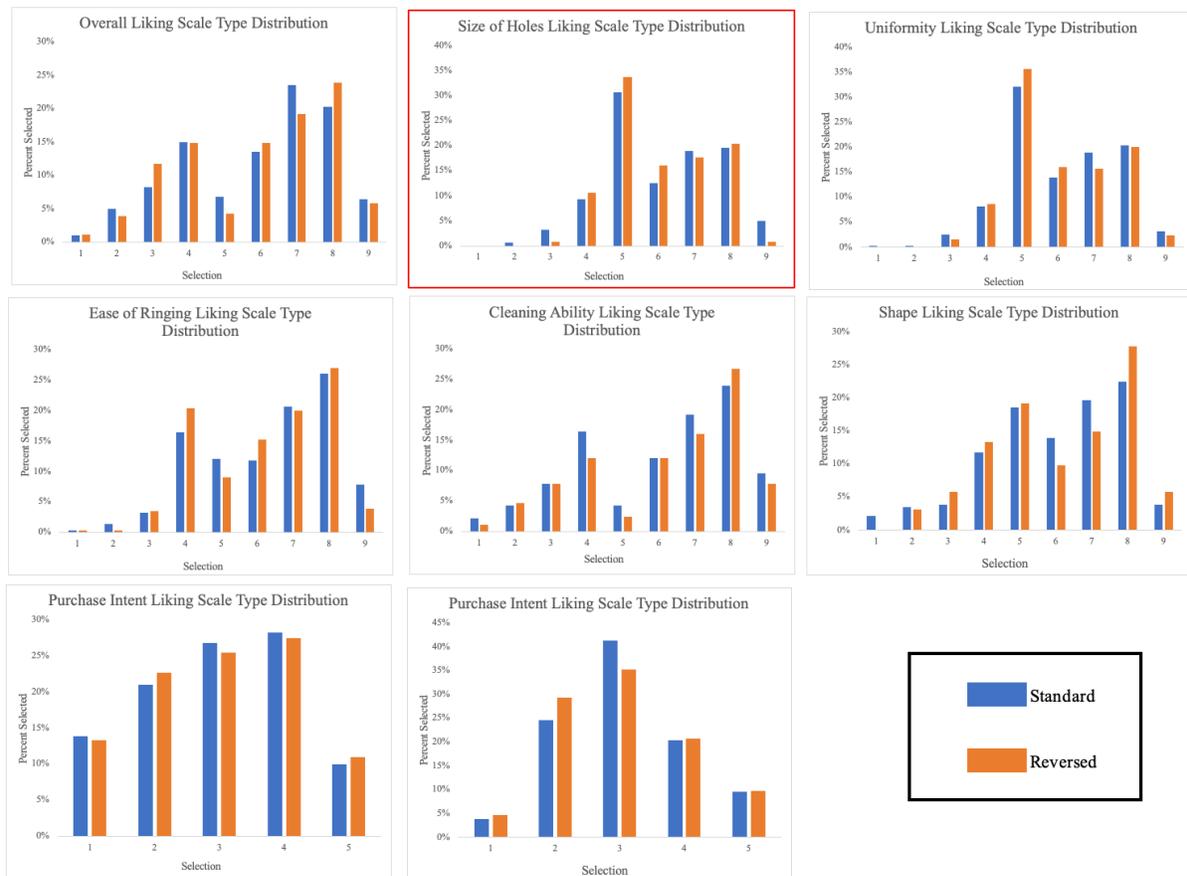
\*\*\*The overall liking scores were based on a 9-point scale -1 (extremely dislike) to 9 (extremely like).

The two attributes that showed significant differences in the spread of the selections were the shape liking and uniformity characteristics, as indicated by the red border. The shape liking showed a bimodal distribution for both the right- and left-handed individuals, with the highest peaks being at 8 and the second peak being at 5. The main difference in the spread was due to the way individuals used the scale, as left-handed individuals used a higher percentage of selections 6, 7, and 8 while right-handed individuals used 1, 2, 5, and 9 more. Uniformity liking

also had a bimodal distribution for both handedness with peaks at 5 and 8 for right-handed individuals and peaks at 5 and 7 for left-handed individuals. The main difference between the distributions is the use of 5 and 7, where 10% more right-handed participants used the middle point of 5 and 12% more left-handed participants used 7.

Distributions were also analyzed when the two scale types were compared, and chi-square test was run to find if the differences were significant. The only attribute that was found to have a significant difference between scale type distributions was for size of hole liking ( $p > 0.05$ ) and is shown in Figure 3.6.

**Figure 3.5** Distribution Spreads Based on Scale Orientation Among Attribute Categories for Sponges.



\*Red border indicates significant difference in the spread of the distribution between the two groups using the chi-squared test ( $p < 0.05$ ).

\*\* Groups included individuals receiving the standard scale (Standard)  $n = 56$ , and individuals receiving the reversed scale (Reversed)  $n = 51$ .

\*\*\*The overall liking scores were based on a 9-point scale -1 (extremely dislike) to 9 (extremely like).

The majority of attributes did not show a significant difference in the way individuals evaluated the products ( $p > 0.05$ ). This was not the case for the size of holes distribution as it had a significant difference for the spread of selections depending on if the reversed or standard scales were used ( $p < 0.05$ ). Individuals receiving the reversed scale used selections 5 and 6 slightly more, whereas individuals using the standard scale used 2, 3, and 9 a bit more. This evaluation of whether or not the difference in scale type produces significantly different results needs to be further evaluated as it was only significant in one of the eight liking attributes.

The just-about-right scores were also evaluated to understand if there was any difference in the way right- and left-handed individuals use these scales. Although these scores are designed to improve products and ANOVA is not generally run for analysis, it was still performed in this case to understand the different ways in which individuals use the scale. The p-values for the model showed all attributes using a 5-point scale had differences in the mean except expectation. The main reason for this variation in scoring is due to the differences in the samples. However, the interaction between scale orientation and handedness was a factor for the size of holes just-about-right attribute (Table 3.6).

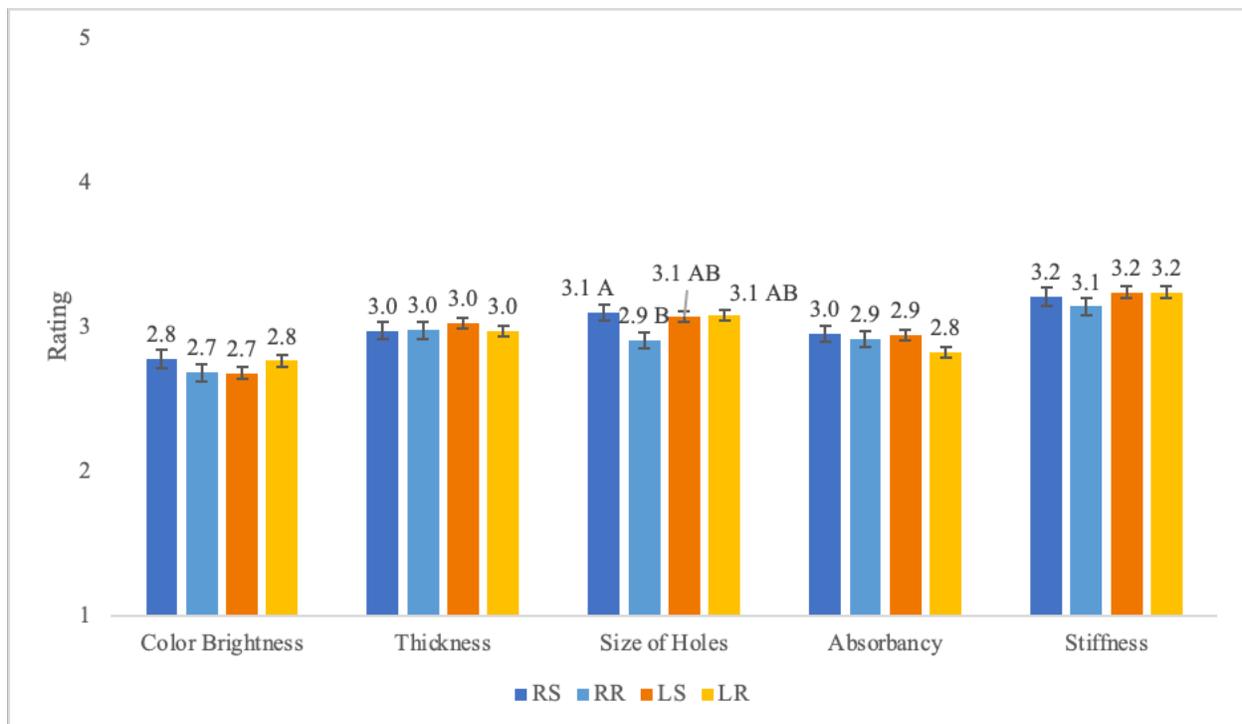
**Table 3.6.** P-Values of ANOVA Model and Factors for Sponges Using a 5-Point Scales.

	Color JAR Brightness	Thickness JAR	Size of Holes JAR	Absorbancy JAR	Stiffness JAR	Purchase Intent	Expectation
Model	<0.0001	<0.0001	<0.0001	0.029	0.002	0.001	0.370
Handedness	0.905	0.656	0.128	0.295	0.243	0.218	0.582
Scale Orientation	0.940	0.593	0.059	0.104	0.520	0.984	0.674
Sample	<0.0001	<0.0001	<0.0001	0.002	<0.0001	<0.0001	0.319
Handedness*Scale Orientation	0.094	0.572	0.032	0.346	0.507	0.969	0.618
Handedness*Sample	0.541	0.631	0.169	0.717	0.726	0.850	0.204
Scale Orientation*Sample	0.521	0.549	0.991	0.600	0.724	0.384	0.314

\*Values in red display significance ( $p < 0.05$ ).

The just-about-right mean scores showed little difference in the way individuals used the scale. The only attribute to show a difference was size of holes where right-handed individuals receiving the standard scale and left-handed individuals receiving the reversed scale scored higher than right-handed individuals receiving the reversed scale. All other attributes did not show differences between the four groups. It is not common to run analysis of variance on just-about-right data, and penalty analysis was run for the different sponges to understand what changes could be made to the products.

**Figure 3.6.** Bar Graphs Comparing Mean Values for Handedness Groups and Scale Orientation on a 5-Point Just-About-Right Scale for Sponges.



\*Means with the same letter are not significantly different ( $p \leq 0.05$ ). Scores not sharing the same letter were significantly different ( $p \leq 0.05$ ).

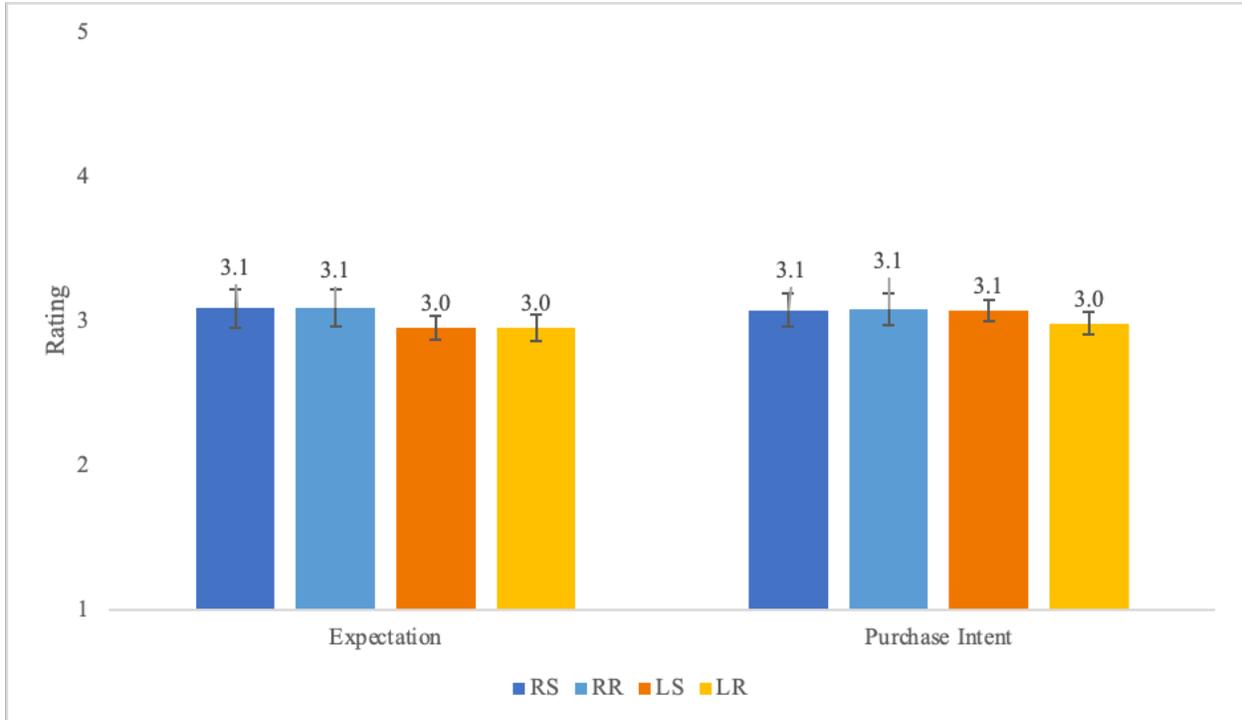
\*\* Groups included right-handed standard scaling (RS)  $n = 16$ , right-handed reversed scaling (RR)  $n = 17$ , left-handed standard scaling (LS)  $n = 40$ , and left-handed reversed scaling (LR)  $n = 34$ .

\*\*\*The just-about-right scores were based on a 5-point scale -1 (far too weak) to 5 (far too strong).

Unlike with the 9-point scales, there were no clear trends observed with the groups' ratings based on their handedness and scale orientation. This could be due to fewer number of points on the scale, resulting in less variation among possible selections. The trend for the 9-point scale was rather slight, and when the number of choices were reduced to only five the trend is not detected. Another possible reason may be that individuals do not perceive these scales as being on a positive and negative continuum. Unlike the 9-point hedonic scale, the 5-point just-about-right scale asks how the product can be improved and no indication of liking is portrayed.

The purchase intent and expectation also used the 5-point scales, although the anchor wordings used were different than those used in the just-about-right scale. The comparisons of each of the groups for both the purchase intent and expectation is shown in Figure 3.8.

**Figure 3.7.** Bar Graphs Comparing Mean Values for Handedness Groups and Scale Orientation on a 5-Point Expectation/Purchase Intent Scale for Sponges.



\*Means with the same letter are not significantly different ( $p \leq 0.05$ ). Scores not sharing the same letter were significantly different ( $p \leq 0.05$ ).

\*\* Groups included right-handed standard scaling (RS) n = 16, right-handed reversed scaling (RR) n = 17, left-handed standard scaling (LS) n = 40, and left-handed reversed scaling (LR) n = 34.

The expectation and purchase intent results did not show a significant difference among the groups based on handedness and scale orientation ( $p > 0.05$ ). However, the scale usage trend that was seen in the 9-point hedonic scale evaluation was again observed when using expectation and purchase intent scales. The mean scores showed that the reverse scale had higher values in right-handed individuals while the standard scale had higher values in left-handed individuals. This was also seen in the previous study pertaining to pet food as well, as the right-handed participants rated more highly on the reversed scale while left-handed participants rated more highly on the standard scale. This strengthens the idea that individuals use slightly different ends of the scale based on their handedness and the orientation.

Overall, the results from this study show that there is no significant difference in the mean scores for each of the four groups based on handedness and the orientation of the scale. However, there were trends that emerged in and should be further evaluated to understand individuals better. The results showed consistently higher mean values on the 9-point hedonic scale when the reversed scale was employed for right-handed individuals. Oppositely, left-handed participants rated attributes more highly when using the standard scale. The trends identified in this study give better insight into how the spatial perceptions of individuals affect their scoring on the 9-point scale.

The 5-point scales produced differing results possibly due to the anchor wordings used on the continuum. The just-about-right scale did not have a clear trend associated with it and thus was unclear on if the orientation affects individuals' perceptions. However, the trend seen with the hedonic scales reemerged with the purchase intent and expectation results. This trend may appear when individuals give opinions on product liking rather than the traits that need to be

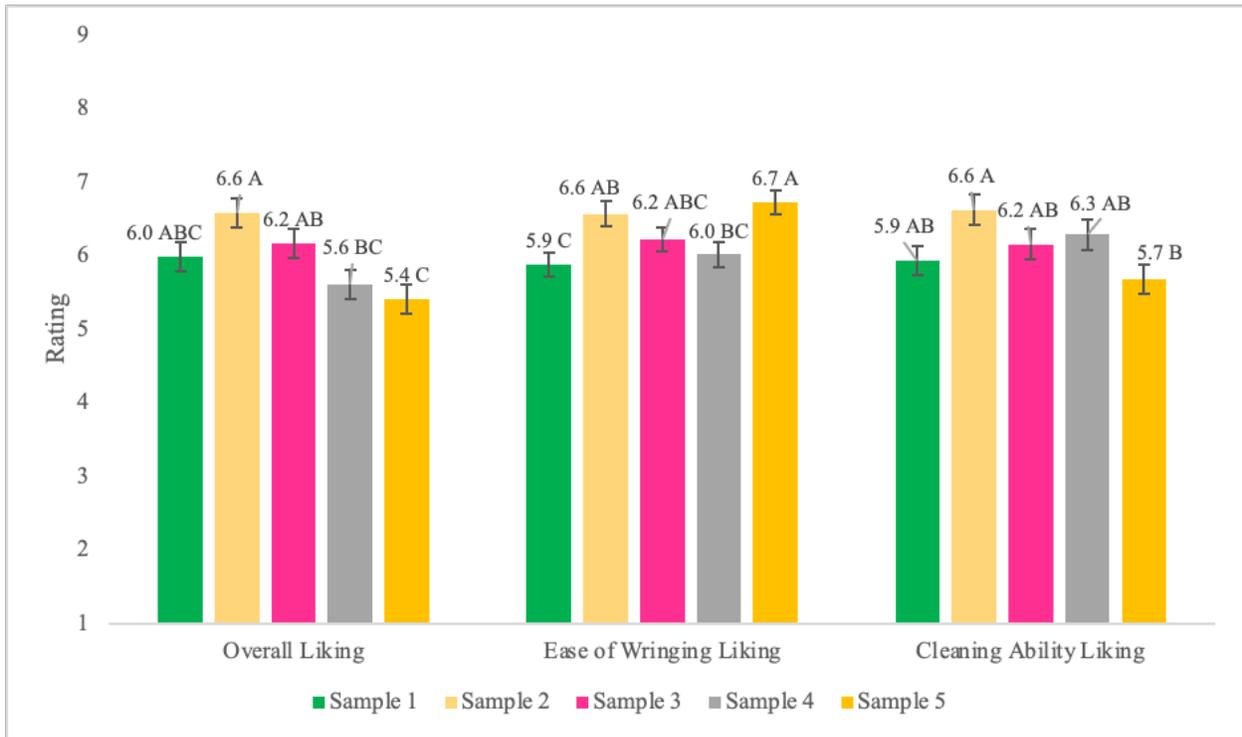
altered. This study gives future researchers a strong foundation on which to further understand whether there is difference in the way right and left-handed individuals perceive sensory scales and if the trends discussed in this paper are present among various demographics.

### **Sponge Evaluation**

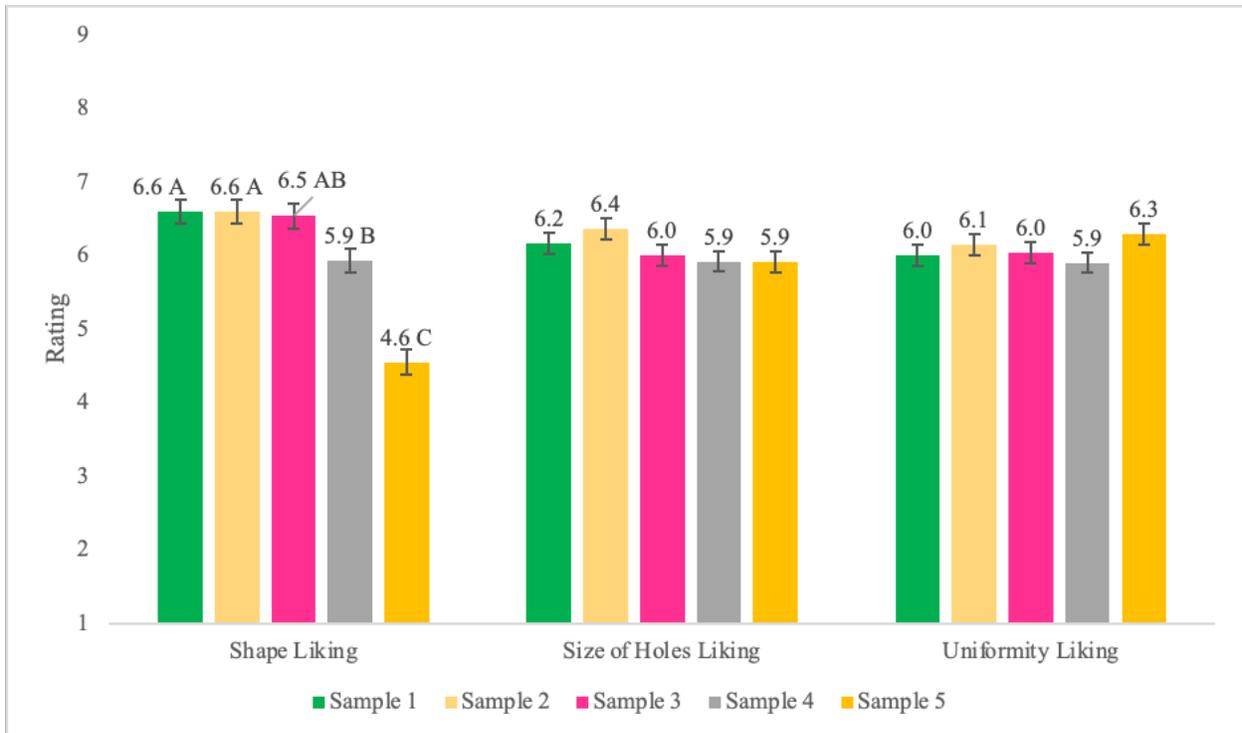
This study used five sponges of which average consumers could easily identify the differences and unique uses of each. No documented study has ever evaluated sponges and their usefulness although research has been conducted on non-food items such as cosmetics (Martins et al., 2020) and fabrics (Jeguirim et al., 2010). This research is a first, due to the use of sponges, and opens a door for understanding more products beyond the food category. Questions were carefully constructed to gain a full understanding of how well individuals like both the look of the sponge as well as its usefulness. This research found that there are differences in how much individuals liked the specific sponges, and this information could aid product developers in creating more desirable products.

