Making healthful decisions: A redesign of the Nutrition Facts Label using principles of graphic user interface

Jessica Palo
Iowa State University

Follow this and additional works at: https://lib.dr.iastate.edu/etd
Part of the Graphic Design Commons, and the Human and Clinical Nutrition Commons

Recommended Citation
Graduate Theses and Dissertations. 13790.
https://lib.dr.iastate.edu/etd/13790

This Thesis is brought to you for free and open access by the Iowa State University Capstones, Theses and Dissertations at Iowa State University Digital Repository. It has been accepted for inclusion in Graduate Theses and Dissertations by an authorized administrator of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.
Making healthful decisions: A redesign of the Nutrition Facts Label using principles of graphic user interface

by

Jessica Palo

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:
Paul Bruski, Major Professor
Lisa Fontaine
James Hollis

Iowa State University
Ames, Iowa
2014

Copyright © Jessica Palo, 2014 All rights reserved
TABLE OF CONTENTS

ACKNOWLEDGEMENTS...........................................................................................................v
LIST OF FIGURES.................................................................................................................vi
LIST OF TABLES..................................................................................................................ix
ABSTRACT.............................................................................................................................x

CHAPTER 1. OVERVIEW........................................................................................................1
  1.1 Introduction...................................................................................................................1
  1.2 Purpose of the Study...................................................................................................3
  1.3 Theoretical Context OF the Study..............................................................................4
  1.4 Definition of Key Terms............................................................................................7
  1.5 Research Questions..................................................................................................8
  1.6 Thesis Outline..........................................................................................................8

CHAPTER 2. REVIEW OF LITERATURE............................................................................9
  2.1 Origins of the Nutrition Facts Label.........................................................................9
    2.1.1 Food and Drug Administration (FDA)..............................................................9
    2.1.2 Legislation.........................................................................................................9
    2.1.3 Current Nutrition Facts initiatives .................................................................10
  2.2 Principles of Graphic User Interface.......................................................................13
    2.2.1 Graphic Representation as Metaphor..............................................................13
    2.2.2 Organization and Visual Structure.................................................................16
  2.3 Graphic Design Principles.......................................................................................19
    2.3.1 Hierarchy.........................................................................................................20
ACKNOWLEDGMENTS

I would like to take this opportunity to say thank everyone involved in the completion of this thesis study. My family who encouraged and supported in my pursuit of the MFA degree, I could not have realized my potential without them.

Paul Bruski, my major professor for his insightful guidance and for keeping me accountable and focused throughout this process, especially during our semester abroad in Rome. Additionally I would like to thank him for his continued support beyond this study.

Lisa Fontaine, for encouraging me to explore the extremes of my designs and for posing challenging questions. James Hollis for accepting to be on my committee after a single conversation; and his knowledge of food science and human nutrition whom without this wouldn’t have been possible.

Nora Ladjahasan, for taking the time to teach me how to clean, add values, recode and run the data.

Mona Pett for expertise and willingness to answer my questions about forms, procedures and deadlines especially during my semester aboard in Rome.
LIST OF FIGURES

Figure 1. Group 1 of label formats, two servings, single-column formats.........................11
Figure 2. Group 2 of labels, two servings, dual-column formats........................................11
Figure 3. Group 3 of labels, one serving, single-column formats.........................................12
Figure 4. The figure shows the two essential ingredients of a representational system........15
Figure 5. The represented world versus the representing world.....................................16
Figure 6. This excerpt from the Official Airline Guide Worldwide Edition (November 1990) shows three flights between San Diego and London.............................18
Figure 7. This figure has taken the information in Figure 6 and has reconfigured it..........18
Figure 8. This figure displays information consumers would use in flight planning decisions..............................................................18
Figure 9. This figure has taken the information in Figure 8 and has reconfigured it........18
Figure 10. An example of typographic hierarchy from Thinking with Type by Ellen Lupton. The cues used include indent, line spacing and font change..................21
Figure 11. The Nutrition Facts Labeling guidelines of the FDA........................................22
Figure 12. This image shows how we typically perceive two distinct groups based on their visual proximity.................................................................24
Figure 13. This is the Nutrition Facts Label as a means to discuss proximity issues.................................................................26
Figure 14. The emergent feature of the alignment.............................................................27
Figure 15. The emergent feature of the symmetry.............................................................27
Figure 16. The emergent feature of the parallelism.............................................................27
Figure 17. Color wheel to aid in designing for people with partial sight and color deficiencies Part 1.................................................................32
Figure 18. Color wheel to aid in designing for people with partial sight and color deficiencies Part 2.................................................................32
Figure 19. Smart Choices Label…………………………………………………………………35
Figure 20. Sara Lee’s Nutritional Spotlight Label…………………………………………35
Figure 21. IQ Nutrition Label…………………………………………………………………36
Figure 22. Grocery Manufactures Association’s Nutrition Keys Label………………….36
Figure 23. Version one of the prototype design……………………………………………38
Figure 24. Version two of the prototype design ……………………………………………39
Figure 25. Version three of the prototype design…………………………………………..40
Figure 26. Version four of the prototype design………………………………………….41
Figure 27. Version five of the prototype design……………………………………………42
Figure 28. Version six of the prototype design ……………………………………………43
Figure 29. Version seven of the prototype design…………………………………………44
Figure 30. Version eight of the prototype design ………………………………………..45
Figure 31. Version nine of the prototype design…………………………………………..46
Figure 32. Prototype Label compared to the Nutrition Facts Label…………………....47
Figure 33. Comparison of the first change………………………………………………….49
Figure 34. Calories per gram close up………………………………………………………..50
Figure 35. Change two…………………………………………………………………………51
Figure 36. Change three……………………………………………………………………….52
Figure 37. Change four………………………………………………………………………..54
Figure 38. Screen shot of the online survey comparison question…………………….57
Figure 39. Screen shot of the online survey healthfulness question…………………..58
Figure 40. 2014 FDA proposed Nutrition Facts Label Update…………………………72
Figure 41. Proposed Label vs Nutrition Facts Label vs Prototype Label; Hierarchy of
serving size and calories……………………………………………………………………...76
Figure 42. Proposed vs Nutrition Facts Label; Calories from Fat.................................77

Figure 43. Proposed vs Nutrition Facts Label; Vitamins and Minerals........................78

Figure 44. Proposed Label vs Nutrition Facts Label vs Prototype Label; Proximity and Line........................................................................................................................................79

Figure 45. Proposed Label vs Nutrition Facts Label; Added Sugars.............................80
LIST OF TABLES

Table 1. Nutrition profiles of the four food products shown to participants in the FDA study. .................................................................12

Table 2. Use of Nutrition Facts Label frequency values. .................................................64

Table 3. Comparison of healthfulness values. .................................................................64

Table 4. Correlation between frequency of Nutrition Facts Label use and selecting the more healthful chip product. .................................................65

Table 5. Correlation between frequency of Nutrition Facts Label use and selecting the more healthful frozen product. .................................................66

Table 6. Rating Scale for the healthfulness of a product. ................................................67

Table 7. Correlation between frequency of Nutrition Facts Label use and rating the healthfulness of a chip product. ................................................67

Table 8. Correlation between frequency of Nutrition Facts Label use and rating the healthfulness of a frozen product. .................................................68

Table 9. Based on what you can see on the labels if you wanted to buy the healthier chip product, which of these two would you select? .................................69

Table 10. Which chip product has the fewest calories per container? .............................69

Table 11. Which chip product has the fewest calories per serving? ...............................69

Table 12. Assume you were going to grab a snack, how healthy of a choice would this chip snack be”? .................................................................70

Table 13. Based on what you can see on the labels if you wanted to buy the healthier frozen product, which of these two would you select? .............................70

Table 14. Which frozen product has the fewest calories per container? ..........................71

Table 15. Which frozen product has the fewest calories per serving? .............................71

Table 16. Assume you were going to grab a snack, how healthy of a choice would this frozen snack be”? .................................................................71
ABSTRACT

The world we live in is derived of a multitude of natural and human-made systems. These systems provide us with groundwork to contextualize and better comprehend information. This thesis proposes using Graphic User Interface as the foundation for a systematic redesign of the Nutrition Facts Label. “Graphic User Interface thrives on its ability to display elements; such elements are structured by grouping those related in order to create a visual hierarchy while maintaining balance within the composition” (Mullet and Sano 82). Nutrition is a science, the facts incorporated in the Nutrition Facts Label is based in this system. The nutrient facts on the Nutrition Facts Label are interrelated, however, the current design portrays them as separate entities. This thesis aims to clarify the relatedness of facts and help clarify the information by incorporating two principles of Graphic User Interface. The first principle is Graphic Representation as Metaphor, which will bring in a visual component amongst the text. The second is Organization & Visual Structure, which will bring related nutrient facts closer in proximity of one another. The prototype label was tested to parallel the recent 2013 FDA study, which tested possible updates (not a complete redesign) to the Nutrition Facts Label.
CHAPTER 1. OVERVIEW

1.1 Introduction

The legislation of 1990, Nutrition Labeling & Education Act (NLEA) (1990, 21 U.S.C. 301.) was one of the most significant in regards to the Nutrition Facts Label. The underlying aim of that legislation was to provide reliable information to consumers; so the best decision pertaining to their health could be made. It set a standard for the health and nutritional claims on packaged food products. This included a “Nutrition Facts” label to provide consumers with “calorie, fat, saturated fat, cholesterol, sodium, fiber, sugar, protein, and vitamin and mineral content” (Silverglade 148). Graphic designers serve as visual communicators using a combination of design principles and elements that we know to be truths. The graphic designer enlisted to reformulate the Nutrition Facts Label was Burkey Belser.

Interestingly enough Belser was not a trained graphic designer, however his background and experience had provided him with knowledge of the field. Belser’s success with the design of the Energy Guide for the Federal Trade Commission led government regulators to entrust him with the task of the reformulation. In his article Emerson stated “the success of the [energy guide] label convinced government regulators that you could modify consumer behavior through clear, friendly information design, gently pushing them towards more environmentally friendly, if slightly more expensive, purchases”(1). Government regulators indeed hoped to apply this same logic with regards to the nutritional health of consumers.

