Creating a better product experience in organic cereal packaging design

by

Lei Zhang

A thesis submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

MASTER OF FINE ARTS

Major: Graphic Design

Program of Study Committee:
Sunghyun Kang, Major Professor
Debra Satterfield
Fred Malven

Iowa State University

Ames, Iowa

2013

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

I would like to thank my committee chair, Prof. Sung Kang, and my committee members, Prof. Debra Satterfield and Prof. Fred Malven, for their guidance and support throughout the course of this research.

I would also like to thank my friends, colleagues, the department faculty and staff for making my time at Iowa State University a wonderful experience. I want to also offer my appreciation to those who were willing to participate in my surveys and observations, without whom, this thesis would not have been possible.

In addition, I would like to give my special thanks to Jing Xu, who helped me greatly with statistical analysis of my research data, and Susan Posch, who proofread my thesis carefully to eliminate mistakes.

Finally, thanks to my family for their encouragement and great support.

ABSTRACT

Organic foods have been in great demand lately, and more and more people tend to buy them to enjoy their healthy benefits. However, packages of organic food are not distinguishable from those of conventional food as a unique identity of the food that contains higher values. In grocery stores, most organic foods are placed with conventional foods together on shelves and present little attractions to consumers. As a result, they are often overlooked by organic food buyers due to designs similar to those of conventional food packages. Therefore, it is necessary to redesign organic food packages and explore design elements that can help the enhance product experience of organic foods.

With that purpose, the current study focuses on an exploration of both materials and designs in organic cereal packaging design and tries to add emotional and sensory elements to the design by applying different materials, color palettes, and imagery styles. The study adopts Kansei Engineering methodology, a method that incorporates people's sensory and emotional responses into product design and services, in the design of new prototypes of organic cereal packages; the methodology is also used to measure people's sensory and emotional responses to those prototypes through a list of Kansei words that are related to people's sensory and psychological feelings.

Results of the study indicate that different physical materials used in packaging elicited different sensory and emotional responses from study participants, and color variations in packaging also led to differences in participants' emotional and sensory responses to organic food prototypes. However, different virtual materials and imagery

styles (computer mockups) used in virtual packages didn't produce a significant difference in eliciting emotional and sensory responses from the participants.

CHAPTER 1

INTRODUCTION

1.1 Context

Organic foods have been greatly popular in recent years because of their overall better health benefits and higher quality over conventionally processed food. Most organic foods are free from toxic pesticides, chemicals, antibiotics, and artificial hormones during their production process and are safe to consume. As a result, more and more people are willing to pay premium prices for certified organic foods, and organic food markets have been growing every year. In major grocery stores, organic food can be found in a large variety to meet consumers' different needs. Fruits, vegetables, meats, milk, grains, eggs, and flours are common organic foods consumed by people on a daily basis.

1.2 Problem

Compared with conventional foods, organic foods are usually sold with higher prices due to their special growing and processing procedures. However, most organic foods are very similar in their packaging materials and designs to those of conventional foods and even are placed on the same shelves with conventional foods. The only distinguishable element on their packages is a small round circle with the word "USDA" in it to indicate certification of organic foods, and that differentiates organic foods from conventional foods. As a result, many organic foods often remain unnoticed on grocery store shelves among other non-organic products.

Figure 1. *USDA certification label for organic food*

The following is an example of organic products and all-nature products with very similar packaging designs placed together on grocery store shelves; this increases consumers' difficulty in differentiating them.

Figure 2. *Organic and non-organic foods are placed together on grocery store shelf (Note: The purple box at left corner contains organic crackers since it has a small, round green USDA logo on its package.)*

1.3 The current study

Since organic foods are more expensive than conventional foods, they deserve more exploration of their packaging with regards to various design elements, which may

help create better product experiences for consumers. The present study focuses on three major design elements in existing organic cereal packaging design (material, imagery style, and color), and designs packaging prototypes for organic cereals under the guidance of Kansei Engineering methodology and sensory and emotional design principles. In doing so, the researcher expects to collect information and data about people's preferences of materials, imagery, and color palette in organic cereal packaging and therefore will be able to use those data to create a better product experience for organic food consumers. The choice of organic cereals/grains for this study was based on the following: first, cereal products as essential parts of a healthy diet are consumed in over 90% American households, and the average American eats about 160 bowls of cereal a year (Bruce, Falci, Hoffman). Second, statistics show that "breakfast cereals rank the third in the list of grocery store items on which Americans spend their money …" (Hoffman, 2005, p8). Third, in the organic food market, cereal and grain products ranked among the top 4 major food categories in sales according to statistics from organic foods sales in the United States in 2005 (Winter & Davis, 2006).

1.4 Methodology

The current study is grounded on previous studies of multisensory design, emotional design, and Kansei Engineering. Specifically, Kansei Engineering methodology was adopted in compiling a Kansei word list that was used to measure participants' emotional and sensory responses from packaging prototypes for organic cereals. Kansei Engineering methodology (Nagamachi, 1997) is a design method that aims to transfer human emotions and feelings into product design by linking them to

specific properties of the product. It is user-centered, and successful implementation of it into products can lead to user satisfaction and improved product experience. Research literature shows that the Kansei Engineering methodology and the emotional design concept have been applied widely in the fields of industrial design, but few cases were found on their application in food packaging design. Since organic foods have been popular and in great demand in grocery stores and their packaging designs deserve more innovations to link consumers' emotions and feelings of the product with the product itself, it is interesting to combine Kansei Engineering with emotional and sensory design principles and apply them in the design of an organic cereal package. In particular, the current study can use Kansei Engineering methodology to investigate how different materials, color palettes, and imagery styles from organic cereal packaging prototypes affect people's sensory and emotional responses. Results of the study are believed to bring useful data and information that can help enhance product experience in the design of organic food packaging.

1.5 Research questions

Three research questions are expected to be answered through the current study:

1. Will different packaging materials bring difference product experiences to consumers in organic cereal packages?
2. Will different color palettes bring difference product experiences to consumers in organic cereal packages?
3. Will different imagery styles on packaging covers bring difference product experiences to consumers in organic cereal packages?

1.6 Study procedure

The study consists of the following major steps in its process:

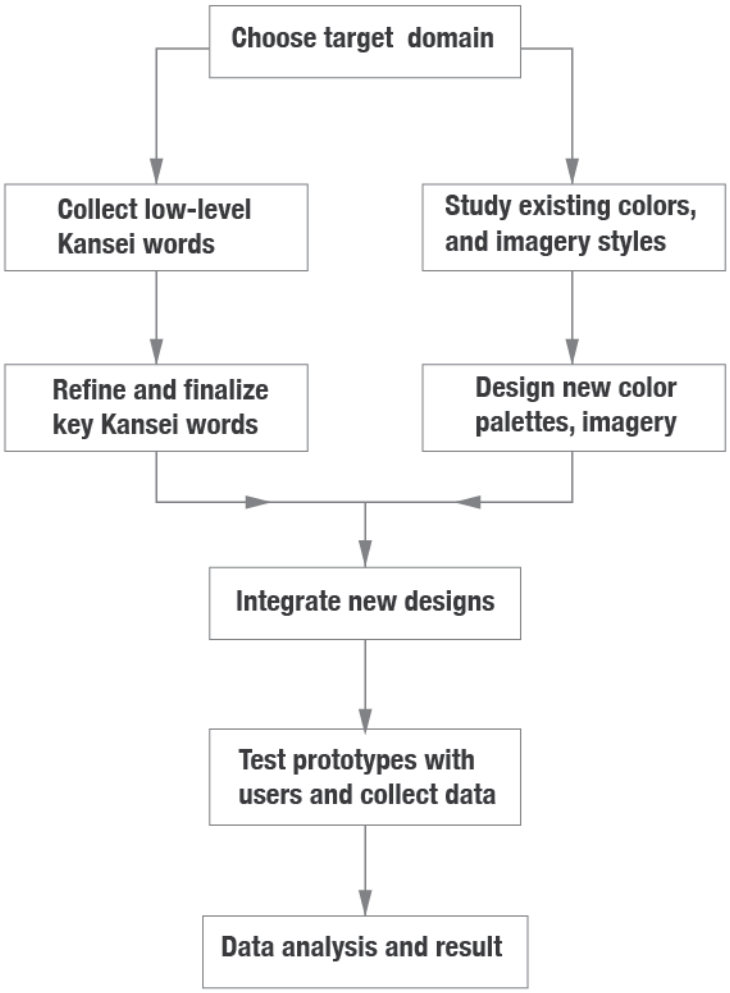


Figure 3. Study procedure flow chart

CHAPTER 2

LITERATURE REVIEW

2.1 Organic foods

2.1.1 Definition

In the world of agricultural industries, the term "organic" usually refers to a way that food and fiber are grown and processed differently from conventional food processing methods. The difference is that organic food and farming mainly rely on healthy, rich soil and biological pest controls to create an ecological system while prohibiting the use of toxic and synthetic chemicals in food production. Plants grown in such an ecological system are strong and resistant to pests and diseases.

Toxic pesticides, chemical fertilizers, plant growth regulators (hormones), livestock antibiotics, and food additives are strictly prohibited in organic food production because they can contaminate soil, air, water, and food when dissolved into soil and harm human health in the long run. Farmers who produce organic products often use techniques such as crop rotation, green manure, compost, and biological pest control to enrich soil and eliminate contamination by toxic chemicals in the soil. Livestock raised on organic farms are also fed with only organic feeds and are free from antibiotics or synthetic hormones. Farmers keep their livestock healthy and productive through good nutrition and low-stress living conditions.
(http://www.nal.usda.gov/afsic/pubs/ofp/ofp.shtml).

2.1.2 Organic versus all-natural

Organic foods are often put on the same shelves with all-natural foods in grocery stores, and many people are wondering, are they the same? Actually there are a lot of differences between organic and all-natural foods and need to be noted here.

First, the term "organic" means that the food was produced under regulations defined by the USDA, and its production was free from the use of toxic pesticides, GMOs, and antibiotics or artificial growth hormones. A small round “organic” logo is attached to products that meet the above criteria during their production. By comparison, “all natural” food is less restricted by those regulations during its production, and the term "all natural" only means that the food is free from artificial colors, flavors, sweeteners, preservatives, or thickeners.

2.1.3 Organic food consumers

Organic foods have substantial benefits over conventionally produce foods, but who are their major consumers? And what are the major reasons they choose organic foods? A recent report from a *Thomson Reuters* poll shows people’s preferences of organic foods and their reasons. It found that the majority (58%) of consumers prefer organic food to conventional food. This preference is particularly strong among those with a higher education and those of a younger demographic. 63% of respondents under age 35 choose organics when possible *(Table 1)*.

Table 1*. Organic and non-organic food preferences by age and education*

QUESTION 1: Given a choice, would you prefer to eat organic or non-organic foods?

	Organic	Non-Organic	No Preference
Age			
<35	62.80%	30.50%	6.70%

(Table 1. Continued)

35-64	60.60%	28.70%	10.70%
65+	44.80%	38.20%	17.00%
Total	57.60%	31.00%	11.40%
Education			
High School or Less	52.70%	36.40%	10.90%
Some College	54.20%	34.70%	11.00%
College+	63.50%	24.70%	11.90%
Total	57.60%	31.00%	11.40%

Among those who prefer organic food, their primary reasons were divided into four categories: supporting local farms (36%), avoiding toxins (34%), environmental health (17%), and taste (13%). Price is the primary reason that respondents preferred non-organic food. As for the shopping locations of organic food, over 40% people preferred to buy it at farmers' markets *(Table 2)*.

Table 2. *Reasons for choosing organic food by age, income, and education*

QUESTION 2: Which of these statements best describes your preference (for organic foods)?
1. I am concerned about exposure to toxins in non-organic foods
2. I believe organic foods taste better
3. I like to support local farmers
4. I believe food is better for the environment

	1	**2**	**3**	**4**
Age				
<35	36.40%	11.90%	39.90%	11.80%
35-64	34.40%	13.30%	34.80%	17.50%
65+	30.50%	12.40%	34.40%	22.70%
Total	34.20%	12.90%	35.70%	17.20%
Income				
< $25k	27.50%	21.90%	31.30%	19.40%
$25k — $49.9k	29.70%	10.00%	40.40%	19.90%
$50k — $99.9k	42.30%	9.50%	36.80%	11.40%
$100k+	36.70%	10.40%	31.90%	21.00%
Total	34.20%	12.90%	35.70%	17.20%
Education				
High School or Less	26.10%	17.50%	40.20%	16.20%
Some College	26.80%	13.20%	41.60%	18.40%
College+	43.40%	10.20%	29.50%	17.00%
Total	34.20%	12.90%	35.70%	17.20%

Rachael L. Dettmann (2008) from the Economic Research Service of the US Department of Agriculture, did a study on organic food consumers and tried to outline a demographic profile for them. According to her, many conventional studies profiling organic food consumers used surveys to collect information and yielded contradictory results. In comparison, she used statistical methods to analyze the purchase data of 41,000 households and tried to find out which demographic characteristics influence the likelihood a household buys organic food and the share of organic food a household buys in its total grocery purchase. Her data analysis yielded two important findings:
First, education and income were two significant factors that contributed to people's likelihood of buying organic food. A person's educational level determined his or her likelihood of making organic food purchase. Highly educated people tended to buy more organic food and a large share of fruits and vegetable in their purchase. Second, household income levels influenced people's likelihood of organic food purchase in the first decision stage (whether to buy organic) but presented surprising results in the second decision stage (how much to buy). Specifically, higher income households were more likely to try organic food but were unlikely to consistently spend a large potion of their money on it.

2.2 Packaging design principles and criteria

Packaging plays an important role in restoring and protecting products, and it is essential for designers to know these basic functions before creating prototypes that can be put into actual use. Meanwhile, specific design principles need to be applied to prototypes for branding and marketing purposes.

"The basic function of food packaging is to identify the product and ensure that it travels safely through the distribution system to the consumer." (Paine, p 3, 1983). However, modern food packaging has more functions than the basic ones in order to add value to products. The researcher's study of existing packaging design concluded that there are six major functions of modern food packaging:

- **Containment.** Liquids, solids, and small-sized items usually need containment from a package to hold, protect, and carry.
- **Security / Barrier protection.** In packaging design, it is important to keep products inside free from invasions of unwanted oxygen, water vapor, and dust in order to extend shelf life of the products. Special indicators and seals are needed to tell consumers effective storage time of the products.
- **Physical protection.** Packages should be able to protect products inside from being damaged during their transporting and handling process.
- **Convenience.** Packages need to have features that facilitate product transportation, display, as well as help consumers open, close, use, and reuse the product easily.
- **Information.** Packages and labels should provide necessary information about the product and handling instructions for consumers to help them use the product in a proper way.
- **Marketing.** Packages need to communicate with consumers and convey product information to them through effective ways and attract potential consumers. Graphic design is a common method used in packaging design to visually connect the product with the target audience.

The International Trade Centre (2012) specifies three major functions for organic food packaging: containment, protection, and promotion, which are similar with those applied to general food packaging. However, it states that due to special health concerns in organic food, safety and sustainability are very important in its packaging design and need to be taken into great consideration.

Food packaging principles tend to vary based on different design focuses. AlTai (2012) outlined six principles of effective packaging design that are focused on basic functions of food packages. Those principles can be briefly summarized as follows:

1. **Visibility:** This means that effective packaging design for a specific product needs to make it stand out among other similar products on store shelves.

2. **Shopability**: Since there are so many new products launched every day, it is necessary to define and elaborate the uniqueness and benefits of a new product via packaging design and attract consumers' attention to buy it.

3. **Differentiation**: Consumers often make their purchase decision emotionally instead using of fact-based judgment, and their intuition is largely based on packaging design. Therefore, in order to stand out from other products, a specific package needs to look positively different from its competitors.

4. **Messaging**: Eye tracking studies show that consumers spend very little time (5 seconds) analyzing a package. Therefore, it is important to use simple, clear claims on packages that reach out to consumers directly.

5. **Consumption**: This design principle deals with after-purchase use and functionality of the product. Designers need to extend packages into new usage situations and attract consumers for repeat purchase.

6. **Sustainability**: Packaging design needs to take great consideration of product packages' impact on the natural environment. Designing for sustainability can actually attract consumers' attention and increase product sales.

Another set of packaging design principles has a different focus on packaging as an effective tool of branding, which was elaborated by Chandler (2009) as simplicity, honesty, personality, practicality, sustainability, and authenticity. By simplicity, he states that effective packaging should be concise and clear in conveying its product information to consumers and be able to stand out among noisy messages from other brands. Honesty in packaging design helps provide consumers with true information about the product without misleading them. The personality in packaging also helps create an emotional attachment to the brand among its users. With practicality applied to packaging design, consumers will be able to access the product with ease and use it with pleasure.

In summary, although packaging design principles and their emphasis are different for different packages, understanding the needs of the target audience is the most important factor to help designers choose specific principles that best communicate product information to consumers. Based on those principles and design standards in existing packaging design, the major goals for the design of packaging prototypes in the study will be focused on differentiation, practicality, and conveying of clear messages of the product to consumers through a sensory and emotional emphasis on design elements used on organic cereal packages. It is hoped that by applying those design principles,

packages of organic cereals will stand out from conventional foods on grocery store shelves while at the same time providing a pleasant product experience to organic food consumers.

2.3 Organic food packaging in current grocery stores

Observation of various organic foods in several local grocery stores (Hy-Vee, Wal-Mart, etc.) and health markets (Campbell's Nutrition, etc.) showed that currently, most organic food packages are virtually the same as those of convention foods in terms of container shapes, materials, and designs. Taking cereals as an example, both organic and non-organic cereals are stored in boxes of similar sizes. Their packaging designs are very similar. The only element that distinguishes organic cereals from conventional cereals is a round, small USDA certification label attached to organic cereal packages, and it often remains unnoticeable when mixed with colors and graphics on packages. In terms of materials, smooth cardboard is used on packages of both cereals, and it is hard to tell the difference between the two through tactile information. Do organic food consumers like the packages that contain the food they brought? A report on organic food consumers in European countries (European Consumers' Conceptions of Organic Food, 2004) suggests that people who buy organic foods want more information from their packaging, as well as having more concerns. For example, they want in-depth information on packaging labels about the organic foods and their processing. They also have concerns for environmental protection and sustainability. The findings from the observations of organic cereals packaging in local grocery stores and the information provided from organic food consumers' reports suggest that it is necessary to make

packages of organic foods different from those of conventional foods through designs that focus on a better product experience for organic food consumers.

Figure 4. *Organic food and all-natural food placed together in grocery stores (Note: The purple box at right corner contains organic cracker since it has a small, round green USDA logo on its package.)*

2.4 Multisensory design

2.4.1 Multisensory design procedures

In recent years, multisensory design has become an approach to improve the product experience for consumers. It goes beyond conventional visual-dominant product design and incorporates other sensory modalities such as tactile, olfactory, and auditory to create a better product experience for users. “Designers who intentionally try to create specific experiences for people, are more likely to succeed if they are aware of the messages conveyed by the different sensory channels and of their contribution to the overall experience.” (Schifferstein, p 361, 2011). Strengths of the multisensory design approach are noteworthy: It can enrich the product experience, avoid unwanted conflicting messages, and result in products that are also comprehensible for users with

sensory impairments. To apply a multisensory design approach in product design, Schifferstein (2011) outlines eight procedures as follows:

1. Selecting the target expression:

   An expression of the to-be-designed object, for example, "eagerness, cheerfulness, innocence, etc.," will be chosen first as a starting point for the whole project to be designed.

2. Conceptual exploration:

   Once a target expression has been decided, designers will need to develop ideas to express the concept by brainstorming and putting down associations that connect to the expression when thinking of it.

3. Sensory exploration:

   During this step, the designers need to collect examples that can evoke the target design concept from different sensory modalities. Specifically, they need to address sensory properties of objects and figure out how the target concept feels in different sensory modalities.

4. Sensory analysis:

   In this step, the designers will try to build up a relationship between perceived sensory properties and product expression. They will try to find out why certain examples match a specific expression well while they don't work with other expressions.

5. Multisensory mind map:

   A multisensory mind map helps the designers make their concepts of the target expression concrete with the addition of physical examples.

6. User-interaction scenario:

In the multisensory design setting, a scenario is used to record all encounters between sensory touch points and users' actions, specifically, which senses are stimulated when users pick up, unwrap, use, or store the product.

7. Model making:

   In this step, the designers will build physical models or prototypes and incorporate specific sensory properties into them. They will also put the models into user context and assess the appropriateness of those models.

8. Multisensory presentation:

   Final designs of a multisensory product need to be presented in a way that the target audience can feel the benefits of multisensory design. Usually visuals, materials, and sounds that are related to the product will be presented to the audience when the product is introduced.

The multisensory design approach is unique in that perceptual knowledge is explicitly incorporated in the design process. “The ultimate design challenge is to develop a product that provides users with an interesting, rich experience, and nonetheless is perceived as a coherent whole" (Schifferstein, p361, 2011).

2.4.2 Studies on sensory dominance

Although multisensory design may create a better product experience for consumers, each sensory modality incorporated may not play an equal role in the product. Therefore, “…it is interesting to know which sensory modality plays a leading role in a particular experience, so that designers could concentrate on the creation of the most relevant product properties.” (Fenko, Schifferstein, and Hekkert, p289/2, 2009). In terms of

product design, sensory dominance often refers to the relative importance of different sensory modalities when contributing to overall product experience. Several studies (Fenko, et al; Schifferstein, et al; Heller) were conducted to explore the sensory dominance in different stages of a product's life. Knowing what sensory modality dominates at a specific product stage is very important for product design because it helps designers to focus on the enhancement of product properties related to certain sensory modalities and create a better product experience for consumers. In the current study of packaging prototype design, it is also necessary to have a clear idea about which sensory modalities play more important roles during the product buying stage.

Fenko, et al. (2009) investigated the importance of different sensory modalities when a product is used during different periods of its life. In the study, participants were asked to describe their experiences with consumer products in different usage stages: when buying a product and after using the product for the first week, the first month, and the first year. Results from their study suggested that the dominant modality changed depending on the period of product usage. To be specific, at the buying stage, vision played the most important role, but as the product was used for a while, other sensory modalities gradually took that role and became more important than vision. Fenko stated that, “The dominance of a particular modality may depend on its appropriateness for the particular task (Fenko, et al., p289/1, 2009).” In addition, they also found that product functions and characteristics of the user-product interaction were important factors that affected modality importance during long-term usage.