The first form of evaluations used was the 9-point hedonic scale which indicated how well individuals liked the product and its specific characteristics. The same questions used to evaluate handedness and orientation were used to determine how well the various sponges were liked.

**Figure 3.8A** Bar Graphs Comparing Mean Values of Sponges on a 9-Point Hedonic Scale.



**Figure 3.9B** Bar Graphs Comparing Mean Values of Sponges on a 9-Point Hedonic Scale.



\*Means with the same letter are not significantly different ( $p \leq 0.05$ ). Scores not sharing the same letter were significantly different ( $p \leq 0.05$ ).

\*\*The overall liking scores were based on a 9-point scale -1 (extremely dislike) to 9 (extremely like).

Unlike the results from the handedness portion of the study, there were clear differences in liking scores among the various attributes. These differences in liking were also apparent in the previous study where individuals evaluated the various dry dog food products. The only attributes where there was no significant difference among the liking scores between samples were the size of holes and uniformity liking ( $p > 0.05$ ). These two attributes do not appear to play an essential role in the way participants show preference toward one sponge type and may be due to the similarities of spongy appearance.

There were more characteristics that differentiated the sponges and indicated greater liking to a single brand. For overall liking, Sample 2 scored the highest among consumers and was significantly more liked than Samples 4 and 5. This was a bit surprising as Sample 2 is considered to be an off- or store-brand of Sample 1 and is less expensive. Sample 1 costs approximately \$0.88 per sponge whereas Sample 2 costs less than \$0.50 per sponge. The appearance attributes of both Sample 1 and 2 are at parity, but it is the usefulness attributes that individuals found the greatest differences. Sample 2 scored highest for cleaning ability and second highest for ease of wringing which was significantly higher than Sample 1 ( $p < 0.05$ ). These usefulness characteristics are what set apart Sample 2 from the other products as the most well-liked sponge.

Sample 5 was not particularly liked by participants and its low score was due to its shape and cleaning ability. Sample 5 scored significantly lower than all the other samples for shape liking ( $p < 0.05$ ) and may be due to the uniform shape type of all of the other samples. Samples 1-4 had the same square shape to them which are more commonly sold in supermarkets where

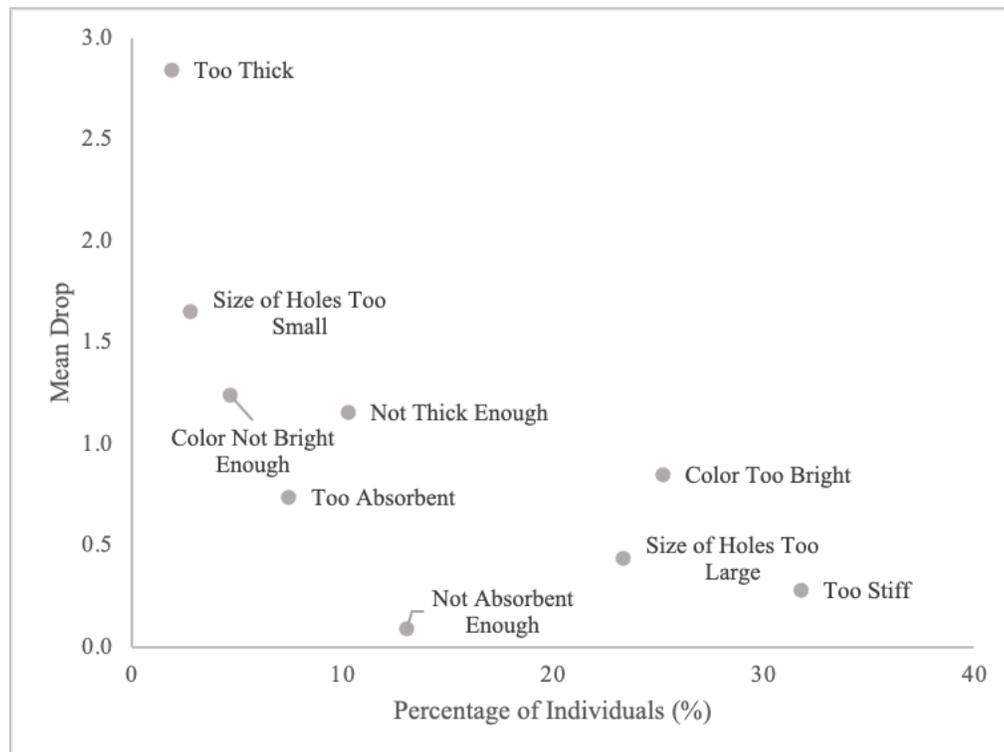
they shop, whereas Sample 5 was much thicker. It also scored lowest for cleaning ability liking and was significantly lower than Sample 2 ( $p < 0.05$ ). It should be noted that the Sample 5 was the only sample that did not include a dense scrubbing pad to help with cleaning. The lack of scrubbing pad may have created more difficulty gripping the sponge to clean the thick, sticky molasses and thus scored lowly for cleaning ability and overall liking. Sample 5 was rated highly for its ease of wringing, which again may be due to the lack of scrubbing pad which inhibits wringing out the sponge. Even with Sample 5 scoring significantly higher than Sample 1 and 4 for ease of wringing ( $p < 0.05$ ) it still scored lower than these samples for overall liking.

Samples 3 and 4 scored in the middle for most of the liking attributes, not scoring the highest or lowest. Sample 2 had the second highest score for overall liking while Sample 4 had the second lowest. Sample 2 scored at parity with the Samples 1 and 2 for shape liking while Sample 4 was significantly less liked when compared to the first two samples ( $p < 0.05$ ). This is interesting as Sample 4 is the same shape as the other Samples 1-3 but scored much lower, possibly due to its unique uncommon gray color.

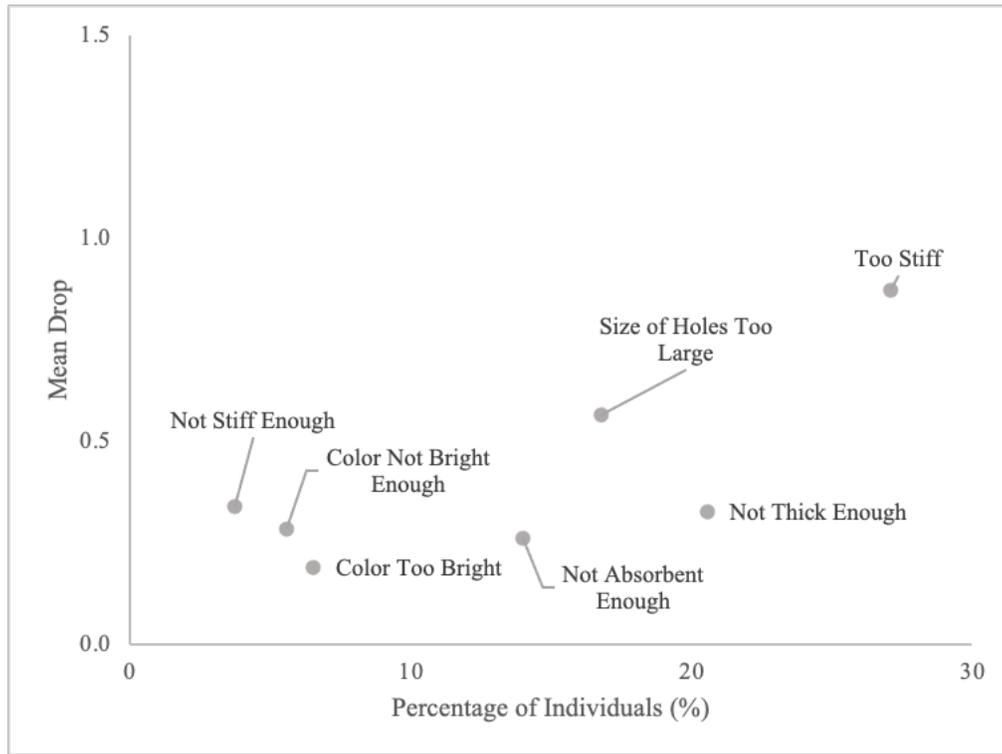
To better understand the consumers insights toward sponges, penalty analysis was run on the just-about-right scores to see how the product could be improved. Penalty analysis uses two main components convey results for product developers to determine if action is needed, percentage and mean drop. The percentage refers to the percent of individuals indicating that the products' attributes are "too weak" or "too strong," while the mean drop is the average scores above and below the "just-about-right" subtracted from the mean of the jar group (Lawless and Heymann, 2010). For this analysis, percentages greater than 20% and a mean drop between 1.0-1.5 were considered moderate penalties, while percentages greater than 20% and mean drops greater than 1.5 were considered high penalties.

Penalties were not observed in the majority of the products, however Samples 4 and 5 did contain both moderate and high penalties. Sample 4 was assessed a moderate penalty for color not being bright enough and a high penalty for being too stiff. This sample was a plain gray color and not indicative of other sponge colors at sold at supermarket; it was also made of fibrous plant-based materials making it stiffer than other samples. Sample 5 was given a moderate penalty for size of holes being too small and color not being bright enough as well as a high penalty for not being thick enough. The thickness penalty was substantial as over 80% of the participants indicated this and had a mean drop of 1.7. Samples 1-3 did not have any combination of mean drops and percentages of individuals that noted a major issue with the product.

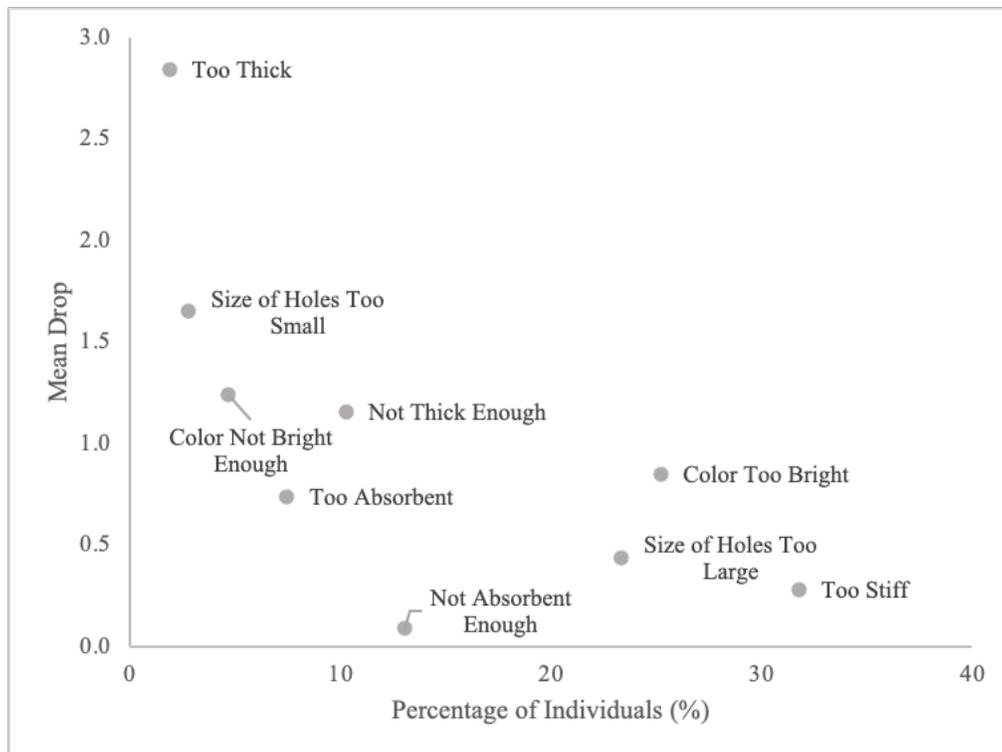
**Figure 3.9A Penalty Analysis of Sample 1**



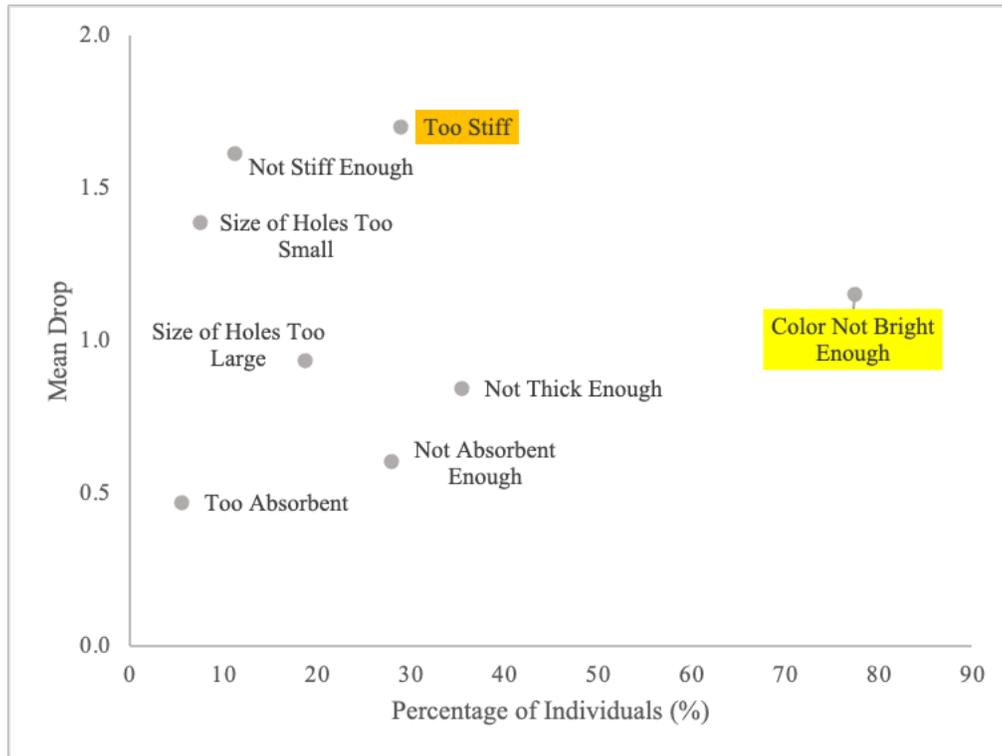
**Figure 3.10B Penalty Analysis of Sample 2**



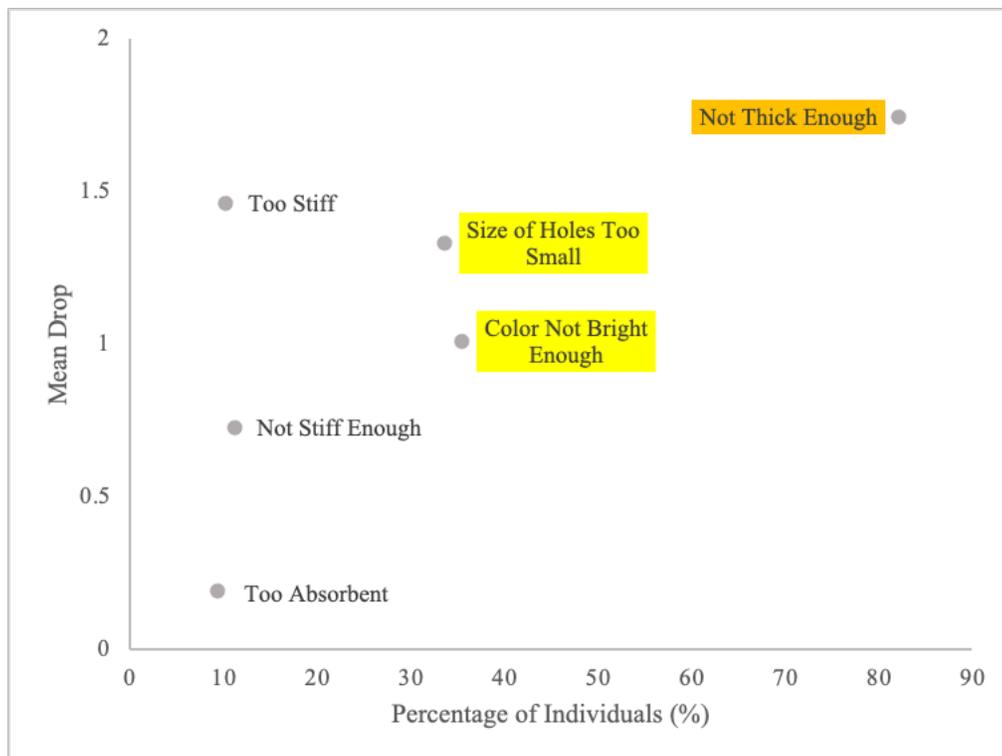
**Figure 3.10C Penalty Analysis of Sample 3**



**Figure 3.10D Penalty Analysis of Sample 4**



**Figure 3.10E Penalty Analysis of Sample 5**

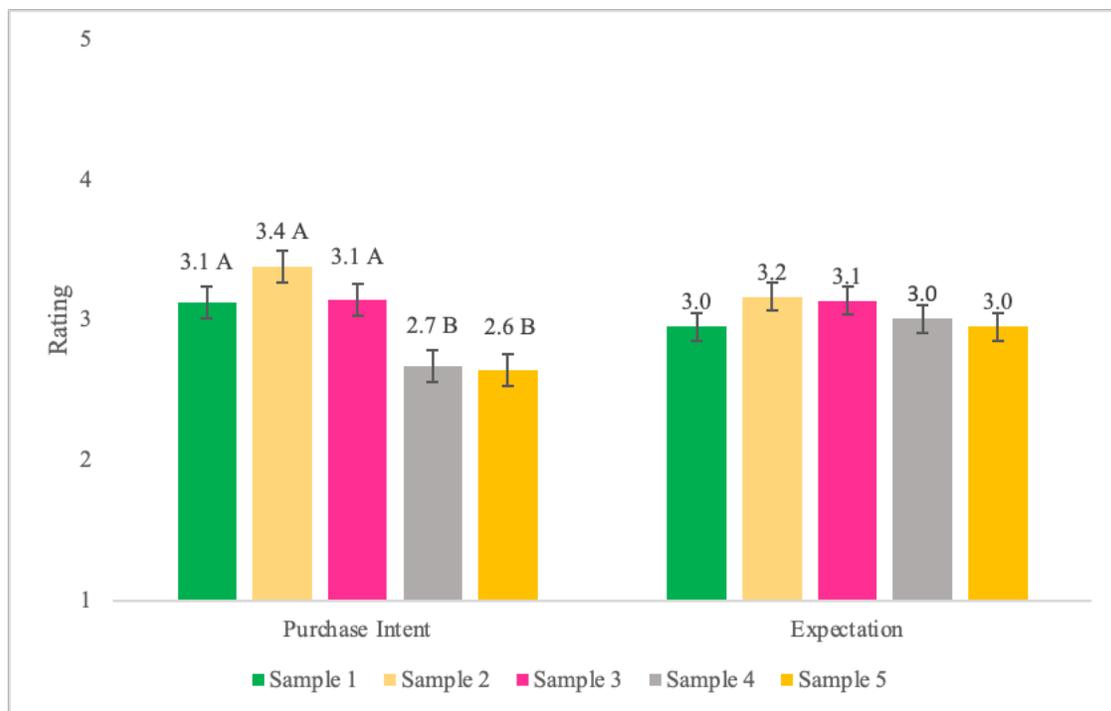


\* Moderate penalties (20% of individuals and 1.0-1.5 mean drop) are highlighted in yellow, high penalties (20% of individuals and mean drop >1.5) are highlighted in orange.

\*\*The just-about-right scores were based on a 5-point scale -1 (far too weak) to 5 (far too strong).

The last portion of evaluation for the sponges was the purchase intent and expectation which were rated on a 5-point scale. This scale is not the same as the just-about-right scale as the number indicating the best selection is 5 as opposed to 3. The data from these questions was also analyzed through an ANOVA test with a Tukey's Post Hoc and the results are shown in Figure 3.11.

**Figure 3.10.** Bar Graphs Comparing Mean Values for Sponges on a 5-Point Expectation/Purchase Intent Scale.



\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

\*\*The purchase intent/expectation scores were based on a 5-point scale -1 (definitely will not buy/much worse than expected) to 5 (definitely will buy/much better than expected).