According to Emerson the science behind the Nutrition Facts Label was originally formulated to fight malnutrition (Emerson 2). Moreover the intention of Belser’s
reformulation was to target the rising obesity epidemic (Emerson 2). The FDA originally enlisted scientists to do the label themselves but realized they lacked knowledge in public communication. Sharon Natanblut, an advisor to the Commissioner for Strategic Initiatives indicated that, “the scientists saw graphic design as a trivial thing,” she recalls. “They thought more information is better. But ultimately, it is the design that helps you understand it” (Emerson 2). Belser’s design was based on found truths during his research and process. Belser’s final label design was essentially based on literacy, layout, and hierarchy.

The Nutrition Facts Label had to be comprehensible to the readers of all levels. Belser and his staff “found that poor readers stumbled over commas, dashes and semicolons, and that graphs, icons, pie charts are more sophisticated than they’d thought, requiring a relatively high degree of visual literacy” (Emerson 2). Second, the mindful layout, grouping and font variation was organized to emphasize “calories, fat, and cholesterol” (Emerson 2). The emphasized facts were key elements linked to obesity. The obesity epidemic has increased since the Belser’s reformulation of the Nutrition Facts Label. As a result the FDA is currently considering updating the Nutrition Facts Label.

As it stands the Nutrition Facts Label is just that, facts. Although the facts are interrelated the design of the Nutrition Facts Label portrays them as separate entities. The Nutrition Facts are currently in the form of a column on the majority of packaged foods. The information is to be read linearly, however, the preceding and proceeding information do not necessarily directly relate to each other. All design is interrelated; how can we apply other aspects of design in order to connect and reshape things? A possible answer is the addition of Graphic User Interface.
The world we live in derives from a multitude of natural and human-made systems; these systems provide us with groundwork to contextualize and better comprehend information. This thesis proposes Graphic User Interface as the foundation for a systematic redesign of the Nutrition Facts Label. Graphic User Interface thrives on “its ability to display elements; such elements are structured by grouping them in a visual hierarchy while maintaining balance within the composition” (Mullet and Sano 82). Nutrition is a science and the facts incorporated in the Nutrition Facts label are based in this system, however, the scientific facts on the Nutrition Facts Label do not fully consider the context of packaged foods.

1.2 Purpose of the Study

The purpose of the study is to redesign the Nutrition Facts Label using two principles of Graphic User Interface; Graphic Representation as Metaphor and Organization & Visual Structure. These two fundamentals of Graphic User Interface do in fact originate from traditional graphic design print. Implementing the fundamentals of Graphic User Interface into the Nutrition Facts Label will aim to enhance comprehension. The increase in comprehension will derive from combining the facts into a systematic layout; interacting elements of the Nutrition Facts Label.

Selecting the two Graphic User Interface principles helped isolate which graphic design elements were used in the prototype design. Graphic Representation as Metaphor isolated the use of a visual image while Organization and visual structure isolated: hierarchy, proximity, space and color. Visual objects combined with text addressed “Paivio’s (1971) dual-coding hypothesis proposes that people convert concrete verbal information into images in order to process and encode them. Therefore, adding text to an image supports differences
in learning styles and increases the effectiveness of the visual metaphor. A word or phrase integrated into the visual image or accompanying text references can facilitate the learner's interpretation (Williams 3).

The FDA is in the process of testing updates to the Nutrition Facts Label; not a complete redesign. The FDA testing focused on format and specifically highlighting “calories”, “serving size” and “calories from fat”; they designed 10 updated versions of the Nutrition Facts Label. “The 10 labeling formats can be classified into three groups: listing 2 servings per container with a single column, listing 2 servings per container with a dual column, and listing 1 serving per container with a single column” (Lando and Lo 242). Within these 3 format categories the FDA varied “calories”, “serving size” and “calories from fat”.

This thesis is a redesign rather than update a few aspects of the Nutrition Facts Label. I believe updating has the possibility of creating new problems while trying to solve specific problems. The updates proposed by the FDA are specifically to help clarify “serving size” and “calories per container” to help consumers make more healthful decisions. While the FDA’s initiative will be considered it is proposed in this thesis to systematically redesign the Nutrition Facts Label using Graphic User Interface to help clarify the label as a whole instead of clarifying a few aspects.

1.3 Theoretical Context of the Study

“The purpose of Graphic User Interface is to provide screen displays that create an operating environment for the user, forming an explicit visual and functional context for the computer user's actions” (Lynch 1). Likewise, the purpose of the Nutrition Facts Label is to provide consumers with contextualized facts about the nutrients within packaged foods to
make more healthful decisions. According to Lynch “The structure of the interface plays a significant role [in] creating an efficient and effective experience for the user” (1). Moreover Lynch discussed how “a good interface not only directs but also orchestrates and focuses the users experience”.

Building the redesign of the Nutrition Facts Label on Graphic User Interface aims to diminish the limits of print, specifically its dynamics. This idea is twofold. The first part includes Ellen Lupton; author of *Thinking with Type*. Lupton suggests that, “the cultural habits of the screen are driving changes in design for print, while at the same time affirming print’s role as a place where extended reading can still occur” (2004). This implies that information should be concise enough to portray the meaning, however still retain the possibility for further reading at a later time. The second part arises from Lynch, “understanding that the world is fundamentally linked to visual stimulation and the tactile experience of manipulating objects in our environment”(1). Lynch is suggesting the manner in which information can be made concise, taking into account the way in which technology has changed the way in which people process and understand information. According to Lupton, people now find, scan and mine information, she quotes “the Internet is one of the most influential factors in the digital age. The restlessness of the digital age is not because of computer screens but because of new behaviors engendered by the Internet, a place of searching and finding, scanning and mining” (74).

The Nutrition Facts Label diminishes comprehension with its lack of visual simulation and interaction between the Nutritional Fact elements; this idea came from cognitive and developmental psychologist Jean Piaget and Jerome Bruner; “Bruner’s model recognizes three aspects of human development including, enactive skills (manipulating
objects, knowing where you are in space), iconic skills (visually recognizing, comparing, contrasting), and symbolic skills (the ability to understand long sequences of abstract reasoning)” (Lynch 1). Such principles considered in Graphic User Interface are not present in print. The focus on Bruner’s human development aspects helps “exploit the user’s manipulative and visual skills” (Lynch 1). This is important to consider for Nutrition Facts Label as it activates the consumers’ role by enabling them to make quicker and more comprehensive connections. Douglas Englebart (an engineer) has also contributed the field of human cognitive manipulation skills.

In his article “Augmenting human intellect: a conceptual framework” he reasoned that “networked computing would not only make individuals more intellectually effective; it would enable collaborative methods of sharing knowledge” (65). Engelbart also proposed a “language, process, methodology, and conceptual framework for the real time interaction of collaborative computing” (65).

By augmenting human intellect we mean increasing the capability of man to approach a complex problem situation, to gain comprehension to suit his particular needs, and to derive solutions to problems. Increased capability in this respect is taken to mean a mixture of the following: more rapid comprehension, better comprehension, the possibility of gaining a useful degree of comprehension in a situation that previously was too complex, speedier solutions, better solutions, and the possibility of finding solutions to problems that before seemed insoluble. And by complex situations we include professional problems of diplomats, executives, social scientists, life scientists, physical scientists, attorneys, designers—whether the problem situation exists for twenty minutes or twenty years. (Engelbart 65)
With regard to the Nutrition Facts Label Engelbart ideas suggests that, “performance of consumers can best be improved by considering the whole as a set of interacting components” (66). For the Nutrition Facts Label this means interacting elements such as: “calories”, “grams”, “daily value percentages” etc, rather than by considering the components in isolation, the whole is greater than the sum of its parts.

1.4 Definition of Key Terms

For the purpose of this thesis the definitions of the following key terms are listed below;

- **Graphical User Interface**: “A computer program designed to allow a computer user to interact easily with the computer typically by making choices from menus or groups of icons” (Merriam Webster 2013).

- **Nutrition Facts Label**: Is defined by the Food and Drug Administration in Nutrition Facts Label Programs & Materials as an, “easy tool for making quick, informed food choices that contribute to a healthy diet” (2013).

- **Food and Drug Administration (FDA)**: The FDA defines itself in FDA Fundamentals as an, “agency within the U.S. Department of Health and Human Services. It consists of the Office of the Commissioner and four directorates overseeing the core functions of the agency: Medical Products and Tobacco, Foods and Veterinary Medicine, Global Regulatory Operations and Policy, and Operations” (2013).

- **Spatial Relationship**: “The position of or way in which something is situated. This position can be described using content or the negative space between the content” (Merriam Webster 2013).
• **Visual Metaphor**: “Using this perspective, one image or set of images might be used to represent another image or set of images, and serve to assist the learner in recalling prior knowledge of familiar concepts before encountering new, unfamiliar concepts” (Williams 1).

• **Computer Display**: “The viewable content on the computer screen with the possibility of scrolling” (Merriam Webster 2013).

### 1.5 Research Questions

This research will focus on two questions:

1. Can the Nutrition Facts Label be systematically redesigned to help consumers make more healthful decisions?

2. Can the addition of a visual element in addition to text make the Nutrition Facts Label more comprehensible?

3. Can the use of two Graphic User Interface principles help make the Nutrition Facts Label more visually comprehensible?

• Graphic Representation as Visual Metaphor

• Organization and Visual Structure

### 1.6 Thesis Outline

Chapter 2 reviews relevant literature to support the research questions as well as provide a historical context. Chapter 3 contains the methods and procedures of the research study such as the design process. Chapter 4 covers data collection, analysis, summary and discussion. Chapter 5 discusses future work. The appendices contain supporting information and data essential to the presentation of findings and summary of discussion.
CHAPTER 2. REVIEW OF LITERATURE

2.1 Origins of the Nutrition Facts Label

2.1.1. Food and Drug Administration (FDA)

Prior to the formation of the FDA each state had control over production and distribution of goods to consumers; this model was found to be inconsistent. In his article “FDA Origins” John P. Swann stated that the “FDA was founded in 1906 to comprehensively protect consumers”. According to the “FDA Fundamentals” section of the FDA website the administration consists of four core areas: Products and Tobacco, Foods and Veterinary Medicine, Global Regulatory Operations and Policy, and Operations. The administration covers most foods not including livestock, meat and poultry (regulated by the Department of Agriculture). With regards to food the FDA states in the “FDA Fundamentals” section of its website that it protects consumers by ensuring that products are safe, wholesome, sanitary and properly labeled.