Another similar study was conducted by Schifferstein, et al. (2013) on the different dominances of sensory modalities and consumers' different emotional responses during different stages of product usage. Specifically, they investigated a dehydrated food product to see how it was experienced during different periods of usage. Their study results showed that, at the buying stage, vision was the dominant sensory modality. Smell was the most important at the cooking stage, and taste was dominant when people were eating the food. They also tested the influence of food packaging on food experience during the study and chose two different packaging materials for the dehydrated food; one was a commercial glossy package, while the other was a matte finish and had a special tactile feel. Their data showed that, "the particular tactile characteristics of the packages in the second experiment resulted in higher importance ratings for touch in the buying stage, but tended to produce lower ratings for touch for the other stages compared to the commercial packages of the first experiment" (Schifferstein, et al., p21, 2013).

Results from previous studies suggested that, during the buying stage of a product, vision and touch were the two most dominant sensory modalities that provided customers with the most information from products' packaging. Such a finding was further tested and proven by Schifferstein and Cleiren (2005) in a study to investigate an individual sensory modality's contribution to an overall product experience. To separate each sensory modality from others, they developed a split-modality approach in which participants used only one of their sensory modalities (vision, touch, audition, or olfaction) to experience real-life products. They then collected participants' responses of one-sensory experience from their interaction with the products. Their study result indicated that, of all four sensory modalities, vision and touch helped participants get the

most detailed information from products and identify the products with easiest efforts. The two modalities also helped participants recall clearest memories from their past experiences and associations with people and with other products.

Another study conducted by Heller (1982) also provided evidence that a cooperation of visual and tactile modalities worked better than either one alone. In the study, Heller explored multisensory cooperation on visual and tactual perception of textures. Specifically, participants in three experimental groups were asked to make texture judgments of abrasive surfaces by choosing the smoothest one from three surfaces. Study result showed that vision and touch provided similar level of performance in choosing a textured surface. However, a bimodal approach of both visual and tactile input helped participants to achieve greater accuracy. In the bimodal exploration of abrasive textures, vision served as guidance for tactile exploration.

2.4.3 Studies on packaging materials, imagery, color, and their associations with sensory perceptions

The dominance of visual and tactile modalities during the buying stage of a product connects directly with its packaging design, especially the materials, imagery, and colors chosen by designers of the product's package. Some studies have been conducted on how material, imagery, and color transfer taste perceptions through customers' visual and tactile experiences with food packages. Their findings have provided valuable information for the exploration and application of material, imagery, and color in the current study.

1) Materials and perception of tastes

Brown (1958) conducted an interesting study on the influence of wrappers made of different materials on the perception of freshness in bread. In the study, he first tested a hypothesis from a previous study by choosing four different wrappers for the bread one day fresh. The four wrappers were cellophane, Saran, regular wax, and a special wax with a subwrapper. Students were asked to feel the wrappers and give their perception of freshness of bread wrapped inside. The result showed the percentage of judgments of freshness in those four wrappers: cellophane, 68%; Saran, 56%; regular waxed, 42%; and the special waxed with subwrapper, 34%. Shortly after, Brown did another experiment to test if people felt the same level of freshness in bread held for different numbers of days from specific wrappers. He chose three wrappers for this experiment: cellophane, cellophane with a five-inch waxed paper insert band, and waxed. Results showed that fresh, one-day-old, and two-day-old breads wrapped in plain cellophane wrappers felt fresher than breads wrapped in waxed paper or cellophane with a waxed paper band. Brown's studies provided examples that packaging materials can influence consumers' perception of freshness of the product inside.

Krishna & Morrin (2008) did a study to investigate the perceptual transfer of haptic cues from product container to taste impressions. In the study, they tested participants' feelings of water held in containers of different firmness. Results from their study showed that people with low liking for haptic input were significantly affected by haptic cues compared with those with high liking for haptic input. Such a result indicated that transfer of tactile feelings from product packaging to taste perceptions varied with people of different likings for haptic input.

2) Colors and perception of tastes

Becker et al. (2011) conducted a study to examine how color saturation and container shapes in packaging design affected consumers' perception of tastes. In the study, they specifically tested to what extent shape curvature and color saturation of yoghurt packages transferred potency-related impressions to participants' subsequent taste experiences. They also examined participants' sensitivity to design since different people had different perceptions of potency in tastes from packaging designs. Their result showed that, for yoghurt packaging, angular shape may bring about taste impressions for consumers, but the effect may vary depending on consumers' sensitivity to design. Compared with the influence of packaging shapes on taste potency, however, color manipulation in the study didn't achieve clear results to prove researchers' hypothesis that highly-saturated color on packages will inspire intense taste perceptions; they called for further studies on the color-intensity and taste intensity relationship.

3) Images and perception of tastes

Mizutani, et al. (2012) did a study on how fruit images on juice packages affect consumers' flavor memories and shed some light on the influence of imagery on food packages. In the study, they divided participants into three experimental settings (apple-label, peach-label, and control-label) and had them taste fruit juices with fruit images attached to cups. In each setting, participants were first asked to taste 100% pure fruit juices. After a couple of minutes, they were asked to taste juices of different concentration ratios. They were then asked to rate the similarity of juices in different concentration ratios to that of 100% pure juices and the degree of congruity between the

juice flavors and the label images. The result of the study showed that there is high congruity between the apple image and the flavor of apple juice while much less congruity between the peach image and the flavor of peach juice. One possible reason, according to the researchers, may be that apple juice had been much more commonly consumed than peach juice and so people were very familiar with it. The peach juice, on the contrary, was less frequently consumed by participants and contributed less to an association between the peach image and peach juice flavor. Findings from the study suggested that images on food packaging did have influence on people's perception of food flavors inside, but the influence of images on food flavors depended mostly on people's familiarity and prior consumption experience with the food.

4) Summary

Reviews of previous studies on multisensory design and sensory perceptions from packaging materials, imagery, and colors suggest that vision and touch are two dominant sensory modalities during the buying stage of a product and therefore are the focuses of packaging design for this study. In addition, packaging materials, imagery, and colors affect customers' perceptions of tastes, and their influences on organic cereal packaging are also worth testing through the current study.

2.5 Emotional design

Emotion, as defined by Webster's dictionary, is:

> "A conscious mental reaction (as anger or fear) subjectively experienced as strong feeling usually directed toward a specific object and typically accompanied by physiological and behavioral changes in the body."

A product emotion can be some strong feelings elicited from consumers' experience with a certain product. It can be liking or disliking, love or hate, etc. Consumers' emotional responses related to a certain product play important roles in helping them make purchase decisions and therefore need to be paid great attention by product designers. Positive product emotions can also help build a bond between consumers and the product, prevent consumers from throwing it away, and be sustainable within the environment. As a result, more and more designers are challenged to modify the emotional impact of their designs to attract potential consumers. However, in real-life practice, it is not easy to do so since emotions elicited from products are intangible and hard to predict and design for. Moreover, emotions are personal, and people's emotional responses to a given product are very different. Products often evoke multiple emotions among their consumers based on various aesthetic and functional aspects. Although it is hard to measure emotions elicited from products, it is possible for designers to influence emotions elicited from products through their designs (Desmet, p 2, 2003). Therefore, based on theories of cognitive and psychological studies, Desmet (2002) introduced an appraisal-based model (*Figure 5*) to help designers better understand product emotions. The model proposes three main variables that lead to an elicitation of emotions: (1) appraisal, (2) concern, and (3) product. The interaction of the three variables plays an important role in determining if a product can elicit an emotion, and if so, which emotion is evoked.

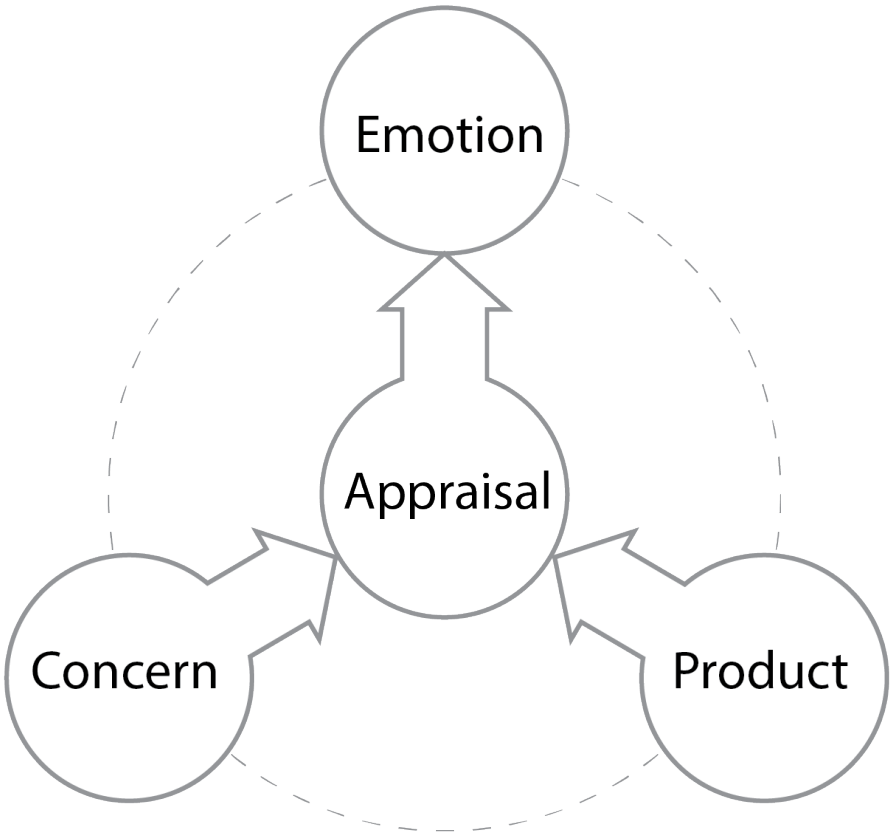


Figure 5. *Desmet's model of product emotions (2002)*

In the model, appraisal is often considered as "a non-intellectual, automatic evaluation of the significance of a stimulus of one's personal well-being" (Desmet, p108, 2002). This concept comes from cognitive theorists' argument that "an emotion always involves an assessment, or appraisal, of how an event may harm or benefit a person" (Desmet, p3, 2003). The evaluation process of the significance of the stimulus evokes one's emotions. Concern in the model refers to a more or less stable preference for certain states of the world (Frijda, 1986). According to Frijda, concerns serve as references in the process of appraisal. Therefore, products that match our concerns are appraised as being beneficial to our well-being, and those that don't match our concerns are determined as being harmful to our well-being. The third variable in the model,

product, can be subjects that evoke emotional responses or events related to subjects that elicit emotional responses. As people focus their attention on the products themselves or different aspects of products, different emotions can be evoked. Emotion here in the model is mainly an interaction, the result of the other three above-mentioned variables, and refers to an acute state that exists only for a very short period of time. Compared with moods, which tend to last a relatively long period of time, emotions are often limited to seconds, or minutes at most. In conclusion, Desmet's model of product emotions facilitated the study of relationship between products and emotions and provided a useful tool for designers to modify emotions elicited from products.

Apart from Desmet's model of product emotions, Norman (2004) also did extensive studies on emotional design and categorized product emotions into three levels. According to him, emotional responses can be divided into three levels of design that are applicable to everyone: visceral, behavioral, and reflective. The visceral response is people's first reaction to things, and visceral design is about the appearance and how users evaluate it through their senses. For example, books with attractive cover designs are easy to be chosen by readers among a lot of other books. The behavioral level of response is how people feel about the pleasure and effectiveness from the use of a product. For instance, if a car is easy to drive and functions well without problems, as well as having a lot of comfortable accessories, people will tend to have a lot of positive feelings regarding with it. The reflective level is associated with memories and prior experiences aroused by a certain object, for example, old photos and antique design in products. In product design, it can be reflected from some elements like pride of ownership and brand recognition.

As Norman (2004) noted, each emotional level is as important as the other, but each requires a different approach by the designer, so it is very important for designers to adopt different design approaches for each of the three levels of emotional design: visceral, behavioral, reflective. Specifically, at the visceral design level, physical features – look, feel, and sound – dominate and "…the response is entirely to the surface look of an object" (Norman, p 87, 2004). Attractiveness is a visceral-level phenomenon; for example, vase-shaped mineral water bottles or streamlined cars may attract people's great attention at this level. At the behavioral level of design, it is entirely about the use of the product, so appearance is less relevant. However, the appearance in the context of use is a contributing factor since it can imply an expectation of how the product should be operated and what it will feel like. Function, understandability, usability, and physical feel are the four components at the level of behavioral design (Norman, 2004), and their importance were stressed by Norman (p81, 2004), "Good behavioral design should be human-centered, focusing upon understanding and satisfying the needs of the people who actually use the product." Products from athletic, sports, and craft industries may be the best examples of the behavioral level of design since they are designed based on people's real-life needs and experiences. The reflective level of design deals with issues about message, culture, and meaning of a product or its use (Norman, 2004). It is how we see the product reflecting our self-image and aspirations to others. The watch industry is such an example. Although most watches have the same mechanical structures, their faces and straps are designed differently to cater for people's different preferences and experiences.

2.6 Kansei Engineering methodology

2.6.1 What is Kansei?

"Kansei is the instantaneous feeling and emotion that people experience when they interact with things, such as products and services." (http://instinctivechoice.co.uk/Article/23/What_is_Kansei_Engineering/).

People usually develop certain kinds of feelings and emotions from sensory information they received from things and products they interact with. Such kinds of feelings often help them make decisions in product selection. Feelings about certain products can be positive or negative, and there is no right or wrong. Moreover, feelings are also very personal and vary a dos individuals. Kansei is such a kind of feeling occurred naturally from products and services, and it can be strong or weak, desirable or undesirable, like or dislike, etc.

2.6.2 What is Kansei Engineering?

"Kansei Engineering methods build models in which peoples emotional responses to design are linked to the product properties. It is a methodology that integrates affective elements already in the developing process (Mamaghani and Tajoddini, p2, 2010)."

To put it another way, Kansei Engineering is a methodology that helps designers and manufacturers to create desirable emotional responses in their products or services. The process allows the designers and manufacturers to model customer's feelings and emotions and then translate them into design parameters and finally incorporate them into product properties.

2.6.3 Real life applications of Kansei Engineering

Originated in Japan, Kansei Engineering has been applied to car industries in automobile designs extensively by big auto companies like Mazda, Nissan, and Mitsubishi Motors and made great contribution to their auto sales. Kansei has been used in both exterior and interior designs of cars. Specifically, in exterior design, Kansei has been applied to the designs of the front body of luxury cars to make the heights of the front hood and grille appear higher without actually increasing their physical heights and air resistance. In interior design, Kansei has been used to make limited physical space inside of a car appear more spacious, as well as making interiors look luxurious and premium. One famous case of Kansei Engineering application in auto design is Mazda's MX5, a sport coupe that was sold around the world with popularity. In order to realize a top design concept called Human-Machine Unity (HMU), which means that the driver feels the car as a natural extension of the body, the design team of MX5 researched driving habits of young males and came up with 600 Kansei words from their data. They then refined the words around the HMU concept and focused on a combination of tight feeling, direct feeling, speedy feeling, and communication between the car and the driver. In creating a tight driving feeling, they chose a 4-meter body length and only 2 seats for the car from participants' votes. For the direct feeling, they used statistical data and experimented with different shift lever lengths and finally chose a 9.5 cm shift lever that best fit the intended Kansei. In the case of speedy feeling, the team worked on the shortening of the lag time between pressing the accelerator and feeling the car

accelerating by modifying both engine power train and the response time of the speedometer (Nagamachi, 1997).

Apart from applications in auto industries, Kansei Engineering also had successes in the electronics and household devices markets. One case is Sharp's redesigned video camera, which increased its market share from 3% to 25% after application of Kansei in its redesign. During the redesign process, the design team visited hundreds of participants' homes and kept track of their picture-taking habits. After their research, they discovered that a rotating lens plus liquid crystal display were essential parts of a video camera and made those features a standard in future video camera design.

2.6.4 Types of Kansei Engineering

Since its birth several decades ago, Kansei Engineering has been continuously evolving and has developed into at least six different types currently. Nagamachi (1997) collected applications of Kansei Engineering and identified them as different types according to the tools used in the process and task areas:

1) Type I: Category classification. This is the most commonly used type of Kansei Engineering, in which a product domain is identified and customer's affective needs are analyzed. Those affective needs are then connected to product properties during the process of product design.

2) Type II: Kansei Engineering system. Kansei in this category is a computer-aided system that connects emotional demands of users with product properties via mathematical and statistical tools. A Kansei database is often used in the system to facilitate design.

3) Type III: Hybrid Kansei Engineering system. This type of Kansei is also a computer-based system similar to Type II; however, what is special about this type is that designers can predict Kansei elicited from product properties by using prototypes or mock-ups.

4) Type IV: Kansei Engineering modeling. This type builds mathematical prediction models that are able to assess human feelings in a more validated way than Type II and III.

5) Type V: Virtual Kansei Engineering. This type of Kansei replaces the physical presentation of products with virtual presentations by combining Virtual Reality techniques with a data collection system.

6) Type VI: Collaborative Kansei Engineering designing. In this type, product design can be conducted through a sharing of an accessible Kansei database via the Internet, which supports group work and concurrent engineering.

2.6.5 Process of applying Kansei engineering methodology

Schütte (2005) has proposed a Kansei model that includes the following steps: choice of domain, span the semantic space, span the space of properties, synthesis, test of validity, model building (*Figure 6*).

The first step is the choice of domain, and during this step the target group, market, and specification of the new product will be selected and decided. Product samples are also collected to represent the domain.

The second step is to span the semantic space. During this step, a list of higher-level Kansei words that can be connected directly to product properties will be compiled from lists of lower-level Kansei words. There are three sub-steps involved in the procedure: collection of lower-level Kansei words, Kansei structure identification, and data compilation.

The third step is to span the space of properties. In this step, product related materials are collected and analyzed, and desired properties are identified. Properties from existing products are also taken into consideration and combined with new properties developed by designers. Finally, all chosen properties are put together to build up product mock-ups or prototypes to be used in the next step.

In the fourth step of synthesis, collected Kansei words from the semantic space will be linked with new properties from the step of property space and their validity will be tested.

After the validity test, a new model will be proposed for new products based on results from the synthesis of Kansei words and product properties.

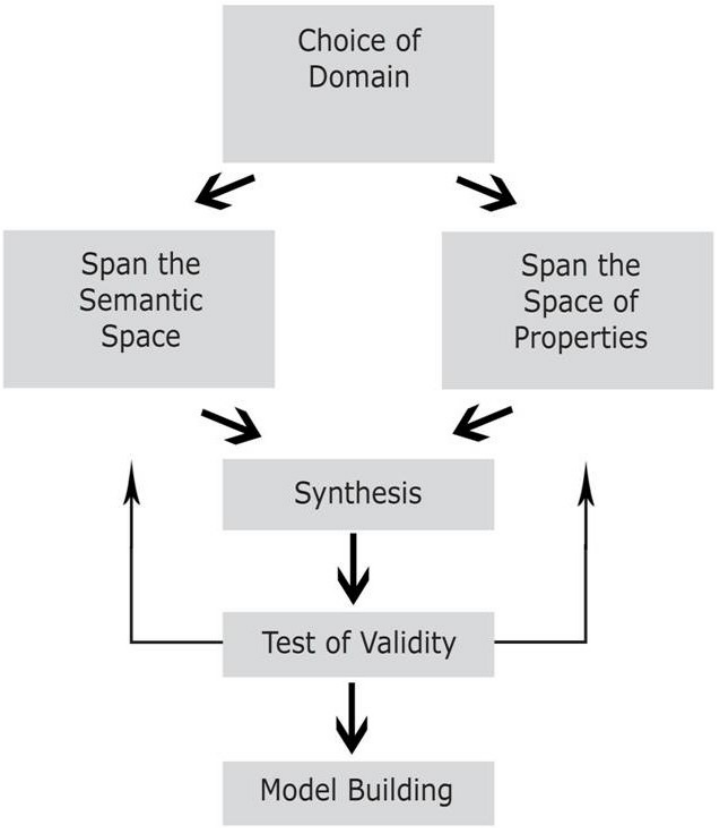


Figure 6. *Kansei Model (Schütte, p56, 2005)*

2.6.6 Kansei Engineer as a research methodology

Kansei Engineering as a research methodology has also been frequently combined with other research methods by many researchers to come up with better criteria for new designs and more comprehensive assessments of new products.

Lai et al. (2004) did an experimental study on mobile phones to examine how product form and product color affected product image individually and as a whole. Specifically, they tried to use Kansei to extract product image and data that could provide information on thw optimal combination of forms and colors for popular mobile phones. They then combined Kansei data with Quantitative Theory Type I and neural networks

(NNs) in their study and proposed an approach that helped product designers transform users' psychological perceptions into product elements design. Their study result suggested that "product color is more influential than product form on product image of mobile phones" (Lai et al., p265, 2004).

Satterfield, et al. (2008) also conducted a study on a real-life application of a combined methodology of activity theory, Kansei Engineering and the ZMET process, on a redesign of Frito Lay's potato chips packaging. In the study, they argued that ZMET methodology alone couldn't provide sufficient information that was associated with the usability of the product in terms of physical, tactile, and sensory properties. Therefore, Kansei Engineering was a necessary supplementary method to help gather information from target audience. In practice, they used Kansei to construct a word inventory from the target audience and applied it to the redesign of chip packaging and selection of chips. Then, they used Kansei again to evaluate modified chips and chip packaging for their physical, sensory, and emotional properties. Such a hybrid methodology of ZMET process, Kansei, and activity theory worked well in the study since it allowed designers to establish a set of design criteria that could be used to create various new designs and then evaluate those designs effectively by repeating the same process.

CHAPTER 3

METHODOLOGY

The methodology of current study can be divided into the following major steps under the guidelines of Kansei Engineering:

- Choose target study domain: organic cereal packaging
- Collect low-level Kansei words from two sources: existing Kansei words inventory and customers' reviews on organic cereals (www.amazon.com)
- Refine low-level Kansei words and finalize key Kansei words
- Research materials, colors, and imagery styles of existing cereal packages
- Design new color palettes, imagery, and choose materials for prototypes
- Integrate above-mentioned design elements into new prototypes
- Present the prototypes to users and collect data on their emotional and sensory responses through Kansei words
- Analyze collected data via statistical software, SPSS
- Based on the results of analyzed data, formulate design recommendations for new organic cereal packages, as well as making modifications for further studies

3.1 Choice of study domain

Major organic cereal brands were chosen for this study. Their products can be found in most grocery stores, health market, and organic food stores in central Iowa. Target consumers of those organic cereals were common adults.