The expectation characteristic showed no significant difference ( $p > 0.05$ ) across the board, as all of the sponges met consumer expectations. This was to be anticipated as all of the

samples were clearly sponges and resembled products that may be in a common household. All of the samples were made of material that would clearly be identified as sponge like material. The purchase intent showed greater variation among the products following a pattern similar to overall liking. Sample 2 scored the highest followed by Samples 1 and 3.. These samples had significantly higher purchase intent ratings than Samples 4 and 5 ( $p < 0.05$ ).

### **Limitations**

This study is unlike any other in the way it evaluated handedness, scale orientation, and sponges for liking characteristics, and thus there were limitations that could be improved upon. One of the limitations of this study was the large number of left-handed individuals compared to that of right-handed individuals. This was due to high cancellations of right-handed individuals the prior to the studies start date, and recruitment of left-handed individuals for replacement. Although this may be a limitation, it also serves as an advantage as it increases the overall data on left-handed individuals which has been noted in other studies as difficult to obtain (Casasanto, 2009). Also, each of the four groups had low number of participants within them which may have been insufficient to accurately perform some data analysis such as the chi-squared test. The study was designed to provide a preliminary examination into whether there is a substantial difference between right- and left-handed people when scoring questionnaires and provides a basis for additional testing to ensue.

The questionnaire also had limitations due to it being the first reported questionnaire focusing on consumer perceptions of sponges. In order to adequately evaluate the sponges participants had to perform cleaning processes which may be unfamiliar to them in a testing environment. Some of the questions should be formatted differently in future studies, such as the color appropriateness which should not be evaluated using a 5-point just-about-right scale, but

rather a 9-point hedonic scale. This question was asked in a way that indicated it was not measuring a just-about-right quality but was more similar to that of the expectation and purchase intent scales. Also, the number of instructions for evaluation of the sponges as well as the questions on the ballot may have confused participants resulting in less precise results. Future studies may choose to discuss all the supplies given to individuals and possibly a demonstration of the cleaning process as well. For future studies aiming to evaluate sponges, further refinement of the questionnaire should be considered as researchers in the field of cleaning products would be more experienced in identifying product specific attributes.

It should also be noted that the products used in this study could be easily differentiated from one another as is the case with previous dry dog food study. It is yet unclear if this is a limitation and if products that are more similar would further enhance the biases of individuals based on handedness. The following study looking at breakfast sandwiches will test this idea as only three similar breakfast sandwiches were used.

## **Conclusion**

The main purpose of the study was to determine if handedness and scale orientation influences how participants use the scale when evaluating samples. Overall, there is no significant effect in the way individuals use the 9-point or 5-point scales based on handedness or scale orientation. Although the MANOVA test found there to be a significant effect from the handedness of the individuals, further analysis using ANOVA did not reveal differences in mean scores among the specific attributes for handedness. The ANOVA and Tukey's Post Hoc tests did not determine significant differences among the four groups of participants and scale types. However, when the data was analyzed using the samples as variables there were significant differences in how well individuals liked each of the sponges.

The handedness results displayed a trend that was present throughout all of the attribute liking scores. The right-handed individuals gave higher liking scores when they received the reversed scale as opposed to the standard scale. This was completely opposite for left-handed individuals who gave higher scoring when receiving the standard scale. It was originally speculated that left-handed individuals would give higher scores when receiving the reversed scale as it would correlate with their notion of positive traits being linked to the dominant side of their body.

Comparing the results from the sponge study with the dry dog food study differences occur for left-handed individuals while right-handed individuals stayed consistent. In the dry pet food study, there existed a trend of higher scoring when the participants received the reversed scale for both right- and left-handed participants. However, in the sponge study this was not the case for left-handed individuals and may be related to the manipulation of the products. The purpose of using sponges was to have participants physically manipulate the sponges engaging the motor neuron pathway in their hand all the way to the specific nerve receptors in their brain. It may be possible that the receptor sites in the brain trigger greater relation of the dominant side being positive while the non-dominant side is negative. Although this physical manipulation study did not find the expected results, in fact finding the opposite, it still found slight differences in the way individuals scored products when participants received different scales.

This research acts as a starting point for further investigation into the spatial perceptions individuals have based on handedness and how it affects their responses to scaling questions. Further research should use products with greater physical manipulation, thus greatly increasing the number signals passed between the brain and hand.

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## **Chapter 4 - Handedness and Scale Orientation Effect on Oral**

### **Evaluation of Breakfast Sandwiches**

#### **Abstract**

Breakfast sausage, egg, and cheese sandwiches were used to evaluate if participants scored differently based on their handedness or the orientation of the scale. In this study, three breakfast sandwiches were investigated with varying ingredients to determine how well individuals liked the products and how they can be improved. The data obtained during the study was segregated into four groups based on the handedness of the participant and the scale orientation given to evaluate the product. The results showed that when using the 9-point hedonic scale the participants handedness and scale orientation had little effect as only one of the eight attributes showed significant difference. However, there was a trend observed that when left-handed individuals received the standard scale, they assigned higher liking scores than when given the reversed scale. In addition, right-handed individuals using the reversed scale assigned higher scores as opposed to those using the standard scale. This trend requires additional research with a larger sample of individuals for confirmation but gives some insight into the subconscious minds of the participants. The number of samples and similarity between the samples did not affect the scores of the individuals as the findings from this study were similar to those performed previously. Lastly, for the just-about-right scaling results, there was only one attribute in which the four groups had significantly different results. The just-about-right results did not show a trend like the hedonic scoring due to the way in which the scale is configured, but further testing is required. This study provides a glimpse on the influence of an individual's

handedness on their scoring of food products. This information may aid in improvements of the scale and improve further research methodologies.

## **Introduction**

Sensory and consumer science focuses on obtaining, understanding and quantifying the perceptions of individuals when consuming, using or interacting with products. The preponderance of these studies center around food products which require participants to taste specific foods. Foods used for this type of research have ranged from liquids including orange juice (Kim et al., 2013) and tea (Lee et al., 2009) to solid products including chocolate (Ramón-Canul et al., 2020) and bread (Sandvik, 2017). The use of sensory science has been critical for major corporations, allowing researchers to provide direct feedback to companies from their consumers (Lawless and Heymann, 2010).

The use of sensory scaling is not without drawbacks, as researchers constantly aim to improve the testing methodology. Even in the original paper discussing the 9-point hedonic scale Peryam and Pilgrim noted some of the pitfalls that can occur and how to avoid them (Peryam and Pilgrim, 1957). One of the effects that this current research is focused on is investigating if right- and left-handed individuals score differently on various sensory scales based on their subconscious bias of spatial perception.

The comparisons between right- and left-handed individuals ranges from biological differences in the brain to cultural differences in the world. Casasanto has documented variances in the two groups and identified how handedness can attribute positive emotions to the dominant side of their bodies (Casasanto, 2009; 2011). Handedness can even play a role in how individuals chew their foods due to the lateralization of the brain (Khamnei et al., 2019).

Differences in the way individuals may perceive foods in relation to their dominant hand may provide further insight into perfecting sensory testing.

The main objective of this study was to understand if the orientation of the scale or handedness of the individuals effects their scoring of sensory scaling. This study used breakfast sausage, egg, and cheese sandwiches which were similar with only small variations in the sausage ingredients. The study used 9-point hedonic, 5-point just-about-right, and 5-point expectation and purchase intent scales for evaluation. Data was compiled from four groups based on handedness and scale orientation and analysis was performed to determine if the groups give significantly different results. This study will increase the knowledge base of understanding individuals' differences when performing sensory evaluations on food products.

## **Materials and Methods**

### **Samples**

In the current study, three breakfast sausage, egg and cheese sandwiches sold commercially at convenience stores in the local Kansas City area were evaluated. The three versions of sausage used in the study were the Control, Test 1 and Test 2. All of the other components of the sandwich, (cheese, egg and biscuit) were kept consistent to determine if interactions with the sausage formulations changed the perception of taste of the other components. The three breakfast sandwiches exhibited no visual differences from each other. Participants were required to taste each of the samples to evaluate attributes in the products. Table 4.1 shows the sausage, egg, and cheese breakfast sandwiches used and a photo of each sample.

**Table 4.1.** Sausage Egg and Cheese Breakfast Sandwich Samples Used for the Central Location Test.

Sample	Photo
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Control Sausage



Test Sausage



Test Sausage + Umami



The sandwich ingredients were delivered to the testing facility and employees assembled the sandwiches a day prior to testing. The sandwiches were wrapped in foil packaging that included a three-digit code and placed in a refrigerator at 4 °C overnight. The sandwiches were then heated in a microwave 20 minutes before each session and placed in a warming cabinet. The sandwiches were then served in a paper wrapping.

## **Subjects**

The individuals participating in this study were recruited around the greater the Kansas City area from the Sensory and Consumer Science Center's database using Compusense Cloud. To recruit appropriate participants, a questionnaire was completed prior to selection. To be selected for the study, individuals had to identify that they were frequent breakfast consumers. In addition, the participants chosen for the study must indicate that they purchase breakfast from a convenience store, coffee shop, or fast-food restaurant on at least a monthly basis.

For the purposes of handedness, an attempt was made to recruit an even number of right- and left-handed individuals. As previous studies have shown, there is difficulty in recruiting left-handed participants (Casasanto, 2009). This limit, along with the screener criteria, restricted the number of left-handed individuals that were eligible for the study. In total, 68 right-handed participants and 38 left-handed participants were recruited for the evaluation of the breakfast sandwiches. This number still exceeds the percentage ratio of left-handed individuals in the general population (10%) as well as those used in previous studies evaluating handedness (Casasanto, 2009; Casasanto & Tania, 2012).

The research was approved by the Institutional Review Board for Protection of Human Subjects (IRB # 10347).

## **Central Location Test**

The test was conducted at the Center for Sensory and Consumer Research at Kansas State University in Olathe, Kansas. The participants were asked to choose one of 6 sessions to attend, each lasting 45 minutes. Sessions ranged from starting times of 6:45 A.M to the last session beginning at 10:05 A.M as to accommodate individuals who purchase breakfast sandwiches early in the morning on their way to work. Two rooms were prepared for the study, each capable of hosting a total of 12 individuals. The use of two rooms was not ideal but required due to the capacity limitations of each room due to COVID protocols. The rooms were arranged in an identical manner to limit any blocking/session effect and avoid results from being skewed. Tables were also arranged with paper placemats, water bottles, and iPads with Compusense software downloaded. Participant would sign into their specific account and wait for the moderator to instruct them and begin the test.

Samples were served in a monadic order and the three samples were evaluated by all participants in the 45-minute session. The order was completely randomized for each participant and all possible permutations were used to ensure an even distribution of sample orders.

## **Questionnaire**

A 9-point hedonic scale was used to determine how well individuals liked specific attributes of the sandwich where 1 indicated “dislike it extremely,” 9 indicated “like it extremely,” and 5 indicated “neither like nor dislike.” The other points followed a standard liking continuum with positive liking on one extreme and negative liking on the other extreme depending on the scale type. The attributes that were selected for evaluation were liking for overall appearance, aroma, and texture and component liking for the egg, cheese, sausage, and biscuit.

The questionnaire also used 5-point just-about-right scale to indicate how the product can be changed to increase liking. The scale consisted of five points where 1 indicated the attribute was “much too weak,” 5 indicated “much too strong,” and 3 indicated “just about right.” The just-about-right scale was used to determine improvements in the product for biscuit, sausage, egg, cheese, salty and spicy flavors.

Purchase intent and expectation of the breakfast sausage, egg, and cheese sandwiches was also evaluated using a 5-point scale. The purchase intent scale indicated how willing individuals would be to purchase the product if it was easily available with 1 indicating “definitely will not buy,” 5 indicating “definitely will buy,” and 3 indicating “might or might not buy.” Likewise, expectation queried how well the sample met the individual’s expectation with 1 indicating “much worse than expected,” 5 indicating “much better than expected,” and 3 indicating “meets expectations.”

Demographic questions were used at the end of the study once all samples had been evaluated. The purpose of these questions was to understand the composition of the pool of participants as well as confirming that they met the requirements for the study. The questions solicited information about the individuals’ gender, age, handedness, and where they typically purchase breakfast sandwiches. The demographics of the individuals are shown in Table 4.2.

**Table 4.2.** Demographics of Breakfast Sandwich Consumers for CLT.

<b>Owner Characteristics</b>	<b>Categories</b>	<b>Frequency</b>	<b>%</b>
Gender	Male	73	74%
	Female	25	26%
Age	17 years or younger	0	0%
	18-20 years	3	3%
	21-30 years	12	12%

	31-40 years	40	41%
	41-50 years	27	28%
	51-60 years	16	16%
	61 years or older	0	0%
Handedness	Right	68	69%
	Left	30	31%
Purchase Frequency	3-6 times per week	22	22%
	2 times per week	39	40%
	Once per week	28	29%
	2-3 times per month	6	6%
	Once per month	3	3%

The questionnaire was also modified based on whether the person was right- or left-handed. Two versions of the questionnaire were created, a standard form which had traditional scaling, where numbers and liking increase from left to right, and a reversed scale, where numbers and liking increase from right to left. Four groups were created for the sessions each consisting of right-handed participants receiving the standard scale, right-handed individuals receiving the reversed scale, left-handed individuals receiving the standard scale, and left-handed individuals receiving the reversed scale.

The scheduler and screener were used to determine how many right- and left-handed individuals were present at each session. These individuals were then manually placed into one of the four groups and given either the standard or reversed questionnaire. The questionnaire groups were divided evenly among the right- and left-handed participants in order to have identical number of individuals in each of the handedness groups evaluate the scales. Individuals

were also split evenly for scale type in each individual session as to prevent any session effect from occurring.

## **Data Analysis**

The data was downloaded from the Compusense software and copied into an Excel spreadsheet (Excel, Microsoft Office 2021, Version 16.47.1). The first analysis run on the data was a multivariate analysis of variance (MANOVA) to determine if there is an effect from handedness or scale orientation on individuals scoring. The data was also placed into one of four groups based on the individuals' handedness and the orientation of the test they used. The software was used to determine means, percentages, standard deviations, and sums of various data. For further data manipulation XLSTAT by Addinsoft (Version 21.1.1) was used to determine analysis of variance (ANOVA) using the Tukey's Post Hoc test. Chi-squared test was also used to determine if there were significant differences in the spread of selections among the participants through the XLSTAT software.

## **Results and Discussion**

### **Handedness Evaluation**

Multivariate analysis of variance was run to determine if the factors evaluated had an effect on participants scoring of the sandwiches when using a 9-point hedonic scale. The factors included were appearance, aroma, texture, overall, biscuit, egg, cheese, and sausage liking. Neither handedness nor scale orientation proved to be a main factor influencing the scoring of the participants (Table 4.3). However, there was a significant effect due to the interaction between handedness and scale orientation. The MANOVA test also detected differences among samples when combining all of the attributes.

**Table 4.3.** P-Values for MANOVA Testing of Handedness and Scale Orientation of Breakfast Sandwiches When Using the 9-Point Hedonic Scale.

	Handedness	Scale orientation	Sample	Handedness *Scale orientation	Handedness *Sample	Scale orientation* Sample
Lambda	0.978	0.983	0.897	0.940	0.950	0.961
F (Observed values)	0.769	0.582	1.926	2.203	0.890	0.698
DF1	8	8	16	8	16	16
DF2	277	277	554	277	554	554
F (Critical value)	1.972	1.972	1.662	1.972	1.662	1.662
p-value	0.630	0.793	0.016	0.027	0.581	0.798

\*Values in red display significance ( $p < 0.05$ ).

The p-values for the ANOVA also showed few differences from the handedness, scale orientation and sample factors. The interaction between handedness and scale orientation produced different mean scores across the four groups of participants. The sample also showed different mean scores ( $p < 0.05$ ) for sausage liking and texture liking for the samples used. Although the p-value for overall texture was shown to be significant ( $p < 0.05$ ) for the interaction between handedness and scale orientation, the Tukey's Post Hoc test did not show differences between the groups. The majority of attributes did not have significantly mean scores based on the factors and their interactions.

**Table 4.4.** P-Values of ANOVA Model and Factors for Breakfast Sandwiches Using a 9-Point Scale.

	Overall Appearance	Aroma Liking	Overall Liking	Biscuit Liking	Sausage Liking	Egg Liking	Cheese Liking	Overall Texture
Model	0.430	0.573	0.076	0.448	0.227	0.126	0.779	0.056
Handedness	0.916	0.890	0.892	0.951	0.657	0.125	0.173	0.594
Scale orientation	0.968	0.767	0.678	0.436	0.871	0.463	0.478	0.508
Sample	0.663	0.248	0.066	0.183	0.044	0.170	0.400	0.021
Handedness*Scale orientation	0.543	0.333	0.107	0.726	0.438	0.020	0.879	0.047
Handedness*Sample	0.362	0.193	0.130	0.388	0.372	0.163	0.638	0.477
Scale orientation*Sample	0.089	0.496	0.140	0.160	0.237	0.869	0.768	0.365

\*Values in red display significance ( $p < 0.05$ ).

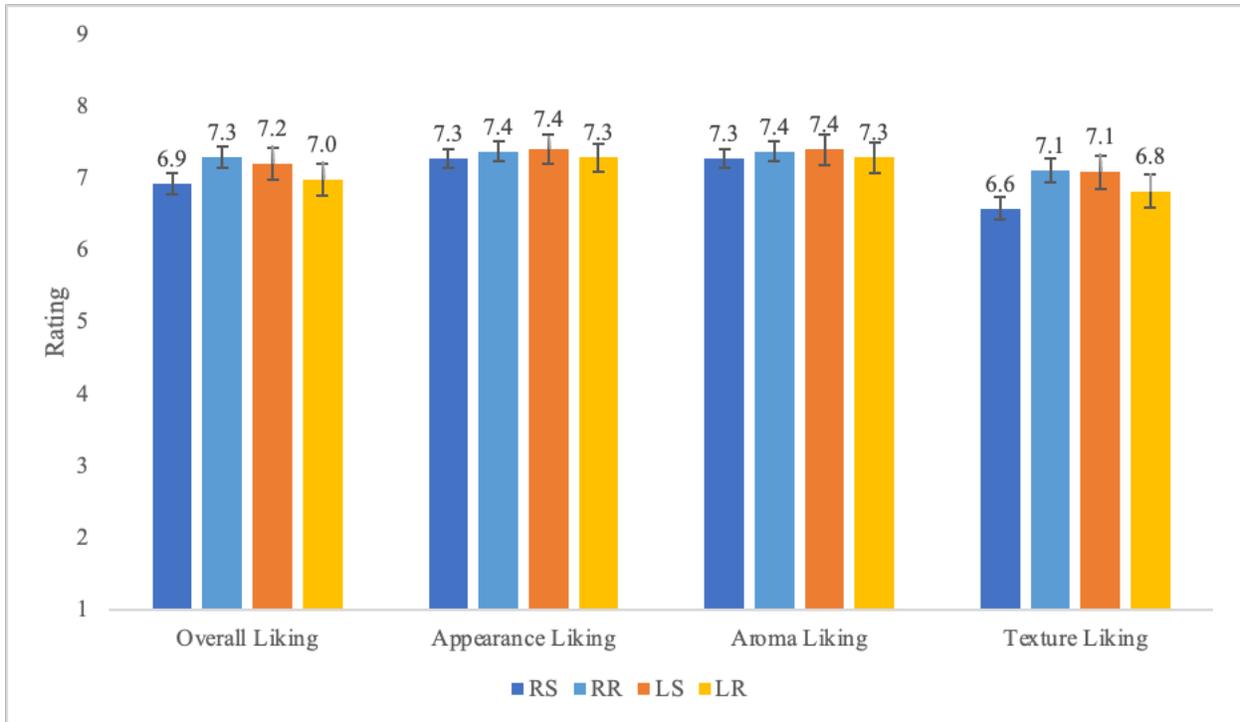
The groups of individuals with different dominant hands and receiving the two forms of the scales were evaluated to see if they use the scales differently. ANOVA was used to identify

if there was difference in the mean scores for each of the groups and a Tukey's Post Hoc test was used to determine which groups were different.