2.1.2 Legislation

The two acts that helped establish the Nutrition Facts Label include the 1906 Food and Drugs Act and the Nutrition Label and Education Act (NLEA) of 1990. According to the “Legislation” section of the FDA website the 1906 Food and Drugs act put into effect inspection of food, drugs, medicines and liquors within the United States. The NLEA Act of 1990 also discussed in “FDA History” section of the their website stated that the “FDA took the inspection of food further by providing consumers with a written account of the contents of inspected foods”. The NLEA put in place the Nutrition Facts Label.

The NLEA as described by the “FDA History” section states that it,
Requires all packaged foods to bear nutrition labeling and all health claims for foods to be consistent with terms defined by the Secretary of Health and Human Services. The law preempts state requirements about food standards, nutrition labeling, and health claims and, for the first time, authorizes some health claims for foods. The food ingredient panel, serving sizes, and terms such as “low fat” and “light” are standardized.

2.1.3 Current Nutrition Facts initiatives

The FDA recently conducted a study that was printed in the 2013 February issue of the *Journal of the Academy of Nutrition and Dietetics*. Amy Lando and Serena Lo (Center for Food Safety and Applied Nutrition) were heads in the study that included 9,000 participants to test its initial proposed updates to the Nutrition Facts Label since 1991 (“Can changes” 2013). In an interview for the *Journal of the Academy of Nutrition and Dietetics* Lando gave an overview of the study. She stated that “the objective of the study was to examine the effects of modifications to the Nutrition Facts Label on foods that can be listed as having 1 or 2 servings per container, but are reasonably consumed at a single eating occasion” (Lando and Lo “Can changes” 2013). According to Lando and Lo these recent initiatives were “in response to the continued high levels of obesity in the United States, the FDA has been considering changes to the food label to help consumers eat a more healthful diet and maintain a healthy weight” (“Can changes” 2013).

The participants in the study were randomly assigned labels 10 labels categorized within three groups. “The 10 labeling formats can be classified into three groups: listing 2 servings per container with a single column, listing 2 servings per container with a dual column, and listing 1 serving per container with a single column” (Lando and Lo “Single
Larger” 242). The first group (2 servings per container with a single column) (Fig 1) consisted of 5 formats (Lando and Lo “Single Larger” 242):

Figure 1. Group 1 of label formats, two servings, single-column formats. Full Nutrition Facts labels were shown to participants but have been truncated in this figure.

The second group (listing 2 servings per container with a dual column) (Fig 2) consisted of 3 label formats (Lando and Lo “Single Larger” 242):

Figure 2. Group 2 of labels, two servings, dual-column formats. Full Nutrition Facts labels were shown to participants but have been truncated in this figure.
The third group in (Fig 3) (listing 1 serving per container with a single column) consisted of 2 label formats (Lando and Lo “Single Larger” 242);

![Nutrition Facts](image)

Figure 3. Group 3 of labels, one serving, single-column formats. Full Nutrition Facts labels were shown to participants but have been truncated in this figure.

The formats from 2013 Lando and Lo study were tested using labels on fictitious products. In their press release the FDA stated these products consisted of two frozen meals and two grab bag size chips. The nutritional profiles are shown in Table 1; one of each product was formatted to be more healthful than the other (Lando and Lo “Single Larger” 243). The study combined the aforementioned Nutrition Facts Label formats with the nutrient profiles to make the various Nutrition Facts Labels for the study.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Chips A</th>
<th>Chips B</th>
<th>Frozen Meal A</th>
<th>Frozen Meal B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>140 g</td>
<td>180 g</td>
<td>220 g</td>
<td>300 g</td>
</tr>
<tr>
<td>Calories from fat</td>
<td>60 g</td>
<td>80 g</td>
<td>40 g</td>
<td>80 g</td>
</tr>
<tr>
<td>Total fat</td>
<td>8 g</td>
<td>10 g</td>
<td>5 g</td>
<td>9 g</td>
</tr>
<tr>
<td>Saturated fat</td>
<td>1 g</td>
<td>2 g</td>
<td>2 g</td>
<td>10 g</td>
</tr>
<tr>
<td>Trans fat</td>
<td>0 g</td>
<td>0 g</td>
<td>0 g</td>
<td>0 g</td>
</tr>
<tr>
<td>Cholesterol (mg)</td>
<td>120 g</td>
<td>0 g</td>
<td>15 g</td>
<td>5 g</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>10 g</td>
<td>240 g</td>
<td>35 g</td>
<td>30 g</td>
</tr>
<tr>
<td>Total carbohydrate</td>
<td>19 g</td>
<td>25 g</td>
<td>12 g</td>
<td>10 g</td>
</tr>
<tr>
<td>Dietary fiber</td>
<td>3 g</td>
<td>10 g</td>
<td>6 g</td>
<td>4 g</td>
</tr>
<tr>
<td>Sugars</td>
<td>2 g</td>
<td>3 g</td>
<td>7 g</td>
<td>8 g</td>
</tr>
<tr>
<td>Protein</td>
<td>2 g</td>
<td>2 g</td>
<td>9 g</td>
<td>11 g</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>5 mg</td>
<td>5 mg</td>
<td>5 mg</td>
<td>2 mg</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>0 mg</td>
<td>0 mg</td>
<td>20 mg</td>
<td>4 mg</td>
</tr>
<tr>
<td>Calcium</td>
<td>0 mg</td>
<td>2 mg</td>
<td>20 mg</td>
<td>15 mg</td>
</tr>
<tr>
<td>Iron</td>
<td>2 mg</td>
<td>0 mg</td>
<td>8 mg</td>
<td>6 mg</td>
</tr>
</tbody>
</table>

Table 1. Nutrition profiles of the four food products shown to participants in the FDA study.
“Lando stated their methodology consisted of a questionnaire about the healthfulness of the products as well as questions about the number of calories and the amount of fat and other nutrients that were in a serving of the product and in the entire package” (Lando and Lo “Single Larger” 242). Moreover, how useful, trustworthy and helpful the label was. The results of the study showed favor in the single serving and dual-column formats (Lando and Lo “Single Larger” 245).

In essence the study conducted by the FDA focused on the content. The updates were structured to increase comprehension, however, the comprehension is focused on serving size; specifically products with multiple servings but are reasonably consumed at a single eating occasion. This thesis proposes a redesign rather than an update. The consideration of the FDA’s initiative coupled with Graphic User Interface principles will further any success of this initial study.

2.2. Principles of Graphic User Interface

2.2.1. Graphic Representation as Metaphor

The pie chart serves as a metaphor as it, “…serves to assist the [consumer] in recalling prior knowledge of familiar concepts…” (Williams 1). A pie chart was used to implement Graphic Representation as metaphor. The pie chart is nothing new, however it serves as metaphor by referencing a real world object (a pie) into a virtual space. Vicki Williams author of Creating Effective Visual Metaphors continues this idea by stating, “The Microsoft TM Windows operating system GUI it followed on Apple's heels, employing the Recycle Bin, folders, and other similar icons to support its desktop office metaphor. Its “Office” name for the popular software package is a reflection of that virtual office metaphor” (2).
According to Patrick Lynch in his article, “Visual design for the user interface” also acknowledges that “visual interface design functions as concrete objects in a virtual context, such as documents, folders, mail boxes, etc” (as cited in Littman 1998). “The interface metaphor to familiar habits, tasks, and concrete objects function to take abstract and invisible computer functions and make them easier to understand and remember” (Lynch 1). Metaphors in the concrete world once again activate the user’s role by engaging the user mentally, thus leading to better comprehension and experience. Lynch in his article continued to discuss metaphors in regards to retaining its simplicity. He stated that, “successful interface metaphors should be simple systems that do not require the user to learn and remember many rules and procedures. If the user is forced to remember many arbitrary rules the primary value of the metaphor is lost” (1). One problematic area in the Nutrition Facts Label that could be addressed is how it lists the nutrition facts. The list of the nutrient facts doesn’t ask the consumer to activate their mind. They read information without retaining it long enough to make a comprehensive decision. Including graphic representation as metaphor will help them activate the consumers mind by forcing them to relate the pie chart to the text.

Lynch also discussed Donald Norman and his idea that “the use of metaphors increases comprehension by activating the user to react to established conventions” (as cited in Norman, 1988). According to Norman, “the powers of cognition come from abstraction and representation; the ability to represent perceptions, experiences, and thought in some medium other than that in which they have occurred, abstracted away from irrelevant details” (Things That Make Us Smart 47). Norman believes that the significancerests in the fact that
“people make marks or symbols to represent things moreover, would use them to reason” (Things That Make Us Smart 47).

According to Norman, words must go beyond the text into allegory. “It is through allegory, metaphors that multiple levels of meaning hidden beneath the literal text comes through. It transforms the 2D word into a virtual concreteness” (Things That Make Us Smart 46). To Norman “the power is in the representation; although an abstraction is how it enables one to analyze and add power and precision to memory. The representation thrives on its ability to create hierarchy, thus one can concentrate on the essentials without distraction from irrelevancies” (Things That Make Us Smart 49). Norman defines the representation or metaphors to two essential ingredients (see Fig 4).

Figure 4. The figure shows the two essential ingredients of a representational system.

Figure 5 shows,

The world to be represented is shown on top—the “represented” world consisting of people, a tree, mountains, and a ball. The “representing” world is shown as marks-symbols-on a sheet of paper. The representing world is an abstraction and a simplification of the represented world. In this example of a representing world, the tally marks each represent one person, and the drawing represents the tree. The other aspects of the real (represented) world are absent from the representing world (Things That Make Us Smart 49).
Figure 5. The represented world versus the representing world.