3.2 Collection and construction of Kansei words

Words describing the product domain were chosen from the following sources:

- Product brands review by editors

- Amazon product reviews
- Product discussion forums

Since there are many organic cereal brands and each brand has products of different flavors, the choice of product reviews was first based on an editor's recommendation of the brands, and then customers' reviews of cereal products from those brands were browsed for Kansei words. The following are review examples taken from organic cereal product reviews on Amazon.com. Lower-level Kansei words in the reviews were highlighted in yellow. (See Appendix IV for more review samples)

> "I've been eating Honey Nut O's for several years now. It tastes good, the texture is comfortable to chew, and it keeps me full for hours, really filling. When I eat cereals I can buy in stores I'm hungry in an hour. This cereal is organic from a very reputable company in the northwest so I also feel I'm helping to keep the environment free from pesticides."

> "Some organic foods can be bland, especially cereals. Not as sweet as cheerios, but they taste good enough that everyone in our family often eats more than just 1 bowl. I usually poor to much milk in the bowl just to have a good reason to pour more cereal in! Good price, taste, and Healthy!"

The following table shows the frequency of lower-level Kansei words chosen from Amazon reviews of several popular organic cereals. Those words were roughly put into several categories for further selection of higher-level Kansei words.

Table 3. *Frequency of lower-level Kansei words from Amazon product reviews*

Product Brands and Names	
Cascadian Farm Organic Honey Nut O's Cereal	Nature's Path Organic Flax Plus Maple Pecan Crunch Cereal
Cascadian Farm Organic Multigrain Squares Cereal	Nature's Path Organic Flax Plus Pumpkin Granola Cereal
Cascadian Farm Organic Fruitful O's Cereal	Nature's Path Organic Whole O's, Gluten Free Cereal
Envirokidz Organic Koala Crisp Chocolate Cereal	Nature's Path Organic Flax Plus Multibran Cereal
Kashi Organic Promise Cereal	Nature's Path Organic Mesa Sunrise Cereal
Kashi Organic Cereal, Cinnamon Harvest	Nature's Path Organic, Heritage Flakes, Whole Grains Cereal

Low-level Kansei Words and Frequences from Product Reviews													
Packaging	**#**	**Taste**	**#**	**Price**	**#**	**Nutrition**	**#**	**Health**	**#**	**Texture**	**#**	**Others**	**#**
smalll box	1	yummy	3	high	3	fat	3	Low sugar	4	nutty	3	hooked	1
tiny box	1	delicious	2	deal	2	fiber	6	Healthy	7	crunchy	14	addictive	4
not fully filled	2	sweet	2	cheap	4	Omega 3	8	Low sodium	3	texure	5	fun	3
box lable error	1	tasty	5	save	8	protein	4	dietary	4	seeds	7	trusted	2

(Table 3. Continued)

Packaging	#	Taste	#	Price	#	Nutrition	#	Health	#	Texture	#	Others	#
wrong weight	2	filling	5	competitive	2	wheat	5	low calorie	6	shredded	2	easy-preparing	4
shrinkwrapped box	1	not soggy	3	great value	5	well-rounded	4	gluten free	7	bite-size	3	convenient	5
pulverized content	1	dry	2			nutritious	9	natural	3	creamy	4	energizing	3
picture (hard ingredients)	1	hearty	3					non-GMO	5	crispy	8	enjoyable	7
		cinnamon	3					naturally sweetened	4			comfortable	4
		fruit	2					organic ingredients	2				
		snacky	3					less fatty	3				
		flavorful	2					cholesterol-lowering	5				

After a rough selection of lower-level Kansei words, further screening of those words resulted in the following higher-level Kansei words: convenient (easy preparing/eat, snacking), great value, textured (w/seeds and nuts), addictive, healthy, nutritious, flavorful, enjoyable, tasty, filling, natural (non-GMO). Those Kansei words were then combined with words from the existing Kansei word inventory to compile a final list of Kansei words used for the study.

The final Kansei words chosen for evaluation of packaging prototypes combined higher-level words from Amazon reviews and existing Kansei words and were divided into two groups regarding sensory and emotional perceptions (Table 4).

Table 4. *High level Kansei words*

Groups	Selected high level Kansei words
Sensory perceptions:	crunchy, crispy, sweet, tasty, filling (perception of taste) warm, cold (perception of tactile)
Emotional perceptions:	fresh, healthy, organic, good value, comfortable, enjoyable

In the following study, those two groups of words were printed on packaging prototype evaluation forms and presented to selected users for them to rank the strength

of sensory and emotional perceptions they receive from those prototypes. (See Appendix II for prototypes evaluation form)

3.3 Design of packaging prototypes

The design of packaging prototypes took into consideration both sensory and emotional elements. Specifically, color, material, and imagery style were three emphasized areas. Their design concepts and processes are elaborated as follows:

3.3.1 Color palettes

Color palettes for the new packaging prototypes were designed based on an analysis and modification of existing color palettes found in various brands of organic cereals. A brief analysis of existing color palettes by the researcher revealed that certain warm and cold colors are used frequently on organic cereal packaging. Therefore, colors used on the packages of twelve commonly seen organic cereals were studied and modified into the compilation of new color palettes for prototypes. The analysis of existing colors on cereal packages was conducted in the following way: First, all chosen cereal packages' front covers were put into a 40x40 grid (*Figure 7*) to calculate percentage of primary and second colors on those covers (*Figure 8*).

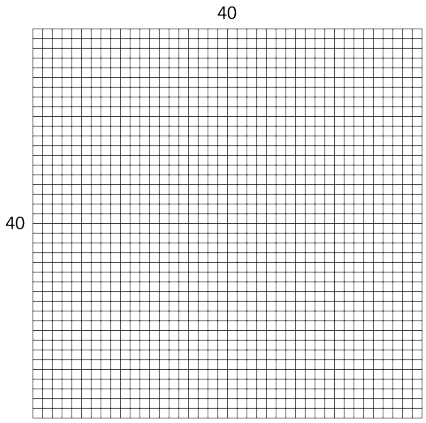


***Figure** 7. A 40 by 40 grid for calculation of color percentage*

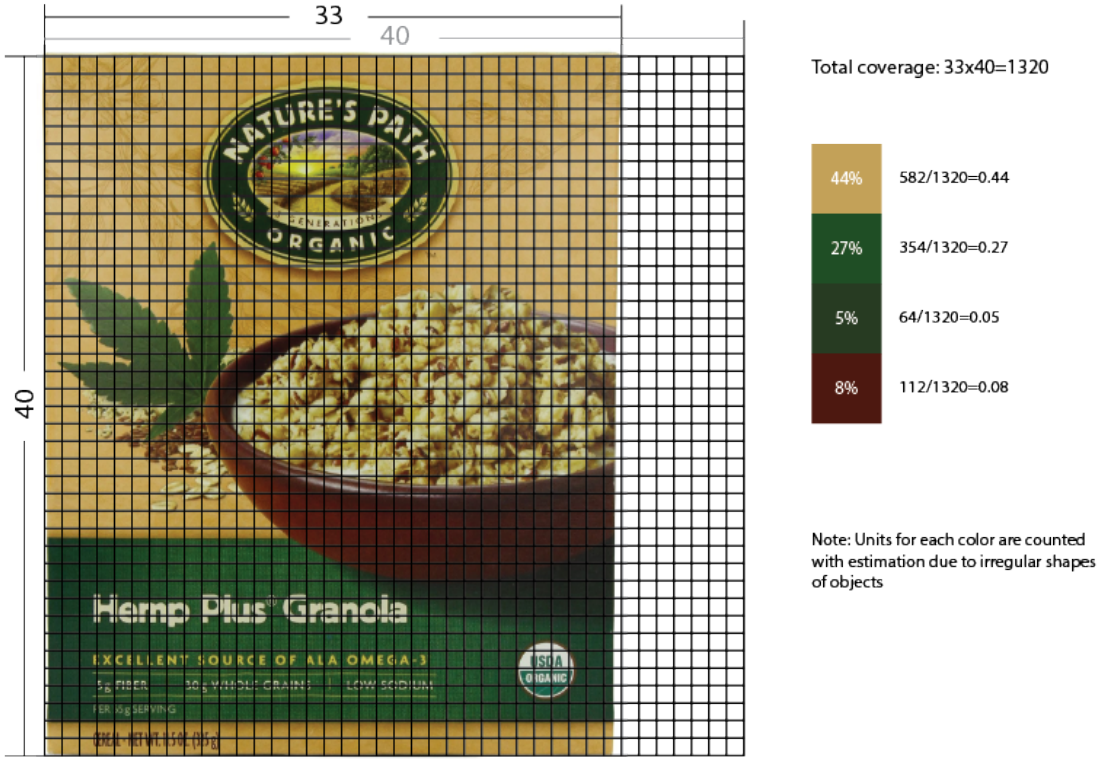


***Figure 8.** Calculation of color percentage on chosen cereal package front cover*

After calculation of percentage of colors on all chosen cereal package covers, colors with a coverage of 10 percent and more were chosen as potential candidates for new color palettes (*Figure 9*).

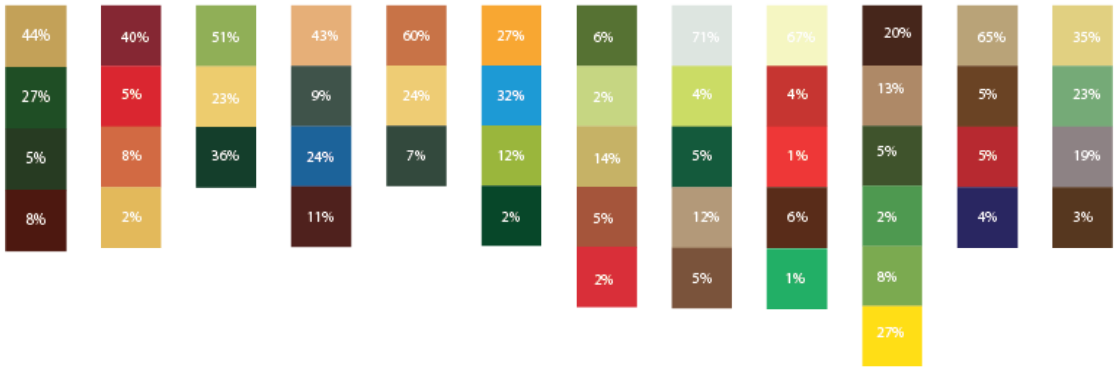


Figure 9. *Color percentage from twelve cereal package covers (See Appendix III for all cover photos)*

In the end, four color palettes were modified and compiled from existing colors on front covers of chosen organic cereal packages (*Figure 10-13*). These four color palettes were then divided into two color sets; one set is generally made of warm colors and the other made of cold colors. Each color set contains two color palettes that are different in their tones and values, though they are both warm colors. In general, one palette is brighter and another palette is darker in value. The purpose to create such a difference in value is to test people's sensory responses to color variations in the color set.

Figure 10. *Warm color palette 1 (color variation 1)*

Figure 11. *Warm color palette 2 (color variation 2)*

Figure 12. *Cold color palette 1 (color variation 3)*

Figure 13. *Cold color palette 2 (color variation 4)*

3.3.2 Material selection

A brief research on packaging materials used in existing organic cereal packaging showed that cardboard, thick paper, and plastics are the major materials used for packages with some variations. For example, the cardboard surface can be smooth to rough. For plastics, visibility varies from full transparency, to partial transparency, to opaque. Therefore, the prototype materials were designed into three types: cardboard smooth, cardboard rough, and plastic. Thick paper was not chosen because its surface mostly feels the same as smooth cardboard. As a result, two cereal boxes were made of smooth and rough cardboard respectively and one plastic bag with full transparency was made as physical prototypes, and they were included in packaging prototypes group 1 (*Figure 14*). They were presented to participants to touch and feel in the study. However, due to printing limitation, the other packaging prototypes with colors and images were designed only as computer mockup, and the participants were asked to look at them from a big computer screen and "feel" them visually.

Figure 14. *Physical material prototypes (left to right: rough cardboard, smooth cardboard, plastic)*

3.3.3 Package image design

A study on existing cover design of organic cereals showed that graphic styles on cereal packaging covers generally falls into two types: one is a product photo dominant design, another is an illustration dominant design.

Figure 15. *(left) photo dominant design* *(right) illustration dominant design*

To test people's emotional responses about these two different graphic styles, images used on prototypes were also designed into two types; one was an illustration of wheat heads, another was a manipulated photo of wheat heads. Choosing raw materials that produce cereals, such as wheat heads, instead of the actual products is because existing products of cereals are manufactured into various shapes, and it is hard to decide which one is better to be used for the study. In addition, the wheat heads picture often reminds people of natural environments in which organic cereals originally grow and

come from and may add some emotional feeling of being healthy to the package. Four color palettes were applied to designed images with simple, striped backgrounds (*Figures 16-17*). Although typography is a major design element on existing cereal packages, it was designed minimally on prototypes to eliminate influence on other design elements on the package when eliciting participants' emotional and sensory responses. As a result, the final designs are as follows:

Figure 16. *Computer mock-up prototypes: manipulated photos in four color palettes*

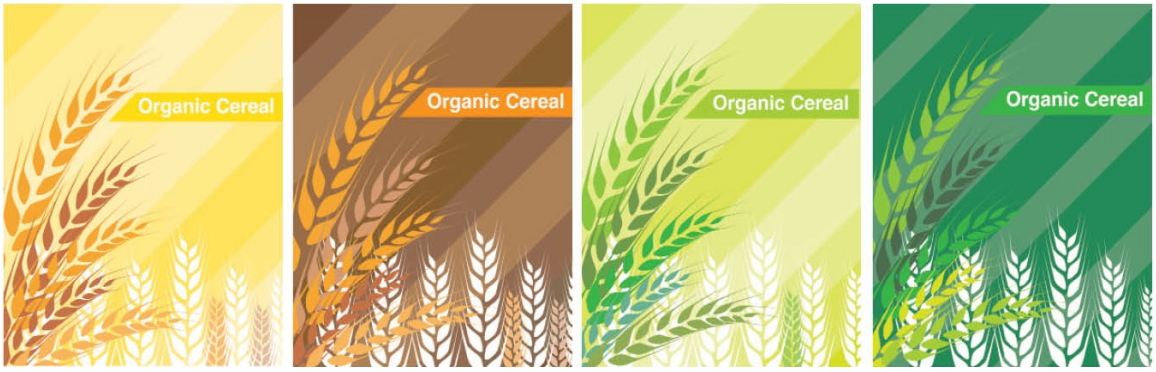


Figure 17. *Computer mock-up prototypes: illustrations in four color palettes*

3.3.4 Prototypes and test groups

Design of prototypes in test groups was mainly based on research questions and aimed to discover people's sensory and emotional responses to different colors, materials, and images on organic cereals packages. In general, 33 prototypes were designed and divided into 9 test groups. Their specifications and test objectives are as follows:

Test 1.

Objective: Sensory and emotional responses to different physical materials

Prototype 1*. Rough cardboard,

Prototype 2*. Smooth cardboard,

Prototype 3*. Transparent plastic,

Figure 18. *Physical prototypes in three different materials*

Test 2.

Objective: Sensory and emotional responses to photos on smooth cardboard in four colors

Prototype 4. Smooth cardboard, Photo with color palette 1.

Prototype 5. Smooth cardboard, Photo with color palette 2.

Prototype 6. Smooth cardboard, Photo with color palette 3

Prototype 7. Smooth cardboard, Photo with color palette 4.

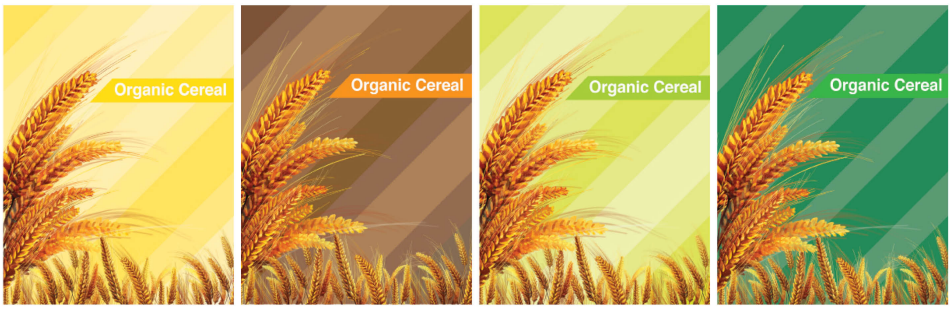


Figure 19. *Computer mock-up prototypes, Test 2*

Test 3.

Objective: Sensory and emotional responses to illustrations on smooth cardboard in four colors

Prototype 8. Smooth cardboard, illustration with color palette 1.

Prototype 9. Smooth cardboard, illustration, with color palette 2.

Prototype 10. Smooth cardboard, illustration, with color palette 3

Prototype 11. Smooth cardboard, illustration, with color palette 4

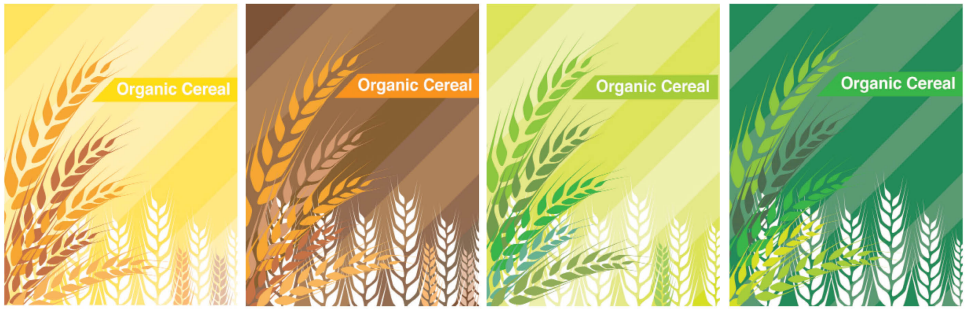


Figure 20. *Computer mock-up prototypes, Test 3*

Test 4.

Objective: Sensory and emotional responses to photos on rough cardboard in four colors

Prototype 12. Rough cardboard, Photo with color palette 1.

Prototype 13. Rough cardboard, Photo with color palette 2.

Prototype 14. Rough cardboard, Photo with color palette 3

Prototype 15. Rough cardboard, Photo with color palette 4.

Figure 21. *Computer mock-up prototypes, Test 4*

Test 5.

Objective: Sensory and emotional responses to illustrations on rough cardboard in four colors

Prototype 16. Rough cardboard, illustration with color palette 1.

Prototype 17. Rough cardboard, illustration, with color palette 2.

Prototype 18. Rough cardboard, illustration, with color palette 3

Prototype 19. Rough cardboard, illustration, with color palette 4

Figure 22. *Computer mock-up prototypes, Test 5*

Test 6.

Objective: Sensory and emotional responses to photos on opaque plastic in four colors

Prototype 20. Opaque plastic, Photo with color palette 1.

Prototype 21. Opaque plastic, Photo with color palette 2.

Prototype 22. Opaque plastic, Photo, with color palette 3.

Prototype 23. Opaque plastic, Photo, with color palette 4.

Figure 23. *Computer mock-up prototypes, Test 6*

Test 7.

Objective: Sensory and emotional responses to illustrations on opaque plastic in four colors

Prototype 24. Opaque plastic, Illustration with color palette 1.

Prototype 25. Opaque plastic, Illustration with color palette 2.

Prototype 26. Opaque plastic, Illustration with color palette 3.

Prototype 27. Opaque plastic, Illustration with color palette 4.

Figure 24. Computer mock-up prototypes, Test 7

Test 8. Objective: Sensory and emotional responses to photos on plastic of different transparency styles

Prototype 28. Opaque plastic, Photo with color palette 4*

Prototype 29. Partial transparent plastic, Photo with color palette 4*

Prototype 30. Full transparent plastic, Photo with color palette 4*

Figure 25. *Computer mock-up prototypes, Test 8*
*(*color palette 4 was randomly assigned for the prototypes in this test)*

Test 9. Objective: Sensory and emotional responses to photos on plastic of different transparency styles

Prototype 31. Opaque plastic, Illustration with color palette 4*

Prototype 32. Partial transparent plastic, Illustration with color palette 4*

Prototype 33. Full transparent plastic, Illustration with color palette 4*

Figure 26. *Computer mock-up prototypes, Test 9*
*(*color palette 4 was randomly assigned for the prototypes in this test)*

3.4 Prototypes evaluation procedure

After the design of 33 prototypes, the researcher wanted to find out how design elements such as color, material, and imagery style in those prototypes affected people's sensory and emotional responses when they were touching and seeing a package. For that purpose, 22 participants were recruited as potential users to evaluate those prototypes and give their feedback. During their participation, each user was given nine copies of prototype evaluation forms with previously chosen Kansei words divided into two groups of sensory and emotional feelings, respectively. Then, eight prototype groups were displayed to them on a large Mac computer screen, except prototype group 1, which is physical and can be touched by them. The participants were asked to rank the strength of the Kansei words when they saw prototypes in each prototype group. The evaluation forms were collected at the end of their participation and used for statistical analysis.

3.4.1 Participants

Since organic cereals are consumed by adults of all ages, there is no strict limitation to participants' ages for the study, so anyone over 18 years old is eligible for the study. The participants were recruited mostly from the researcher's friends,

classmates, and office co-workers and were of diverse educational backgrounds and different organic food consumption experiences. In total, 22 people participated the study. The age of the participants ranged from 18 to 67, with a majority of them from 18-23 (10 out of 22). 9 participants were male and 13 female. The participants came mainly from two cultural origins (Asia and North America), and all of them had higher levels of education. 10 participants had or are working on a major related to art and design and the remaining 12 had majors in various disciplines (Chemistry, IE, Engineering, Kinesiology, Psychology, etc.). As for organic food consumption experience, 15 participants buy organic food on a weekly or monthly basis and the other 7 participants hadn't any organic food consumption experiences *(Table 5).*

Table 5. *Participants' demographic information*

1	**Age**	
	18- 23	N=10
	24-29	N=5
	30-35	N=1
	36-41	N=1
	42- 47	N=1
	49-53	N=2
	54-59	
	60-65	N=1
	65+	N=1
2	**Gender**	
	Male	N=9
	Female	N=13
3	**Native language**	
	English	N=11
	Chinese	N=10
	Korean	N=1
4	**Education**	
	High school	
	Undergraduate	N=5
	College Graduate	N=8
	Advanced Degree	N=9
5	**Cultural background**	
	North America	N=10
	South America	
	Europe	
	Asia	N=12
	pacific	

	Africa	
6	**Education background**	
	Art-related	N=2
	Design-related	N=8
	Other	N=11
	Psychology, MBA, Education, Science, Linguistics, Meteorology, Chemistry, IE, Engineering, Kinesiology, Global Resources Systems and Economics,	
7	**Occupation**	
	Creative director, Student (15), Graphic designer, Lecturer, Teacher, Advisor, Researcher, Adjunct instructor	
8	**Do you buy organic foods in grocery stores?**	
	Yes	N=15
	No	N=7
	if Yes, please specify what categories of organic foods _____	
	Vegetable, milk, fruits, egg, soymilk, flour, meat, grains, cookies, juice, pasta, cereals	
	if No, please briefly give your reasons_____	
	Too expensive	N=5
	N/A	N=2

3.4.2 Procedures of prototype evaluation

After recruitment, participants were contacted by the researcher with details of the study via informed consent form. They were notified with exact time and location for their participation. On the date of their participation in the study, they were required to sign a printed consent form. After that, the researcher briefly introduced the prototype evaluation process to them and answered their questions. The evaluation then began, and the participants were shown with prototypes in both physical forms (prototype group 1) and computer mockup pictures (Tests 2-9). For computer mockup of prototype pictures, a large screen Mac computer was used to ensure the pictures were displayed in accurate colors and were large enough with details.