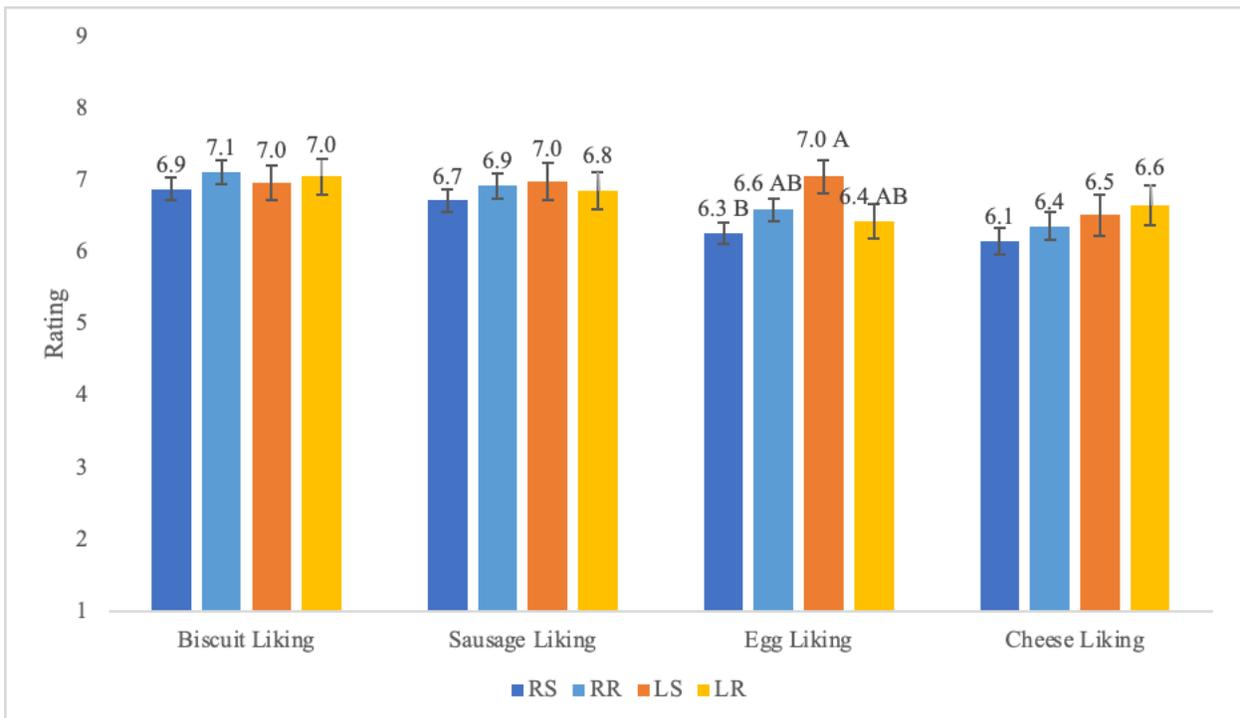
The evaluation of both the attribute and the component liking revealed little difference across the four groups. The ANOVA test showed that there was no significant difference for any of the groups when evaluating attribute liking ( $p > 0.05$ ). However, mean scores for these attributes did demonstrate an interesting trend. It showed that right-handed individuals scored more highly using the reversed scale whereas left-handed individuals scored more highly using the standard scale.

The component liking mean scores showed that only the egg exhibited significant differences between the four groups ( $p < 0.05$ ). The Tukey's test indicated that the mean score for left-handed individuals using the standard scale was significantly greater than for right-handed individuals using the standard scale ( $p < 0.05$ ). The trend previously noted in the attribute liking was also seen for the egg and sausage liking but absent for biscuit and cheese liking. Overall, this trend was seen with six of the eight attributes using the 9-point hedonic scale and should be further evaluated with larger sample sizes to establish significance.

**Figure 4.1A** Bar Graphs Comparing Mean Values for Handedness Groups and Scale Types on a 9-point Scale for Breakfast Sandwiches.



**Figure 4.1B** Bar Graphs Comparing Mean Values for Handedness Groups and Scale Types on a 9-point Scale for Breakfast Sandwiches.



\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

\*\* Groups included right-handed standard scaling (RS)  $n = 36$ , right-handed reversed scaling (RR)  $n = 32$ , left-handed standard scaling (LS)  $n = 15$ , and left-handed reversed scaling (LR)  $n = 15$ .

\*\*\*The overall liking scores were based on a 9-point scale -1 (extremely dislike) to 9 (extremely like).

The top 2 and bottom 2 selection percentages did not show perceptible trends for any of the handedness and scale type groups. However, some observations can be discerned from this analysis. A consistent trend noticed was left-handed individuals using the standard scale generally used a higher percentage of the top two selections compared to right-handed individuals, although this was not the case for aroma and cheese liking and expectation.

The bottom 2 box percentages displayed a relatively even split amongst the four groups for the attributes evaluated. The only comparison that demonstrated a trend was the right-handed individuals using the standard and reversed scales. Right-handed participants using the standard scale appeared to use the lowest two points more often than right-handed participants who received the reversed scale.

**Table 4.5.** Comparison of % Top 2 Box and % Bottom 2 Box Across Handedness and Scale Orientation for Breakfast Sandwiches.

	Overall Liking	Appearance Liking	Aroma Liking	Texture Liking	Biscuit Liking	Sausage Liking	Egg Liking	Cheese Liking	Purchase Intent	Expectation
<b>% Top 2 Box</b>										
RS	41%	54%	42%	41%	49%	47%	27%	27%	65%	31%
RR	26%	58%	35%	49%	50%	44%	29%	32%	78%	48%
LS	49%	58%	31%	53%	53%	51%	51%	36%	80%	44%
LR	40%	56%	47%	42%	38%	44%	27%	42%	69%	47%
RR-RS	-15%	5%	-6%	8%	1%	-3%	2%	5%	13%	17%
LR-LS	-9%	-2%	16%	-11%	-16%	-7%	-24%	7%	-11%	2%
RS-LS	-8%	-4%	11%	-13%	-4%	-4%	-24%	-9%	-15%	-14%
RR-LR	-14%	3%	-11%	7%	12%	-1%	3%	-10%	9%	1%
<b>% Bottom 2 Box</b>										
RS	2%	1%	1%	3%	4%	5%	2%	6%	17%	22%
RR	0%	0%	1%	0%	0%	0%	1%	5%	6%	13%
LS	2%	2%	2%	2%	4%	2%	2%	2%	9%	11%
LR	0%	2%	0%	0%	0%	0%	2%	2%	13%	13%
RR-RS	-2%	-1%	0%	-3%	-4%	-5%	-1%	-1%	-10%	-10%
LR-LS	-2%	0%	-2%	-2%	-4%	-2%	0%	0%	4%	2%
RS-LS	0%	-1%	-1%	1%	-1%	2%	0%	4%	8%	11%
RR-LR	0%	-2%	1%	0%	0%	0%	-1%	3%	-7%	-1%

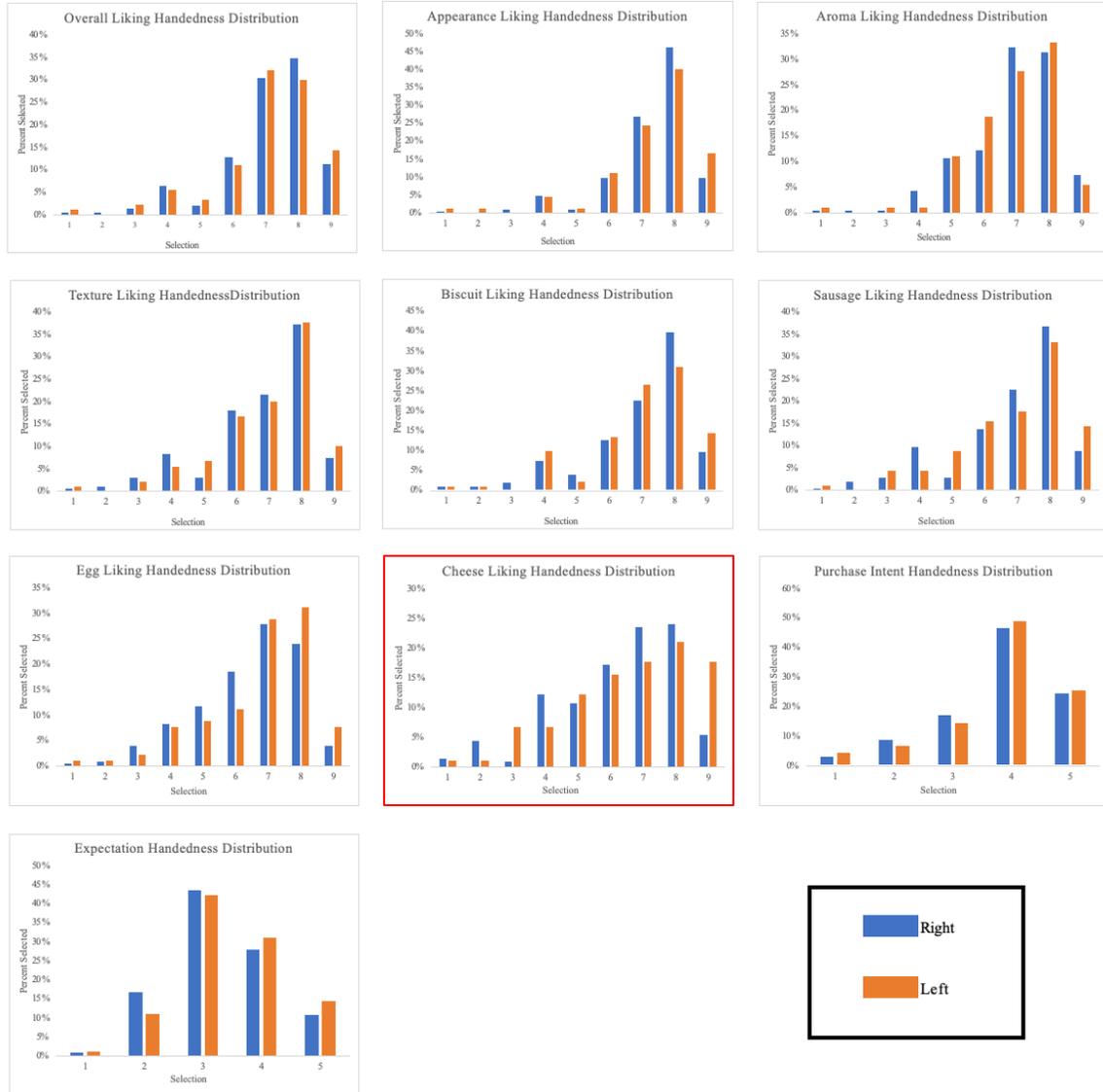
\* Groups included right-handed standard scaling (RS) n = 36, right-handed reversed scaling (RR) n = 32, left-handed standard scaling (LS) n = 15, and left-handed reversed scaling (LR) n = 15.

\*\* Values highlighted in red indicate negative numbers as represented by the formula on the left side of the table.

The distributions of selections were also analyzed for the handedness and scale orientation groups to gauge how each uses the 9-point scale. Chi-squared tests were performed to determine if these distributions were significantly different from one another. When comparing the handedness groups together only one of the eight characteristics displayed a significant difference in the way right- and left-handed individuals use the 9-point hedonic scale

( $p < 0.05$ ). This characteristic was cheese liking and is shown in Figure 4.2.

**Figure 4.2.** Distributions Spreads Based on Handedness among Attribute Categories for Breakfast Sandwiches.



\*Red border indicates significant difference in the spread of the distribution between the two groups using the chi-squared test ( $p < 0.05$ ).

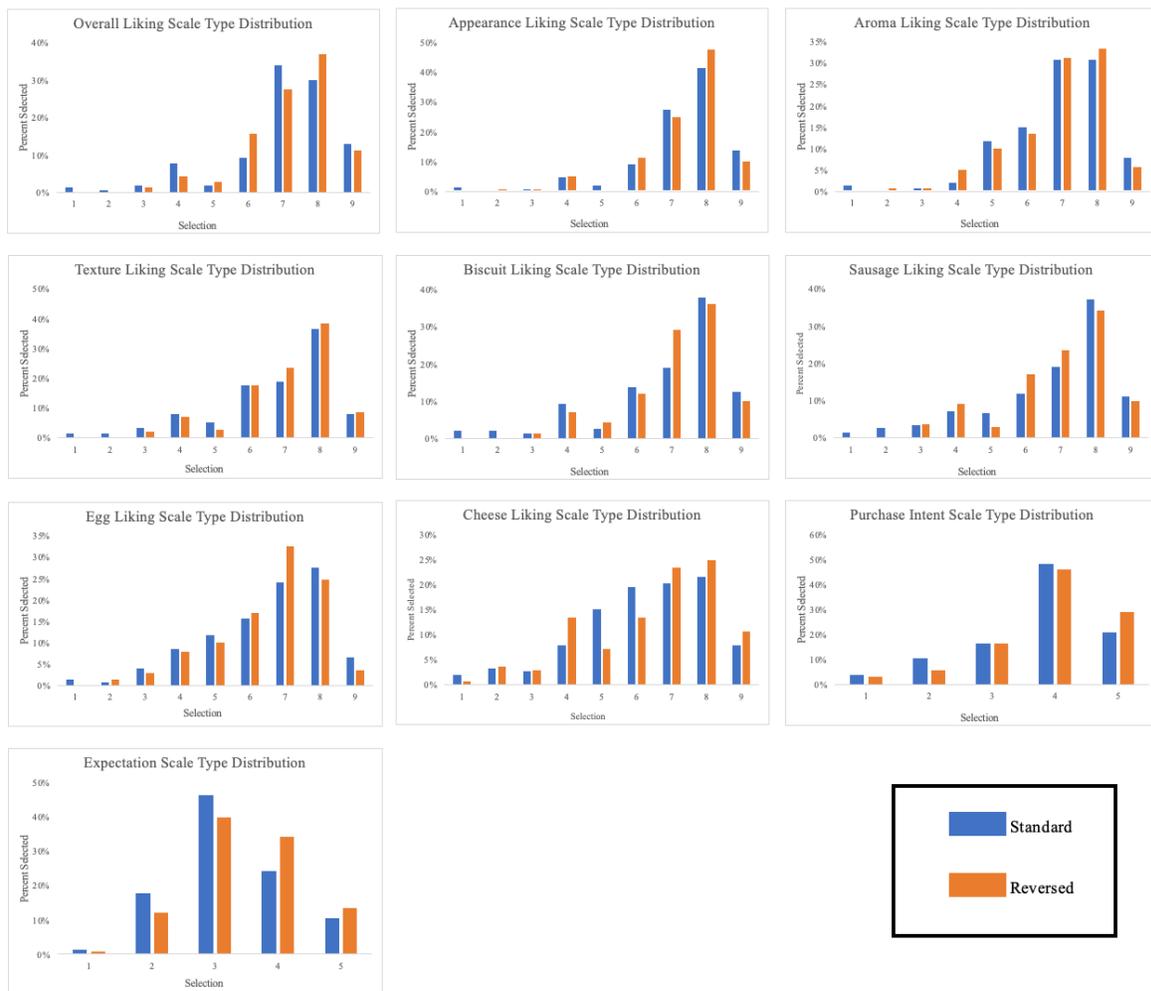
\*\* Groups included right-handed individuals (Right)  $n = 68$ , and left-handed individuals (Left)  $n = 30$ .

The distribution graph for cheese liking shows differences in selections between the right- and left-handed individuals. As discussed, the chi-squared test determined that the distributions of these two groups was significantly different ( $p < 0.05$ ). Both handedness groups

showed a right-skewed distribution, indicating that individuals liked the cheese on the sandwiches.

The evaluation of distribution selections between the groups of individuals receiving the standard and reversed scale proved no difference using the chi-squared test ( $p > 0.05$ ). This indicates that the scale orientation had little effect on the participants when scoring their liking along a 9-point hedonic scale. Figure 4.3 shows these distribution spreads even though none of the attributes showed a significantly different spread.

**Figure 4.3.** Distribution Spreads Based on Scale Type among Attribute Categories for Breakfast Sandwiches.



\*Red border indicates significant difference in the spread of the distribution between the two groups using the chi-squared test ( $p < 0.05$ ).

\*\* Groups included individuals receiving the standard scale (Standard) n = 51, and individuals receiving the reversed scale (Reversed) n = 47.

The 5-point just-about-right scale was also used to evaluate if handedness and scale orientation have an effect on individuals when no hedonic factors are involved. The p-values for the ANOVA model showed that there was significant differences in mean scores for sausage flavor JAR, spicy JAR, expectation, and purchase intent. Sausage Flavor JAR was affected by the different samples as Control sample needed stronger flavor. The spiciness attribute was affected by both sample, as the Control and Test 2 could improve on spiciness, and handedness, as right-handed individuals rated samples as needing higher spicy flavors. Although it was not significant in the model, right- and left-handed individuals had differing mean scores for biscuit flavor. The purchase intent had different mean scores ( $p < 0.05$ ) due to the interaction between handedness and scale orientation. The p-values for the 5-point scales are shown in Figure 4.6.

**Table 4.6.** P-Values of ANOVA Model and Factors for Breakfast Sandwiches Using a 5-Point Scale.

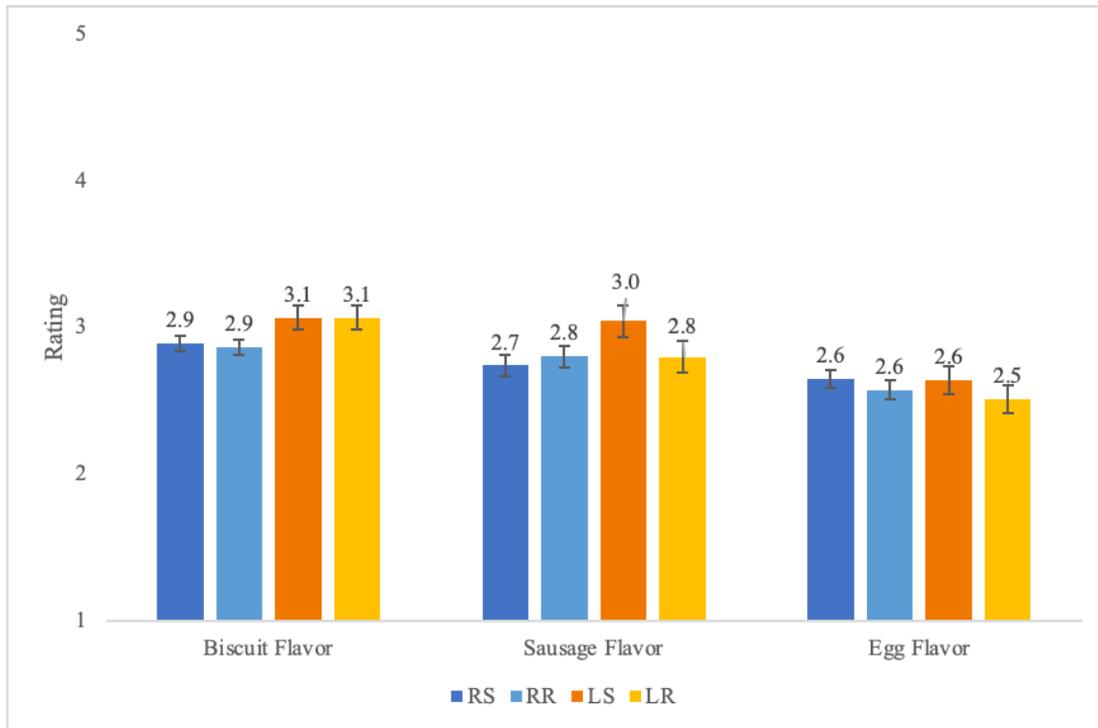
	Biscuit Flavor JAR	Sausage Flavor JAR	Egg Flavor JAR	Cheese Flavor JAR	Salty JAR	Spicy JAR	Purchase Intent	Expectation
Model	0.279	0.001	0.706	0.567	0.755	<0.0001	0.031	0.047
Handedness	0.006	0.105	0.686	0.992	0.286	0.002	0.860	0.195
Scale orientation	0.859	0.324	0.198	0.910	0.380	0.513	0.679	0.193
Sample	0.555	0.000	0.312	0.229	0.225	<0.0001	0.344	0.321
Handedness*Scale orientation	0.859	0.100	0.720	0.066	0.665	0.133	0.001	0.091
Handedness*Sample	0.613	0.578	0.802	0.555	0.818	0.811	0.403	0.168
Scale orientation*Sample	0.649	0.813	0.388	0.863	0.768	0.676	0.382	0.411

\*Values in red display significance ( $p < 0.05$ ).

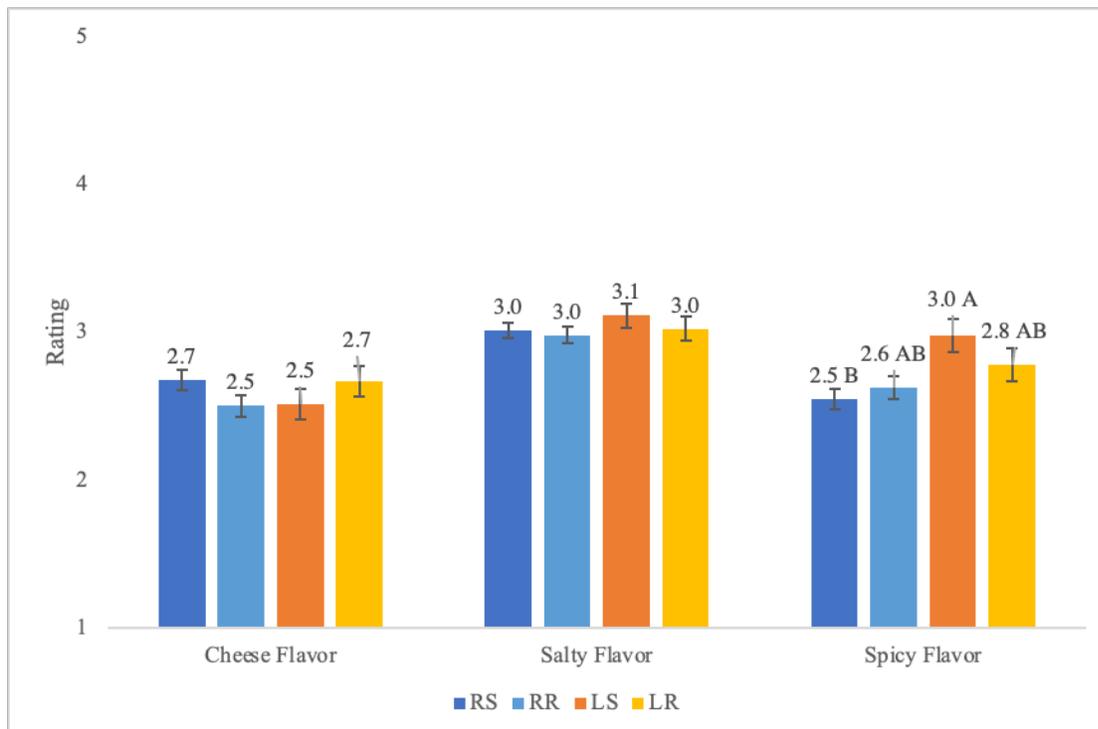
Although the majority of the characteristics evaluated by the 5-point just-about-right scale did not show a significant difference from the ANOVA test, the exception was the spicy flavor ( $p < 0.05$ ). For this attribute, left-handed individuals receiving the standard scale scored significantly higher, closer to the just-about-right point of 3, than right-handed individuals using the standard scale. Interestingly, both left-handed groups indicated that the spicy level was just-

about-right whereas both groups of right-handed individuals indicated that the spicy level was too low. This noted difference in preference of spiciness level on right- and left-handed individuals should be further evaluated to understand if one group tolerates spice better than the other.