“The critical property of the representations supported by cognitive artifacts is that they are themselves artificial objects that can be perceived and studied” (Things That Make Us Smart 51). These objects exist in Graphic User Interface design in the form of Organization and Visual Structure principle.

2.2.2 Organization and Visual Structure

The Organization and Visual Structure of the content applies to computer display and the spatial relationships between the content elements. The interaction between screen elements is just as important as how these elements appear on the screen itself. For the purpose of this thesis one can regard the nutritional facts as the “elements” and the food package panel as the “screen” or “display”.

Elements of computer displays were derived by emulating traditional graphic design print relationships, however there are some differences, including orientation and spatial resolution. In his article “Visual design for the user interface “Lynch discusses how these differences cause for a different design approach. Print design has predominantly remained vertical, while computer screens are horizontal (Lynch 1). The vertical page layouts
according to Lynch have been avoided to diminish scrolling for the consumer, continually; scrolling is confusing as the consumer is constantly forced to remember previous objects (Lynch 1). Just like vertical page layouts on the computer causes for forgetfulness so does the Nutrition Facts Label. While the consumer does have the complete list of facts in front of them, they are still required to scroll with their eyes to capture the entire contents of the packaged foods. As this is done it is hard to retain what came before to form complete conclusions and make healthful decisions about the contents of the packaged foods. One way to diminish the scrolling effect is to add metaphor in spatial relationships.

The spatial relationships on screen mimic “our day-to-day visual experience conditioning us to believe that dynamic, interactive objects naturally exist three-dimensional space, and have logical visual and spatial relationships to one another” (Lynch 1). Lynch continues with examples of overlapping screen objects and scrolling off screen amongst others; “in this way objects have a definite spatial relationship to each other. It is these relationships that reinforce interface metaphors; and such metaphors help connect 2-D object to our 3-D world increasing the connection and comprehension of the objects” (1).

Donald Norman also examines this idea using the following figures (Fig. 6-9) to illustrate two points. First, “the form of representation makes a dramatic difference in the ease of the task, even though, technically, the choice does not change the problem”. [Second], the proper choice of representation depends on the knowledge, system and method being applied to the problem” (Things That Make Us Smart 57).
Figure 6. *This excerpt from the Official Airline Guide Worldwide Edition (November 1990) shows three flights between San Diego and London.*

Figure 7. *This figure has taken the information in Figure 6 and has reconfigured it.*

Figure 8. *This figure displays information consumers would use in flight planning decisions.*

Figure 9. *This figure has taken the information in Figure 8 and has reconfigured it.*
Both Figure 6 and 8 portray the original information, while Figures 7 and 9 show the same information in alternative representations. Figure 6 presents the following: flight number, departure, arrival, time difference and flight duration. The presentation is designed to pack as much information as possible into the smallest amount of space” (*Things That Make Us Smart* 56). Figure 8 shows the following elements: “airline and flight number, duration and stops, arrival and departure times” (*Things That Make Us Smart* 57). Norman suggests that these new representations (Fig. 7 and 9) provide a simple way to compare the information.

This supports his first point that that “form of the representation makes a dramatic difference in the ease of the task” (*Things That Make Us Smart* 55). His second point with regards to the proper choice can be related to Figure 7 and 9. Figure 7 would serve better for a task requiring the exact departure. Furthermore, Figure 9 would be appropriate for tasks on duration. While Figures 7 and 9 are better represented than their originals 6 and 8 respectively, the conclusion on the appropriate overall figure between 7 and 9 is in apt. As previously state by Norman the form follows the function.

This is missing in the Nutrition Facts Label; the display of information is not appropriate for the task of deciphering healthfulness. The inclusion of the two Graphic User Interface principles will aim to decrease the comprehension issues of the Nutrition Facts Label.

### 2.3. Graphic Design Principles

It was determined that the spatial relationships of the elements should be determined by the task. Similarly the graphic representation of the elements must also reflect the task. GUI draws from the foundations of information design, graphic design, industrial design,
interior design and architecture. The foundations are adapted and applied to software
development. In order to promote visual clarity, in doing so enhances the usability of the
product. Thus, it is still necessary to draw from the basic principles of Graphic Design in
order to implement the principles of Graphic User Interface.

In his article “Principles of Effective Visual Communication for Graphical User
Interface Design” Aaron Marcus discusses how, “Graphic design can help GUls achieve their
potential to communicate. Information-oriented, systematic graphic design is the use of
typography, symbols, color, and other static and dynamic graphics to convey facts…”(425).

Marcus also indicated that the reason graphic design principles can help GUI achieve their
potential is because as stated above, GUI draws its foundation from information design, and
“Information-oriented, systematic graphic design helps people understand complex
information” (425). The following graphic design principles chosen to implement the two
GUI principles (Graphic Representation as Metaphor, and Organization & Visual Structure)
chosen to redesign the Nutrition Facts Label is as follow: hierarchy, spacing, proximity and
color.

2.3.1 Hierarchy

Ellen Lupton describes using typography to create hierarchy. While the typeface
choices of the FDA will not be changed for this study, the clarity of the information can be
enhanced with the application of Lupton’s ideas. Lupton describes typographic hierarchy as,
“an organizational system for content, emphasizing some data and diminishing others. A
hierarchy helps readers scan a text, knowing where to enter and exit and how to pick and
choose among its offerings” (94). Lupton continues to discuss how “each level of hierarchy
should be signaled by one or more cues, applied consistently across a body of text. A cue can be spatial (indent, line spacing, placement on page) or graphic (size, style, color of typeface). Infinite variations are possible (94)”. Figure 10 is an example from Lupton’s book showcasing how hierarchy can be established using some of the aforementioned cues.

![Figure 10. An example of typographic hierarchy from Thinking with Type by Ellen Lupton. The cues used include indent, line spacing and font change.](image)

This particular example is the most applicable to the Nutrition Facts Label. In fact the Nutrition Facts Label (as seen in Figure 11) draws on these cues, however it also creates a “type crime” a term coined by Lupton in so far that too many cues are used. She suggests using no more than three cues for each level or break in a document. In the Nutrition Facts Labeling guidelines five cues are counted; alignment, font change, line breaks, size, and symbols. While these cues are used consistently used throughout the label the inclusion of too many cues diminish the effectiveness of emphasis, thus diminishing the effectiveness of the hierarchy.
Another important aspect is spacing, “it is important to establish clear spatial groupings over the entire visual field in order to make distinctions of content. At the same time these spatial groupings are limited in their variation so that there is an overall visual consistency or rhythm within and between frames” (Marcus 427).

2.3.2 Spacing

Spacing can refer to many different aspects of design; for the purpose of this thesis spacing is in reference to line spacing. According to *Typographic Design: Form and Communication* interline spacing is dependent on two other factors, type size and length, all three form a triadic relationship to create spatial harmony and legibility which lead to greater comprehension (Carter, Day, Meggs 78-79). While the authors give general criteria for determining line spacing, type size and length they stress the importance of a designers
sensitively trained eye for typographic details. “When working with the optimum sizes of 9-, 10-, 11-, and 12-point text type, a maximum of ten to twelve words (or sixty to seventy characters) per line would be acceptable” (Carter, Day, Meggs 78-79). Once text type and line length have been determined interline spacing can be adjusted.

Proper interline spacing is important as it helps carry the eye in a natural manor. “When there is inadequate space between lines, the eye takes in other lines as well, moreover if the lines are too widely spaced, a reader may have trouble locating the next line” (Carter, Day, Meggs 78-79). The authors list the rules of line spacing as follows

- Typefaces with larger x-heights need more interline spacing than those with smaller x-heights
- Optimum sizes of text type (9,10,11,12 point), one to four points of interline spacing can be effectively added between lines to increase readability.

These principles of spacing will be applied to the prototype label to ensure the text is readable to provide consumers with the highest chance of comprehension of the information. The specifications as selected by the FDA was Helvetica, that and the type size will stay consistent with the FDA’s current choices going no more than 1 or 2 pt sizes higher or lower. This decision is to accommodate the proposed new design elements and insure that all elements are relatively similar. The FDA label guidelines can be viewed in Figure 10.

### 2.3.3 Proximity

For the purpose of this study, the design principle of proximity is being applied to the display elements of the Nutrition Facts Label. The aforementioned display for the purpose of this study refers to the packaging that the Nutrition Facts Labels appear on. Additionally, the elements refer to the nutrition facts themselves within the food product.
In Section 2.2 it was previously mentioned that, “the principle of proximity states that elements which are close to each other will be grouped together” (Fig. 12) (Chang, Nesbitt, Wilkins, sec 2.2). Moreover the principle of proximity cannot be discussed without the inclusion of Gestalt theory. “Gestalt theory tries to explain how humans organize individual elements into groups and how humans perceive and recognize patterns” (Chang, Nesbitt, Wilkins, sec. 2).

![Figure 12](image.png)

**Figure 12.** *This image shows how we typically perceive two distinct groups based on their visual proximity.*

In their report discussing the proximity compatibility principle Wilkens and Carswell address proximity in relation to interface design. This idea is relevant in so far that, “the greater flexibility of electronic display options enabling display integration, color, and multi-functionality increases the flexibility of design and lead to far more complex meaning assigned to the concept of “where”. The proximity compatibility principle (PCP) is used by Wilkens and Carswell as “one guideline to use in determining where a display element should be located, given its relatedness to other display elements” (473). They go on to break down proximity into two dimensions, perceptual proximity and processing proximity.

“Perceptual proximity is defined as how close together two display conveying task-related information lie in the user’s multi-dimensional perceptual space. Thus two
sources will be perceptually more similar (in close proximity) if they are close together, share the same color, use the same physical dimensions. Mental or processing proximity defines the extent to which the two or more sources are used as part of the same task. The PCP proposes compatibility between these two dimensions. If there is close processing proximity, then close perceptual proximity is advised; conversely, if independent processing is required, distant perceptual proximity is prescribed. This relationship is important with regards to information access and working memory of humans” (473-474).