Figure 27. *Prototype evaluation environment and setup*

While viewing prototypes in each prototype group, participants were required to fill out one evaluation form to record their sensory and emotional responses to those prototypes, which were measured by Kansei words. They were asked to rank the strength of each Kansei word in a numerical scale for prototypes in each prototype group with number (1) indicating the strongest senses and emotions and (5) indicating the weakest. For example, if there are four prototypes in one test group, they need to give numbers 1-4 to rank the strength of senses and emotions they feel from each prototype in terms of Kansei words . If there are only three prototypes in one group, they just gave numbers 1-3 to rank the strength of Kansei words for the three prototypes. In total, participants needed to fill out 9 evaluation forms corresponding to 9 prototype test groups. *(Please see Appendix 1 for evaluation form in detail).*

CHAPTER 4

DATA ANALYSIS AND RESULTS

4.1 Analysis of Prototype Evaluation Data

Data collected from study participants' prototype evaluation sheets were input into computer and analyzed by IBM Statistical Package for the Social Sciences (SPSS). In order to seek answers to three research questions, several statistical analyses were conducted. Specifically, the researcher did the following six comparisons with collected data to seek statistical significance in the difference between different groups of prototypes:

1. Difference among four different color palettes*. (Friedman test)*
2. Difference between photos and illustrations. *(Wilcoxon test)*
3. Difference among physical materials. *(Friedman test)*
4. Difference among virtual (computer mockup) materials. *(Kruskal-Wallis one way ANOVA)*
5. Difference in statistical significance of physical and virtual materials
6. Difference among three transparency styles in virtual plastic material *(Friedman test)*

Three different types of statistical analysis were conducted to run data for different comparison purposes due to the nature of the data. Since all data collected were from a ranking-based evaluation system, only nonparametric statistical analysis can be conducted on those data. Specifically, within the category of nonparametric statistical analysis, a Friedman test was carried out to seek statistical

significance from a single group of samples and was applied to comparison 1 (color palette test), comparison 3 (physical material test), and comparison 6 (plastic material transparency style test). A Wilcoxon test was used to seek statistical significance between matched pairs of samples and was used on comparison 2 (imagery style test). A Kruskal-Wallis one way ANOVA test was conducted to seek statistical significance between independent groups of samples (more than 2 groups) and was used on comparison 4 (three computer mockup material tests). Results from those tests are reported below.

Comparison 1. Difference among four different color palettes*. (Friedman test)*

Friedman test was conducted to run analysis to seek statistical significance in the difference among four different color palettes used on prototypes. The result shows that there is very strong statistical significance (sig. <0.05, highlighted in yellow in tables) in the difference among four color palettes regarding most Kansei words in the following six tests (see page 42 for test specifics):

Test 2. Photos on smooth cardboard in four colors (Table 6-1)

Table 6-1. *Friedman test of photos on smooth cardboard in four colors*

Kansei Words	Mean Rank				Sig.
	Color 1	Color 2	Color 3	Color 4	
Sensory perceptions					
Crunchy	1.95	2.27	2.23	3.55	.000
Crispy	1.64	2.77	2.09	3.50	.000
Sweet	2.18	2.64	2.27	2.91	.215
Tasty	2.00	2.82	1.77	3.41	.000
Warm	1.68	2.23	2.68	3.41	.000
Cold	3.32	2.91	2.23	1.55	.000
Filling	2.23	1.82	2.86	3.09	.004
Emotional perceptions					
Fresh	2.41	3.64	1.32	2.64	.000
Healthy	2.32	3.41	1.45	2.82	.000
Organic	2.32	3.05	1.68	2.95	.001
Good Value	2.05	2.55	2.55	3.23	.011
Comfortable	2.00	3.00	1.68	3.32	.000

Enjoyable	1.77	3.18	1.68	3.36	.000
Likeliness in purchase					
Likeliness	1.82	3.23	1.59	3.36	.000

(p<0.05)
Note: For Mean Rank, lower value means higher rank

Test 3. Illustrations on smooth cardboard in four colors (Table 6-2)

Table 6-2. *Friedman test of illustrations on smooth cardboard in four colors*

Kansei Words	Mean Rank				Sig.
	Color 1	Color 2	Color 3	Color 4	
Sensory perceptions					
Crunchy	1.68	2.41	2.55	3.36	.000
Crispy	1.68	2.95	2.09	3.27	.000
Sweet	2.45	2.59	2.18	2.77	.484
Tasty	1.73	2.77	2.23	3.27	.001
Warm	1.45	2.23	2.77	3.55	.000
Cold	3.50	2.82	2.14	1.55	.000
Filling	2.27	1.50	2.91	3.32	.000
Emotional perceptions					
Fresh	2.32	3.55	1.50	2.64	.000
Healthy	2.23	3.14	1.73	2.91	.001
Organic	2.27	3.27	1.77	2.68	.001
Good Value	1.55	2.95	2.95	3.27	.000
Comfortable	1.91	3.00	1.86	3.23	.000
Enjoyable	1.68	3.00	2.05	3.27	.000
Likeliness in purchase					
Likeliness	1.95	2.95	1.91	3.18	.001

(p<0.05) Note: For Mean Rank, lower value means higher rank

Test 4. Photos on rough cardboard in four colors (Table 6-3)

Table 6-3. *Friedman test of photos on rough cardboard in four colors*

Kansei Words	Mean Rank				Sig.
	Color 1	Color 2	Color 3	Color 4	
Sensory perceptions					
Crunchy	1.82	2.55	2.36	3.27	.003
Crispy	1.82	2.82	1.95	3.41	.000
Sweet	2.14	2.59	2.18	3.09	.050
Tasty	1.82	2.77	2.09	3.32	.000
Warm	1.55	2.32	2.45	3.68	.000
Cold	3.23	2.59	2.59	1.59	.000
Filling	2.36	1.64	2.68	3.32	.000
Emotional perceptions					
Fresh	2.14	3.36	1.68	2.82	.000
Healthy	2.23	2.86	1.86	3.05	.007
Organic	2.23	3.23	1.77	2.77	.001
Good Value	2.09	2.59	2.59	3.14	.029
Comfortable	2.00	2.55	2.27	3.18	.017
Enjoyable	1.95	2.86	2.09	3.09	.006
Likeliness in purchase					
Likeliness	1.73	2.91	2.09	3.27	.000

(p<0.05) Note: For Mean Rank, lower value means higher rank

Test 5. Illustrations on rough cardboard in four colors (Table 6-4)

Table 6-4. *Friedman test of illustrations on rough cardboard in four colors*

Kansei Words	Mean Rank				Sig.
	Color 1	Color 2	Color 3	Color 4	
Sensory perceptions					
Crunchy	1.73	2.45	2.55	3.27	.001
Crispy	1.82	2.55	2.32	3.32	.001
Sweet	1.91	2.59	2.36	3.14	.016
Tasty	1.77	2.91	2.00	3.32	.000
Warm	1.59	2.00	2.82	3.59	.000
Cold	3.32	2.82	2.32	1.55	.000
Filling	2.00	1.86	2.64	3.50	.000
Emotional perceptions					
Fresh	2.27	3.50	1.50	2.73	.000
Healthy	2.14	3.18	1.73	2.95	.000
Organic	2.27	3.23	1.64	2.86	.000
Good Value	1.77	2.82	2.82	2.95	.011
Comfortable	1.64	2.91	2.36	3.09	.001
Enjoyable	1.64	3.27	2.05	3.05	.000
Likeliness in purchase					
Likeliness	1.77	3.09	1.95	3.18	.000

(p<0.05)

Note: For Mean Rank, lower value means higher rank

Test 6. Photos on opaque plastic (Table 6-5)

Table 6-5. *Friedman test of photos on opaque plastic in four colors*

Kansei Words	Mean Rank				Sig.
	Color 1	Color 2	Color 3	Color 4	
Sensory perceptions					
Crunchy	1.68	2.59	2.27	3.45	.000
Crispy	1.64	3.00	2.00	3.36	.000
Sweet	2.32	2.41	2.45	2.82	.591
Tasty	1.95	2.64	2.18	3.23	.006
Warm	1.64	2.27	2.45	3.64	.000
Cold	3.27	2.73	2.27	1.73	.001
Filling	2.05	1.73	2.95	3.27	.000
Emotional perceptions					
Fresh	2.09	3.50	1.41	3.00	.000
Healthy	2.41	2.95	1.59	3.05	.001
Organic	2.27	3.14	1.77	2.82	.002
Good Value	2.05	2.73	2.73	2.95	.078
Comfortable	1.73	3.18	1.73	3.36	.000
Enjoyable	1.68	3.05	2.00	3.27	.000
Likeliness in purchase					
Likeliness	2.00	3.18	1.64	3.18	.000

(p<0.05)

Note: For Mean Rank, lower value means higher rank

Test 7. Illustrations on opaque plastic (Table 6-6)

Table 6-6. *Friedman test of illustrations on opaque plastic in four colors*

Kansei Words	Mean Rank				Sig.
	Color 1	Color 2	Color 3	Color 4	
Sensory perceptions					
Crunchy	1.86	2.36	2.27	3.50	.000
Crispy	1.64	2.95	1.95	3.45	.000
Sweet	2.00	2.32	2.64	3.05	.048
Tasty	1.91	2.73	2.00	3.36	.000
Warm	1.45	2.18	2.77	3.59	.000
Cold	3.36	2.86	2.09	1.68	.000
Fresh	2.23	3.50	1.50	2.77	.000
Filling	2.23	1.50	3.05	3.23	.000
Emotional perceptions					
Healthy	2.64	3.32	1.41	2.64	.000
Organic	2.55	3.14	1.59	2.73	.001
Good Value	1.91	2.86	2.86	3.18	.002
Comfortable	1.82	3.00	1.95	3.23	.000
Enjoyable	1.82	2.91	2.09	3.18	.001
Likeliness in purchase					
Likeliness	1.82	3.09	1.68	3.41	.000

(p<0.05)

Note: For Mean Rank, lower value means higher rank

Data of the tests show that most Kansei words in all six tests are statistically significant regarding difference in four colors except the following word: sweet (sig. = .215) in Test 2, sweet (sig.= .484) in Test 3, and sweet (sig.= . 591) in Test 6. The data also show that color palette 1. and color palette 3. have generally higher ranks (lower value of mean rank in Tables) than color palette 2. and color palette 4. in all six tests in terms of likeliness in purchase, which suggests that they were more favored by the participants.

Comparison 2. Difference between photos and illustrations *(Wilcoxon test)*

This comparison aimed to seek statistical significance in difference between photos and illustrations on four different types of virtual materials respectively: rough cardboard, smooth cardboard, opaque plastic, plastic of different transparencies. Specifically, Kansei words in Test 2 (photos on smooth cardboard) and Test 3 (illustrations on smooth cardboard), Test 4 (photos on rough cardboard)

and Test 5 (illustrations on rough cardboard), Test 6 (photos on opaque plastic) and Test 7 (illustrations on opaque plastic), and Test 8 (photos on plastic of different transparencies) and Test 9 (illustrations on plastic of different transparencies) were compared in pairs respectively. Data from analysis show different results in four test pairs, and only some of the Kansei words show statistical significance in the difference between photos and illustrations of the four types of materials, and they were selected and compiled into tables for comparisons below. Full data of comparison are available in Appendix V.

For Test 2 and 3 comparison, photos and illustrations on smooth cardboard (Table 7-1), statistical significance was found in Kansei words tasty (sig.=.043), fresh (sig.=.046), enjoyable(sig.=.046), and likeliness of purchase (sig.=.035) in color palette 3  , and good value (sig.=.039) in color palette 2  . Mean rank in the table shows that photos on smooth cardboard have higher ranks (lower in value) than illustrations on the same material in Kansei words and suggests that photos were more favored than illustrations on smooth cardboard for certain Kansei words.

Table 7-1. *Statistically significant Kansei words from comparison of photos and illustrations on smooth cardboard*

Kansei words	Mean rank		Z	Asymp. Sig. (2-tailed)
	Test 2. Photo	Test 3. Illustration		
Tasty C**	1.77	2.23	-2.027b	.043
Fresh C**	1.32	1.50	-2.000b	.046
Good value B*	2.55	2.95	-2.066b	.039
Enjoyable C**	1.68	2.05	-1.999b	.046
Likeliness C**	1.59	1.91	-2.111b	.035

Note: p<0.05, *B=Color palette 2, **C=Color palette 3

For Test 4 and 5 comparison, photos and illustrations on rough cardboard (Table 7-2), statistical significance was found in Kansei words warm (sig.=.046) and cold

(sig.=.034) in color palette 3  , comfortable (sig.=.011) in color palette 1  , and enjoyable (sig.=.046) in color palette 2  . Mean rank shows that photos were more favored in Kansei words warm (2.45) in color palette 3 and enjoyable (2.00) in color palette 2, while illustrations were more favored in Kansei words cold (2.32) in color palette 3 and comfortable (1.64) in color palette 1.

Table 7-2. *Statistically significant Kansei words from comparison of photos and illustrations on rough cardboard*

Kansei words	Mean rank		Z	Asymp. Sig. (2-tailed)
	Test 4. Photo	Test 5. Illustration		
Warm C* **	2.45	2.82	-1.999b	.046
Cold C* **	2.59	2.32	-2.121a	.034
Comfortable A*	2.00	1.64	-2.530a	.011
Enjoyable B**	2.86	3.27	-1.998b	.046

Note: p<0.05, *A=Color palette 1, **B=Color palette 2, ***C=Color palette 3

For Test 6 and 7 comparison, photos and illustrations on opaque plastic, statistical significance was not found in all Kansei words, which suggests photos and illustrations may produce similar emotional and sensory responses in the participants.

For Test 8 and 9 comparison, photos and illustrations on three different transparency styles of plastic material (opaque, opaque with a clear window, fully clear), statistical significance was found in Kansei words tasty (sig.= .046) on opaque plastic, enjoyable (sig.= .014) on opaque plastic with a clear window, comfortable (sig.= .030) and enjoyable (sig.= .024) on clear plastic. Mean rank shows that photos were more favored on opaque plastic for tasty (2.64) and on opaque plastic with a clear window for enjoyable (1.32), while illustrations were more favored on clear plastic for comfortable (1.86) and enjoyable (1.82).

Table 7-3. *Statistically significant Kansei words from comparison of photos and illustrations on plastic of different transparency styles*

Kansei words	Mean rank		Z	Asymp. Sig. (2-tailed)
	Test 8. Photo	Test 9. Illustration		
Tasty A*	2.64	2.82	-2.000b	.046
Enjoyable B**	1.32	1.59	-2.449b	.014
Comfortable C***	2.27	1.86	-2.165a	.030
Enjoyable C***	2.23	1.82	-2.251a	.024

Note: p<0.05, *A=Opaque plastic, **B=Opaque plastic w/ a clear window, ***C=clear plastic

Results of imagery test suggested that, on three computer-simulated textures, smooth cardboard, rough cardboard, and plastic, there is generally not much difference between photo and illustration in terms of most Kansei words.

Comparison 3. Difference among physical materials *(Friedman test)*

Three physical materials, smooth cardboard, rough cardboard, and clear plastic, were tested for this comparison, and statistical significance in difference was found in Kansei words sweet (sig.= .028), comfortable (sig.= .002), and likeliness in purchase (sig.= .009) on smooth cardboard, warm (sig.= .001), healthy (sig.= .022), and organic (sig.= .002) on rough cardboard, and cold (sig.= .001) on clear plastic (Table 8). Specifically, rough cardboard ranks higher than the other two materials in Kansei words warm (1.36), healthy (1.64), and organic (1.50). Smooth cardboard ranks higher than the other two materials in Kansei words sweet (1.55), comfortable (1.59), and likeliness in purchase (1.59). Clear plastic ranks higher than the other two materials in Kansei word cold (1.64).

Table 8. *Statistically significant Kansei words from comparison of photos and illustrations on three physical materials*

Kansei words	Mean Rank*			Chi-Square	df	Asymp. Sig.
	Rough	Smooth	Plastic			
Sensory perceptions						
Crunch	1.91	2.27	1.82	2.545	2	.280
Crispy	2.00	2.00	2.00	.000	2	1.000
Sweet	2.14	1.55	2.32	7.182	2	.028
Tasty	2.05	1.68	2.27	3.909	2	.142
Warm	1.36	2.14	2.50	14.818	2	.001
Cold	2.64	1.73	1.64	13.455	2	.001
Filling	1.77	2.09	2.14	1.727	2	.422
Emotional perceptions						
Fresh	2.32	1.91	1.77	3.545	2	.170
Healthy	1.64	1.91	2.45	7.636	2	.022
Organic	1.50	1.95	2.55	12.091	2	.002
Good Value	2.00	1.68	2.32	4.455	2	.108
Comfortable	1.82	1.59	2.59	12.091	2	.002
Enjoyable	1.86	1.73	2.41	5.727	2	.057
Likeliness in purchase						
Likeliness	1.91	1.59	2.50	9.364	2	.009

Note: $p<0.05$, *lower values in mean rank indicate higher ranks in perceptions

Comparison 4. Difference among virtual (computer mockup) materials *(Kruskal-Wallis one way ANOVA)*

This comparison aimed to seek statistical significance in difference among three virtual (computer mock) materials: rough cardboard, smooth cardboard, and opaque plastic. Since data contain independent groups of samples (more than 2 groups), a Kruskal-Wallis one way ANOVA test was conducted to analyze the data. However, the analysis result shows that there isn't any statistical significance in difference in all Kansei words, which is quite different from the test result of physical materials (See Appendix VI for full results in table). One possible reason is that, without tactile feeling, computer simulated materials may not generate as strong sensory and emotional feelings as those by real physical materials.

Comparison 5. Difference in statistical significance of physical and virtual materials in Kansei words

The initial objective for this comparison is to seek some similarity in statistically significant Kansei words from results of both physical material and virtual material comparisons. However, since there is no statistical significance in difference found in all Kansei words from the comparison of virtual materials, similarities couldn't be found in statistically significant Kansei words between physical and virtual materials. Some possible reasons can be as follows: First, the physical materials can be touched directly, and participants relied on their tactile feelings to get their sensory and emotional perceptions of the product, while virtual materials can only be seen through computer screen and all tactile feelings will be imagined through participants' visuals. Second, the physical materials have nothing on them while the virtual materials have designs on them. Such a difference may bring different sensory and emotional perceptions to the participants and make their responses hard to measure.

Comparison 6. Difference among three transparency styles in virtual plastic material (Friedman test)

Three different transparency styles of plastic (opaque, opaque with a clear window, fully clear) were tested for this comparison. Since those plastic prototypes have designs on them, they were divided into two groups: one with photos on them and another with illustrations on them. Friedman test was conducted for each group to measure statistical significance in difference within sample group. For photo

group (Table 9-1), the result shows that all Kansei words, except good value (sig.= .142), have statistical significance (p< .05) among three different transparency styles. Mean rank value shows that the participants felt stronger perception of cold (1.27) on opaque plastic than on the other two transparency styles. On the opaque plastic with a clear window, Kansei words sweet (1.68), tasty (1.50), comfortable (1.41), enjoyable (1.32), and likeliness in purchase (1.32) were stronger in perception than the other two transparency styles. On full clear plastic, Kansei words crunchy (1.36), crispy (1.59), warm (1.45), fresh (1.41), filling (1.27), and healthy (1.45) were stronger than the other two plastic styles. On both opaque plastic with a clear window and full clear plastic, Kansei word organic (1.64) received the same strength in perception, and stronger than that on opaque plastic.

Table 9-1. *Statistical significance in three transparency styles of plastic with photos on them*

Three Different Plastic Prototypes (Photo Group)

Kansei words	Mean Rank			Chi-Square	df	Asymp. Sig.
	Opaque	Partial*	Clear			
Sensory perceptions						
Crunchy	2.77	1.86	1.36	22.455	2	.000
Crispy	2.59	1.82	1.59	12.091	2	.002
Sweet	1.77	1.68	2.55	9.909	2	.007
Tasty	2.64	1.50	1.86	14.818	2	.001
Warm	2.73	1.82	1.45	18.909	2	.000
Cold	1.27	2.00	2.73	23.273	2	.000
Filling	2.82	1.91	1.27	26.545	2	.000
Emotional perceptions						
Fresh	2.77	1.82	1.41	21.545	2	.000
Healthy	2.82	1.73	1.45	22.909	2	.000
Organic	2.73	1.64	1.64	17.455	2	.000
Good Value	2.32	1.73	1.95	3.909	2	.142
Comfortable	2.32	1.41	2.27	11.545	2	.003
Enjoyable	2.45	1.32	2.23	15.909	2	.000
Likeliness in purchase						
Likeliness	2.73	1.32	1.95	21.909	2	.000

Note: p<.05. For transparency styles, lower value means higher rank. *opaque w/ a clear window

For the illustration group, statistical significance in difference (p< .05) was also found in all Kansei words, except crispy (sig.= .113), on all three different transparency styles of plastic (Table 9-2). Mean rank value shows that, on opaque plastic, cold (1.14) was the strongest perception felt by the participants among three transparency styles. On the opaque plastic with a clear window, Kansei words sweet (1.68), tasty (1.55), good value (1.55), comfortable (1.59), enjoyable (1.59), and likeliness in purchase (1.55) are stronger in sensory and emotional perceptions than on the other two transparency styles. On the full clear plastic, crunchy (1.55), warm (1.18), filling (1.18), fresh (1.32), healthy (1.50), and organic (1.36) produce stronger sensory and emotional perceptions than on the other two transparency styles.