**Figure 4.4A** Bar Graphs Comparing Mean Values for Handedness Groups and Scale Orientation on a 5-Point Just-About-Right Scale for Breakfast Sandwiches.



**Figure 4.4B** Bar Graphs Comparing Mean Values for Handedness Groups and Scale Orientation on a 5-Point Just-About-Right Scale for Breakfast Sandwiches.



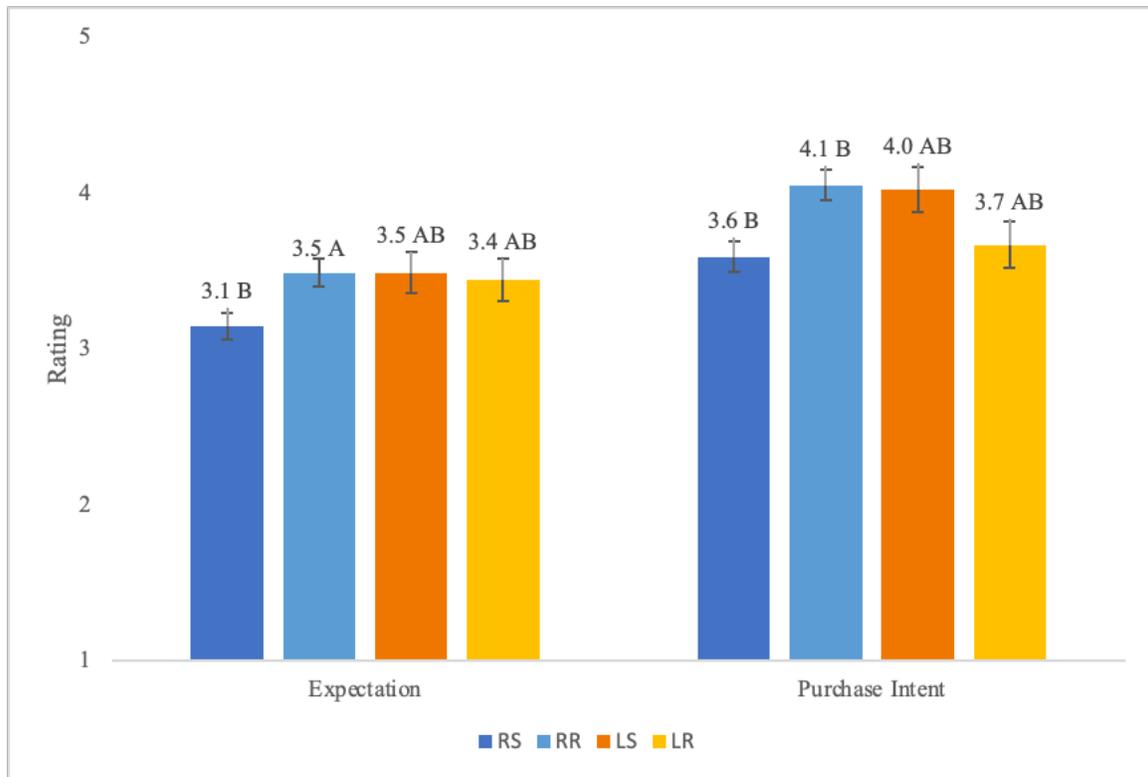
\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

\*\* Groups included right-handed standard scaling (RS)  $n = 36$ , right-handed reversed scaling (RR)  $n = 32$ , left-handed standard scaling (LS)  $n = 15$ , and left-handed reversed scaling (LR)  $n = 15$ .

\*\*\*The just-about-right scores were based on a 5-point scale -1 (far too weak) to 5 (far too strong).

Overall, the just-about-right scale is not an ideal tool for the evaluation of differences between right- and left-handed individuals. This may be due to the fact that the scale enquires about product improvement rather than liking. This is further illustrated by the fact that the 5-point expectation and purchase intent results showed significant differences across groups as shown in Figure 4.5.

**Figure 4.5.** Bar Graphs Comparing Mean Values for Handedness Groups and Scale Orientation on a 5-Point Expectation/Purchase Intent Scale for Breakfast Sandwiches.



\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

\*\* Groups included right-handed standard scaling (RS)  $n = 36$ , right-handed reversed scaling (RR)  $n = 32$ , left-handed standard scaling (LS)  $n = 15$ , and left-handed reversed scaling (LR)  $n = 15$ .

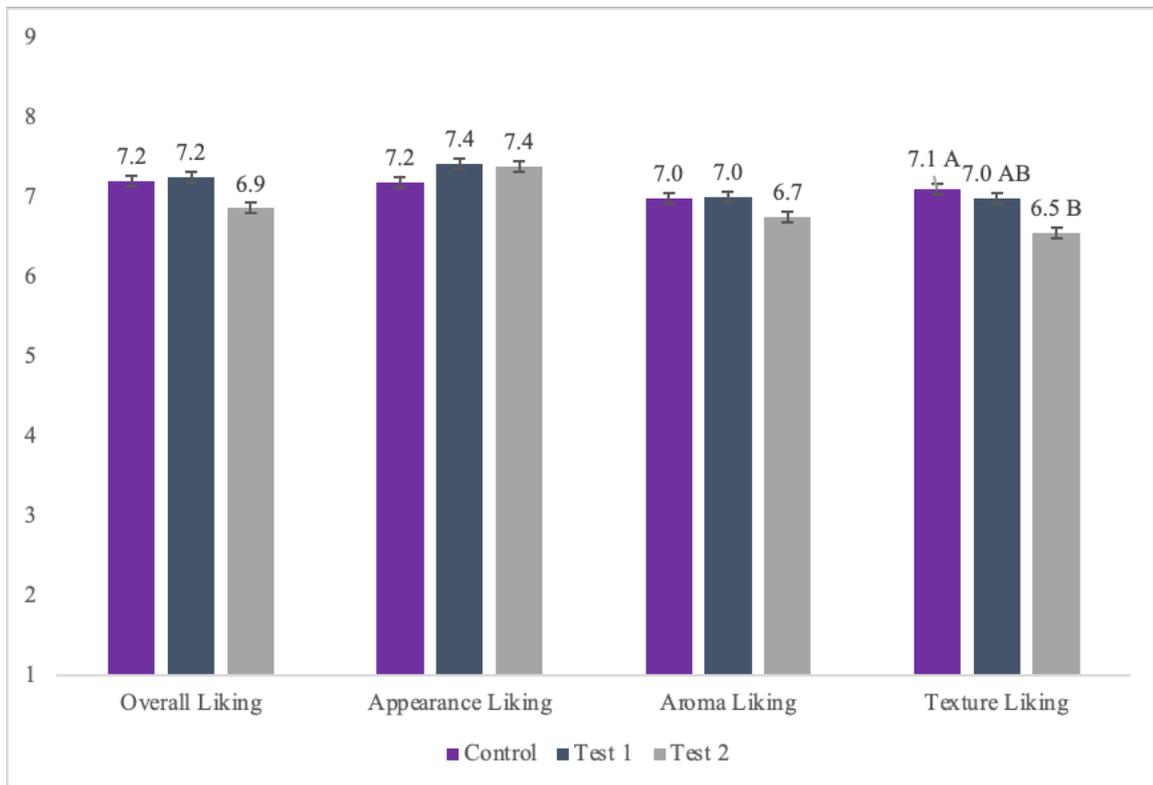
\*\*\*The purchase intent/expectation scores were based on a 5-point scale -1 (definitely will not buy/much worse than expected) to 5 (definitely will buy/much better than expected).

The expectation and purchase intent means showed significant differences when using the ANOVA test. Right-handed individuals receiving the reversed scale scored significantly higher mean values than right-handed individuals using the standard scale ( $p < 0.05$ ). For left-handed participants, there was no significant differences for mean scoring between any of the groups. However left-handed individuals receiving the standard scale scored slightly higher than left-handed individuals receiving the reversed scale. As noted previously, this trend should be further evaluated in future studies with a greater number of individuals in each studied group.

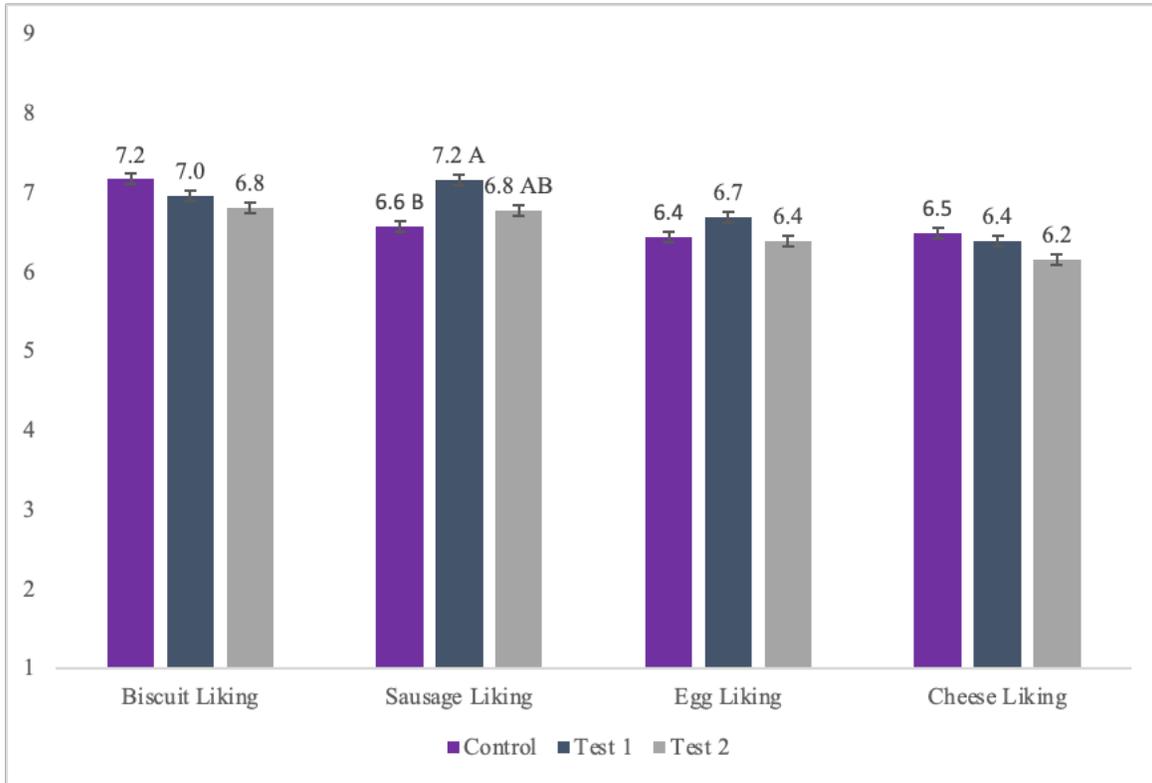
## Breakfast Sandwich Evaluations

The breakfast sandwich study also attempted to elucidate if individuals could identify differences between the breakfast sandwiches and whether the different components affected liking. Each of the samples were identical except for the sausage variants and participants may experience more difficulty in identifying differences. As with the handedness groupings, ANOVA testing was used to find significant differences in liking for the three breakfast sandwiches. Figure 4.5 shows the mean scores used to evaluate the sandwiches for liking along a 9-point hedonic scale.

**Figure 4.6A** Bar Graphs Comparing Mean Values of Breakfast Sandwiches on a 9-Point Hedonic Scale.



**Figure 4.6B** Bar Graphs Comparing Mean Values of Breakfast Sandwiches on a 9-Point Hedonic Scale.



\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

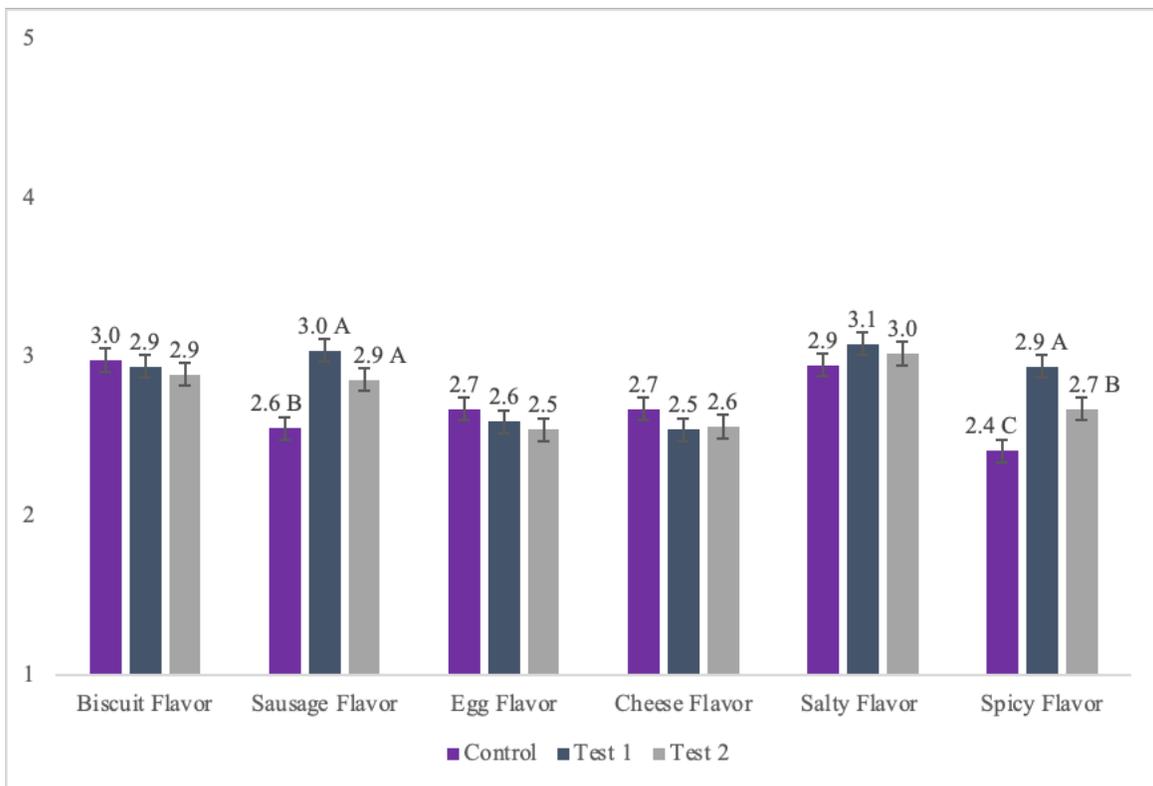
\*\*The overall liking scores were based on a 9-point scale -1 (extremely dislike) to 9 (extremely like).

The results for the breakfast sandwiches showed that participants liked all of the breakfast sandwiches at parity. Across the eight questions using the 9-point hedonic scale, only two attributes were found to be significantly different. The ANOVA test showed that the mean scores for the sausage and texture liking were significantly different across the three samples ( $p < 0.05$ ). The variance in the sausage liking was not surprising as this was the only independent variable in the study. The sausage that had the highest mean liking score was the test sausage which was significantly more liked than the control sausage ( $p < 0.05$ ). For texture liking the control sandwich was significantly more liked than the test sausage plus umami component ( $p < 0.05$ ). This texture difference in the sandwiches may have been affected by the specific sausage

ingredient, umami, as this was the only variance between it and the test sandwich. One interesting note is that for overall liking all three sandwiches were liked at parity.

The just-about-right scores were also evaluated by the ANOVA test to demonstrate the difference in mean scoring between the sandwiches. The ANOVA test is not usually performed when using just-about-right data, rather penalty analysis should be considered. However, for this study the ANOVA test helped to clarify if there were significant differences found between sandwiches that were not seen between handedness groups. Figure 4.7 shows the just-about-right mean scores amongst the different sandwiches for the four attributes evaluated.

**Figure 4.7.** Bar Graphs Comparing Mean Values of Breakfast Sandwiches on a 5-Point Just-About-Right Scale.



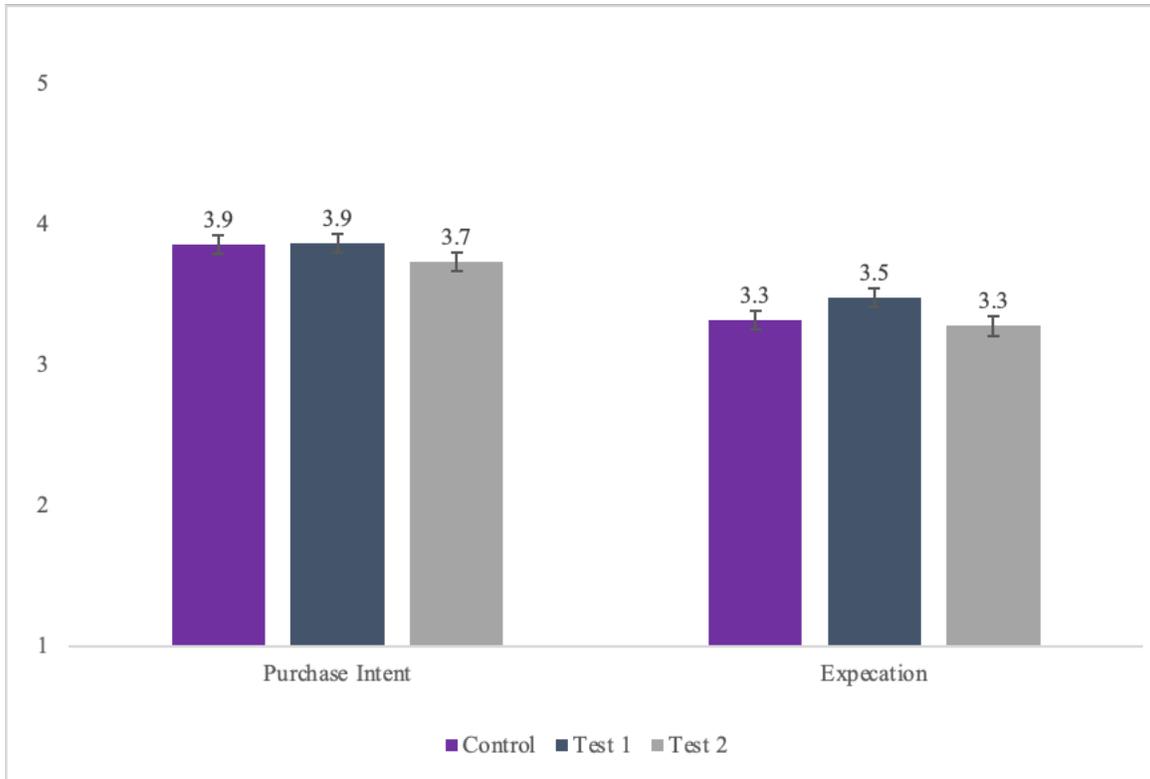
\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

\*\*The just-about-right scores were based on a 5-point scale -1 (far too weak) to 5 (far too strong).

The just-about-right scores indicated that only two of the six attributes displayed significant differences in sandwich preferences ( $p < 0.05$ ). The sausage flavor of the sandwiches was perceived as just-about-right in the test sausage, while the test plus umami sausage needed more sausage flavor but acted at parity with the test ( $p > 0.05$ ). Participants indicated that the control sausage needed higher sausage flavor and was significantly lower than the two test products ( $p < 0.05$ ). This difference in liking is most likely due different ingredient formulations for these products. The other attribute which displayed difference was the spiciness of the sandwiches, where all samples were significantly different from one another ( $p < 0.05$ ). The test sandwich was judged to be just-about-right for spicy flavor while the other two samples needed to increase their spicy flavors. This difference is likely linked to the sausage ingredients as it provides much of the spicy flavor throughout the sandwich. However, since the only difference between the test, and the test plus umami is the umami, it would be interesting to study whether this ingredient neutralizes some of the intensity of the spices.

The purchase intent and expectation were also used to understand which product had the highest preferences among sandwich samples. Figure 4.8 shows the purchase intent and expectation mean scores for the samples.

**Figure 4.8.** Bar Graphs Comparing Mean Values for Breakfast Sandwiches on a 5-Point Expectation/Purchase Intent Scale.



\* Scores with different letters were significantly different ( $p \leq 0.05$ ).

\*\*The purchase intent/expectation scores were based on a 5-point scale -1 (definitely will not buy/much worse than expected) to 5 (definitely will buy/much better than expected).

The purchase intent and expectation mean scores across all of the sandwiches were rated at parity. These individuals indicated that they were somewhat likely to purchase the sandwiches and that the sandwiches met their expectations.