The Nutrition Facts Label has proximity issues between the various display elements. It combines the two dimension of PCP inversely. Related information has distant proximity while independent information is in close proximity. In the Nutrition Facts Label (Fig 13) as it stand consumers can see that “total fat” is 9g, however to see how that 9g is translated to the percent “daily value” the eye must travel all the way to the right hand side. Furthermore when the eye does land on the 15% it also take in the 19% which is an independent value relating to the percent “daily value” of “saturated fat”. The lines in the Nutrition Facts Label are placed to help separate these values, however the close proximity of the values makes them inefficient. The consumer continues on a pattern of left to right movements to confirm the relatedness of the values, furthermore, proceeds down to the next line of nutrient information only to continue the cycle.
The right application of proximity discussed by Wilkens and Carswell “will generally make their comparison and integration easier because of the decrease in visual search cost and time necessary to go from one to the other. The search effort depends not only on eye and head movements but also on the internal movements. This has been referred to as information access cost (IAC), involving movement of attention, the eye, and the head” (479). Suggestions by Wilkens and Carswell for physical proximity manipulations included emergent features.

“Emergent features are properties of the visual display other than the so called raw codes the designer uses to represent individual data values” (Wilkens and Carswell 480). These properties according to Wilkens and Carswell are inherent in the relations between two
or more raw codes— that is, in the manner in which these codes configure (480). The following figures (Fig. 14, 15, 15) give examples of emergent features discussed by Wilkens and Carswell. In Figure 14 “three bars in the chart (the individual codes) can produce an emergent feature of alignment, which is not a property of any of the individual bars in isolation” (Wilkens and Carswell 477). Likewise, information in Figure 15 “coded as radii from a hub may produce the emergent feature of symmetry (Wilkens and Carswell 477).” Lastly in Figure 16 a bank of angular meters may produce the emergent feature of parallelism” (Wilkens and Carswell 1995).

Figure 14. *The emergent feature of the alignment.*

Figure 15. *The emergent feature of the symmetry.*

Figure 16. *The emergent feature of the parallelism.*
“The importance of these and other emergent features according to Wilkens and Carswells becomes obvious when the features serve as a direct cue for a task that would otherwise require the mental computation or comparison of the individual data values” (480). Additionally, “a mental combination of values that must be carried out effortfully in working memory can be replaced with perceptual operation that is carried out more or less automatically” (Wilkens and Carswell 480).

The application of these emergent features in addition to the Gestalt theory of proximity would help increase comprehension of the Nutrition Facts Label. Unifying the nutrient with the data number by the use of emergent features and the Gestalt theory of proximity would simplify the mental operation the consumer for the aforementioned reasons discussed by Wilkens and Carswell.

2.3.4 Color

In the Color Design Workbook color is recognized as having, “the ability to evoke a response, create a mood, symbolize an idea, and express an emotion” (Adams, Stone, Morioka 2006). In order to effectively use color 10 rules were outlined in the Color Design Workbook. The 10 rules are derived from “physics, theory, psychology, economics, aesthetics, and usage in order to effectively harness this powerful design element” (Adams, Stone, Morioka 2006). The 10 rules are as follows (Adams, Stone, Morioka 2006):

Convey Information

Every color has its own set of connections that convey information, with color itself acting as a signifier of ideas—both positive and negative. For example some
positive associations of the color yellow include: intellect, optimism and radiance. The same color yellow also has some negative associations, jealousy, cowardice and caution (Adams, Stone, Morioka 34-35).

**Create color harmony**

Color harmony nevertheless is related to the organizing principle of all artwork: balance, variety, proportion, dominance, movement, rhythm, and repetition. Colors must engage viewer and provide a balanced visual experience. Eight rules for building a color palette are as follows (Adams, Stone, Morioka 40-43):

1. Figure out the purpose,

   With regards to the Nutrition Facts Label the amount of daily nutrients needed depends on the individual consumer. The addition of color besides black and white could serve as a general guideline accenting the amount of nutrients in the packaged food. Additionally limiting the use of color to accents will help minimize confusion for those who are colorblind.

2. Review color basics

   If color were added to the Nutrition Facts Label it would be important that all the colors have the same hue, saturation and intensity. This would insure the colors are in balance with each other and will not agitate or create chaotic reaction in the viewer.

3. Choose a dominant color, then accent colors

   The dominant color on the label will be white as that is the current background choice of the FDA. Moreover black is the second most dominant color choice by the FDA for text. The hue, saturation and intensity of any
added color would have to make sure they were in balance with the black and white dominant colors.

4. Select shades, then vary them

“Because a shade of color heavily impacts the overall impression, decide what feeling must be conveyed—bright and cheery, or perhaps serene and dignified. Varying the shades of hues to create contrast of light and dark can be effective and dramatic”

5. Look at compatibility of hues

“Consider a variety of tints and shades, look at the overall compatibility of colors. Is the contrast pleasing”?

6. Limit the number of colors

“Two or three colors are usually enough. Four must be choose with care, while five might be too many.”

7. Put the colors into action

“Put the colors to use in a few typical pieces to look how they work together. If the color palette is successful, your design will be harmonious”

8. Keep a logbook

“Once you have found color palettes that work, document them in a journal to serve as a reference for future color palettes.”

Attract and hold attention

“As color is a visual language in and of itself, a designer can use it to attract the eye and focus attention on the intended messages in the work. Color can be used to irritate or relax, encourage participation or alienate it—it is completely up to the
designer” (Adams, Stone, Morioka 46-47). In the context of the Nutrition Facts Label color could be used to attract and focus attention on the amount of nutrients or lack of nutrients within packaged foods, so an informed decision could be made.

Remember that context is everything

“Color is always seen in context. Sometimes that context is proximity to another color, which altars its meaning or even the perception of color itself. At other times the context the environment surrounding the color—for example, the white of a page” (52). Thus it is important to note that, “warm colors always advance and seem nearer, while cool ones recede and seem more distant. Knowing such basics of colors can help make transitions fairly invisible and ease the flow of the eye by using more harmoniously related colors” (Adams, Stone, Morioka 52).

Consider that experimentation is key

“Experimenting with colors allows designer to develop keen observations about color interactions” (Adams, Stone, Morioka 58).

Know that people see color differently

“People with dichromatic color blindness lack either red-green or blue yellow receptors and cannot see hues in these respective ranges. People with color weakness, or anomalous trichromatism can perceive a color but need greater intensity of the associated wavelength in order to see it normally. The natural aging process in humans may also reduce color vision and acuity” (Adams, Stone, Morioka 64). The Color Design Workbook outlined how to design for dealing with those with color perception issues by citing Designing for People with Partial Sight and Color Deficiencies (Adams, Stone, Morioka 66-69).
1. Exaggerate lightness difference between foreground and background colors to avoid using colors of similar lightness adjacent to one another, even if they differ in saturation or hue.

2. Choose dark colors with hues from the bottom half of Figure 17 against light colors from the top of Figure 17. Avoid contrasting light colors from the bottom half against dark colors from the top half.

![Figure 17. Color wheel to aid in designing for people with partial sight and color deficiencies Part 1.](image)

3. Avoid contrasting hues from adjacent parts of the hue circle, especially if the colors do not contrast sharply in lightness (see Fig 18).

![Figure 18. Color wheel to aid in designing for people with partial sight and color deficiencies Part 2.](image)
Assist in mnemonic value

“Many psychologists researching the process by which humans see and process visual information conclude that its influence highly by color. Color can work as a mnemonic device itself, aiding people’s memories” (Adams, Stone, Morioka 70).

Think about composition

“Color can be used to make the eye travel, comfortably or not, and pickup information from a design. Transitions can be produced using line, shape, contours (edges of shapes), and motifs in various colors for both images an typographic elements in compositions. Variations in hues and their specific placement create interest, while intervals of visual silence (e.g., a dark solid-color background) between repeating elements provides rest stops for the eye. Areas of pure white and pure black boot impact and contrast” ((Adams, Stone, Morioka 76).

Use standardized color systems & Understand limitations

Consistent colors are managed through the use of standardized color systems. This is used to insure the design will work across a multitude of media including print, online, broadcast, packaging and environment (Adams, Stone, Morioka 82-83). Moreover, it is important to know how the color systems will be affected by the choice of media.

Conclusion

The aforementioned criteria from *The Color Workbook* show how use of color within in any work is intricate and must be carefully applied. Moreover, it proved valuable in the decision to not include color in the prototype label for this thesis (discussed in Chapter 3).
CHAPTER 3. METHODOLOGY AND PROCEDURES

3.1 Introduction

The methodology for this thesis was based on the aforementioned literature review. The literature review discusses existing data and findings using the principles of Graphic User Interface implemented in this prototype label. The literature review discusses how Graphic Representation as Metaphor and Organization and Visual Structure may help increase comprehension of information. Furthermore the previously mentioned graphic design principles of hierarchy, color, spacing and proximity were discussed as a means to implement the two GUI principles in the prototype label.

Context of the Prototype Design

The initial research for the Nutrition Facts Label consisted of looking at all the updated designs made by the FDA since the initial design of the Nutrition Facts Label in 1991. No actual changes to the Nutrition Facts Label itself had occurred until the dual label column was introduced in the Lando and Lo 2013 study. However, there has been a variety of front package labeling added to the front of food products to give consumer a quick idea of the nutritional components of the food item. These front package labels were reviewed in addition to the dual label before the design process began.

The first front package label was the Smart Choices Food Label (Fig. 19) applied in October of 2008. This was a result of the FDA’s NLEA Act of 1990 that required the following information on food packaging; ingredients, allergy warning and nutrient information. According to “A Brief History” from the FDA website, the FDA gave manufactures the option to publish health claims on the front of the food packages. “The
Smart Choices Food Label was the first of its kind. It was then formally launched in September of 2009” (Weingarten).

The next update to the front of package label was the Nutritional Spotlight (Fig. 20), put into place in January of 2009 by Sara Lee (Weingarten).