Table 9-2. *Statistical significance in three transparency styles of plastic with illustrations on them*

Three Different Plastic Prototypes (Illustration Group)

Kansei words	Mean Rank			Chi-Square	df	Asymp. Sig.
	Opaque	Partial*	Clear			
Sensory perceptions						
Crunchy	2.68	1.77	1.55	15.909	2	.000
Crispy	2.36	1.82	1.82	4.364	2	.113
Sweet	1.86	1.68	2.45	7.182	2	.028
Tasty	2.82	1.55	1.64	22.182	2	.000
Warm	2.86	1.95	1.18	31.182	2	.000
Cold	1.14	1.95	2.91	34.636	2	.000
Filling	2.86	1.95	1.18	31.182	2	.000
Emotional perceptions						
Fresh	2.91	1.77	1.32	29.545	2	.000
Healthy	2.86	1.64	1.50	24.818	2	.000
Organic	2.91	1.73	1.36	28.727	2	.000
Good Value	2.41	1.55	2.05	8.273	2	.016
Comfortable	2.55	1.59	1.86	10.636	2	.005
Enjoyable	2.59	1.59	1.82	12.091	2	.002
Emotional perceptions						
Likeliness	2.82	1.55	1.64	22.182	2	.000

Note: p<.05. For transparency styles, lower value means higher rank. *opaque w/ a clear window

4.2 Summary of Prototype Evaluation Data Analysis

Combined results from comparisons of three transparency styles suggest that the opaque plastic prototype is the least favored type in producing sensory and emotional perceptions on most Kansei words. One reason may be, according to participants' feedback, that the opaque plastic didn't allow them to see the product inside and reduced their sensory and emotional perceptions. By comparison, opaque plastic with a clear window prototype is the most favored type in terms of likeliness in purchase and produced the strongest sensory and emotional perceptions in sweet, tasty, comfortable, and enjoyable. The reason is that it allowed participants to see part of the product inside and made them feel comfortable with purchase. Fully clear plastic prototype shows the most of the product to participants and also generated strong sensory and emotional feelings in terms of crunchy, warm, filling, fresh, and healthy, the majority of which may be produced from perceptions of looking at the product.

4.3 Analysis of Participants' Feedback on Least Favored Prototypes

In the study, the participants were asked to give their brief reasons for prototypes that were least favored and not chosen by them. Their comments provided valuable information for the study and were analyzed briefly to seek connections between design elements on prototypes and the sensory and emotional perceptions produced by them. The following is a summary of participants' comments collected from their evaluation of physical materials, color palettes, and plastic of different transparency styles.

In terms of physical materials used in the study, clear plastic was the least favored material by participants, and products packaged by it wouldn't be purchased by a majority of participants. The primary reasons for this, according to the feedback, are the following: First, plastic looked cheap, inexpensive, and gave participants a feeling of low quality compared with rough and smooth cardboards. Second, plastic also gave participants a feeling of lacking protection and being hard to handle as well as environmentally unfriendly. *(Table 10-1)*

Table 10-1. *Reasons for the least likely to purchase prototype in Test 1. Physical materials*

User	Gender	Reasons for the least likely to purchase packaging prototype
1	F	rough paper looks too earthy, too much effort to eat, more expensive
2	F	plastic looks low quality, not environment friendly
3	M	plastic not organize well on shelf
4	F	plastic low quality, not healthy
5	F	plastic low quality
6	F	plastic not protective and easy to crush
7	M	rough paper seems more costly
8	F	too simple
9	M	plastic cannot be recycled
10	F	rough paper looks more expensive
11	M	plastic looks fresh inside
12	M	plastic hard to handle
13	F	smooth paper is normal, not easy to distinguish from others
14	M	plastic looks not so clean
15	F	plastic looks inexpensive, not well packaged, less quality product
16	F	plastic reminds of cheap knock-off products, not appealing
17	F	rough paper is unfamiliar
18	M	plastic seems inefficient, not able to get as much product
19	F	plastic might not be safe
20	M	rough paper looks too healthy
21	M	rough paper looks like chemical stuff inside, cannot see what's inside
22	F	plastic seems cheap and without protection

Interestingly, reasons for not choosing clear plastic vary by gender. Female participants were concerned mostly for the cheapness and low quality expressed from the plastic material, while male participants were concerned more about other

issues, such as handling, containment efficiency, recycling, and cleanness, which indicates that gender difference can be an important factor in making a purchase decision.

In terms of color palettes used in the study, participants' feedback suggests the following findings: 1. Personal color preferences played a great role in participants' choice of prototypes with colors. 2. Participants' color preferences were often related to their prior experiences with food and other living experiences. 3. Dark color palettes were the least favored ones by participants in terms of healthy and organic. In this study, particularly, color palette 2  and 4  were the least favored color palettes. For color palette 2  , the dark brown and yellow colors in it reminded some participants of colors of chocolates and gave them an unfamiliar sensory and emotional experience when connected to organic cereal. For color palette 4  , some participants mentioned that the dark green looked unappealing and its high saturation conveyed information of being artificially flavored and therefore were opposite to being healthy and organic. Some participants also mentioned that the dark green gave them a feeling of being stale or moldy according to their prior experiences. *(See Appendix VII for full text of reasons for least chosen prototypes regarding color palettes and other tests.)*

In terms of three different transparency styles of plastic materials, participants' feedback shows that opaque plastic was the least favored type of packaging prototype for organic cereals. The major reason for it is that opaque plastic wouldn't allow participants to see the product inside and so they didn't know

about the quality of product inside. Therefore, they were not sure about what they would get for their money. *(Table 10-2)*

Table 10-2. *Reasons for the least likely to purchase prototype in Test 8. Different transparency styles*

User	Gender	Reasons for the least likely to purchase packaging prototype
1	F	can't see product
2	F	value looks worst
3	M	hides too much, like to see what's inside
4	F	doesn't look healthy due to non-transparency
5	F	seals too much
6	F	can't see product
7	M	no deco with all transparent exposure
8	F	can't see product, not sure about quality
9	M	design is too simple
10	F	unable to see what you are getting for your money
11	M	can't see product
12	M	not appealing, less designs
13	F	not appealing
14	M	looks not fresh, less content
15	F	like gold and brown, no green
16	F	looks like chip bag, unhealthy snack bag
17	F	prefer to see products
18	M	want to see product
19	F	hard to see what's inside
20	M	looks too healthy
21	M	can't see what's inside
22	F	seems cheap

CHAPTER 5

DISCUSSIONS

From test results and data analysis, the researcher was able to find some answers to the research questions posed at the beginning of this study.

For the first research question, “Will different packaging materials bring difference product experiences to consumers in organic cereal packages?”:
The answer is two-fold. For physical materials, the difference in packaging materials did show statistical significance in many Kansei words in terms of sensory and emotional perceptions, and that indicates the participants’ preferences of different physical materials. Specifically, rough cardboard as packaging material was more favored in generating sensory and emotional experiences like warm, healthy, and organic than other materials. Smooth cardboard was mostly favored for generating sweet, comfortable experiences and likeliness in purchase; and plastic as packaging material only generated a sensory feeling of being cold. However, in terms of different virtual materials, statistical significance was not found in most of the Kansei words, which indicates that without tactile experience, visual cues only brought limited sensory and emotional experiences to the participants.

For the second research question, "Will different color palettes bring difference product experiences to consumers in organic cereal packages?":
The answer is yes. Color did bring different packaging prototype preferences to participants during the test. Statistical significance was found in almost all Kansei words regarding different colors. And results showed that for organic cereals, color

palette 1  and color palette 3  generally were more favored by participants and generated stronger sensory and emotional experiences in Kansei words than color palette 2  and color palette 4  . During the tests, it was also found that participants' color preferences had a strong connection with their common knowledge and prior food and living experiences. For example, some didn't like color palette 4  because it felt unappealing and gave them a feeling of use of food coloring. Some even associated dark green with un-fresh, moldy food. Some others didn't like color palette 2  , feeling it's too intense, like colors of chocolates and maybe too sweet.

For the third research question, "Will different imagery styles on packaging covers bring difference product experiences to consumers in organic cereal packages?": The answer to this question is not certain based on data analysis results. Statistical significance was found in a few Kansei words on different virtual prototypes. However, since those photos and illustrations were designed together with four color palettes, it is hard to see whether those statistical differences came from the imagery styles themselves or from the different color palettes. Further studies are needed to separate the influence of colors from imagery styles.

CHAPTER 6

CONCLUSION AND IMPLICATIONS

6.1 Summary of the study

This study explored the use of design elements such as material, color, imagery, and transparency in organic cereal packaging design, in the hope to elicit positive sensory and emotional responses from consumers and thus bring better product experience to them. It also applied Kansei Engineering technology to the design and assessment of organic food packaging design to gather information of consumers' emotional and sensory responses to different packaging prototypes. Findings of the study are briefly summarized below, and their connections with previous studies are also explored in the following text.

Data and statistical analysis in the study provided information on participants' emotional and sensory responses to materials, imagery, and color palettes used in packaging prototypes. Some suggestions can be made from the data analysis result: First, in terms of physical materials, rough cardboard can provide stronger sensory and emotional perceptions of warm, healthy, and organic, while smooth cardboard gave participants stronger perceptions in sweet, comfortable, and likeliness in purchase. These findings indicate that different packaging materials can create different sensory and emotional perceptions among consumers. A similar finding is from Brown's (1982) study on packaging materials and perception of tastes, in which wrappers of different materials gave subjects different perceptions of freshness for the bread inside. Moreover, bread of different freshness (fresh, one-

day-old, two-day-old) wrapped in the same material created the same perception of freshness in subjects. Compared with the result from physical materials, data from virtual materials yielded little information on participants' emotional and sensory responses to different materials, which suggests that virtual materials may not work as effectively as physical materials in gathering emotional and sensory information from participants. Several factors may account for the ineffectiveness of virtual materials in the study. One is that virtual materials were only showed to participants on computer screens during prototype evaluation without provision of direct tactile contact with real materials, which may not work well in transferring tactual perceptions of virtual materials to the participants. The result of the virtual material test also suggests that in a texture-rich context, a cooperation of visual and tactile modalities may work better than either alone. Such a finding was very similar to what Heller (1982) discovered in her study: a bimodal of vision and touch worked better to get more accurate information from abrasive textures than single-modal alone. In the situation of the current study, participants were able to get more sensory input from physical prototypes through both visual and tactile contact with the prototypes. However, they could only get visual information from virtual prototypes, which affected their sensory and emotional perceptions greatly.

Results from the prototype color palette test in the study show stronger statistical significance in Kansei words regarding color differences, which suggests that colors play an important role in packaging design to elicit emotional and sensory responses from consumers. In the study, the test result of color palettes showed that people had general preferences for light yellow (color palette 1

) and light green (color palette 2 ) and thought they looked good on organic cereals' packaging prototypes. In contrast, the two darker color palettes 3  and 4  seemed to be less favored. One particular reason, according to participants' feedback, is that participants were prone to associate those two color palettes with their prior experiences in food consumptions, and most of those experiences were negative. For example, dark brown in color palette 2 reminded some participants of the colors of chocolates and therefore recalled in them a feeling of being too sweet and having too much sugar. Deep green from color palette 4 was associated with artificial food coloring and moldy food. Such findings suggest that people's emotional and sensory responses to different colors in food packaging associate greatly with their living experiences and familiarity with certain kinds of food, which is in accordance with findings from Mizutani's (2012) study on fruit images and their associations with taste perceptions. In that study, the apple image had higher congruity with apple juice than the peach image with peach juices because many people had more prior experience with apple juice than with peach juice.

The imagery style test result in the study shows that there isn't statistical significance in the difference between photos and illustrations used on packaging prototypes in most Kansei words, which indicates that people's sensory and emotional responses to different styles of packaging imagery may be very similar. However, further studies may be needed to test the validity of the imagery test result due to prototype designs. This is because the imagery on prototypes in the study were designed with colored palettes together and had colored backgrounds,

which may add a second variable to the test and skew the result. Therefore, it is necessary to isolate imagery from colors in a revised test to further investigate the relationship between packaging imagery and sensory and emotional responses.

The result from the plastic transparency styles test indicates that different transparency styles may bring different sensory and emotional responses to consumers. Specifically, a clear plastic package may bring stronger senses than the other two plastic packages in crunchy, crispy, fresh, healthy, warm, and organic. This is probably because participants could see the actual product through clear plastics and had a direct feeling of what was inside. Opaque plastic packaging with a clear window may bring stronger feelings in sweet, tasty, good value, comfortable, enjoyable, and likeliness in purchase. The full opaque plastic packaging prototype is the least favored one simply because it didn't show participants what was actually inside and made them feel unsure about what they would get for their money. According to participants' feedback on their preferences of packaging prototypes, opaque plastic packaging has been widely used in many conventional food storage packages such as potato chips, which made some participants associate it with cheap and unhealthy commodities. In contrast, the opaque plastic with a clear window package prototype allowed participants to see part of the product inside and get details of the actual product, and it became a favorite choice. At the same time, the package also looked more complicated than other two plastic packages and created an emotional feeling of high-end and good value in participants.

6.2 Implications of the study

It is hoped that data and results of the study can be of some use in the following ways: First, practitioners can use the study data as a source of reference in their real packaging designs of organic products regarding applications of material, imagery, color, and plastic transparency style of packages for a better product experience. Additionally, the study provides an example of Kansei Engineering application in the area of food packaging design, which currently has few Kansei Engineering cases compared to areas in the auto and electronic industries. However, it should be noted that the major goal of this research is not intended to use sensory and emotional design for marketing and branding purposes; instead, it aims to explore possibilities in eliciting and controlling consumers' sensory and emotional responses/perceptions through applications of specific design elements in product packaging, such as material, color, imagery, and transparency, and therefore enhance product experience of consumers.

CHAPTER 7

LIMITATIONS

Although this study has achieved some interesting findings during the process of its design and execution, there are some questions it failed to address. Due to the exploratory nature of the study, limitations are unavoidable, and it is noteworthy to take them into consideration and make revisions in future studies.

First, the scope of the study is a bit broad, trying to address the application of several design elements at the same time for their effectiveness in eliciting sensory and emotional responses from study participants; this increases the risk to the validity of the study result for individual design elements. One problem found in this study is that designs of color palettes and imagery styles were created together on prototypes and tested together. Results show that the color palette may have a dominant effect over imagery styles on sensory and emotional responses, and the actual result of imagery styles on emotional responses was hard to measure accurately. Therefore, it is suggested that future studies narrow the scope to one or two design elements and keep variables in the study in a controlled number or separate them as necessary so that they won't influence each other when tested for specific purposes.

Second, prototype design in the study needs to be further modified according to specific study purposes. The result from the virtual material test shows no statistical significance of different materials while the physical material test yielded a lot of statistical significance in materials for certain sensory responses. One

possible reason is that virtual materials failed to provide participants enough tactile information compared with physical materials. Therefore, it is suggested that for packaging material studies in future that physical forms may be the best solution to gather real-life information on people's sensory responses to different materials in the test. This is mainly because people still make a lot of use of their tactile feelings to sense new materials. Visual simulation of real materials only transfers limited tactile perceptions to people.

Third, for more statistical validity in the study, the participants' demography and number also need to be expanded and increased. The participants in the study were limited to the researcher's friends, classmates, and work mates only, and half of them are students with age under 25. As for their cultural background, half of them are from North America and half of them from Asia, which limits the diversity of the study. Since participants for this study are general grocery store consumers over 18, it is suggested that future studies recruit participants from a more diverse cultural and educational background and increase the diversity of participants' demography. With a sample number of 22, the study results may be skewed statistically. Therefore, a larger sample number will be needed for future studies to ensure statistical accuracy of data.

Fourth, gender differences in sensory and emotional perceptions of design elements on packaging prototypes were not explored much due to the small sample number, and there is no statistical data to measure it in the study. However, gender difference in participants' sensory and emotional responses/perceptions on packaging is a very interesting topic and deserves further studies in depth. It is

therefore suggested that future studies cover this topic specifically as a valuable addition to the main study.

REFERENCES

AlTai, A. (2012). Six Principles of Effective Packaging Design
http://www.imagemme.com/blog/six-principles-of-effective-packaging-design/

Becker, L., van Rompay, T. J. L., Schifferstein, H. N. J., & Galetzka, M. (2011). Tough package, strong taste: The influence of packaging design on taste impressions and product evaluations. Food Quality and Preference, 22, 17–23.

Brown, R. (1958). Wrapper Influence on the Perception of Freshness in Bread. Journal of Applied Psychology, Vol. 42, No. 4. 1958

Bruce, S. (1995). Cerealizing America: The Unsweetened Story of American Breakfast Cereal. *Faber & Faber; 1ST edition (March 23, 1995)*

Chandler, B. (2009). Nice package: Six principles of good packaging design. Retail World September 28 - October 9, 2009

Desmet, P. (2002). Designing Emotions. Netherlands: Delft University Press

Desmet, P. (2003). A Multilayered Model of Product Emotions, The Design Journal Vol 6, issue 2

Dettmann, R. L. (2008). Organic Produce: Who's Eating it? A Demographic Profile of Organic Produce Consumers, Economic Research Service, USDA, Selected Paper prepared for presentation at the American Agricultural Economics Association Annual meeting, Orlando, FL, July 27-29, 2008.

Dhar, R. & Seidel, K. (2012). Packaging for Organic Foods. International Trade Centre (ITC). Geneva: ITC, 2012.

Falci, L. (2006). Mass of US Breakfast Cereal Consumption
http://hypertextbook.com/facts/2006/LauraFalci.shtml

Fenko, A., Schifferstein, H. N. J., and Hekkert, P. (2009). Which senses dominate at different stages of product experience? In: Undisciplined! Design Research Society Conference 2008, Sheffield Hallam University, Sheffield, UK, 16-19 July 2008.

Frijda, N.H. (1986). The emotions. Cambridge: Cambridge University Press.

Frijda, N.H. (1994). 'Varieties of affect: emotions and episodes, moods, and sentiments.' In P. Ekman and R.J. Davidson (Eds.), The nature of emotion, fundamental questions (59-67). Oxford: Oxford University Press.

Heller, M. A. (1982). Visual and tactual texture perception: intersensory cooperation. Perception & Psychophysics, 31, 339–344.

Hoegg, J., & Alba, J. W. (2007). Taste perception: More than meets the eye. Journal of Consumer Research, 33, 490–498.

Hoffman, D. (2005). The Breakfast Cereal Gourmet. *Andrews McMeel Publishing (May 1, 2005)*

Hughner, R. S., McDonagh, P., Prothero, A., Shultz, C. J., and Stanton, J. (2007). Who are organic food consumers? A compilation and review of why people purchase organic food, Journal of Consumer Behaviour J. Consumer Behav. **6**: 94–110 (2007)

Kanamori, T., Imai, Y., Takeno, J. (2005). Extraction of 430,000 Association Words and Phrases from Internet Web Sites. Proceedings of the IEEE International Conference on Mechatronics & Automation Niagara Falls, Canada, July 2005

Krishna, A. (2010). Sensory Marketing: Research on the Sensuality of Products. Routledge; 1 edition (December 18, 2009)

Krishna, A. & Morrin, M. (2008). Does Touch Affect Taste? The Perceptual Transfer of Product Container Haptic Cues. Journal of Consumer Research, Vol. 34, No. 6 (April 2008), pp. 807-818

Lai, H-H; Lin, Y-C; Yeh, C-H; Wei, C-H. (2006). User-oriented design for the optimal combination on product design. Int. J. Production Economics 100 (2006) 253–267

Lindstrom, M. (2005). Brand Sense: How to Build Powerful Brands Through Touch, Taste, Smell, Sight and Sound. Kogan Page Ltd (February 3, 2005)

Mamaghani, N. K., Tajoddini, M. (2010). Design with emotional approach by implementing Kansei Engineering case study: Design of kettle. *International Conference on Kansei Engineering and Emotional Research 2010.*

Marlow, N., Jansson-Boyd, C. V. (2011). To touch or not to touch; that is the question. Should consumers always be encouraged to touch products, and does it always alter product perception? Psychology & Marketing, Vol. 28(3): 256–266 (March 2011)

Mizutani, N., Dan, I., Kyutoku, Y., Tsuzuki, D., Clowney, L., Kusakabe, Y., Okamoto, M., Yamanaka, T. (2012). Package images modulate flavors in memory: Incidental learning of fruit juice flavors. Food Quality and Preference 24 (2012) 92–98

Nagamachi, M. (1997). Kansei Engineering: The framework and methods. In: M. Nagamachi (Ed.) Kansei Engineering 1. Kure: Kaibundo Pulishing.

Nagamachi, M. (2002). Kansei Engineering in Consumer Product Design. Spring, 2002. Ergonomics in Design.

Nagamachi, M., Lokman, A. M. (2010). Innovations of Kansei Engineering. CRC Press; 1 edition (September 17, 2010)

Norman, D. (2004). Emotional Design: Why we love (or hate) everyday things. New York: Basic books.

Packaging, Labeling, & Branding Products: A resource guide for food entrepreneurs. Agriculture Innovation Center.

Paine, F. A. & Paine, H. Y. (1983). A handbook of food packaging. Institute of Packaging. Council. Glasgow : L. Hill 1983

Spence, C., Gallace, A. (2011). Multisensory Design: Reaching Out to Touch the Consumer. Psychology & Marketing, Vol. 28(3): 267–308 (March 2011)

Satterfield, D., Kang, S., Baer, R., Ladjahasan, N. (2008). Food as Experience A Design and Evaluation Methodology. Proceedings of the Design Research Society Conference 2008

Schütte, S. (2005). Engineering Emotional Values in Product Design. Kansei Engineering in development. Linköping University, Linköping

Schifferstein, H. N. J. (2011). Multi Sensory Design. Proceedings of the Second Conference on Creativity and Innovation in Design, Pages 361-362

Schifferstein, H. N. J.; Fenko, A.; Desmet, P. M. A.; Labbe, D.; Martin, N. (2013). Influence of package design on the dynamics of multisensory and emotional food experience. Food Quality and Preference 27 (2013) 18–25

Schifferstein, H.N.J., & Cleiren, M.P.H.D., (2005). Capturing product experiences: a split-modality approach. Acta Psychologica, 118, 293-318.