### **Limitations**

A limitation that was noted during the study was the lower number of left-handed individuals compared to right-handed individuals. Previous studies detail the difficulty in recruiting left-handed participants as they only make up 10% of the population. Participation

was further limited as these individuals needed to qualify for the specific food being evaluated (Casasanto, 2009, 2011; Casasanto & Chrysikou, 2011). Extended recruiting time prior to the study may have increased the participation of left-handed individuals.

Another aspect that should be evaluated is the sandwich study was the only study among the three modalities in which the samples were similar and not easily differentiated. This is viewed as a positive as it isolates the independent variables and allows for better evaluation of the handedness and scale orientation effects. Future studies should focus on testing similar products and possibly use only one sample to completely isolate the handedness variable.

## **Conclusion**

The main goal of this study was to better understand whether a relationship exists between individuals' handedness, scale orientation and scoring. This was examined using three different breakfast sandwiches with varying sausage patties where participants of left or right handedness were provided scales with standard or reversed orientations. This information is useful in understanding if left-handed individuals should use standard or reversed scale orientation to more appropriately correlate with their sense of positive spatial continuum.

In considering this study, it should be noted that the breakfast sandwiches were similar and few differences in liking and just-about-right scores were perceived among the samples. Studies involving product modification, as in the case of the sausage, may not expose differences in liking as easily as other products. In this case, the cheese, biscuit, and egg may overshadow the minute differences in the sausage. The similarity of the samples in the study allow for better

isolation of the handedness/scale orientation variables and a clearer understanding if trends occur based on these variables.

The data from the handedness and scale orientation studies provide interesting insights into the differences between the four groups and encourages further exploration into the topic. The data from the 9-point hedonic scale showed that only one attribute had a significant difference between the groups, egg liking. It would appear as though there is no relation between handedness and scale orientation, however it should be noted that there was a small sample size within each of the groups (>40). Furthermore, there were trends existing within four groups such as that right-handed individuals scored more highly when receiving the reversed scale than when receiving the standard scale, and left-handed individuals scored more highly when receiving the standard scale than when receiving the reversed scale. This trend is opposite of the speculated outcome. It was initially proposed that left-handed participants would score more highly when using the reversed scale. Casasanto discussed that left-handed individuals have a greater perception of the left side being positive than do right-handed individuals, and thus it was expected they would be more willing to score highly on reversed scale (Casasanto, 2009; 2011).

This trend stretched outside of 9-point hedonic scaling and was also seen in shorter scales which quantified liking. The 5-point purchase intent and expectation scales also revealed this trend, while the just-about-right scale did not show any trend related to handedness or scale orientation. The lack of this trend in the just-about-right section of the study may be due to the way in which the continuum is constructed. The most ideal selection for the just-about right questions is the center point of 3, indicating that the product is “just-about-right,” while the

hedonic scales have a top point of 5 on a 5-point scale and 9 on a 9-point scale. The just-about-right scale allows for two degrees of imperfection, too much or too little, above and below the center point whereas hedonic scales use a spectrum of liking and disliking. This difference in the way the scales are constructed may contribute to the lack of consistent results.

The distributions across both the handedness and scale types did not show major trends that could be interpreted across all attributes. The only attribute that displayed a significant difference in distribution spread was the cheese liking when right- and left-handed individuals were compared. This distribution difference is shown in Figure 4.2 while all other non-significant distributions are found in the appendix.

Overall, the correlations between handedness and scale orientations between mean scores, distributions of selections, and top/bottom 2 box were small, thus more research should be conducted with larger groups. This study will act as a foundation for researchers to further investigate the topic of handedness and scale orientation and its effect on individuals during sensory studies.

## **Overall Conclusion Across the Three Studies**

The three studies presented in this thesis are focused on understanding if differences exist in the way right- and left-handed individuals perceive and use sensory scales. The three studies conducted involved various modalities to investigate whether the way individuals evaluate products affects their usage of sensory scaling. The modalities included were appearance for pet food, touch for sponges, and taste for breakfast sandwiches. However, when comparing the results of the individual studies together, only a few minor differences exist.

Analysis for all statistical tests were performed at a confidence level of 95%. It was considered to run these tests again at a 90% confidence level to see if this would help identify more trends. However, the differences in the results between these two confidence levels was minor and did not cause significant differences in group means.

The most consistent similarities existed between the sponge and breakfast sandwich studies, primarily due to the mean scores. In both studies, although not significant, the majority of left-handed individuals rated products slightly higher using the standard scale as compared to those using the reversed scale, while right-handed individuals rated products slightly higher when using the reversed scale as opposed to using the standard scale. Again, these differences were small and not significant, but worth a mention because were consistent across product categories. This trend was also consistent when consumers were evaluating products using the 9-point hedonic scale and the 5-point expectation and purchase intent scales. The correlation was also seen in the pet food study for right-handed individuals. However left-handed individuals showed an opposite trend where the reversed scale had higher ratings than the scale with standard orientation. For the sponge and breakfast sandwich studies, the findings are in opposition to what was expected and what Casasanto found in his previous work when

understanding perceptions of right- and left-handed individuals (2009, 2011). It was anticipated that left-handed individuals would have higher scores when using the reversed scale, which was seen in the pet food study, and right-handed individuals would score more highly when using the standard scale, which was not seen. More testing will need to be conducted to understand if these results can be applied to large scale populations.

A question that was kept consistent across all the studies was the evaluation of overall liking. For this reason, it was possible to evaluate these scores across all three studies and understand if the trends were consistent. Analysis of variance was run on the data across all three studies to determine if the mean values of handedness, scale orientation and their interaction were significantly different regardless of product type. Combining the overall liking scores across studies allowed for a higher number of total participants resulting in 309 individuals. The ANOVA model displayed significant differences ( $p < 0.05$ ) however this is mainly due to the sample effect. For handedness, scale orientation and their interaction there was no difference ( $p < 0.05$ ) in the mean scores.

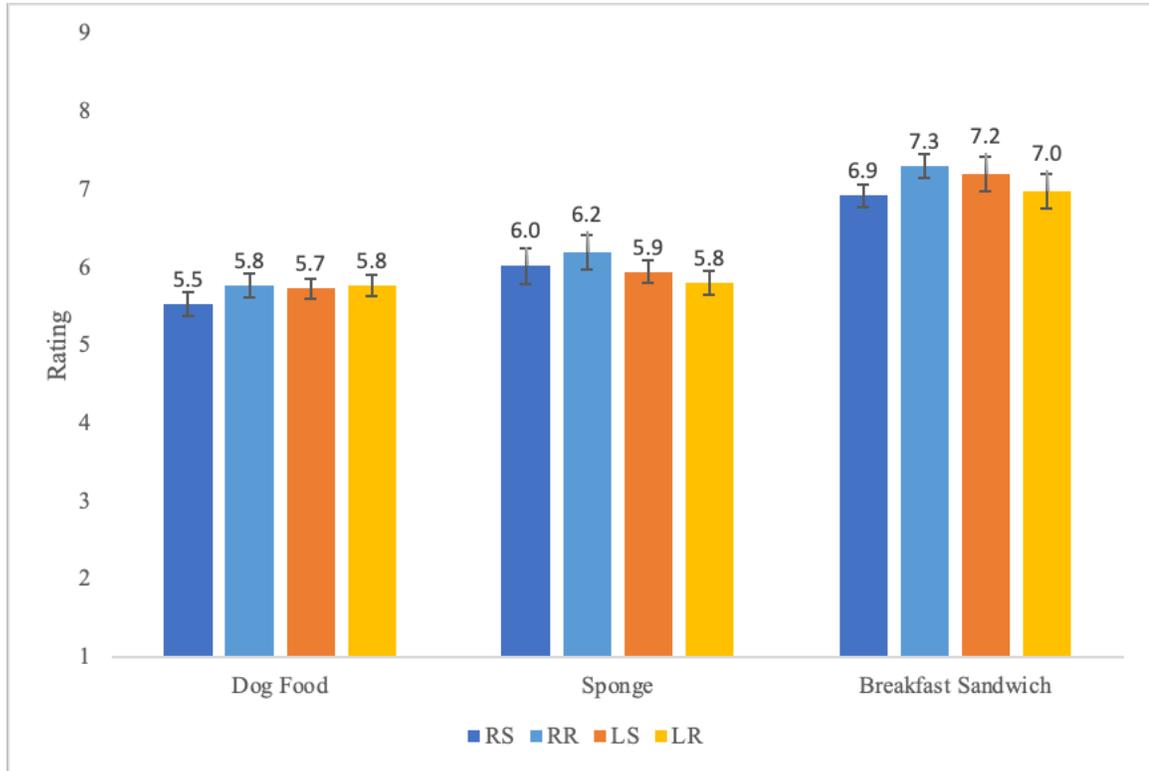
**Table 4.7.** P-Values for ANOVA Testing of Handedness and Scale Orientation for Overall Liking Across the Three Studies.

	Overall Liking
Model	<0.0001
Handedness	0.721
Scale	0.339
Sample	0.000
Handedness*Scale	0.128
Handedness*Sample	0.448
Scale*Sample	0.722

The overall liking scores across the studies are fairly different. Figure 4.9 shows just how slight the trend is in the way right-handed individuals use the reversed scale more highly, and how left-handed individuals use the standard scale more highly for the sponge and breakfast

sandwich studies. This difference is so small that for the number of individuals evaluated, it is negligible and thus is the reason further studies with larger groups should be conducted.

**Figure 4.9.** Overall Liking Scores of Handedness Groups Across all Three Studies.



Evaluation of the distributions and use of the chi-squared tests showed that there were no significant differences between the handedness and scale orientation groups across studies. Throughout the studies only a few attributes displayed minor significant differences across handedness groups or scale orientations for distribution of selection. For most of these distributions, even the ones that reached significance, the comparisons appear similar and revolve around the usage of one or two points on the scale. The only distribution table that shows a highly divergent usage of selections for right- and left-handed individuals is the aroma liking for the pet foods. The graph displayed oppositely skewed graphs between the right- and left-handed individuals. This distribution may be the reason for an elevation in all of the mean scores in left-handed individuals as they more frequently select higher numbers to evaluate the

pet foods. However, it should be noted that this happened in only one attribute and this difference in distribution was not shared across the attributes.

The just-about-right scale did not show clear differences in the way each group used the scale nor were there trends observed as in the 9-point hedonic scores. The only instance in which there were significant differences between two of the handedness and scale orientation groups was for the spicy attribute in the breakfast sandwich study. Right-handed individuals rated the products as being low in spicy flavor whereas the left-handed individuals rated the products as being just-about-right. Spicy perception is a unique sensation that is actually a type of pain that affects the trigeminal nerve, and many different factors influence how individuals perceive this feeling (Törnwall et al., 2014). Future studies to better understand the differences in right- and left-handed individuals may include identifying spiciness toleration between the two groups. There may prove to be a neurological correlation between the two groups which explains their tolerance or partiality to spicy foods.

Lastly, it does not appear that the number of samples nor the similarity between the samples affects the scores between right- and left-handed individuals or the scale orientations used. The dog food study, which involved the evaluation of 7 samples showed no significant difference from the sandwich study which had only three samples. In addition, the dog food and sponge study which had samples that were clearly visually distinguishable from each other did not show statistical differences from the sandwich study where differences were evaluated only by taste.

Overall, this test evaluated the correlations between handedness and scale orientations evaluating for statistical significance. Various modalities were used to determine if different stimuli and sensory receptors influence the participants scoring of the product. The tests found

that there is no significant difference between the participants handedness or scale orientation affecting their scoring, outside of a few isolated cases. However, even though differences were small, the trend of left-handed individuals using the standard scale more highly and right-handed individuals using the reversed scale more highly should be further investigated with larger sample sizes. These studies provide a foundation for further exploration into how different groups use sensory scaling and how the scales can be modified to best fit consumer perception.

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## Appendix A - Questionnaires

Figure 4.10. Standard Questionnaire Used for Dry Dog Food CLT.



**Welcome Panelist name!**  
Click the *next* button to begin

1. I agree to participate as a panelist in research conducted by the Sensory & Consumer Research Center.
2. I understand that the purpose of this project is to participate in a **pet food** test.
3. I understand that this is a **confidential test** and I'm not to talk with others about what I evaluated.
4. I will receive participation payment when I complete this study.
5. I understand my performance as an individual will be treated as research data and will in no way be associated with me for anything other than identification purposes, thereby assuring confidentiality of performance and responses.
6. I understand that I do not have to participate in this research and may choose not to participate without penalty.
7. I understand that I may withdraw at any time.
8. If I have any questions concerning this study, I understand that I may contact Martin Talavera at (785) 532-5160 or at the KSU Manhattan Ice Hall.
9. If I have any questions about my rights as a consumer or about the manner in which this research was conducted, I may contact Dr. Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 1 Fairchild Hall (532-2334), Manhattan, KS, 66506.

By typing my name in the space below, I am providing my electronic signature and acknowledging that I understand the above statements.

Thank you for choosing to participate in this Dry Pet Food Study. You will be evaluating 7 different types of dry pet foods for their appearance and aroma.  
Please make sure that the 3-digit code on the sample matches that which is shown on the survey.  
Follow the instructions carefully and **when you are not looking or smelling the sample keep the lid on**, as to keep the samples as fresh as possible.

**Please wait for your FIRST Pet Food sample.**



When you have received sample **BC111**, click *next* to continue.

**Please do not open the sample until after the timer has expired.**



Overall, how much do you LIKE/DISLIKE this sample?

Sample: BC111

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

How much do you LIKE/DISLIKE the aroma of this sample?

Sample: BC111

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Please evaluate the intensity of the aroma in this sample.

Sample: BC111

Far too weak	Too weak	Just-about-right	Too strong	Much too strong
<input type="text"/>				

How much do you LIKE/DISLIKE the appearance of this sample?

Sample: BC111

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

How much do you LIKE/DISLIKE the color of the sample?

Sample: BC111

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Please evaluate the intensity of color of this sample.

Sample: BC111

Far too light	Too light	Just-about-right	Too dark	Far too dark
<input type="text"/>				

**How much do you LIKE/DISLIKE the size of the individual kibbles?**

**Sample: BC111**

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**The size of the kibble in this sample is...**

**Sample: BC111**

Far too small	Too small	Just-about-right	Too Large	Far too large
<input type="text"/>				

**How much do you LIKE/DISLIKE the shape of this sample?**

**Sample: BC111**

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**How much do you LIKE/DISLIKE the uniformity of this sample?**

**Sample: BC111**

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**How much do you LIKE/DISLIKE the oily appearance of this sample?**

**Sample: BC111**

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**Please evaluate the intensity of oily appearance of this sample.**

**Sample: BC111**

Not nearly oily enough	Not oily enough	Just-about-right	Too oily	Much too oily
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**How much do you think your dog would like this product?**

**Sample: BC111**

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

**What, if anything, did you LIKE about this product?**

**Sample: BC111**

**What, if anything, did you DISLIKE about this product?**

**Sample: BC111**

**How interested would you be in purchasing this pet food sample if it were available where you normally shop?**

**Sample: BC111**

Definitely will not buy	Probably will not buy	Might or might not buy	Probably will buy	Definitely will buy
<input type="checkbox"/>				

**How well does this pet food sample meet your expectations for pet food?**

**Sample: BC111**

Much worse than expected	Worse than expected	Meets expectations	Better than expected	Much better than expected
<input type="checkbox"/>				

You have finished answering questions about the dog food samples.

Please click **next** to answer questions about yourself.

**You aren't quite finished yet....**

**What is your gender?**

Male

Female

**Which of the following best describes your age?**

17 years or younger

18-24 years

25-34 years

35-44 years

45-54 years

55-64 years

65 years or older

**Which of the following best describes your household income?**

Below \$25,000

\$25,001-\$49,999

\$50,000-\$74,999

\$75,000-\$99,999

\$100,000 or more

**Which hand do you consider to be dominant? (If you can use both, check the **ambidextrous** box as well as the hand you use to write.)**

Right

Left

Ambidextrous

**How many dogs do you have currently living in your household?**

- 1
- 2
- 3
- 4 or more

**Please select the size of your dog(s).** (check all that apply)

- Extra Small (less than 16 lbs.)
- Small (16 to 35 lbs.)
- Medium (36 to 55 lbs.)
- Large (more than 55 lbs.)

**Who in your household is the primary decision maker and/or purchaser of pet food?**

- Myself only
- I share the responsibility with someone in my family
- Someone else

**Where do you purchase your dog food?** (check all that apply)

Grocery Stores

Wholesale Clubs (Sams, Costco)

Pet specialty store (Petco, Petsmart, etc.)

Veterinarian

Online from pet specialty store

Online from general retailer

Other

**What brand(s) of dog food do you purchase most often?** (check all that apply)

<input type="checkbox"/> Hill's Science Diet	<input type="checkbox"/> Eukanuba	<input type="checkbox"/> Purina Pro Plan
<input type="checkbox"/> Royal Canin	<input type="checkbox"/> Pedigree	<input type="checkbox"/> Blue Buffalo
<input type="checkbox"/> Wellness	<input type="checkbox"/> Natural Choice	<input type="checkbox"/> Merrick Pet Foods
<input type="checkbox"/> Natural Balance	<input type="checkbox"/> Aplo	<input type="checkbox"/> Nature's Recipe
<input type="checkbox"/> Purina ONE	<input type="checkbox"/> Beneful	<input type="checkbox"/> Iams
<input type="checkbox"/> American Journey	<input type="checkbox"/> Taste of the Wild	<input type="checkbox"/> Diamond Naturals
<input type="checkbox"/> Other <input type="text"/>		

**Which of the following types of food do you feed your dog? (check all that apply)**

<input type="checkbox"/> Dry
<input type="checkbox"/> Wet/Canned
<input type="checkbox"/> Homemade
<input type="checkbox"/> Fresh/refrigerated
<input type="checkbox"/> Fresh Frozen
<input type="checkbox"/> Other <input type="text"/>





**Please raise your hand to be excused (for social distancing).**

**Thank you! Please check out with the receptionist to collect your incentive.**

Finished

Figure 4.11 Reversed Questionnaire Used for Dry Dog Food CLT.



**Welcome Panelist name!**  
Click the *next* button to begin

1. I agree to participate as a panelist in research conducted by the Sensory & Consumer Research Center.
2. I understand that the purpose of this project is to participate in a **pet food** test.
3. I understand that this is a **confidential test** and I'm not to talk with others about what I evaluated.
4. I will receive participation payment when I complete this study.
5. I understand my performance as an individual will be treated as research data and will in no way be associated with me for anything other than identification purposes, thereby assuring confidentiality of performance and responses.
6. I understand that I do not have to participate in this research and may choose not to participate without penalty.
7. I understand that I may withdraw at any time.
8. If I have any questions concerning this study, I understand that I may contact Martin Talavera at (785) 532-5160 or at the KSU Manhattan Ice Hall.
9. If I have any questions about my rights as a consumer or about the manner in which this research was conducted, I may contact Dr. Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 1 Fairchild Hall (532-2334), Manhattan, KS, 66506.

By typing my name in the space below, I am providing my electronic signature and acknowledging that I understand the above statements.

Thank you for choosing to participate in this Dry Pet Food Study. You will be evaluating 7 different types of dry pet foods for their appearance and aroma.  
Please make sure that the 3-digit code on the sample matches that which is shown on the survey.  
Follow the instructions carefully and **when you are not looking or smelling the sample keep the lid on**, as to keep the samples as fresh as possible.

**Please wait for your FIRST Pet Food sample.**



When you have received sample **BC111**, click *next* to continue.

**Please do not open the sample until after the timer has expired.**



0:15

Overall, how much do you LIKE/DISLIKE this sample?

Sample: BC111

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="checkbox"/>								

How much do you LIKE/DISLIKE the aroma of this sample?

Sample: BC111

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="checkbox"/>								

Please evaluate the intensity of the aroma in this sample.

Sample: BC111

Much too strong	Too strong	Just-about-right	Too weak	Far too weak
<input type="checkbox"/>				

How much do you LIKE/DISLIKE the appearance of this sample?

Sample: BC111

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="checkbox"/>								

How much do you LIKE/DISLIKE the color of the sample?

Sample: BC111

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="checkbox"/>								

Please evaluate the intensity of color of this sample.

Sample: BC111

Far too dark	Too dark	Just-about-right	Too light	Far too light
<input type="text"/>				

**How much do you LIKE/DISLIKE the size of the individual kibbles?**

**Sample: BC111**

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>				

**The size of the kibble in this sample is...**

**Sample: BC111**

Far too large	Too Large	Just-about-right	Too small	Far too small
<input type="text"/>				

**How much do you LIKE/DISLIKE the shape of this sample?**

**Sample: BC111**

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>				

**How much do you LIKE/DISLIKE the uniformity of this sample?**

**Sample: BC111**

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>				

**How much do you LIKE/DISLIKE the oily appearance of this sample?**

**Sample: BC111**

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>				

**Please evaluate the intensity of oily appearance of this sample.**

**Sample: BC111**

Much too oily	Too oily	Just-about-right	Not oily enough	Not nearly oily enough
<input type="text"/>				

How much do you think your dog would like this product?

Sample: BC111

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="checkbox"/>								

What, if anything, did you LIKE about this product?

Sample: BC111

What, if anything, did you DISLIKE about this product?

Sample: BC111

How interested would you be in purchasing this pet food sample if it were available where you normally shop?

Sample: BC111

Definitely will buy	Probably will buy	Might or might not buy	Probably will not buy	Definitely will not buy
<input type="checkbox"/>				

How well does this pet food sample meet your expectations for pet food?