The third front of package label was Supervalu introduced IQ (Fig. 21) in June of 2009. The goal was to, “aid shoppers in choosing low fat, high fiber and other good foods” (Weingarten).
The IQ Nutrition Label was the basis for the January 2011 Grocery Manufactures Associations design of the Nutrition Keys Label (Fig.22) still being used today. The name was changed to Facts Up Front in September 2011 (Weingarten).

![Figure 21. IQ Nutrition Label.](image)

**Figure 21. IQ Nutrition Label.**

**Figure 22. Grocery Manufactures Association’s Nutrition Keys Label.**

**Conclusion**

The idea of the front package label was introduced to help consumers. “The FDA found that the overflow of Nutrition Facts information from the side or back of food packaging was confusing for consumers. The consumer had a hard time relating the two areas of information” (Weingarten). One of the issues with the front package labels discussed by Weingarten is “inconsistency in design of the front package label claims”. Manufactures who opt into the front of package label are required to include certain information. However,
the design and colors are still in their control. Weingarten says, “the inconsistency adds to confusion amongst consumers when trying to comprehend the nutritional value of individual and multiple products”. Moreover, that “The FDA has not stepped in to standardize front of package nutrition information”. The dual label update to the Nutrition Facts Label introduced by the Lando and Lo 2013 study still deals with the same issues discussed in the literature review. Additionally it adds to the problems by doubling the amount of information on the label. The shortcoming of the front of package claims and the dual label update were coupled with Graphic User Interface and graphic design principles to attempt an effective redesign of the Nutrition Facts Label.
3.2 Prototype Design Process

3.2.1 Prototype Design Versions

The first version of the prototype label was done when I was pursuing my Master of Arts before switching to Master of Fine Arts. This is relevant, as the initial designs were not rooted in Graphic User Interface. These designs however were the starting point once the thesis project had been established. The initial design exploration focused on testing out different arrangements, colors, while maintaining certain qualities of the Nutrition Facts Label. The issues with this first version (Fig. 23) include a heavy reliance on color and too many separate entities.

Figure 23. Version one of the prototype design.
Version Two

This second version (Fig. 24) was designed using the initial ideas in version 1, however the principles of GUI and graphic design chosen for this thesis were implemented. The issues discussed with this version included a lack of standardization in the direction of the circle graphs. Additionally the segmented bar graph added too many separate entities discussed in version one. Moreover, in this version color was reduced to black and white with hints of the stoplight colors (red, yellow and green).

![Version two of the prototype design.](image-url)
**Version Three**

Version three (Fig. 25) consisted of 24 variations of the prototype label; the full 24 can be viewed in the appendix. This version focused on two basic arrangements that concentrated on proximity of the elements. The 24 variations were done to see how slight changes affected the label. This was done to begin narrowing down the prototype designs.

---

**Figure 25.** Version three of the prototype design.
Version Four

Version four (Fig. 26) consisted of 36 variations of the label; the full 36 can be viewed in the appendix. This version focused on the same two basic arrangements as seen in version 3, however, the focus was varying the typographic elements of the nutrient information. The 36 variations were done to see how slight changes affected the label. This was done to begin narrowing down the label designs.

**Figure 26. Version four of the prototype design.**
Version Five

This prototype label (Fig. 27) concentrated on rule sizes, headers, and placement of the daily values disclaimer. Additionally, the arrangement of the words “gram” and “calories” within the nutrient section were explored. This version had eight variations.

Figure 27. Version five of the prototype design.
**Version Six**

This version (Fig. 28) focused on color, and the application of the grey scale values to create distinction on the label. The reasoning behind the application of the grey scale to the design is discussed in detail in the methodology.

![Nutrition Facts](image)

**Figure 28.** *Version six of the prototype design.*
Version Seven

Version seven (Fig. 29) looked at the extremes of applying the pie chart to the label. Variations of the pie chart exposure were examined in this version. The full set of variations can be seen in the appendix. This revision resulted in showing more of the pie chart and reducing the size of the black circle.

Figure 29. Version seven of the prototype design.
**Version Eight**

This version (Fig. 30) concentrated on alignment of the elements. The final design ended up on a 3-column grid.

![Figure 30. Version eight of the prototype design.](image)
Version Nine

Version nine (Fig. 31) was dedicated to applying the nutritional values of the selected products to the prototype label as well as the label for the online survey.

![Nutrition Facts](image)

**Figure 31. Version nine of the prototype design.**

3.2.2 Final Design

The final design was attained through nine versions that consisted of 81 variations. The process to the final design exhausted possibilities to effectively implement Graphic Representation as Metaphor and Organization and Visual Structure. The following will discuss how each change made to the final design implements the aforementioned Graphic User Interface principles.
3.2.3 Typography and Rules

For the purposes of this thesis project the font was not changed. The focus of this thesis aims to discover the effectiveness of the addition of Graphic Representation as Metaphor and Organization and Visual Structure. To maintain the integrity of the variables being tested the font and type size remained as enforced by the FDA. The FDA allows for the use of Franklin Gothic Heavy, or Helvetica Black, no smaller than 13 point for the Heading, and uses Helvetica between 6 and 8 points for all remaining typography (FDA.Gov). The rules were also kept to the FDA standards of 7, 3 and $\frac{1}{4}$ for the various sections of the Nutrition Facts Label. Figure 32 showcases the maintained font and rule on the final prototype label compared to the Nutrition Facts Label.

![Prototype Label](image)

![Current Label](image)

Figure 32. Final redesigned Nutrition Facts Label compared to the Nutrition Facts Label.
3.2.4 Color

Color was discussed in depth in the literature review. Originally in the context of the Nutrition Facts Label color was going to be used to attract and focus attention on the amount of nutrients or lack of nutrients within packaged foods. This was due to the fact that, “As color is a visual language in and of itself, a designer can use it to attract the eye and focus attention to the intended messages in the work. Color can be used to irritate or relax, encourage participation or alienate it—it is completely up to the designer.” (Adams, Stone, Morioka 46-47).

There were two reasons in the decision to have the final prototype label based on a grey scale. The first reason is that the Nutrition Facts Label is designed in black and white to accommodate those with color issues. The grey scale for the prototype label for this thesis was added to differentiate values within the pie chart used for Graphic Representation as Metaphor while maintaining the integrity of the black and white of the Nutrition Facts Label. The second reason was to keep the integrity of the variables being tested. Having the prototype label in color compared to the label in black and white would skew results, as color is such a strong visual component. Additionally, including color would make it hard to decipher the data on what made participants choose one label over the other since none of the questions on the survey pertained to color.
3.2.5 Change One

Beginning at the top the prototype label first change was made to the display of the servings within the packaged food product (Fig.33).

![Comparison of the first change.](image)

On the Nutrition Facts Label the “serving size” and “servings per container” are written and located immediately under the Nutrition Facts heading. Graphic Representation as Metaphor is implemented here with use of the pie chart. An additional metaphor is added in the clockwise direction of the fill of the pie chart. Organization and Visual Structure is implemented with proximity and hierarchy.

The hierarchy is implemented by moving the word “calories” central to bring focus to the information being displayed in this section of the label. The proximity of the “calories” associated with “single serving” and “servings per container” help reinforce the written
component. Placing the numerical calorie amounts within the pie chart reiterate the relation between the pie chart, numerical calorie amounts and the written components. The principle of proximity discussed in the literature review states that elements that are close to each other will be grouped together. Spacing (line spacing) works alongside with proximity.

While related elements are placed in close proximity they need to maintain line spacing to avoid “… inadequate space between lines, [which causes the reader to ] take in other lines as well, moreover if the lines are too widely spaced, a reader may have trouble locating the next line” (Carter, Day, Meggs 2007). In addition, proper interline spacing is important as it helps carry the eye in a natural manor.

Change Two

The second change (Fig. 34) consists of highlighting information that is made minimal on the Nutrition Facts Label.

Figure 34. Calories per gram close up.
As discussed in the literature review, nutrition is a science where each gram of a nutrient contains a specific number of calories. One gram of fat contains 9 calories, one gram of carbohydrate contains 4 calories, and one gram of protein contains 4 calories. This information is important as, “Nutrients are substances that our bodies need for their maintenance, repair, and growth. Our foods contain the following basic nutrients: carbohydrates, fats, proteins, and water” (McDougall). This new section added to the prototype label breaks down the carbohydrates, fats, and protein a product has in a “single serving”. This information is highlighted on the new label to aid in comprehension of what a product is made up of.

The new section of the prototype label (Fig. 35) again uses the pie chart to implement Graphic Representation as Metaphor and uses proximity, hierarchy in the same manner discussed in the first change.

![Redesigned Label](image)

![Current Label](image)

Figure 35. Change two.
Furthermore to aid in hierarchy a sub heading was added to the rule to make it clear what type of information the section is displaying. The highlighting of this information coupled with the graphic representation using the pie charts puts into context the individual nutrient information of “total fat”, “total carbohydrates”, and “total protein”. This is important for comprehension as it relates individual entities to each other. The individual nutrient entities combined is what make up the nutritional value of food. Thus it was deemed important in deciphering healthfulness to show how these individual nutrients relate.

Change Three

The third change (Fig. 36) occurs in the list of the individual nutrients.

**Figure 36.** Change three.
The Nutrition Facts Label displays the nutrients in text format aligned vertically and read left to right. The close proximity of the nutrients and grams vertically forces a reader to take in the nutrient above and below their focus. Moreover to acquire the “daily value” percentage the reader eye must move their focus from the left to the right, in which case the nutrient becomes out of focus and the “daily value” percentage is isolated, and once again the reader is also taking in the “daily value” percentage of the nutrient above and below their focus. This repetitive left to right eye motion disconnects the information.

To keep consistency this third change once more incorporates the pie chart as Graphic Representation of Metaphor and proximity and hierarchy for Organizational and Visual Structure. Placing the “daily value” percentage and “grams” within the pie chart allows for one to have all the information about a particular nutrient in once space. Moreover the “daily value” percentage is placed on top for proximity to show that is the represented percentage being shown in the pie chart. The disclaimer text with regards to the “daily values” being based on a 2,000 calorie diet was moved up on the label. This is important as each individual person has different needs.