Schifferstein, H.N.J., & Hekkert, P. (2007). Product Experience. Elsevier Science; 1 edition, December 31, 2007

The Thomson Reuters-NPR Health Poll: Organic Foods, Thomson Reuters, June 2011

Winter, K. C. & Davis, F. S. (2006) Organic Foods. *Journal of Food Science. November/December 2006. 71[9].*

http://instinctivechoice.co.uk/Article/23/What_is_Kansei_Engineering/

https://en.wikipedia.org/wiki/Organic_food

APPENDIX I. Participant Information and Pre-study Survey

1 Age

18- 23	N=10
24-29	N=5
30-35	N=1
36-41	N=1
42- 47	N=1
49-53	N=2
54-59	
60-65	N=1
65+	N=1

2 Gender

Male	N=9
Female	N=13

3 Native language

English	N=11
Chinese	N=10
Korean	N=1

4 Education

High school	
Undergraduate student	N=5
College Graduate	N=8
Advanced Degree	N=9

5 Cultural background

North America	N=10
South America	
Europe	
Asia	N=12
pacific	
Africa	

6 Education background

Art-related	N=2
Design-related	N=8

Other (please specify_____)

Chemistry, IE, Engineering, Kinesiology, Global Resources Systems and Economics, Psychology, MBA, Education, Science, Linguistics, Meteorology

7 Occupation

Please specify _____

Creative director, Student (15), Graphic designer, Lecturer, Teacher, Advisor, Researcher, Adjunct instructor

8 Do you buy organic foods in grocery stores?

Yes	N=15
No	N=7

if Yes, please specify what categories of organic foods _____

vegetable, milk, fruits, egg, soymilk, flour, meat, grains, cookies, juice, pasta, cereals

if No, please briefly give your reasons_____

Too expensive	N=5
N/A	N=2

9 If your answer is Yes to question 8, please continue to the following questions.

1) How often do you buy organic foods?

Daily	
Weekly	N=8
Monthly	N=7

2) Is it easy for you to find organic foods by their packaging designs in grocery stores?

Please rate difficulty: 1= easy, 5= difficult

1	N=3
2	N=4
3	N=6
4	N=1
5	N=1

3) Is it easy for you to distinguish organic foods from conventional foods by their packaging designs in grocery stores?

Please rate difficulty: 1= easy, 5= difficult

1	N=3
2	N=3
3	N=4
4	N=7
5	N=1

APPENDIX II. Food Packaging Prototype Evaluation Form

1. Please rank the intensity of following senses you feel from the following prototypes. Put 1 – 4 for each prototype, with **1** indicating the **strongest** and **4** the **weakest**.

	A	B	C	D	(from left to right)
Crunchy					
Crispy					
Sweet					
Tasty					
Filling					
Warm					
Cold					

2. Please rank the intensity of emotional feelings you get from the following prototypes. Put 1 – 4 for each prototype, with **1** indicating the **strongest** and **4** the **weakest**.

	A	B	C	D
Fresh				
Healthy				
Organic				
Good value				
Comfortable				
Enjoyable				

Other (Please specify_____)

3. a) Overall, how likely will you buy the product packed in the following prototypes? Put 1 – 4 for each prototype, with **1** indicating the **most likely** and **4** the **least**.

	A	B	C	D
Likeliness in purchase				

b) Please give brief reasons for the prototype that you are **least likely** to buy:

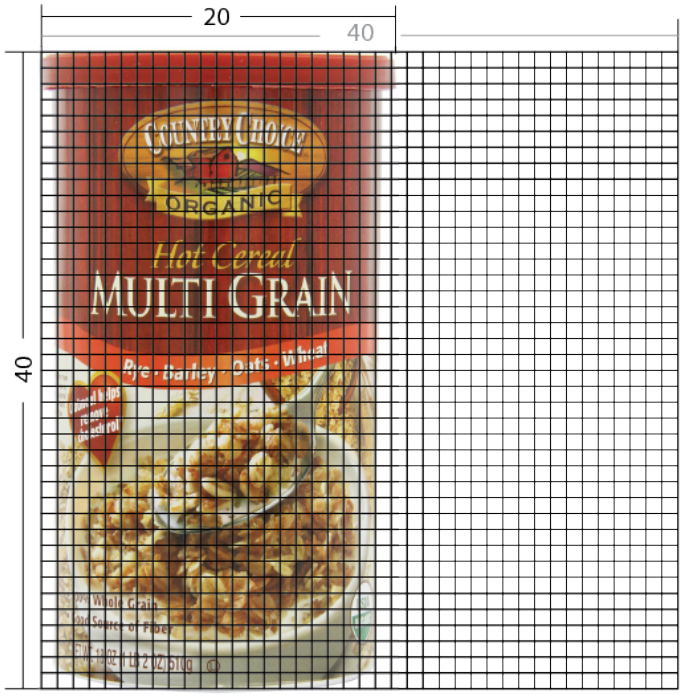
_____

APPENDIX III. Cereal Package Covers and Color Percent Calculation

Total coverage: 33x40=1320

44%	582/1320=0.44
27%	354/1320=0.27
5%	64/1320=0.05
8%	112/1320=0.08

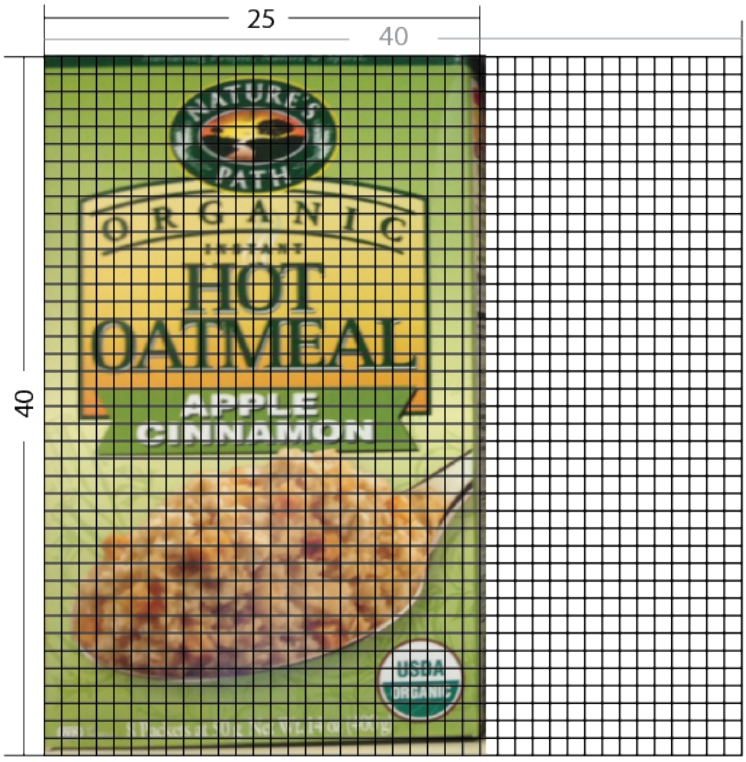
Note: Units for each color are counted with estimation due to irregular shapes of objects



Total coverage: 20x40=800

40%	316/800=0.4
5%	40/800=0.05
8%	60/800=0.08
2%	16/800=0.02

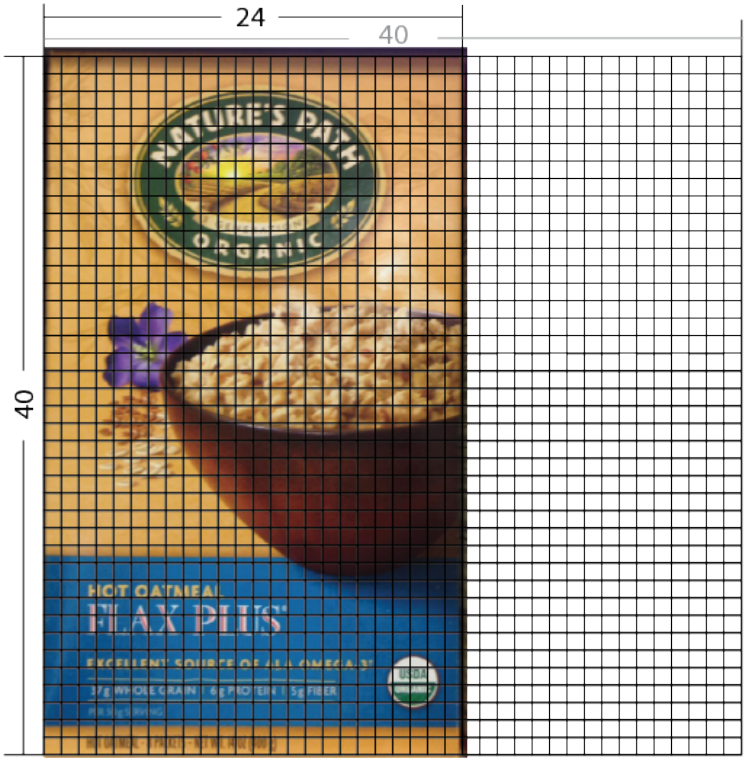
Note: Units for each color are counted with estimation due to irregular shapes of objects



Total coverage: 25x40=1000

51%	505/1000=0.51
23%	228/1000=0.23
36%	36/1000=0.36

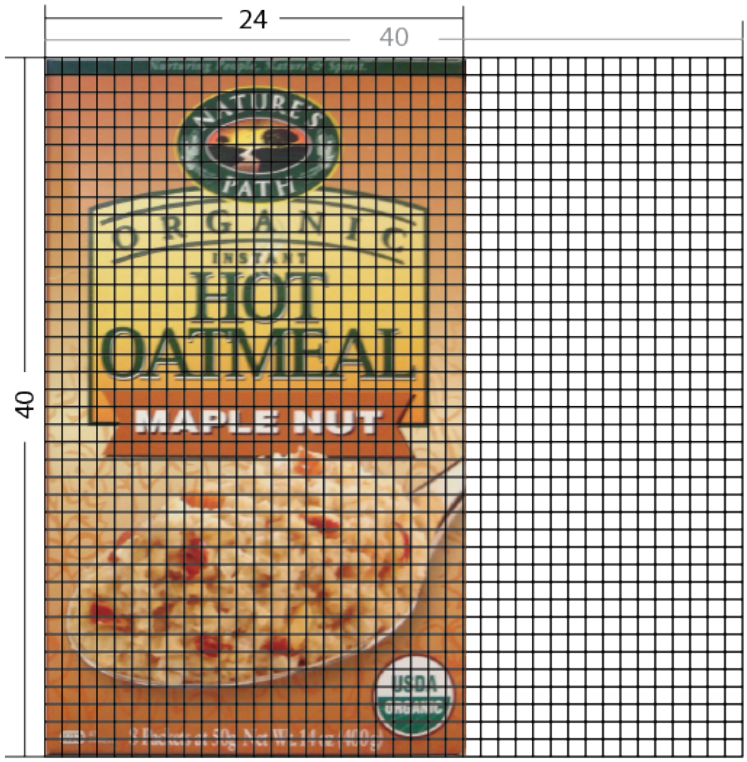
Note: Units for each color are counted with estimation due to irregular shapes of objects



Total coverage: 24x40=960

43%	413/960=0.43
9%	85/960=0.09
24%	234/960=0.24
11%	110/960=0.11

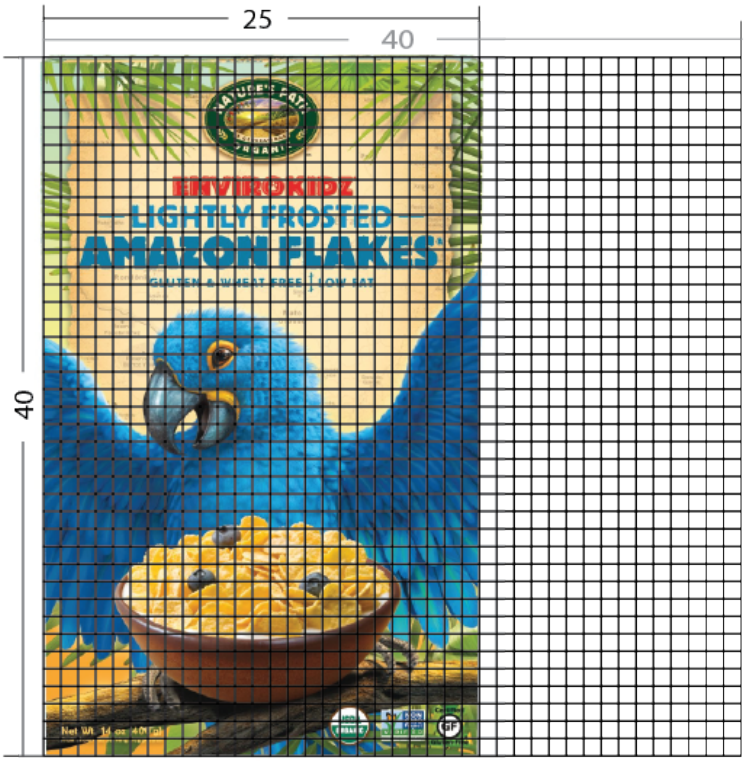
Note: Units for each color are counted with estimation due to irregular shapes of objects



Total coverage: 24x40=960

60%	569/960=0.6
24%	228/960=0.24
7%	70/960=0.07

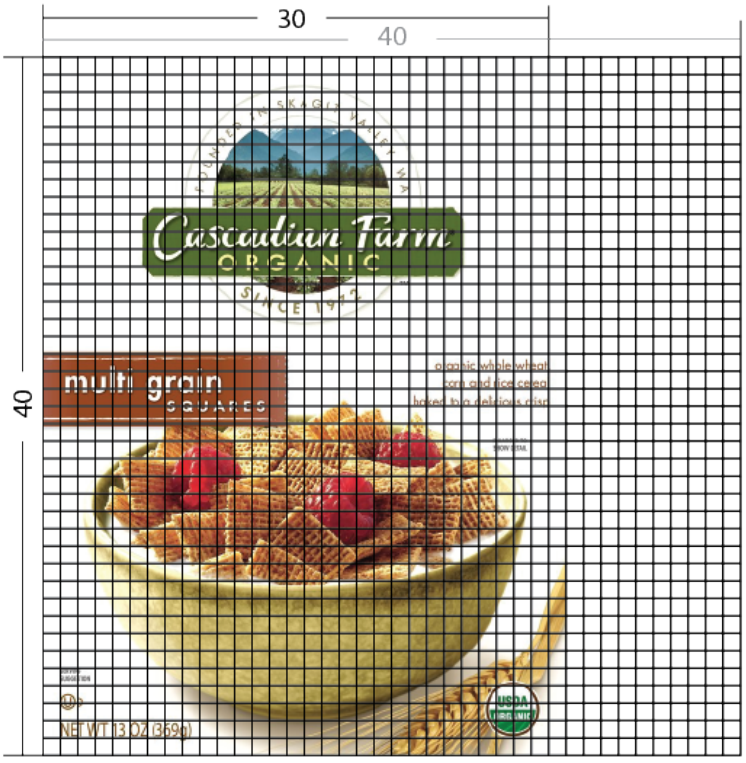
Note: Units for each color are counted with estimation due to irregular shapes of objects



Total coverage: 25x40=1000

27%	274/1000=0.27
32%	316/1000=0.32
12%	123/1000=0.12
2%	18/1000=0.02

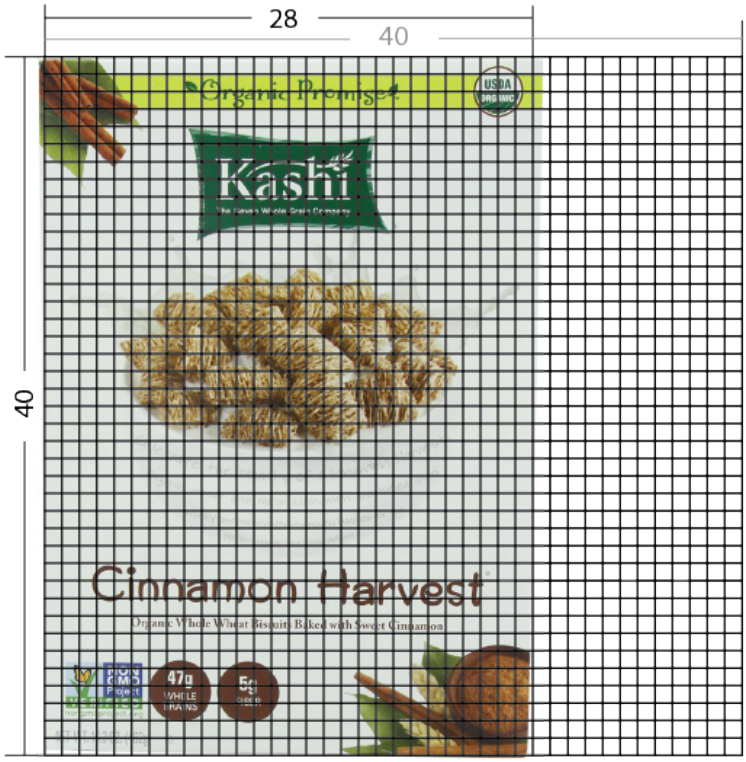
Note: Units for each color are counted with estimation due to irregular shapes of objects



Total coverage: 30x40=1200

6%	72/1200=0.06
2%	20/1200=0.02
14%	165/1200=0.14
5%	56/1200=0.05
2%	28/1200=0.02

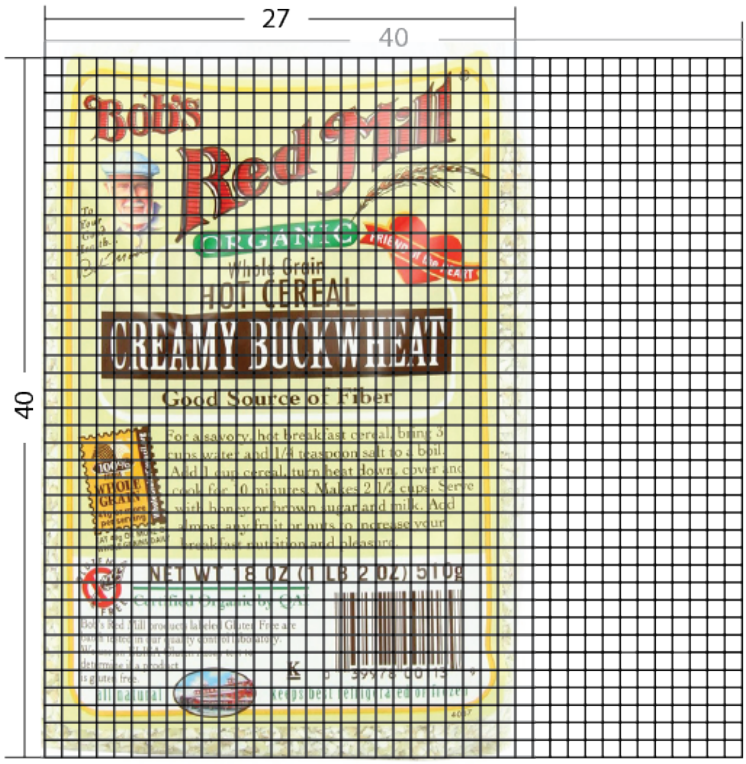
Note: Units for each color are counted with estimation due to irregular shapes of objects



Total coverage: 28x40=1120

71%	798/1120=0.71
4%	44/1120=0.04
5%	55/1120=0.05
12%	132/1120=0.12
5%	51/1120=0.05

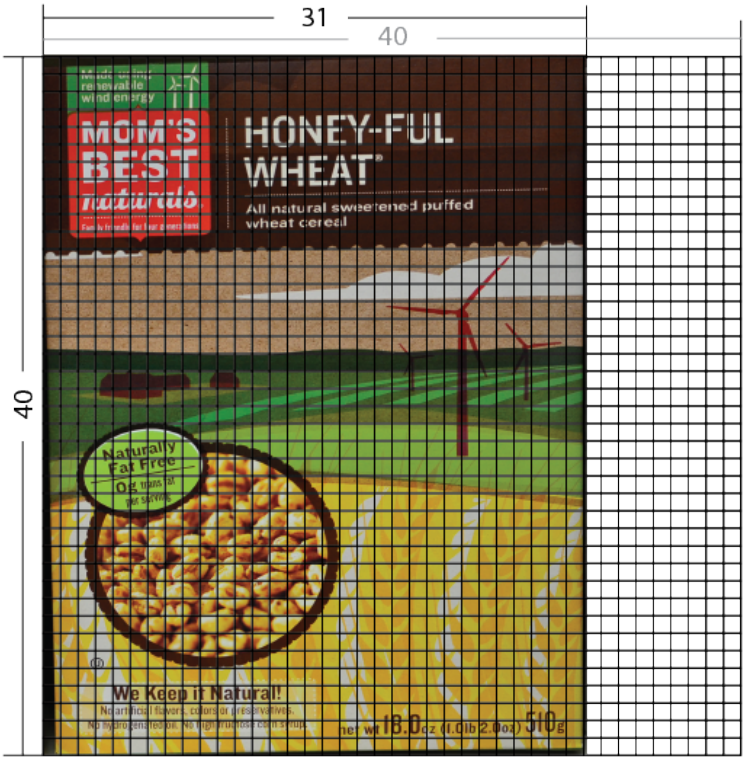
Note: Units for each color are counted with estimation due to irregular shapes of objects



Total coverage: 27x40=1080

67%	725/1080=0.67
4%	40/1080=0.04
1%	15/1080=0.01
6%	60/1080=0.06
1%	10/1080=0.01

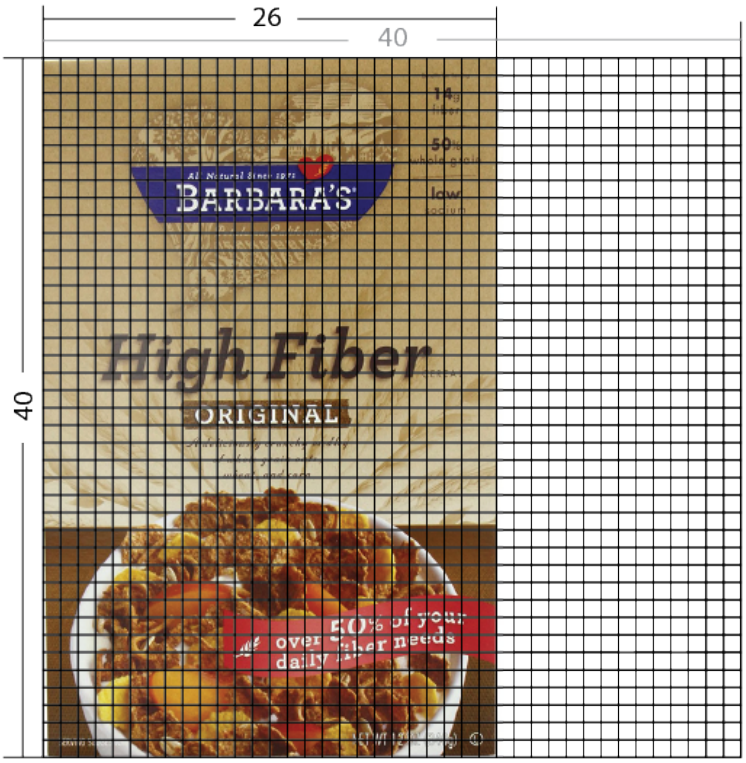
Note: Units for each color are counted with estimation due to irregular shapes of objects