Sample: BC111

Much better than expected	Better than expected	Meets expectations	Worse than expected	Much worse than expected
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

You have finished answering questions about the dog food samples.

Please click **next** to answer questions about yourself.

**You aren't quite finished yet...**

What is your gender?

Male

Female

**Which of the following best describes your age?**

17 years or younger

18-24 years

25-34 years

35-44 years

45-54 years

55-64 years

65 years or older

**Which of the following best describes your household income?**

Below \$25,000

\$25,001-\$49,999

\$50,000-\$74,999

\$75,000-\$99,999

\$100,000 or more

**Which hand do you consider to be dominant? (If you can use both, check the **ambidextrous** box as well as the hand you use to write.)**

Right

Left

Ambidextrous

**How many dogs do you have currently living in your household?**

- 1
- 2
- 3
- 4 or more

**Please select the size of your dog(s).** (check all that apply)

- Extra Small (less than 16 lbs.)
- Small (16 to 35 lbs.)
- Medium (36 to 55 lbs.)
- Large (more than 55 lbs.)

**Who in your household is the primary decision maker and/or purchaser of pet food?**

- Myself only
- I share the responsibility with someone in my family
- Someone else

**Where do you purchase your dog food?** (check all that apply)

<input type="checkbox"/>	Grocery Stores
<input type="checkbox"/>	Wholesale Clubs (Sams, Costco)
<input type="checkbox"/>	Pet specialty store (Petco, Petsmart, etc.)
<input type="checkbox"/>	Veterinarian
<input type="checkbox"/>	Online from pet specialty store
<input type="checkbox"/>	Online from general retailer
<input type="checkbox"/>	Other <input type="text"/>

**What brand(s) of dog food do you purchase most often?** (check all that apply)

<input type="checkbox"/> Hill's Science Diet	<input type="checkbox"/> Eukanuba	<input type="checkbox"/> Purina Pro Plan
<input type="checkbox"/> Royal Canin	<input type="checkbox"/> Pedigree	<input type="checkbox"/> Blue Buffalo
<input type="checkbox"/> Wellness	<input type="checkbox"/> Natural Choice	<input type="checkbox"/> Merrick Pet Foods
<input type="checkbox"/> Natural Balnce	<input type="checkbox"/> Aplo	<input type="checkbox"/> Nature's Recipe
<input type="checkbox"/> Purina ONE	<input type="checkbox"/> Beneful	<input type="checkbox"/> Iams
<input type="checkbox"/> American Journey	<input type="checkbox"/> Taste of the Wild	<input type="checkbox"/> Diamond Naturals
<input type="checkbox"/> Other <input type="text"/>		

**Which of the following types of food do you feed your dog? (check all that apply)**

<input type="checkbox"/> Dry
<input type="checkbox"/> Wet/Canned
<input type="checkbox"/> Homemade
<input type="checkbox"/> Fresh/refrigerated
<input type="checkbox"/> Fresh Frozen
<input type="checkbox"/> Other <input type="text"/>





**Please raise your hand to be excused (for social distancing).**

**Thank you! Please check out with the receptionist to collect your incentive.**

Finished

Figure 4.12. Standard Questionnaire Used for Sponge CLT.



**Welcome Panelist name!**  
Click the *next* button to begin

1. I agree to participate as a panelist in research conducted by the Sensory & Consumer Research Center.
2. I understand that the purpose of this project is to participate in a **sponge** manipulation test.
3. I understand that this is a **confidential test** and I'm not to talk with others about what I evaluated.
4. I will receive participation payment when I complete this study.
5. I understand my performance as an individual will be treated as research data and will in no way be associated with me for anything other than identification purposes, thereby assuring confidentiality of performance and responses.
6. I understand that I do not have to participate in this research and may choose not to participate without penalty.
7. I understand that I may withdraw at any time.
8. If I have any questions concerning this study, I understand that I may contact Kadri Koppel at (785) 532-0163 or at the KSU Manhattan Ice Hall.
9. If I have any questions about my rights as a consumer or about the manner in which this research was conducted, I may contact Dr. Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 1 Fairchild Hall (532-2334), Manhattan, KS, 66506.

By typing my name in the space below, I am providing my electronic signature and acknowledging that I understand the above statements.

**PLEASE READ!**

For this test you will be evaluating various sponges, please follow the instructions.

Upon receiving a sample you will be asked to evaluate the sponge for appearance attributes.

**PLEASE DO NOT DIP THE SPONGE INTO THE WATER AT THIS POINT!**

Once you have finished all of the appearance evaluations you will be told to dip the sponge in the water, this is to assess some attributes of the sponge. **Do not clean the plate at this point**, simply evaluate the characteristics of the sponge.

Lastly you will be told, by the questionnaire, when to scrub the plate. You do not need to completely clean the plate but please scrub enough to get an understanding of how well the sponge cleans.

Once finished with the plate cleaning, set the plate on the side of the table and throw the sponge away in the trash can. Also, pour the soapy water into the Pyrex dish provided and servers will provide fresh soapy water with the next sample.

**Please wait for your FIRST Sponge sample.**



When you have received sample **BC111**, click *next* to continue.

**DO NOT WET YOUR SAMPLE UNTIL INSTRUCTED.**



Please **LOOK** at sample **BC111** and answer the following questions.

Sample: BC111

How appropriate is the **color** of **BC111** for a sponge?

Not at all appropriate	Not very appropriate	Maybe or maybe not appropriate	Slightly appropriate	Very appropriate
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

How would you describe the **color** of this sponge?

Not at all bright enough	Not quite bright enough	Just about right	Somewhat too bright	Much too bright
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

How much do you **LIKE/DISLIKE** the **shape** of the sponge?

Sample: BC111

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>				

Sample: BC111

Please evaluate the **thickness** for this sponge. How would you describe the thickness of this sponge?

Not at all thick enough	Not quite thick enough	Just about right	Somewhat too thick	Much too thick
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Sample: BC111

How much do you **LIKE/DISLIKE** the **size of the holes** in the sponge?

**Please rate based on the sponge and not the scrubbing pad.**

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like Nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**Please evaluate the size of holes for this sponge.**

Much too small	Slightly too small	Just About Right	Slightly too large	Much too large
<input type="text"/>				

**Sample: BC111**

**How much do you LIKE/DISLIKE the uniformity of holes in this sponge?**

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**Please take the sponge and dip it into the water/soap solution.**

**Please make sure to dip the entire sponge in the water.**

**Answer the following questions about texture by manipulating the sponge.**

**Sample: BC111**

**How well do you think this sponge retains water? (Absorbance)**

Not at all absorbent enough	Not quite absorbent enough	Just about right	Somewhat too absorbent	Much too absorbent
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**Sample: BC111**

**How much did you LIKE/DISLIKE the ease of wringing of this sponge?**

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**Sample: BC111**

**How would you describe the stiffness of this sponge?**

Not at all stiff enough	Not quite stiff enough	Just about right	Somewhat too stiff	Much too stiff
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**Using the sponge (including the scrubbing side) please clean the plate in front of you.**

**You may use any part of the sponge to clean the plate. Please clean the plate in the pan as to catch the soapy**

water.

You do not have to clean the entire plate, but just enough to form an opinion on the sponge.

When you are finished, answer the following questions.

Sample: BC111

How much did you LIKE/DISLIKE the sponge's cleaning ability?

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

Did you feel that this sponge scratched the plate, leaving a permanent line?

Sample: BC111

Yes

No

Other

Sample: BC111

After evaluating this sponge's appearance, texture, and usefulness, how much did you LIKE/DISLIKE this sponge overall?

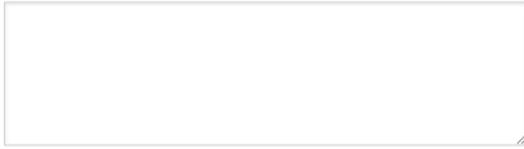
Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

What, if anything, did you LIKE about this sponge?

Sample: BC111

What, if anything, did you DISLIKE about this sponge?

Sample: BC111



Sample: BC111

How interested would you be in purchasing this sponge if it were available where you normally shop?

Definitely will not buy	Probably will not buy	Might or might not buy	Probably will buy	Definitely will buy
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Sample: BC111

How well does **BC111** meet your expectations for sponges?

Much worse than expected	Worse than expected	Meets expectations	Better than expected	Much better than expected
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Once finished with the plate cleaning, set the plate on the side of the table and throw the sponge and paper plate into the trash can.**

**Also, pour the soapy water into the Pyrex dish provided and servers will provide fresh soapy water with the next sample.**

You have finished answering questions about the sponge samples.

Please click **next** to answer questions about yourself.

You aren't quite finished yet...

What is your gender?

<input type="radio"/>	Male
<input type="radio"/>	Female

Which of the following best describes your age?

<input type="checkbox"/>	Grocery Stores
<input type="checkbox"/>	Wholesale Clubs (Sams, Costco)
<input type="checkbox"/>	Online Stores (Amazon)
<input type="checkbox"/>	Other <input type="text"/>

**Purchase products**  
**What brand of cleaning supplies do you most often purchase? (select all that apply)**

<input type="checkbox"/>	Mr.Clean	<input type="checkbox"/>	Scrubbing Bubbles	<input type="checkbox"/>	Clorox
<input type="checkbox"/>	Easy off	<input type="checkbox"/>	Dawn	<input type="checkbox"/>	Finish
<input type="checkbox"/>	Cascade	<input type="checkbox"/>	Scotch-Brite	<input type="checkbox"/>	Swiffer
<input type="checkbox"/>	Pin-Sol	<input type="checkbox"/>	Lysol	<input type="checkbox"/>	Fabuloso
<input type="checkbox"/>	Resolve	<input type="checkbox"/>	Pledge	<input type="checkbox"/>	Oxi Clean
<input type="checkbox"/>	Libman	<input type="checkbox"/>	Meyer's	<input type="checkbox"/>	Other <input type="text"/>

**Cleaning method**  
**How do you go about cleaning dishes?**

Scrubbing them with a sponge

Scrubbing them with a scrubbing brush

Using a dishwasher

Other



**Please raise your hand to be excused (for social distancing).**

**Thank you! Please check out with the receptionist to collect your incentive.**

Finished

Figure 4.13. Reversed Questionnaire Used for Sponge CLT.



**Welcome Panelist name!**  
Click the **next** button to begin

1. I agree to participate as a panelist in research conducted by the Sensory & Consumer Research Center.
2. I understand that the purpose of this project is to participate in a **sponge** manipulation test.
3. I understand that this is a **confidential test** and I'm not to talk with others about what I evaluated.
4. I will receive participation payment when I complete this study.
5. I understand my performance as an individual will be treated as research data and will in no way be associated with me for anything other than identification purposes, thereby assuring confidentiality of performance and responses.
6. I understand that I do not have to participate in this research and may choose not to participate without penalty.
7. I understand that I may withdraw at any time.
8. If I have any questions concerning this study, I understand that I may contact Kadri Koppel at (785) 532-0163 or at the KSU Manhattan Ice Hall.
9. If I have any questions about my rights as a consumer or about the manner in which this research was conducted, I may contact Dr. Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 1 Fairchild Hall (532-2334), Manhattan, KS, 66506.

By typing my name in the space below, I am providing my electronic signature and acknowledging that I understand the above statements.

**PLEASE READ!**

For this test you will be evaluating various sponges, please follow the instructions.

Upon receiving a sample you will be asked to evaluate the sponge for appearance attributes.

**PLEASE DO NOT DIP THE SPONGE INTO THE WATER AT THIS POINT!**

Once you have finished all of the appearance evaluations you will be told to dip the sponge in the water, this is to assess some attributes of the sponge. **Do not clean the plate at this point**, simply evaluate the characteristics of the sponge.

Lastly you will be told, by the questionnaire, when to scrub the plate. You do not need to completely clean the plate but please scrub enough to get an understanding of how well the sponge cleans.

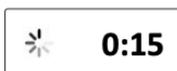
Once finished with the plate cleaning, set the plate on the side of the table and throw the sponge away in the trash can. Also, pour the soapy water into the Pyrex dish provided and servers will provide fresh soapy water with the next sample.

**Please wait for your FIRST Sponge sample.**



When you have received sample **BC111**, click *next* to continue.

DO NOT WET YOUR SAMPLE UNTIL INSTRUCTED.



Please **LOOK** at sample **BC111** and answer the following questions.

Sample: BC111

How appropriate is the color of **BC111** for a sponge?

Very appropriate	Slightly appropriate	Maybe or maybe not appropriate	Not very appropriate	Not at all appropriate
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

How would you describe the color of this sponge?

Much too bright	Somewhat too bright	Just about right	Not quite bright enough	Not at all bright enough
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

How much do you LIKE/DISLIKE the shape of the sponge?

Sample: BC111

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>				

Sample: BC111

Please evaluate the thickness for this sponge. How would you describe the thickness of this sponge?

Much too thick	Somewhat too thick	Just about right	Not quite thick enough	Not at all thick enough
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Sample: BC111

How much do you LIKE/DISLIKE the size of the holes in the sponge?

**Please rate based on the sponge and not the scrubbing pad.**

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like Nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="checkbox"/>								

**Please evaluate the size of holes for this sponge.**

Much too large	Slightly too large	Just About Right	Slightly too small	Much too small
<input type="checkbox"/>				

**Sample: BC111**

**How much do you LIKE/DISLIKE the uniformity of holes in this sponge?**

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="checkbox"/>								

**Please take the sponge and dip it into the water/soap solution.**

**Please make sure to dip the entire sponge in the water.**

**Answer the following questions about texture by manipulating the sponge.**

**Sample: BC111**

**How well do you think this sponge retains water? (Absorbance)**

Much too absorbent	Somewhat too absorbent	Just about right	Not quite absorbent enough	Not at all absorbent enough
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Sample: BC111**

**How much did you LIKE/DISLIKE the ease of wringing of this sponge?**

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="checkbox"/>								

**Sample: BC111**

**How would you describe the stiffness of this sponge?**

Much too stiff	Somewhat too stiff	Just about right	Not quite stiff enough	Not at all stiff enough
<input type="checkbox"/>				

**Using the sponge (including the scrubbing side) please clean the plate in front of you.**

**You may use any part of the sponge to clean the plate. Please clean the plate in the pan as to catch the soapy**

water.

You do not have to clean the entire plate, but just enough to form an opinion on the sponge.

When you are finished, answer the following questions.

Sample: BC111

How much did you LIKE/DISLIKE the sponge's cleaning ability?

Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="checkbox"/>								

Did you feel that this sponge scratched the plate, leaving a permanent line?

Sample: BC111

Yes

No

Other

Sample: BC111

After evaluating this sponge's appearance, texture, and usefulness, how much did you LIKE/DISLIKE this sponge overall?

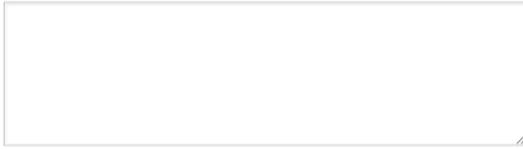
Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
<input type="checkbox"/>								

What, if anything, did you LIKE about this sponge?

Sample: BC111

What, if anything, did you DISLIKE about this sponge?

Sample: BC111



Sample: BC111

How interested would you be in purchasing this sponge if it were available where you normally shop?

Definitely will buy	Probably will buy	Might or might not buy	Probably will not buy	Definitely will not buy
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Sample: BC111

How well does **BC111** meet your expectations for sponges?

Much better than expected	Better than expected	Meets expectations	Worse than expected	Much worse than expected
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Once finished with the plate cleaning, set the plate on the side of the table and throw the sponge away and paper plate into the trash can.**

**Also, pour the soapy water into the Pyrex dish provided and servers will provide fresh soapy water with the next sample.**

You have finished answering questions about the sponge samples.

Please click **next** to answer questions about yourself.

You aren't quite finished yet....

What is your gender?

<input type="radio"/>	Male
<input type="radio"/>	Female

Which of the following best describes your age?

- 17 years or younger
- 18-24 years
- 25-34 years
- 35-44 years
- 45-54 years
- 55-64 years
- 65 years or older

**Which of the following best describes your household income?**

- Below \$25,000
- \$25,001-\$49,999
- \$50,000-\$74,999
- \$75,000-\$99,999
- \$100,000 or more

**Handedness**

**Which hand do you consider to be dominant? (if you can use both, check the last box as well as the hand you use to write)**

- Right
- Left
- Ambidextrous

**Purchase Stores**

**Where do you purchase your cleaning supplies? (select all that apply)**

Grocery Stores

Wholesale Clubs (Sams, Costco)

Online Stores (Amazon)

Other

**Purchase products**  
**What brand of cleaning supplies do you most often purchase? (select all that apply)**

<input type="checkbox"/> Mr.Clean	<input type="checkbox"/> Scrubbing Bubbles	<input type="checkbox"/> Clorox
<input type="checkbox"/> Easy off	<input type="checkbox"/> Dawn	<input type="checkbox"/> Finish
<input type="checkbox"/> Cascade	<input type="checkbox"/> Scotch-Brite	<input type="checkbox"/> Swiffer
<input type="checkbox"/> Pin-Sol	<input type="checkbox"/> Lysol	<input type="checkbox"/> Fabuloso
<input type="checkbox"/> Resolve	<input type="checkbox"/> Pledge	<input type="checkbox"/> Oxi Clean
<input type="checkbox"/> Libman	<input type="checkbox"/> Meyer's	<input type="checkbox"/> Other <input type="text"/>

**Cleaning method**  
**How do you go about cleaning dishes?**

Scrubbing them with a sponge

Scrubbing them with a scrubbing brush

Using a dishwasher

Other



**Please raise your hand to be excused (for social distancing).**

**Thank you! Please check out with the receptionist to collect your incentive.**

Finished

Figure 4.14. Standard Questionnaire Used for Breakfast Sandwich Questionnaire



**Welcome Panelist name!**  
Click the *next* button to begin

1. I agree to participate as a panelist in research conducted by The Sensory and Consumer Research Center.
2. I understand that the purpose of this project is to participate in a sausage egg and cheese biscuit tasting.
3. I will receive participation payment when I complete this study.
4. I understand my performance as an individual will be treated as research data and will in no way be associated with me for anything other than identification purposes, thereby assuring confidentiality of performance and responses.
5. I understand that I do not have to participate in this research and may choose not to participate without penalty.
6. I understand that I may withdraw at any time.
7. If I have any questions concerning this study, I understand that I may contact Marianne Swaney-Stueve at 913-307-7354 at the KSU Olathe Campus Room 162.
8. If I have any questions about my rights as a consumer or about the manner in which this research was conducted, I may contact Dr. Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 1 Fairchild Hall (532-2334), Manhattan, KS, 66506.

By typing my name in the space below, I am providing my electronic signature and acknowledging that I understand the above statements.

**Please remove your mask now, then click Next.**

**Please wait for your server to bring your FIRST sandwich.**  
**While you are waiting, take a bite of cracker and a drink of water to cleanse your mouth.**



**When you have received sandwich **BC111**, click *next* to continue.**  
**DO NOT TASTE UNTIL INSTRUCTED.**

 **1:45**

Sample: BC111

**REMOVE sandwich from bag and LOOK at the sausage egg & cheese biscuit now.**

How much do you like or dislike the **OVERALL APPEARANCE** of this sausage egg & cheese biscuit breakfast sandwich?

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

**LOOK at the sausage egg & cheese biscuit and answer the following questions about its appearance.**

Sample: BC111

How much do you like or dislike the appearance of the **BISCUIT** in this breakfast sandwich?

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

How much do you like or dislike the appearance of the **EGG** in this breakfast sandwich?

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

How much do you like or dislike the appearance of the **CHEESE** in this breakfast sandwich?

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

Sample: BC111

How much do you like or dislike the appearance of the **SAUSAGE** in this breakfast sandwich?

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

How much do you like or dislike the **COLOR** of the **SAUSAGE** in this breakfast sandwich?

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

**What do you LIKE about the appearance of this sausage egg & cheese biscuit breakfast sandwich? (check all that apply)**

**Sample: BC111**

<input type="checkbox"/> Cheese appearance ???	<input type="checkbox"/> Egg appearance ???	<input type="checkbox"/> Biscuit size ???	<input type="checkbox"/> Biscuit thickness ???
<input type="checkbox"/> Egg size ???	<input type="checkbox"/> Egg thickness ???	<input type="checkbox"/> Sausage size ???	<input type="checkbox"/> Sausage thickness ???
<input type="checkbox"/> Size of sandwich ???	<input type="checkbox"/> Egg color ???	<input type="checkbox"/> Sausage color ???	<input type="checkbox"/> Biscuit appearance ???
<input type="checkbox"/> Sausage appearance ???	<input type="checkbox"/> Other (specify) <input type="text"/>	<input type="checkbox"/> None of the above	

**What do you DISLIKE about the appearance of this sausage egg & cheese biscuit breakfast sandwich? (check all that apply)**

**Sample: BC111**

<input type="checkbox"/> Cheese appearance ???	<input type="checkbox"/> Egg appearance ???	<input type="checkbox"/> Biscuit size ???	<input type="checkbox"/> Biscuit thickness ???
<input type="checkbox"/> Egg size ???	<input type="checkbox"/> Egg thickness ???	<input type="checkbox"/> Sausage size ???	<input type="checkbox"/> Sausage thickness ???
<input type="checkbox"/> Size of sandwich ???	<input type="checkbox"/> Egg color ???	<input type="checkbox"/> Sausage color ???	<input type="checkbox"/> Biscuit appearance ???
<input type="checkbox"/> Sausage appearance ???	<input type="checkbox"/> Other (specify) <input type="text"/>	<input type="checkbox"/> None of the above	

**SMELL the sausage egg & cheese biscuit now and answer the following question about its**

**aroma.**

Sample: BC111

How much do you like or dislike the **OVERALL AROMA** of this sausage egg & cheese biscuit breakfast sandwich?