This disclaimer is important to let consumers know that the amount of nutrients and calories may be different based on their specific needs. The disclaimer was moved up on the prototype label to showcase its importance and remind consumers to consider their specific needs when looking over the nutrients within the package food. Moreover below the nutrients on the prototype label is the breakdown of the recommended amounts based on a 2,000 and 2,500 calorie diet. This was also moved up so the consumer could easily relate the recommended amounts to the individual nutrients. Prior to this change the disclaimer and
recommended amounts were placed after the “vitamins and minerals” completely disconnecting it from its related information.

**Change Four**

Change four was a result of the previous 3 changes (Fig 37). The reformatting of the sections according to the GUI principles left the vitamins and mineral section in close proximity to the ingredients. This also works with hierarchy, as “vitamins and minerals” are Micronutrients compared to the other nutrients, which are Macronutrients. For this reason no Graphic Representation of Metaphor was added to the “vitamins and minerals”. While they play a role in nutrition the healthfulness of a product is largely determined by the Macronutrients. The ingredients section was not moved, nor altered; the vitamin and mineral section was lowered slightly in hierarchy but did not change in format.

![Redesigned Label vs Current Label](image)

**Figure 37. Change four.**
3.3 Testing Procedure

The FDA recently conducted a study that was printed in the 2013 February issue of the *Journal of the Academy of Nutrition and Dietetics*. Amy Lando and Serena Lo (Center for Food Safety and Applied Nutrition) were heads in the study that included 9,000 participants to test its initial proposed updates to the Nutrition Facts Label. The Lando and Lo 2013 study was used as a case study for this thesis, thus the testing procedure parallels it.

3.3.1 Survey Format

An online survey was chosen to test the effectiveness of the prototype label compared to that of the Nutrition Facts Label. The FDA also collected its data via an online consumer panel. It is unclear whether or not the participants for the FDA study were compensated. The participants of this thesis study were not compensated. Qualtrics software was used to create the survey for this thesis. There were a total of 16 survey questions to ensure that all possible combinations of labels were presented in the survey for equal exposure as to not skew results (see Appendix M).

3.3.2 Online Consent Form

To insure this thesis study protects it human participants the structure of this thesis study was reviewed by the Institutional Review Board (IRB). One of the requirements was a consent form (Appendix K) stating the purpose of the study, description of procedures, risks, benefits, costs and compensation. There were no foreseeable risks in this study or any compensation.

3.3.3 Demographics Form

The demographics questions were taken from the FDA Lando and Lo 2013 study once again to parallel the study. To ensure a wide variety of participants the following
methods were used to attain participants: email, social media, list serves, word of mouth, and flyers. According to the *Journal of Academy of Nutrition and Dietetics*, “Adults aged 18 years and older were recruited from Synovate’s online household panel. Data were collected during August 2011. A total of 32,897 invitations were sent for a final sample of 9,493 interviews”. This thesis study was sent out to 31,000 invitations for a final sample of 943 responses. The demographic questions (see Appendix L) were supplied in the original research document in the *Journal of Academy of Nutrition and Dietetics* February 2013 Volume 113 Number 2.
3.3.4 Survey Questions and Evaluation Measures

The survey questions served as the evaluation measures for this study. There were two types of survey question included in the online survey for this thesis. The first was a comparison question (Fig. 38), which consisted of different combinations of two labels (Nutrition Facts Label vs. Nutrition Facts Label, Prototype Label vs. Nutrition Facts Label,) for participants compare and answer the following questions:

A. Based on what you can see on the labels, if you wanted to buy the healthier product, which of these two products would you select?
B. Which product has the fewest calories per container?
C. Which product has the fewest calories per serving?

“The product comparison task measured ability to identify the healthier product and the product with fewer calories per container and per serving” (Lando and Lo 2013).

Figure 38. Screen shot of the online survey comparison question. Full Nutrition Facts Labels were shown to participants but have been truncated in this figure line to save space.
The second type of questions was based on healthfulness. The question consisted of one label (either the Nutrition Facts Label or Prototype Label) and asked participants to rate the healthfulness (Fig. 39).

A. Assume you were going to grab a snack, how healthy of a choice would this snack be? Please rate using a 5-point scale (1= Not At All Healthy, 5=Very Healthy)

This question measured healthfulness based on, “the amount of calories and various nutrients per serving and per container, and label perceptions” (Lando and Lo 2013). Once again these question were based on those used by the FDA supplied in the original research document in the *Journal of Academy of Nutrition and Dietetics* February 2013 Volume 113 Number 2.

![Figure 39. Screen shot of the online survey healthfulness question. Full Nutrition Facts labels were shown to participants but have been truncated in this Figure line to save space.](image)
3.3.5 Food Products

The prototype label for this thesis aims to help consumers make more informed and healthful decisions. Thus to test this prototype a healthy product was compared to a less healthy product. Like the FDA, “either for two frozen meals or for two bags of chips were shown. One label showed the more healthful nutrition profile, and the other showed the less healthful profile. Depending on the experimental condition assigned, the label formats for both products could be the same or could be different” (Lando and Lo 2013). The precise product names were not given in the original research document. Thus for the thesis study I used the nutritional profiles provided to select two chips and two frozen meals with similar nutritional profiles. It is to be noted that with the recent FDA updates to the Nutrition Facts Label reveals that the frozen item used in the Lando and Lo 2013 study was likely ice cream.

In an interview with NBC News the FDA stated, “For certain packages that are larger and could be consumed in one sitting or multiple sittings, manufacturers would have to provide ‘dual column’ labels to indicate both ‘per serving’ and ‘per package’ calories and nutrient information,” FDA says. “Examples would be a 24-ounce bottle of soda or a pint of ice cream. This way, people would be able to easily understand how many calories and nutrients they are getting if they eat or drink the entire package at one time.” The use of ice cream in the Lando and Lo 2013 study is not confirmed, the example of ice cream was readily used in multiple interviews given by the FDA with regards to the recent 2014 updates. The recent 2014 updates will be discussed further in Chapter 5.
3.3.6 Data Analysis

The data was collected by Qualtircs and analyzed by myself, the primary investigator with the help of a statistician Nora Ladjahasan. The data results and analysis will be further discussed in Chapter 4.

3.4 Limitations of the Methodology

The review and discussion of the results brought to light limitations in the methodology. The issues will be broken down in order of their occurrence in the methodology.

Context of the Prototype Design

The attempt to parallel the case study used for this thesis (Lando and Lo 2013) proved to be a limitation. Given the differences in research questions modifications should have been made to the organization of the questions used in the testing. The goal of this thesis was to design the Nutrition Facts Label in a way to be more comprehensible so that consumers could make more informed decisions. The Lando and Lo 2013 study focused on whether or not consumers could pick out the healthier product. Consequently the questions should have focused on the visual nature of an all text versus image-based design. Additionally an exit survey with comments would have been valuable in getting feedback from participants to establish anything that may have been overlooked in the testing procedure and label design. Another limitation of this study in relation to the Lando and Lo 2013 study was the term “healthfulness”.

Food Products

The food products selected for this thesis study was based on the nutritional profiles provided in the Lando and Lo 2013 study. This thesis never questioned the implications of
the term “healthy”. What qualifies as “healthy” outside of this study is undetermined. It is unclear how the Lando and Lo 2013 study chose which food product constituted as healthy, however, for the sake of this thesis the food product selected as “healthy” was based on the nutritional profiles provided in the Lando and Lo 2013 study. Asking participants to pick out the healthier product for this study was a limitation since the word “healthy” is undefined and is relative to each individual participant. If the nature of this study had focused on comparing the visual to text components of the label this issue with “healthfulness” would have been averted. The next limitation in this study was the testing audience.

**Testing Audience**

The bias in the testing audience was found during the review of the demographics data. The survey was sent out to 31,000 Iowa State University Students, friends and colleagues. This was a limitation as the survey reached educated, middle class young adults ranging in age from 18-30. This survey didn’t reach those most affected with rising obesity rates. Additionally the survey format was an online survey with limited the test those who had access to a computer or smart device. The last limitation in this study was the data analysis.

**Data Analysis**

The data analyzed focused on the questions and the frequency of the Nutrition Facts Label use. No correlations were made between any other information from the demographic questions. This limitation was due to the time sensitivity and focus of this study. Moving forward with any future work the aforementioned limitations of this study will be considered.
CHAPTER 4. ANALYSIS AND RESULTS

4.1 Data

4.1.1 Data Cleaning

The data collected through Qualtrics was cleaned and analyzed by myself and statistician Nora Ladjahasa. The first step included exporting the raw data from Qualtrics in an SPSS format. The data cleaning involved the following:

1. **Single Variables:** This included combining related questions into a single variable.
2. **Recode values:** When the data was cleaned the following values were inputted 1= unhealthy 2=healthy 3=both. Thus recoding values placed the “both” answers in the middle so 1= unhealthy 2=both 3=healthy. This made it easier to decipher the mean value of the data.
3. **Value Labels:** Since the values were recoded the value labels need to be changed as well to correspond with the aforementioned changes. Without the change in value labels anything that had originally been documented as a “healthy” answer would have taken the value 2. However, in the recoding of values the number 2 was change to correlate with “both” answers. The correction of the value labels insured that all the answers would correctly match up with the recoded values.

4.1.2 Data Analysis

The data were run using three different methods: T –Test, Description and Correlations. The correlation data was used with the description data to answer the following questions:

1. Is there a relation between the frequency consumers use the Nutrition Facts Label and their ability to pick out the more healthful product?
2. Were there any significant differences in answer between similar questions about chips and frozen meal respectively? Moreover, if there were differences what was the label formats viewed by the consumer in the survey.

To answer the above two questions the following steps were taken

1. The data were searched for values below .05 in the Significant (2-Tailed) Test. This value meant that there was a significant difference between the mean values of a specific question and the frequency at which consumers use the Nutrition Facts Label (consumers were asked to rate how frequently they used the Nutrition Facts Label on a scale of 1-4 (1=never, 2=rarely, 3=sometimes, 4=often).