Total coverage: 31x40=1240

20%	246/1240=0.2
13%	155/1240=0.13
5%	61/1240=0.05
2%	19/1240=0.02
8%	95/1240=0.08
27%	335/1240=0.27

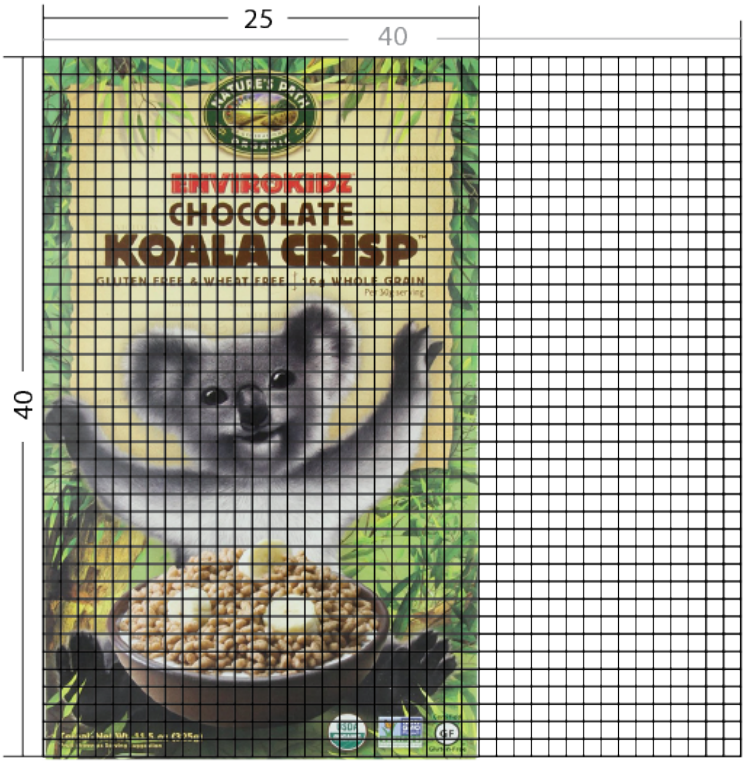
Note: Units for each color are counted with estimation due to irregular shapes of objects



Total coverage: 26x40=1040

65%	676/1040=0.65
5%	50/1040=0.05
5%	48/1040=0.05
4%	41/1040=0.04

Note: Units for each color are counted with estimation due to irregular shapes of objects



Total coverage: 25x40=1000

35%	352/1000=0.35
23%	226/1000=0.23
19%	190/1000=0.19
3%	32/1000=0.03

Note: Units for each color are counted with estimation due to irregular shapes of objects

APPENDIX IV. Selected Amazon Customer Reviews of Organic Cereals

Product: Cascadian Farm Organic Honey Nut O's Cereal

" I've been eating Honey Nut O's for several years now. It tastes good, the texture is comfortable to chew, and it keeps me full for hours, really filling. When I eat cereals I can buy in stores I'm hungry in an hour. This cereal is organic from a very reputable company in the northwest so I also feel I'm helping to keep the environment free from pesticides."

" Some organic foods can be bland, especially cereals. Not as sweet as cheerios, but they taste good enough that everyone in our family often eats more than just 1 bowl. I usually poor to much milk in the bowl just to have a good reason to pour more cereal in! Good price, taste, and Healthy!"

" Honey Nut Cheerios are perhaps my all-time favorite cereal. There's just something about them that reminds me of being a "kid" (hey, I'm still a kid!) and they just fill me with comfort! Unfortunately for me, I'm also a very disciplined eater -- what my mom likes to call "a health nut" -- and there's usually not much room in my diet for a heaping big bowl of Honey Nut Cheerios. Darn it!"

" After doing some research on "healthy cereals" I decided to give the Cascadian Farms Honey Nut O's a try. I didn't have particularly high hopes for the taste before I cracked open the box. After all, how can you expect a healthy alternative to compete with your all-time favorite cereal? But, surprisingly the Honey Nut O's are a very light and delightful snack. I ate them dry and with a bit of skim milk and I must say I prefer them dry. They are a bit smaller than Honey Nut Cheerios and not nearly as resilient when it comes to soaking up the milk (i.e. they go soggy really fast!). As other reviewers have mentioned, they are not nearly as sweet as Honey Nut Cheerios, however, they have a very authentic and light honey flavor. In other words, they taste more "real". The grain texture is also very nice and has a satisfying crunch while still being soft. (I hate cereals that rough up the inside of your mouth)."

" All things considered, I definitely recommend the Cascadian version of my all-time favorite. While I don't get the same warm cozy comfort as the Honey Nut Cheerios, I do enjoy them as healthy small-portion snack. A small container of this cereal definitely beats eating pre-processed cereal bars or something similar which is filled with fat and soy ingredients."

" For those of you who are looking for something to sate your Honey Nut Cheerio craving, you'll probably want to pass on these and just go for the real deal :)"

" My whole family loves these. They have a great taste and I don't have to worry about High fructose corn syrup/corn syrup and additives that aren't organic. Got to love something that is better than the original Cheerio!"

APPENDIX V. Imagery Test All Data (Photo vs Illustration)

Smooth cardboard

A=Color 1, B=Color 2, C=Color 3, D=Color 4

Kansei words	Mean rank		Z	Asymp. Sig. (2-tailed)
	Test 2. photo	Test 3. illustration		
Crunchy A	1.95	1.68	-1.310a	0.19
Crunchy B	2.27	2.41	-.371b	0.711
Crunchy C	2.23	2.55	-1.706b	0.088
Crunchy D	3.55	3.36	-1.265a	0.206
Crispy A	1.64	1.68	-.351b	0.725
Crispy B	2.77	2.95	-.666b	0.506
Crispy C	2.09	2.09	-.047a	0.963
Crispy D	3.50	3.27	-1.184a	0.236
Sweet A	2.18	2.45	-1.051b	0.293
Sweet B	2.64	2.59	-.414a	0.679
Sweet C	2.27	2.18	-.632a	0.527
Sweet D	2.91	2.77	-.690a	0.49
Tasty A	2.00	1.73	-1.231a	0.218
Tasty B	2.82	2.77	-.333a	0.739
Tasty C	1.77	2.23	-2.027b	0.043
Tasty D	3.41	3.27	-.586a	0.558
Warm A	1.68	1.45	-.879a	0.38
Warm B	2.23	2.23	-.277a	0.782
Warm C	2.68	2.77	-.632b	0.527
Warm D	3.41	3.55	-.647b	0.518
Cold A	3.32	3.50	-.700b	0.484
Cold B	2.91	2.82	-.500a	0.617
Cold C	2.23	2.14	-.277a	0.782
Cold D	1.55	1.55	-.182a	0.856
Fresh A	2.41	2.32	-.632a	0.527
Fresh B	3.64	3.55	-.707a	0.48
Fresh C	1.32	1.50	-2.000b	0.046
Fresh D	2.64	2.64	.000c	1
Healthy A	2.32	2.23	-.504a	0.614
Healthy B	3.41	3.14	-1.294a	0.196
Healthy C	1.45	1.73	-1.732b	0.083
Healthy D	2.82	2.91	-.443b	0.658
Organic A	2.32	2.27	-.250a	0.803
Organic B	3.05	3.27	-1.155b	0.248
Organic C	1.68	1.77	-.577b	0.564
Organic D	2.95	2.68	-1.310a	0.19
GoodValue A	2.05	1.55	-1.816a	0.069
GoodValue B	2.55	2.95	-2.066b	0.039
GoodValue C	2.55	2.95	-.263b	0.793
GoodValue D	3.23	3.27	-.159b	0.873

Comfort A	2.00	1.91	-.707a	0.48
Comfort B	3.00	3.00	.000c	1
Comfort C	1.68	1.86	-1.414b	0.157
Comfort D	3.32	3.23	-.632a	0.527
Enjoy A	1.77	1.68	-.368a	0.713
Enjoy B	3.18	3.00	-1.265a	0.206
Enjoy C	1.68	2.05	-1.999b	0.046
Enjoy D	3.36	3.27	-.632a	0.527
Filling A	2.23	2.27	-.144b	0.886
Filling B	1.82	1.50	-1.941a	0.052
Filling C	2.86	2.91	-.302b	0.763
Filling D	3.09	3.32	-.844b	0.399
Likeliness A	1.82	1.95	-1.000b	0.317
Likeliness B	3.23	2.95	-1.613a	0.107
Likeliness C	1.59	1.91	-2.111b	0.035
Likeliness D	3.36	3.18	-1.633a	0.102

Rough cardboard

A=Color 1, B=Color 2, C=Color 3, D=Color 4

Kansei words	**Mean rank**		**Z**	**Asymp. Sig. (2-tailed)**
	Test 4. photo	**Test 5. illustration**		
Crunchy A	1.82	1.73	-.587a	0.557
Crunchy B	2.55	2.45	-.577a	0.564
Crunchy C	2.36	2.55	-.884b	0.377
Crunchy D	3.27	3.27	.000c	1
Crispy A	1.82	1.82	-.047b	0.963
Crispy B	2.82	2.55	-1.310a	0.19
Crispy C	1.95	2.32	-1.660b	0.097
Crispy D	3.41	3.32	-.520a	0.603
Sweet A	2.14	1.91	-1.387a	0.166
Sweet B	2.59	2.59	.000c	1
Sweet C	2.18	2.36	-.758b	0.449
Sweet D	3.09	3.14	-.250b	0.803
Tasty A	1.82	1.77	-.378a	0.705
Tasty B	2.77	2.91	-.832b	0.405
Tasty C	2.09	2.00	-.577a	0.564
Tasty D	3.32	3.32	.000c	1
Warm A	1.55	1.59	-.333b	0.739
Warm B	2.32	2.00	-1.933a	0.053
Warm C	2.45	2.82	-1.999b	0.046
Warm D	3.68	3.59	-.707a	0.48
Cold A	3.23	3.32	-.702b	0.483
Cold B	2.59	2.82	-1.394b	0.163
Cold C	2.59	2.32	-2.121a	0.034
Cold D	1.59	1.55	-.276a	0.783
Fresh A	2.14	2.27	-.832b	0.405
Fresh B	3.36	3.50	-.879b	0.38

Fresh C	1.68	1.50	-1.414a	0.157
Fresh D	2.82	2.73	-.513a	0.608
Healthy A	2.23	2.14	-.312a	0.755
Healthy B	2.86	3.18	-1.408b	0.159
Healthy C	1.86	1.73	-.832a	0.405
Healthy D	3.05	2.95	-.302a	0.763
Organic A	2.23	2.27	-.265b	0.791
Organic B	3.23	3.23	.000c	1
Organic C	1.77	1.64	-.905a	0.366
Organic D	2.77	2.86	-.816b	0.414
GoodValue A	2.09	1.77	-1.588a	0.112
GoodValue B	2.59	2.82	-1.394b	0.163
GoodValue C	2.59	2.82	-1.511b	0.131
GoodValue D	3.14	2.95	-1.265a	0.206
Comfort A	2.00	1.64	-2.530a	0.011
Comfort B	2.55	2.91	-1.558b	0.119
Comfort C	2.27	2.36	-.632b	0.527
Comfort D	3.18	3.09	-.577a	0.564
Enjoy A	1.95	1.64	-1.512a	0.131
Enjoy B	2.86	3.27	-1.998b	0.046
Enjoy C	2.09	2.05	-.264a	0.792
Enjoy D	3.09	3.05	-.250a	0.803
Filling A	2.36	2.00	-1.371a	0.17
Filling B	1.64	1.86	-1.035b	0.301
Filling C	2.68	2.64	-.333a	0.739
Filling D	3.32	3.50	-.933b	0.351
Likeliness A	1.73	1.77	-.277b	0.782
Likeliness B	2.91	3.09	-1.633b	0.102
Likeliness C	2.09	1.95	-.832a	0.405
Likeliness D	3.27	3.18	-.816a	0.414

Plastic

A=Color 1, B=Color 2, C=Color 3, D=Color 4

Kansei words	**Mean rank**		**Z**	**Asymp. Sig. (2-tailed)**
	Test 6. photo	**Test 7. illustration**		
Crunchy A	1.68	1.86	-.973a	0.331
Crunchy B	2.59	2.36	-1.890b	0.059
Crunchy C	2.27	2.27	.000c	1
Crunchy D	3.45	3.50	-.272a	0.785
Crispy A	1.64	1.64	.000c	1
Crispy B	3.00	2.95	-.447b	0.655
Crispy C	2.00	1.95	-.277b	0.782
Crispy D	3.36	3.45	-.520a	0.603
Sweet A	2.32	2.00	-1.208b	0.227
Sweet B	2.41	2.32	-.577b	0.564
Sweet C	2.45	2.64	-.966a	0.334
Sweet D	2.82	3.05	-1.406a	0.16

Tasty A	1.95	1.91	-.107b	0.915
Tasty B	2.64	2.73	-.577a	0.564
Tasty C	2.18	2.00	-1.027b	0.305
Tasty D	3.23	3.36	-.520a	0.603
Warm A	1.64	1.45	-1.414b	0.157
Warm B	2.27	2.18	-.649b	0.516
Warm C	2.45	2.77	-1.611a	0.107
Warm D	3.64	3.59	-.378b	0.705
Cold A	3.27	3.36	-.632a	0.527
Cold B	2.73	2.86	-.756a	0.45
Cold C	2.27	2.09	-.877b	0.38
Cold D	1.73	1.68	-.086b	0.931
Fresh A	2.09	2.23	-1.000a	0.317
Fresh B	3.50	3.50	.000c	1
Fresh C	1.41	1.50	-.816a	0.414
Fresh D	3.00	2.77	-1.311b	0.19
Healthy A	2.41	2.64	-1.311a	0.19
Healthy B	2.95	3.32	-1.428a	0.153
Healthy C	1.59	1.41	-1.265b	0.206
Healthy D	3.05	2.64	-1.642b	0.101
Organic A	2.27	2.55	-1.656a	0.098
Organic B	3.14	3.14	.000c	1
Organic C	1.77	1.59	-1.069b	0.285
Organic D	2.82	2.73	-.540b	0.589
GoodValue A	2.05	1.91	-.540b	0.589
GoodValue B	2.73	2.86	-.504a	0.614
GoodValue C	2.73	2.86	-1.890b	0.059
GoodValue D	2.95	3.18	-1.406a	0.16
Comfort A	1.73	1.82	-.367a	0.714
Comfort B	3.18	3.00	-1.414b	0.157
Comfort C	1.73	1.95	-1.221a	0.222
Comfort D	3.36	3.23	-.965b	0.335
Enjoy A	1.68	1.82	-.690a	0.49
Enjoy B	3.05	2.91	-1.000b	0.317
Enjoy C	2.00	2.09	-.540a	0.589
Enjoy D	3.27	3.18	-.535b	0.593
Filling A	2.05	2.23	-1.265a	0.206
Filling B	1.73	1.50	-1.186b	0.236
Filling C	2.95	3.05	-.832a	0.405
Filling D	3.27	3.23	-.378b	0.705
Likeliness A	2.00	1.82	-.921b	0.357
Likeliness B	3.18	3.09	-.707b	0.48
Likeliness C	1.64	1.68	-.265a	0.791
Likeliness D	3.18	3.41	-1.095a	0.273

Plastic of different transparencies

A=Opaque plastic

B=Opaque plastic with a clear window
C=Fully clear plastic

Kansei words	Mean rank		Z	Asymp. Sig. (2-tailed)
	Test 8. photo	Test 9. illustration		
Crunchy A	2.77	2.68	-1.000a	0.317
Crunchy B	1.86	1.77	-1.000a	0.317
Crunchy C	1.36	1.55	-1.633b	0.102
Crispy A	2.59	2.36	-1.127a	0.26
Crispy B	1.82	1.82	.000c	1
Crispy C	1.59	1.82	-1.311b	0.19
Sweet A	1.77	1.86	-.368b	0.713
Sweet B	1.68	1.68	.000c	1
Sweet C	2.55	2.45	-.513a	0.608
Tasty A	2.64	2.82	-2.000b	0.046
Tasty B	1.50	1.55	-.577b	0.564
Tasty C	1.86	1.64	-1.667a	0.096
Warm A	2.73	2.86	-1.342b	0.18
Warm B	1.82	1.95	-1.342b	0.18
Warm C	1.45	1.18	-1.730a	0.084
Cold A	1.27	1.14	-1.342a	0.18
Cold B	2.00	1.95	-1.000a	0.317
Cold C	2.73	2.91	-1.633b	0.102
Fresh A	2.77	2.91	-1.342b	0.18
Fresh B	1.82	1.77	-.577a	0.564
Fresh C	1.41	1.32	-.707a	0.48
Healthy A	2.82	2.86	-.577b	0.564
Healthy B	1.73	1.64	-1.000a	0.317
Healthy C	1.45	1.50	-.447b	0.655
Organic A	2.73	2.91	-1.633b	0.102
Organic B	1.64	1.73	-1.000b	0.317
Organic C	1.64	1.36	-1.897a	0.058
GoodValue A	2.32	2.41	-.816b	0.414
GoodValue B	1.73	1.55	-1.633a	0.102
GoodValue C	1.95	2.05	-.632b	0.527
Comfort A	2.32	2.55	-2.236b	0.025
Comfort B	1.41	1.59	-1.633b	0.102
Comfort C	2.27	1.86	-2.165a	0.03
Enjoy A	2.45	2.59	-1.342b	0.18
Enjoy B	1.32	1.59	-2.449b	0.014
Enjoy C	2.23	1.82	-2.251a	0.024
Filling A	2.82	2.86	-1.000b	0.317
Filling B	1.91	1.95	-.577b	0.564
Filling C	1.27	1.18	-1.000a	0.317
Likeliness A	2.73	2.82	-1.000b	0.317
Likeliness B	1.32	1.55	-1.667b	0.096
Likeliness C	1.95	1.64	-1.941a	0.052

APPENDIX VI. Virtual Material Comparison Test All Data

PHOTO GROUPS
1=Smooth, 2=Rough, 3=Plastic
A=Color 1, B=Color 2, C=Color 3, D=Color 4

Kansei	Groups	N	Mean Rank	Chi-Square	df	Asymp. Sig.
CrunchyA	1	22	37			
	2	22	32.91			
	3	22	30.59			
	Total	66		1.461	2	.482
CrunchyB	1	22	30.27			
	2	22	34.75			
	3	22	35.48			
	Total	66		1.023	2	.600
CrunchyC	1	22	32.7			
	2	22	34.86			
	3	22	32.93			
	Total	66		.188	2	.910
CrunchyD	1	22	36.64			
	2	22	31.59			
	3	22	32.27			
	Total	66		1.197	2	.550
CrispyA	1	22	32			
	2	22	36.5			
	3	22	32			
	Total	66		.959	2	.619
CrispyB	1	22	32			
	2	22	32.75			
	3	22	35.75			
	Total	66		.527	2	.769
CrispyC	1	22	35.39			
	2	22	31.64			
	3	22	33.48			
	Total	66		.477	2	.788
CrispyD	1	22	34.68			
	2	22	33.18			
	3	22	32.64			
	Total	66		.176	2	.916
SweetA	1	22	32.64			

ILLUSTRATION GROUPS
1=Smooth, 2=Rough, 3=Plastic
A=Color 1, B=Color 2, C=Color 3, D=Color 4

Kansei	Groups	N	Mean Rank	Chi-Square	df	Asymp. Sig.
CrunchyA	1	22	32.23			
	2	22	32.45			
	3	22	35.82			
	Total	66		.571	2	.752
CrunchyB	1	22	33.73			
	2	22	34.14			
	3	22	32.64			
	Total	66		.077	2	.962
CrunchyC	1	22	35.5			
	2	22	35.23			
	3	22	29.77			
	Total	66		1.436	2	.488
CrunchyD	1	22	33.07			
	2	22	32.41			
	3	22	35.02			
	Total	66		.290	2	.865
CrispyA	1	22	33.8			
	2	22	33.93			
	3	22	32.77			
	Total	66		.058	2	.972
CrispyB	1	22	35.57			
	2	22	29.18			
	3	22	35.75			
	Total	66		1.811	2	.404
CrispyC	1	22	32.64			
	2	22	38.41			
	3	22	29.45			
	Total	66		2.790	2	.248
CrispyD	1	22	33.5			
	2	22	32.89			
	3	22	34.11			
	Total	66		.057	2	.972
SweetA	1	22	39.5			

	2	22	32.5					2	22	30.32		
	3	22	35.36					3	22	30.68		
	Total	66		.341	2	.843		Total	66		3.536	2	.171
SweetB	1	22	34.82				SweetB	1	22	34.86		
	2	22	34.07					2	22	34.75		
	3	22	31.61					3	22	30.89		
	Total	66		.363	2	.834		Total	66		.661	2	.719
SweetC	1	22	33				SweetC	1	22	29.91		
	2	22	31.09					2	22	33.05		
	3	22	36.41					3	22	37.55		
	Total	66		.955	2	.620		Total	66		1.909	2	.385
SweetD	1	22	32.5				SweetD	1	22	29.98		
	2	22	36					2	22	35.89		
	3	22	32					3	22	34.64		
	Total	66		.645	2	.724		Total	66		1.286	2	.526
TastyA	1	22	35.68				TastyA	1	22	32.61		
	2	22	31.27					2	22	33.32		
	3	22	33.55					3	22	34.57		
	Total	66		.654	2	.721		Total	66		.136	2	.934
TastyB	1	22	34.39				TastyB	1	22	32.73		
	2	22	34.32					2	22	35.59		
	3	22	31.8					3	22	32.18		
	Total	66		.284	2	.868		Total	66		.434	2	.805
TastyC	1	22	28.23				TastyC	1	22	36.07		
	2	22	35.55					2	22	32.16		
	3	22	36.73					3	22	32.27		
	Total	66		2.809	2	.245		Total	66		.653	2	.721
TastyD	1	22	34.84				TastyD	1	22	33.48		
	2	22	33.7					2	22	32.73		
	3	22	31.95					3	22	34.3		
	Total	66		.318	2	.853		Total	66		.090	2	.956
WarmA	1	22	32.39				WarmA	1	22	32.7		
	2	22	33.11					2	22	35.98		
	3	22	35					3	22	31.82		
	Total	66		.276	2	.871		Total	66		.782	2	.676
WarmB	1	22	32.61				WarmB	1	22	35.11		
	2	22	34.52					2	22	30.8		
	3	22	33.36					3	22	34.59		
	Total	66		.122	2	.941		Total	66		.724	2	.696
WarmC	1	22	36.52				WarmC	1	22	33.18		
	2	22	31.82					2	22	34.32		
	3	22	32.16					3	22	33		