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

**Please TASTE the sandwich now.  
Take at least 3 bites of the sandwich in order to form an opinion.**

You may re-taste as needed while answering the questions.

**DO NOT FINISH THE SANDWICH - YOU WILL BE ASKED TO RE-TASTE AGAIN AT END OF TEST**

Click **next** to continue.

Sample: BC111

Thinking about the taste, texture, appearance, and aroma of the sausage egg & cheese biscuit breakfast sandwich you just tasted, how much do you like or dislike this sausage egg & cheese biscuit **OVERALL**?

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

Sample: BC111

How likely would you be to **PURCHASE** this particular sausage egg & cheese biscuit breakfast sandwich if it were available for \$2.99 at a QuikTrip location near you?

Definitely would not purchase	Probably would not purchase	Might or might not purchase	Probably would purchase	Definitely would purchase
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sample: BC111

How well does this sandwich **MEET YOUR EXPECTATIONS** for a sausage egg & cheese biscuit breakfast sandwich?

Far below expectations	Below expectations	Meets expectations	Exceeds expectations	Far exceeds expectations
<input type="checkbox"/>				

Sample: BC111

How much do you like or dislike the **BISCUIT** on this breakfast sandwich?

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

How much do you like or dislike the **SAUSAGE** on this breakfast sandwich?

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

How much do you like or dislike the **EGG** on this breakfast sandwich?

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

How much do you like or dislike the **CHEESE** on this breakfast sandwich?

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

Sample: BC111

How would you describe the **BISCUIT FLAVOR** of this breakfast sandwich?

Much too weak	Slightly too weak	Just about right	Slightly too strong	Much too strong
<input type="checkbox"/>				

How would you describe the **SAUSAGE FLAVOR** of this breakfast sandwich?

Much too weak	Slightly too weak	Just about right	Slightly too strong	Much too strong
<input type="checkbox"/>				

How would you describe the **EGG FLAVOR** of this breakfast sandwich?

Much too weak	Slightly too weak	Just about right	Slightly too strong	Much too strong
<input type="checkbox"/>				

How would you describe the **CHEESE FLAVOR** of this breakfast sandwich?

Much too weak	Slightly too weak	Just about right	Slightly too strong	Much too strong
<input type="text"/>				

Sample: BC111

How would you describe the **SALTINESS** of this breakfast sandwich?

Not at all salty enough	Not quite salty enough	Just about right	Slightly too salty	Much too salty
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

How would you describe the **SPICINESS** of this breakfast sandwich?

Not at all spicy enough	Not quite spicy enough	Just about right	Slightly too spicy	Much too spicy
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Sample: BC111

How much do you like or dislike the **OVERALL TEXTURE** of this breakfast sandwich?

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

How much do you like or dislike the **TEXTURE OF THE BISCUIT?**

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

How much do you like or dislike the **TEXTURE OF THE SAUSAGE?**

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

How much do you like or dislike the **TEXTURE OF THE EGG?**

Dislike It Extremely	Dislike It Very Much	Dislike It Moderately	Dislike It Slightly	Neither Like Nor Dislike	Like It Slightly	Like It Moderately	Like It Very Much	Like It Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Sample: BC111

How would you describe the **BISCUIT TEXTURE**?

Much too moist	Slightly too moist	Just about right	Slightly too dry	Much too dry
<input type="text"/>				

How would you describe the **SAUSAGE TEXTURE**?

Much too soft	Slightly too soft	Just about right	Slightly too firm	Much too firm
<input type="text"/>				

How would you describe the **EGG TEXTURE**?

Much too fluffy	Slightly too fluffy	Just about right	Slightly too dense	Much too dense
<input type="text"/>				

Sample: BC111

Thinking about the sausage egg & cheese biscuit breakfast sandwiches you currently buy, would you buy **THIS** sausage egg & cheese biscuit **MORE OR LESS FREQUENTLY THAN YOUR CURRENT** sausage egg & cheese biscuit?

Much less frequently than the current	Less frequently than the current	About the same as the current	More frequently than the current	Much more frequently than the current
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Is there anything else you would like to share about this sausage egg and cheese biscuit breakfast sandwich? (if not, click next to continue)

Sample: BC111





You are finished with questions about this sandwich. Please place the remaining sandwich back in the bag and place on plate. Move the plate with sandwich to the SIDE of your station now (keep plates in the same order as you sample them).

**Do NOT throw away or finish the sandwich** - as you will need to re-taste it at the end of the session.

Click "next" to continue.

Thinking about ALL THREE sandwiches you tasted today, please **rank** the 3 sausage egg & cheese biscuit breakfast sandwiches in order of PREFERENCE. You may re-taste the sandwiches if needed.

- Click and drag your most preferred sandwich into the 1st box.
- Click and drag your second most preferred sandwich into the 2nd box.
- Click and drag your least preferred sandwich into the 3rd box.

(The sandwiches are listed below in the order you tasted them).

1st	2nd	3rd
		

		
---	---	--

Which part of the breakfast sandwich made it your most preferred? (check all that apply)

Biscuit ???

Egg ???

Sausage ???

Cheese ???

Other (please specify)

**You indicated that the sausage was a reason that you preferred this breakfast sandwich, please select the specific reason for preferring the sausage. (check all that apply)**

<input type="checkbox"/> Sausage size ???	<input type="checkbox"/> Sausage thickness ???
<input type="checkbox"/> Sausage texture ???	<input type="checkbox"/> Sausage juiciness ???
<input type="checkbox"/> Sausage flavor ???	<input type="checkbox"/> Sausage spiciness ???
<input type="checkbox"/> Sausage saltiness ???	<input type="checkbox"/> Other (specify) <input type="text"/>

**Please re-taste the three breakfast sandwiches now.**

Thinking about THE SAUSAGE, and rank the sandwiches you just tasted in order of PREFERENCE FOR THE SAUSAGE.

- Click and drag the most preferred sausage into the 1st box.
- Click and drag your second most preferred sausage into the 2nd box.
- Click and drag your least preferred sausage into the 3rd box.

(The samples are shown in the order you tasted them).

1st	2nd	3rd

BC111

BC222

BC333

**Why was this your most preferred sausage? (check all that apply)**

<input type="checkbox"/> Sausage size ???	<input type="checkbox"/> Sausage thickness ???
<input type="checkbox"/> Sausage texture ???	<input type="checkbox"/> Sausage juiciness ???
<input type="checkbox"/> Sausage flavor ???	<input type="checkbox"/> Sausage spiciness ???
<input type="checkbox"/> Sausage saltiness ???	<input type="checkbox"/> Other (specify) <input style="width: 100px;" type="text"/>

**Please put your mask back on before continuing to the next questions.**

**What is your gender?**

Female  
 Male

**Which of the following includes your current age?**

- Under 21 years of age
- 21-30 years
- 31-40 years
- 41-50 years
- 51-60 years
- 61 years or older

**Handedness**

**What is your handedness?**

- Left Handed
- Right Handed
- Ambidextrous-Right Dominant
- Ambidextrous-Left Dominant

**On average, how often do you purchase and consume a SAUSAGE, EGG, AND CHEESE BISCUIT from a convenience store, fast food restaurant, or coffee shop?**

- Daily
- 3-6 times per week
- 2 times per week
- Once per week
- 2-3 times per month
- Once per month
- Less than once per month

**From which of the following places do you typically purchase and consume a SAUSAGE, EGG, & CHEESE BISCUIT? (select all that apply)**

<input type="checkbox"/> McDonalds ???	<input type="checkbox"/> Wendy's ???
<input type="checkbox"/> Burger King ???	<input type="checkbox"/> Chick-Fil-A ???
<input type="checkbox"/> Starbucks ???	<input type="checkbox"/> Scooters ???
<input type="checkbox"/> QuikTrip ???	<input type="checkbox"/> Caseys ???
<input type="checkbox"/> 7-Eleven ???	<input type="checkbox"/> Kwik Shop ???
<input type="checkbox"/> Minit Mart ???	<input type="checkbox"/> Jack in the Box ???
<input type="checkbox"/> Hardee's ???	<input type="checkbox"/> None of the above

**Thank you for completing this test!**

**Please click *FINISHED*.**

**Return to the check-out table to receive your payment.**

Finished

Figure 4.15. Reversed Scale Used for Breakfast Sandwich Questionnaire



**Welcome Panelist name!**  
Click the *next* button to begin

1. I agree to participate as a panelist in research conducted by The Sensory and Consumer Research Center.
2. I understand that the purpose of this project is to participate in a sausage egg and cheese biscuit tasting.
3. I will receive participation payment when I complete this study.
4. I understand my performance as an individual will be treated as research data and will in no way be associated with me for anything other than identification purposes, thereby assuring confidentiality of performance and responses.
5. I understand that I do not have to participate in this research and may choose not to participate without penalty.
6. I understand that I may withdraw at any time.
7. If I have any questions concerning this study, I understand that I may contact Marianne Swaney-Stueve at 913-307-7354 at the KSU Olathe Campus Room 162.
8. If I have any questions about my rights as a consumer or about the manner in which this research was conducted, I may contact Dr. Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 1 Fairchild Hall (532-2334), Manhattan, KS, 66506.

By typing my name in the space below, I am providing my electronic signature and acknowledging that I understand the above statements.

**Please remove your mask now, then click *Next*.**

**Please wait for your server to bring your FIRST sandwich.  
While you are waiting, take a bite of cracker and a drink of water to cleanse your mouth.**



**When you have received sandwich **BC111**, click *next* to continue.**  
**DO NOT TASTE UNTIL INSTRUCTED.**

 **1:45**

Sample: BC111

**REMOVE sandwich from bag and LOOK at the sausage egg & cheese biscuit now.**

How much do you like or dislike the **OVERALL APPEARANCE** of this sausage egg & cheese biscuit breakfast sandwich?

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="checkbox"/>								

**LOOK at the sausage egg & cheese biscuit and answer the following questions about its appearance.**

Sample: BC111

How much do you like or dislike the appearance of the **BISCUIT** in this breakfast sandwich?

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="checkbox"/>								

How much do you like or dislike the appearance of the **EGG** in this breakfast sandwich?

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="checkbox"/>								

How much do you like or dislike the appearance of the **CHEESE** in this breakfast sandwich?

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="checkbox"/>								

Sample: BC111

How much do you like or dislike the appearance of the **SAUSAGE** in this breakfast sandwich?

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="checkbox"/>								

How much do you like or dislike the **COLOR** of the **SAUSAGE** in this breakfast sandwich?

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="checkbox"/>								

**What do you LIKE about the appearance of this sausage egg & cheese biscuit breakfast sandwich? (check all that apply)**

**Sample: BC111**

<input type="checkbox"/> Cheese appearance ???	<input type="checkbox"/> Egg appearance ???	<input type="checkbox"/> Biscuit size ???	<input type="checkbox"/> Biscuit thickness ???
<input type="checkbox"/> Egg size ???	<input type="checkbox"/> Egg thickness ???	<input type="checkbox"/> Sausage size ???	<input type="checkbox"/> Sausage thickness ???
<input type="checkbox"/> Size of sandwich ???	<input type="checkbox"/> Egg color ???	<input type="checkbox"/> Sausage color ???	<input type="checkbox"/> Biscuit appearance ???
<input type="checkbox"/> Sausage appearance ???	<input type="checkbox"/> Other (specify) <input type="text"/>	<input type="checkbox"/> None of the above	

**What do you DISLIKE about the appearance of this sausage egg & cheese biscuit breakfast sandwich? (check all that apply)**

**Sample: BC111**

<input type="checkbox"/> Cheese appearance ???	<input type="checkbox"/> Egg appearance ???	<input type="checkbox"/> Biscuit size ???	<input type="checkbox"/> Biscuit thickness ???
<input type="checkbox"/> Egg size ???	<input type="checkbox"/> Egg thickness ???	<input type="checkbox"/> Sausage size ???	<input type="checkbox"/> Sausage thickness ???
<input type="checkbox"/> Size of sandwich ???	<input type="checkbox"/> Egg color ???	<input type="checkbox"/> Sausage color ???	<input type="checkbox"/> Biscuit appearance ???
<input type="checkbox"/> Sausage appearance ???	<input type="checkbox"/> Other (specify) <input type="text"/>	<input type="checkbox"/> None of the above	

**SMELL the sausage egg & cheese biscuit now and answer the following question about its**

**aroma.**

Sample: BC111

How much do you like or dislike the **OVERALL AROMA** of this sausage egg & cheese biscuit breakfast sandwich?

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="checkbox"/>								

**Please TASTE the sandwich now.  
Take at least 3 bites of the sandwich in order to form an opinion.**

You may re-taste as needed while answering the questions.

**DO NOT FINISH THE SANDWICH - YOU WILL BE ASKED TO RE-TASTE AGAIN AT END OF TEST**

Click *next* to continue.

Sample: BC111

Thinking about the taste, texture, appearance, and aroma of the sausage egg & cheese biscuit breakfast sandwich you just tasted, how much do you like or dislike this sausage egg & cheese biscuit **OVERALL**?

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="checkbox"/>								

Sample: BC111

How likely would you be to **PURCHASE** this particular sausage egg & cheese biscuit breakfast sandwich if it were available for \$2.99 at a QuikTrip location near you?

Definitely would purchase	Probably would purchase	Might or might not purchase	Probably would not purchase	Definitely would not purchase
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sample: BC111

How well does this sandwich **MEET YOUR EXPECTATIONS** for a sausage egg & cheese biscuit breakfast sandwich?

Far exceeds expectations	Exceeds expectations	Meets expectations	Below expectations	Far below expectations
<input type="checkbox"/>				

Sample: BC111

How much do you like or dislike the **BISCUIT** on this breakfast sandwich?

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="checkbox"/>								

How much do you like or dislike the **SAUSAGE** on this breakfast sandwich?

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="checkbox"/>								

How much do you like or dislike the **EGG** on this breakfast sandwich?

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="checkbox"/>								

How much do you like or dislike the **CHEESE** on this breakfast sandwich?

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="checkbox"/>								

Sample: BC111

How would you describe the **BISCUIT FLAVOR** of this breakfast sandwich?

Much too strong	Slightly too strong	Just about right	Slightly too weak	Much too weak
<input type="checkbox"/>				

How would you describe the **SAUSAGE FLAVOR** of this breakfast sandwich?

Much too strong	Slightly too strong	Just about right	Slightly too weak	Much too weak
<input type="checkbox"/>				

How would you describe the **EGG FLAVOR** of this breakfast sandwich?

Much too strong	Slightly too strong	Just about right	Slightly too weak	Much too weak
<input type="checkbox"/>				

How would you describe the **CHEESE FLAVOR** of this breakfast sandwich?

Much too strong	Slightly too strong	Just about right	Slightly too weak	Much too weak
<input type="text"/>				

Sample: BC111

How would you describe the **SALTINESS** of this breakfast sandwich?

Much too salty	Slightly too salty	Just about right	Not quite salty enough	Not at all salty enough
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

How would you describe the **SPICINESS** of this breakfast sandwich?

Much too spicy	Slightly too spicy	Just about right	Not quite spicy enough	Not at all spicy enough
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Sample: BC111

How much do you like or dislike the **OVERALL TEXTURE** of this breakfast sandwich?

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>				

How much do you like or dislike the **TEXTURE OF THE BISCUIT?**

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>				

How much do you like or dislike the **TEXTURE OF THE SAUSAGE?**

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>				

How much do you like or dislike the **TEXTURE OF THE EGG?**

Like It Extremely	Like It Very Much	Like It Moderately	Like It Slightly	Neither Like Nor Dislike	Dislike It Slightly	Dislike It Moderately	Dislike It Very Much	Dislike It Extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>				

Sample: BC111

How would you describe the **BISCUIT TEXTURE?**

Much too dry	Slightly too dry	Just about right	Slightly too moist	Much too moist
<input type="text"/>				

How would you describe the **SAUSAGE TEXTURE?**

Much too firm	Slightly too firm	Just about right	Slightly too soft	Much too soft
<input type="text"/>				

How would you describe the **EGG TEXTURE?**

Much too dense	Slightly too dense	Just about right	Slightly too fluffy	Much too fluffy
<input type="text"/>				

Sample: BC111

Thinking about the sausage egg & cheese biscuit breakfast sandwiches you currently buy, would you buy **THIS** sausage egg & cheese biscuit **MORE OR LESS FREQUENTLY THAN YOUR CURRENT** sausage egg & cheese biscuit?

Much more frequently than the current	More frequently than the current	About the same as the current	Less frequently than the current	Much less frequently than the current
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Is there anything else you would like to share about this sausage egg and cheese biscuit breakfast sandwich? (if not, click next to continue)

Sample: BC111





You are finished with questions about this sandwich. Please place the remaining sandwich back in the bag and place on plate. Move the plate with sandwich to the SIDE of your station now (keep plates in the same order as you sample them).

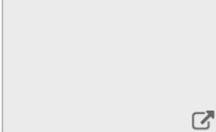
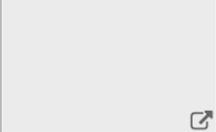
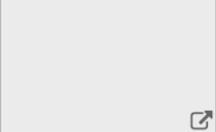
**Do NOT throw away or finish the sandwich** - as you will need to re-taste it at the end of the session.

Click "next" to continue.

Thinking about ALL THREE sandwiches you tasted today, please **rank** the 3 sausage egg & cheese biscuit breakfast sandwiches in order of PREFERENCE. You may re-taste the sandwiches if needed.

- Click and drag your most preferred sandwich into the 1st box.
- Click and drag your second most preferred sandwich into the 2nd box.
- Click and drag your least preferred sandwich into the 3rd box.

(The sandwiches are listed below in the order you tasted them).

1st	2nd	3rd
		

<input type="text" value="BC111"/>	<input type="text" value="BC222"/>	<input type="text" value="BC333"/>
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Which part of the breakfast sandwich made it your most preferred? (check all that apply)

Biscuit ???

Egg ???

Sausage ???

Cheese ???

Other (please specify)

**You indicated that the sausage was a reason that you preferred this breakfast sandwich, please select the specific reason for preferring the sausage. (check all that apply)**

<input type="checkbox"/> Sausage size ???	<input type="checkbox"/> Sausage thickness ???
<input type="checkbox"/> Sausage texture ???	<input type="checkbox"/> Sausage juiciness ???
<input type="checkbox"/> Sausage flavor ???	<input type="checkbox"/> Sausage spiciness ???
<input type="checkbox"/> Sausage saltiness ???	<input type="checkbox"/> Other (specify) <input type="text"/>

**Please re-taste the three breakfast sandwiches now.**

Thinking about THE SAUSAGE, and rank the sandwiches you just tasted in order of PREFERENCE FOR THE SAUSAGE.

- Click and drag the most preferred sausage into the 1st box.
- Click and drag your second most preferred sausage into the 2nd box.
- Click and drag your least preferred sausage into the 3rd box.

(The samples are shown in the order you tasted them).

1st	2nd	3rd

BC111	BC222	BC333
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**Why was this your most preferred sausage? (check all that apply)**

<input type="checkbox"/> Sausage size ???	<input type="checkbox"/> Sausage thickness ???
<input type="checkbox"/> Sausage texture ???	<input type="checkbox"/> Sausage juiciness ???
<input type="checkbox"/> Sausage flavor ???	<input type="checkbox"/> Sausage spiciness ???
<input type="checkbox"/> Sausage saltiness ???	<input type="checkbox"/> Other (specify) <input style="width: 100px;" type="text"/>

**Please put your mask back on before continuing to the next questions.**

**What is your gender?**

<input type="radio"/> Female
<input type="radio"/> Male

**Which of the following includes your current age?**

- Under 21 years of age
- 21-30 years
- 31-40 years
- 41-50 years
- 51-60 years
- 61 years or older

**Handedness**

**What is your handedness?**

- Left Handed
- Right Handed
- Ambidextrous-Right Dominant
- Ambidextrous-Left Dominant

**On average, how often do you purchase and consume a SAUSAGE, EGG, AND CHEESE BISCUIT from a convenience store, fast food restaurant, or coffee shop?**

- Daily
- 3-6 times per week
- 2 times per week
- Once per week
- 2-3 times per month
- Once per month
- Less than once per month

**From which of the following places do you typically purchase and consume a SAUSAGE, EGG, & CHEESE BISCUIT? (select all that apply)**

<input type="checkbox"/> McDonalds ???	<input type="checkbox"/> Wendy's ???
<input type="checkbox"/> Burger King ???	<input type="checkbox"/> Chick-Fil-A ???
<input type="checkbox"/> Starbucks ???	<input type="checkbox"/> Scooters ???
<input type="checkbox"/> QuikTrip ???	<input type="checkbox"/> Caseys ???
<input type="checkbox"/> 7-Eleven ???	<input type="checkbox"/> Kwik Shop ???
<input type="checkbox"/> Minit Mart ???	<input type="checkbox"/> Jack in the Box ???
<input type="checkbox"/> Hardee's ???	<input type="checkbox"/> None of the above

**Thank you for completing this test!**

**Please click *FINISHED*.**

**Return to the check-out table to receive your payment.**

Finished