	Total	66		.909	2	.635
WarmD	1	22	31.14			
	2	22	35.36			
	3	22	34			
	Total	66		.828	2	.661
ColdA	1	22	34.95			
	2	22	32.41			
	3	22	33.14			
	Total	66		.243	2	.885
ColdB	1	22	36.18			
	2	22	31			
	3	22	33.32			
	Total	66		.882	2	.643
ColdC	1	22	30.77			
	2	22	37.86			
	3	22	31.86			
	Total	66		1.889	2	.389
ColdD	1	22	30.5			
	2	22	33.5			
	3	22	36.5			
	Total	66		1.406	2	.495
FreshA	1	22	38.61			
	2	22	31.52			
	3	22	30.36			
	Total	66		2.726	2	.256
FreshB	1	22	36.25			
	2	22	32.09			
	3	22	32.16			
	Total	66		.959	2	.619
FreshC	1	22	30.09			
	2	22	37.64			
	3	22	32.77			
	Total	66		2.412	2	.299
FreshD	1	22	29.91			
	2	22	33.68			
	3	22	36.91			
	Total	66		1.595	2	.451
HealthyA	1	22	33.91			
	2	22	31.55			
	3	22	35.05			
	Total	66		.423	2	.809
HealthyB	1	22	39.91			

	Total	66		.070	2	.966
WarmD	1	22	33.14			
	2	22	34.14			
	3	22	33.23			
	Total	66		.052	2	.974
ColdA	1	22	36.02			
	2	22	31.84			
	3	22	32.64			
	Total	66		.728	2	.695
ColdB	1	22	33.45			
	2	22	33.14			
	3	22	33.91			
	Total	66		.020	2	.990
ColdC	1	22	32.98			
	2	22	35.8			
	3	22	31.73			
	Total	66		.572	2	.751
ColdD	1	22	33.61			
	2	22	32.82			
	3	22	34.07			
	Total	66		.062	2	.970
FreshA	1	22	34.36			
	2	22	33.5			
	3	22	32.64			
	Total	66		.100	2	.951
FreshB	1	22	33.82			
	2	22	33.34			
	3	22	33.34			
	Total	66		.013	2	.994
FreshC	1	22	34			
	2	22	33.25			
	3	22	33.25			
	Total	66		.029	2	.986
FreshD	1	22	32.18			
	2	22	33.84			
	3	22	34.48			
	Total	66		.180	2	.914
HealthyA	1	22	31.39			
	2	22	29.25			
	3	22	39.86			
	Total	66		4.174	2	.124
HealthyB	1	22	32.95			

	2	22	30.07					2	22	32.64		
	3	22	30.52					3	22	34.91		
	Total	66		4.222	2	.121		Total	66		.217	2	.897
HealthyC	1	22	29.68				HealthyC	1	22	36.23		
	2	22	38.41					2	22	35.66		
	3	22	32.41					3	22	28.61		
	Total	66		2.892	2	.235		Total	66		2.654	2	.265
HealthyD	1	22	30.32				HealthyD	1	22	34.57		
	2	22	35.16					2	22	35.48		
	3	22	35.02					3	22	30.45		
	Total	66		1.016	2	.602		Total	66		.933	2	.627
OrganicA	1	22	34.27				OrganicA	1	22	32		
	2	22	32.91					2	22	31.36		
	3	22	33.32					3	22	37.14		
	Total	66		.065	2	.968		Total	66		1.344	2	.511
OrganicB	1	22	31.45				OrganicB	1	22	34.59		
	2	22	36.09					2	22	33.39		
	3	22	32.95					3	22	32.52		
	Total	66		.778	2	.678		Total	66		.154	2	.926
OrganicC	1	22	32.3				OrganicC	1	22	36.36		
	2	22	33.8					2	22	32.68		
	3	22	34.41					3	22	31.45		
	Total	66		.167	2	.920		Total	66		.939	2	.625
OrganicD	1	22	35.43				OrganicD	1	22	32.27		
	2	22	32.07					2	22	35.09		
	3	22	33					3	22	33.14		
	Total	66		.399	2	.819		Total	66		.279	2	.870
GoodValueA	1	22	33.16				GoodValueA	1	22	28.95		
	2	22	34.36					2	22	34		
	3	22	32.98					3	22	37.55		
	Total	66		.075	2	.963		Total	66		2.616	2	.270
GoodValueB	1	22	32.39				GoodValueB	1	22	35		
	2	22	32.95					2	22	32.32		
	3	22	35.16					3	22	33.18		
	Total	66		.275	2	.872		Total	66		.245	2	.885
GoodValueC	1	22	32.82				GoodValueC	1	22	33.73		
	2	22	33					2	22	37.18		
	3	22	34.68					3	22	29.59		
	Total	66		.137	2	.934		Total	66		1.877	2	.391
GoodValueD	1	22	34.55				GoodValueD	1	22	34.8		
	2	22	34.68					2	22	31.09		
	3	22	31.27					3	22	34.61		

	Total	66		.514	2	.774
ComfortA	1	22	34.91			
	2	22	34.82			
	3	22	30.77			
	Total	66		.758	2	.685
ComfortB	1	22	34.59			
	2	22	27.5			
	3	22	38.41			
	Total	66		4.033	2	.133
ComfortC	1	22	29.14			
	2	22	41.89			
	3	22	29.48			
	Total	66		7.194	2	.027
ComfortD	1	22	34.2			
	2	22	33			
	3	22	33.3			
	Total	66		.058	2	.971
EnjoyA	1	22	33.16			
	2	22	36.11			
	3	22	31.23			
	Total	66		.840	2	.657
EnjoyB	1	22	35.55			
	2	22	30.98			
	3	22	33.98			
	Total	66		.730	2	.694
EnjoyC	1	22	29			
	2	22	36.61			
	3	22	34.89			
	Total	66		2.165	2	.339
EnjoyD	1	22	35.91			
	2	22	31.36			
	3	22	33.23			
	Total	66		.744	2	.689
FillingA	1	22	33.75			
	2	22	36.82			
	3	22	29.93			
	Total	66		1.592	2	.451
FillingB	1	22	35.55			
	2	22	30.95			
	3	22	34			
	Total	66		.864	2	.649
FillingC	1	22	34.61			

	Total	66		.614	2	.736
ComfortA	1	22	35.68			
	2	22	30.14			
	3	22	34.68			
	Total	66		1.237	2	.539
ComfortB	1	22	34.27			
	2	22	32.23			
	3	22	34			
	Total	66		.163	2	.922
ComfortC	1	22	29.52			
	2	22	39.68			
	3	22	31.3			
	Total	66		3.895	2	.143
ComfortD	1	22	34.18			
	2	22	32.14			
	3	22	34.18			
	Total	66		.199	2	.905
EnjoyA	1	22	31.93			
	2	22	32.64			
	3	22	35.93			
	Total	66		.665	2	.717
EnjoyB	1	22	31.86			
	2	22	37.64			
	3	22	31			
	Total	66		1.747	2	.418
EnjoyC	1	22	33.18			
	2	22	33.18			
	3	22	34.14			
	Total	66		.041	2	.980
EnjoyD	1	22	35.2			
	2	22	31.07			
	3	22	34.23			
	Total	66		.654	2	.721
FillingA	1	22	35.98			
	2	22	29.64			
	3	22	34.89			
	Total	66		1.601	2	.449
FillingB	1	22	31.09			
	2	22	37.43			
	3	22	31.98			
	Total	66		1.966	2	.374
FillingC	1	22	34.55			

	2	22	30.48					2	22	28.93				
	3	22	35.41					3	22	37.02				
	Total	66		.965	2	.617		Total	66		2.575	2	.276	
FillingD	1	22	31.32				FillingD	1	22	33.09				
	2	22	34.8					2	22	36.07				
	3	22	34.39					3	22	31.34				
	Total	66		.520	2	.771		Total	66		.880	2	.644	
LikelinessA	1	22	33.18				LikelinessA	1	22	34.77				
	2	22	31.14					2	22	31.73				
	3	22	36.18					3	22	34				
	Total	66		.882	2	.643		Total	66		.342	2	.843	
LikelinessB	1	22	35.59				LikelinessB	1	22	32.07				
	2	22	30.52					2	22	34.68				
	3	22	34.39					3	22	33.75				
	Total	66		.965	2	.617		Total	66		.234	2	.889	
LikelinessC	1	22	29.64				LikelinessC	1	22	34.86				
	2	22	40.05					2	22	35.98				
	3	22	30.82					3	22	29.66				
	Total	66		4.519	2	.104		Total	66		1.556	2	.459	
LikelinessD	1	22	34.14				LikelinessD	1	22	31.98				
	2	22	34.05					2	22	31.98				
	3	22	32.32					3	22	36.55				
	Total	66		.155	2	.926		Total	66		.983	2	.612	

APPENDIX VII. Participants' Reasons for the Least Chosen Prototypes

Test 1. Physical materials: smooth, rough, plastic

User	Gender	Reasons for the least interested prototype
1	F	rough paper looks too earthy, too much effort to eat, more expensive
2	F	plastic looks low quality, not environment friendly
3	M	plastic not organize well on shelf
4	F	plastic low quality, not healthy
5	F	plastic low quality
6	F	plastic not protective and easy to crush
7	M	rough paper seems more costly
8	F	too simple
9	M	plastic cannot be recycled
10	F	rough paper looks more expensive
11	M	plastic looks fresh inside
12	M	plastic hard to handle
13	F	smooth paper is normal, not easy to distinguish from others
14	M	plastic looks not so clean
15	F	plastic looks inexpensive, not well packaged, less quality product
16	F	plastic reminds of cheap knock-off products, not appealing
17	F	rough paper is unfamiliar
18	M	plastic seems inefficient, not able to get as much product
19	F	plastic might not be safe
20	M	rough paper looks too healthy
21	M	rough paper looks like chemical stuff inside, cannot see what's inside
22	F	plastic seems cheap and without protection

Test 2. Photo on smooth cardboard in four colors

User	Gender	Reasons for least interested prototype
1	F	not like teal blue color
2	F	not appealing
3	M	color not appetizing
4	F	color too dark, feel sweet, like chocolate
5	F	dislike color combination
6	F	green food is unappealing, not natural, use of food coloring
7	M	dark brown is dull
8	F	dislike color
9	M	personal preference of warm color
10	F	looks dark and heavy
11	M	balance of warm and cool colors
12	M	brown color looks unappealing
13	F	color is not fresh enough to pop up as organic food
14	M	color seems like chocolate
15	F	green is least natural appetizing compared with brown and gold
16	F	colors not appealing, green reminds of flavored in some way
17	F	green background too intense, looks false
18	M	dark color not inviting
19	F	looks so cold
20	M	looks too healthy
21	M	looks dated

22	F	looks like chocolate

Test 3. Illustration on smooth cardboard in four colors

User	Gender	Reasons for least interested prototype
1	F	dislike teal color
2	F	color not appealing
3	M	seems least organic
4	F	looks dirty, not healthy
5	F	color too dark
6	F	dislike dark green color
7	M	not bright and unappealing
8	F	looks no flavor
9	M	like warm color personally
10	F	not as persvasive as others
11	M	dislike combination of colors
12	M	dislike brown box
13	F	color is not light enough to be as fresh as organic
14	M	chocolate like color
15	F	green is least natural/appetizing compared to brown and gold
16	F	feel like it might taste bland
17	F	background color is too intense
18	M	dark, not inviting
19	F	looks so dark
20	M	looks too healthy
21	M	looks dull, not appetizing
22	F	looks like wheat in chocolate, strange

Test 4. Photo on rough cardboard in four colors

User	Gender	Reasons for least interested prototype
1	F	dislike teal blue
2	F	
3	M	colors not organic
4	F	color doesn't match texture, fake
5	F	doesn't like color combination
6	F	dislike dark green
7	M	color too dark, old, not inviting
8	F	looks no flavor
9	M	color difference between dark green and wheats
10	F	color no association with cereal
11	M	color combination w/ texture
12	M	dislike brown
13	F	dark green not fit into texture
14	M	brown likes chocolate and looks filling
15	F	green is least appetizing and natural compared with brown and gold
16	F	color doesn’t appeal
17	F	green background too bright and intense
18	M	visually confusing, distracting
19	F	looks so heavy
20	M	not look tasty
21	M	looks unhealthy, lots of sugar (chocolate)
22	F	looks easy to get dirty

Test 5. Illustration on rough cardboard in four colors

User	Gender	Reasons for least interested prototype
1	F	dislike teal blue
2	F	
3	M	color doesn't feel organic
4	F	looks boring, too filing
5	F	color issue
6	F	color not like *
7	M	dark color not appealing, looks like unfresh content inside
8	F	doesn't associate with food
9	M	dark green doesn't match wheats
10	F	color looks heavy
11	M	color combination issue
12	M	dislike brown
13	F	wheat illustration not stand out from background
14	M	color like chocolate, feeling full
15	F	green is least appetizing and natural compared with brown and gold
16	F	dark green doesn't appeal
17	F	green background too intense
18	M	confusing, blurring almost
19	F	too dark
20	M	doesn't look tasty
21	M	unhealthy, sweet
22	F	feels like lack of nutrition

Test 6. Photo on non-transparent plastic in four colors

User	Gender	Reasons for least interested prototype
1	F	dislike teal
2	F	looks undelicious
3	M	least organic feeling
4	F	color and picture not in harmony
5	F	color pallette issue
6	F	dislike dark green
7	M	color not appealing, not attractive
8	F	doesn't look like delicious
9	M	dark green doesn't match wheats
10	F	looks like has less flavor
11	M	color combination issue
12	M	color issue, not stand out
13	F	dark green not very persuassive as organic color
14	M	not like food
15	F	green not associate with natural and organic as brown and gold
16	F	not appealing, but looks better than before
17	F	intense green looks fake, unrealistic
18	M	hard to read, too bright
19	F	looks too dark
20	M	not look tasty
21	M	doesn't look like organic
22	F	feels taste bitter

Test 7. Illustration on non-transparent plastic in four colors

User	Gender	Reasons for least interested prototype
1	F	dislike teal
2	F	
3	M	color not appetizing
4	F	doesn't like organic food, like chocolate
5	F	overall color too dark
6	F	green associate with food coloring, not organic, not for cereals
7	M	too dark, not appealing for purchase
8	F	looks untasty
9	M	dark green doesn't match wheats
10	F	looks expensive
11	M	color combination issue
12	M	dislike brown
13	F	dark green too normal in non-meat products
14	M	like chocolate
15	F	green not associate with natural and organic as brown and gold
16	F	looks like flavored
17	F	dislike intense green
18	M	very busy
19	F	package doesn't reflect content inside
20	M	doesn't look tasty
21	M	not look tasty
22	F	feels bitter

Test 8. Photo on plastic with three different transpanrencies

User	Gender	Reasons for least interested prototype
1	F	can't see product
2	F	value looks worst
3	M	hides too much, like to see what's inside
4	F	doesn't look healthy due to non-transparency
5	F	seals too much
6	F	can't see product
7	M	no deco with all transparent exposure
8	F	can't see product, not sure about quality
9	M	design is too simple
10	F	unable to see what you are getting for your money
11	M	can't see product
12	M	not appealing, less designs
13	F	not appealing
14	M	looks not fresh, less content
15	F	like gold and brown, no green
16	F	looks like chip bag, unhealthy snack bag
17	F	prefer to see products
18	M	want to see product
19	F	hard to see what's inside
20	M	looks too healthy
21	M	can't see what's inside
22	F	seems cheap

Test 9. Illustration on plastic with three different transpanrencies

User	Gender	Reasons for least interested prototype
1	F	can't see product / but doesn't look cheap with more graphics
2	F	looks worst value
3	M	feels the least organic
4	F	looks too much sealed and boring
5	F	too much sealed and can't see inside
6	F	can't see actual product
7	M	all exposure not deco aesthetically
8	F	can't see inside, not sure about product quality
9	M	designs too common
10	F	can't see what you are paying, what is the product exactly
11	M	combination of color w/ ability to see product (most likely purchased)
12	M	green designs add more to fully transparent one
13	F	normal, not as fresh as the one showing product directly
14	M	seems dirty
15	F	like gold and brown for cereals
16	F	looks like a chip bag
17	F	like to see some or all product inside
18	M	better to be able to see product
19	F	can't see what's inside
20	M	looks too healthy
21	M	can't see whats inside
22	F	looks like perservatives added

APPENDIX VIII. IRB Approval Document

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 4/19/2013

To: Lei Zhang
246 N Hyland
Ames, IA 50014

CC: Dr. Sunghyun Kang
282 Design

From: Office for Responsible Research

Title: Creating Better Product Experience in Organic Cereal Packaging Design

IRB ID: 13-134

Approval Date:	4/19/2013	**Date for Continuing Review:**	4/18/2015
Submission Type:	New	**Review Type:**	Expedited

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University according to the dates shown above. Please refer to the IRB ID number shown above in all correspondence regarding this study.

To ensure compliance with federal regulations (45 CFR 46 & 21 CFR 56), please be sure to:

- **Use only the approved study materials** in your research, **including the recruitment materials and informed consent documents that have the IRB approval stamp.**
- **Retain signed informed consent documents for 3 years after the close of the study,** when documented consent is required.
- **Obtain IRB approval prior to implementing any changes** to the study by submitting a Modification Form for Non-Exempt Research or Amendment for Personnel Changes form, as necessary.
- **Immediately inform the IRB of** (1) **all serious and/or unexpected adverse experiences** involving risks to subjects or others; and (2) **any other unanticipated problems involving risks** to subjects or others.
- **Stop all research activity if IRB approval lapses,** unless continuation is necessary to prevent harm to research participants. Research activity can resume once IRB approval is reestablished.
- **Complete a new continuing review form** at least three to four weeks prior to the **date for continuing review** as noted above to provide sufficient time for the IRB to review and approve continuation of the study. We will send a courtesy reminder as this date approaches.

Please be aware that IRB approval means that you have met the requirements of federal regulations and ISU policies governing human subjects research. **Approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **IRB approval in no way implies or guarantees that permission from these other entities will be granted.**

Upon completion of the project, please submit a Project Closure Form to the Office for Responsible Research, 1138 Pearson Hall, to officially close the project.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

IRB ID: 13-134

INSTITUTIONAL REVIEW BOARD (IRB)
Application for Approval of Research Involving Humans

RECEIVED
MAR 05 2013
By IRB

Title of Project: Creating Better Product Experience in Organic Cereal Packaging Design			
Principal Investigator (PI): LEI Zhang			Degrees: M. F. A
University ID: 532105574	Phone: 515-710-5868	Email Address: leiz@iastate.edu	
Correspondence Address: 3304 Polaris Drive, Unit 1, Ames, IA50010			
Department: Graphic Design		College/Center/Institute: College of Design	
PI Level: ☐ Tenured, Tenure-Eligible, & NTER Faculty ☐ Adjunct/Affiliate Faculty ☐ Collaborator Faculty ☐ Emeritus Faculty ☐ Visiting Faculty/Scientist ☐ Senior Lecturer/Clinician ☐ Lecturer/Clinician, w/ Ph.D. or DVM ☐ P&S Employee, P37 & above ☐ Extension to Families/Youth Specialist ☐ Field Specialist III ☐ Postdoctoral Associate ☒ Graduate/Undergrad Student ☐ Other (specify:)			

FOR STUDENT PROJECTS (*Required when the principal investigator is a student*)			
Name of Major Professor/Supervising Faculty: Sung Kang			
University ID: 835263429	Phone: 515-294-1669	Email Address: shrkang@iastate.edu	
Campus Address: 282 Design, Ames, IA 50011-3092		Department: Graphic Design	
Type of Project (check all that apply): ☒ Thesis/Dissertation		☐ Class Project	☐ Other (specify:)

Alternate Contact Person:	Email Address:
Correspondence Address:	Phone:

ASSURANCE

- I certify that the information provided in this application is complete and accurate and consistent with any proposal(s) submitted to external funding agencies. Misrepresentation of the research described in this or any other IRB application may constitute non-compliance with federal regulations and/or academic misconduct.
- I agree to provide proper surveillance of this project to ensure that the rights and welfare of the human subjects are protected. I will report any problems to the IRB. See Reporting Adverse Events and Unanticipated Problems for details.
- I agree that modifications to the approved project will not take place without prior review and approval by the IRB.
- I agree that the research will not take place without the receipt of permission from any cooperating institutions, when applicable.
- I agree to obtain approval from other appropriate committees as needed for this project, such as the IACUC (if the research includes animals), the IBC (if the research involves biohazards), the Radiation Safety Committee (if the research involves x-rays or other radiation producing devices or procedures), etc.
- I understand that IRB approval of this project does not grant access to any facilities, materials, or data on which this research may depend. Such access must be granted by the unit with the relevant custodial authority.
- I agree that all activities will be performed in accordance with all applicable federal, state, local, and Iowa State University policies.

Lei Zhang 3/4/2013
Signature of Principal Investigator Date

Sung Hyun Kang 3/4/2013
Signature of Major Professor/Supervising Faculty Date
(*Required when the principal investigator is a student*)

- I have reviewed this application and determined that departmental requirements are met, the investigator(s) has/have adequate resources to conduct the research, and the research design is scientifically sound and has scientific merit.

Debra Satterfield
Printed Name of Department Chair/Head/Director

Debra Satterfield 3/4/13
Signature of Department Chair/Head/Director Date

For IRB Use Only			
	Full Committee Review: ☐	Review Date: April 19, 2013
	EXPEDITED per 45 CFR 46.110(b): Category 7 Letter	Approval/Determination Date: April 19, 2013
Approval Not Required: ☐		Approval Expiration Date: April 18, 2015
Not Research: ☐	EXEMPT per 45 CFR 46.101(b):	
No Human Subjects: ☐	Not Approved: ☐	Risk: Minimal ☑ More than Minimal ☐

IRB Reviewer's Signature	Kelly A Agnibel	April 19, 2013

blank