2. The data were searched to determine if the questions with a Significant (2-Tailed) Test were positive or negative. If the Significant (2-Tailed) Test was positive it meant there was a positive relation between how frequent consumers used the Nutrition Facts Label and their ability to pick out the more healthful product. If the Significant (2-Tailed) Test was negative it meant there was a negative relation between how frequent consumers used the Nutrition Facts Label and their ability to pick out the more healthful product?

3. The third step was to find the questions with significant differences on the Descriptive Data sheet. This sheet gave the maximum, minimum and mean values.

In essence Step 1 stated there was something that needed to be looked at more closely. Step 2 stated whether the relationship was positive or negative and Step 3 gave the details as to what the significant finding was.
4.1.3 Results

The questions were categorized in sets to help locate the questions on the actual survey to see which label types were shown to consumers. The complete survey can be found in Appendix M. Below are the values used to evaluate the following questions.

**Table 2. Use of Nutrition Facts Label frequency values.**

<table>
<thead>
<tr>
<th>Label Title</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**Table 3. Comparison of healthfulness values.**

<table>
<thead>
<tr>
<th>Label Title</th>
<th>Unhealthy</th>
<th>Both</th>
<th>Healthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Frequency and Chip Comparison Results

Table 4 below shows the questions about the nutrient components of a bag of chips. According to the data (Appendix N and O) these questions had significant correlations between selecting the more healthful product and the frequency of use of the Nutrition Facts Label.

**Table 4. Correlation between frequency of Nutrition Facts Label use and selecting the more healthful chip product.**

<table>
<thead>
<tr>
<th>Set Question</th>
<th>Correlation</th>
<th>Frequency Mean</th>
<th>Values</th>
<th>Conclusion</th>
<th>Label Type</th>
<th>Healthier Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 1: Which product has the fewest calories per container?</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 3 P: .109 R: .001</td>
<td>The consumers who used the Nutrition Facts Label often and were able to pick out the more healthful product.</td>
<td>Old vs Old</td>
<td>Old</td>
</tr>
<tr>
<td>Set 3: Which product has the fewest calories per serving?</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 3 P: .089 R: .028</td>
<td>The consumers who used the Nutrition Facts Label often and were able to pick out the more healthful product.</td>
<td>New vs Old</td>
<td>New</td>
</tr>
<tr>
<td>Set 5: Based on what you can see on the labels if you wanted to buy the healthier product, which of these two would you select?</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 3 P: .120 R: .006</td>
<td>The consumers who used the Nutrition Facts Label often and were able to pick out the less healthful product.</td>
<td>Old vs New</td>
<td>New</td>
</tr>
</tbody>
</table>

Frequency and Frozen Comparison Results

Table 5. shows the questions about the nutrient components of a frozen food. According to the data these questions had significant correlations between selecting the more healthful product and the frequency of use of the Nutrition Facts Label.
Table 5. Correlation between frequency of Nutrition Facts Label use and selecting the more healthful frozen product.

<table>
<thead>
<tr>
<th>Set Question</th>
<th>Correlation</th>
<th>Frequency Mean</th>
<th>Values</th>
<th>Conclusion</th>
<th>Label Type</th>
<th>Healthier Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 2: Based on what you can see on the labels if you wanted to buy the healthier product, which of these two would you select?</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 3</td>
<td>The consumers who used the Nutrition Facts Label often were able to pick out the more healthful product.</td>
<td>New vs New</td>
<td>New</td>
</tr>
<tr>
<td>Set 4: Based on what you can see on the labels if you wanted to buy the healthier product, which of these two would you select?</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 3 P: .166 R: .000</td>
<td>The consumers who used the Nutrition Facts Label often were able to pick out the more healthful product.</td>
<td>Old vs New</td>
<td>Old</td>
</tr>
<tr>
<td>Set 4: Which product has the fewest calories per container?</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 3 P: .121 R: .002</td>
<td>The consumers who used the Nutrition Facts Label often were able to pick out the more healthful product.</td>
<td>Old vs New</td>
<td>Old</td>
</tr>
<tr>
<td>Set 6: Based on what you can see on the labels if you wanted to buy the healthier product, which of these two would you select?</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 3 P: .091 R: .036</td>
<td>The consumers who used the Nutrition Facts Label often were able to pick out the more healthful product.</td>
<td>New vs Old</td>
<td>Old</td>
</tr>
<tr>
<td>Set 6: Which product has the fewest calories per container?</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 3 P: .136 R: .002</td>
<td>The consumers who used the Nutrition Facts Label often were able to pick out the more healthful product.</td>
<td>New vs Old</td>
<td>Old</td>
</tr>
</tbody>
</table>
**Frequency and Chip Rating Results**

The following are questions about the healthfulness a bag of chips, which had significant correlations between rating the chips and the frequency of use of the Nutrition Facts Label. For these types of questions the consumer was shown a single label and asked to rate its healthfulness.

**Table 6. Rating Scale for the healthfulness of a product.**

<table>
<thead>
<tr>
<th>Label Title</th>
<th>Not At All Healthy</th>
<th>Very Healthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

All of these questions in Table 7 were worded as follows, “Assume you were going to grab a snack, how healthy of a choice would this snack be”?

**Table 7. Correlation between frequency of Nutrition Facts Label use and rating the healthfulness of a chip product.**

<table>
<thead>
<tr>
<th>Set Question</th>
<th>Correlation</th>
<th>Frequency Mean</th>
<th>Values</th>
<th>Conclusion</th>
<th>Label Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 2</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 3 P: -.124 R: .000</td>
<td>The consumers who used the Nutrition Facts Label often and were able to pick out the less healthful product.</td>
<td>New</td>
</tr>
<tr>
<td>Set 4</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 3 P: -.155 R: .000</td>
<td>The consumers who used the Nutrition Facts Label often and were able to pick out the less healthful product.</td>
<td>Old</td>
</tr>
<tr>
<td>Set 6</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 3 P: -.215 R: .000</td>
<td>The consumers who used the Nutrition Facts Label often and were able to pick out the less healthful product.</td>
<td>New</td>
</tr>
<tr>
<td>Set 8</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 3 P: -.145 R: .001</td>
<td>The consumers who used the Nutrition Facts Label often and were able to pick out the less healthful product.</td>
<td>Old</td>
</tr>
</tbody>
</table>
Frequency and Frozen Rating Results

The following are questions about the healthfulness a frozen item that had significant correlations between rating the frozen item and the frequency of use of the Nutrition Facts Label. All of the questions in Table 8 were worded as follows, “Assume you were going to grab a snack, how healthy of a choice would this snack be”?

Table 8. Correlation between frequency of Nutrition Facts Label use and rating the healthfulness of a frozen product.

<table>
<thead>
<tr>
<th>Set Question</th>
<th>Correlation</th>
<th>Frequency Mean</th>
<th>Values</th>
<th>Conclusion</th>
<th>Label Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 3</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 2</td>
<td>The consumers who used the Nutrition Facts Label often and were able to pick out the less healthful product.</td>
<td>New</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>P: -.191 R: .001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set 5</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 2</td>
<td>The consumers who used the Nutrition Facts Label often and were able to pick out the less healthful product.</td>
<td>New</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>P: -.094 R: .019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set 7</td>
<td>Positive</td>
<td>3</td>
<td>Mean: 2</td>
<td>The consumers who used the Nutrition Facts Label often and were able to pick out the less healthful product.</td>
<td>Old</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>P: -.143 R: .001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Similar Chip Question Results

The following are the results from analyzing the mean value of similar question types about chip products. The question types are distinguished by the title of the tables. See Table 3 for the values used for healthfulness values.

**Table 9.** Based on what you can see on the labels if you wanted to buy the healthier chip product, which of these two would you select?

<table>
<thead>
<tr>
<th>Set Question</th>
<th>Correlation</th>
<th>Healthfulness Mean</th>
<th>Label Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 1</td>
<td>Positive</td>
<td>2.12</td>
<td>Old vs Old</td>
</tr>
<tr>
<td>Set 3</td>
<td>Positive</td>
<td>1.90</td>
<td>New vs Old</td>
</tr>
<tr>
<td>Set 5</td>
<td>Positive</td>
<td>1.90</td>
<td>Old vs New</td>
</tr>
<tr>
<td>Set 7</td>
<td>Positive</td>
<td>1.86</td>
<td>New vs New</td>
</tr>
</tbody>
</table>

Conclusion: The consumers were always able to pick out the healthier chip. However, the table above states that consumers had an easier time picking out the healthier product when they were comparing an old label versus another old label.

**Table 10.** Which chip product has the fewest calories per container?

<table>
<thead>
<tr>
<th>Set Question</th>
<th>Correlation</th>
<th>Healthfulness Mean</th>
<th>Label Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 1</td>
<td>Positive</td>
<td>2.92</td>
<td>Old vs Old</td>
</tr>
<tr>
<td>Set 3</td>
<td>Positive</td>
<td>2.79</td>
<td>New vs Old</td>
</tr>
<tr>
<td>Set 5</td>
<td>Positive</td>
<td>2.86</td>
<td>Old vs New</td>
</tr>
<tr>
<td>Set 7</td>
<td>Positive</td>
<td>2.88</td>
<td>New vs New</td>
</tr>
</tbody>
</table>

Conclusion: The consumers were always able to pick out the chip with the fewest calories per container regardless of the label types.

**Table 11.** Which chip product has the fewest calories per serving?

<table>
<thead>
<tr>
<th>Set Question</th>
<th>Correlation</th>
<th>Healthfulness Mean</th>
<th>Label Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 1</td>
<td>Positive</td>
<td>2.12</td>
<td>Old vs Old</td>
</tr>
<tr>
<td>Set 3</td>
<td>Positive</td>
<td>1.90</td>
<td>New vs Old</td>
</tr>
<tr>
<td>Set 5</td>
<td>Positive</td>
<td>1.90</td>
<td>Old vs New</td>
</tr>
<tr>
<td>Set 7</td>
<td>Positive</td>
<td>1.86</td>
<td>New vs New</td>
</tr>
</tbody>
</table>

Conclusion: The consumers were always able to pick out the chip with the fewest calories per serving regardless of the label types.
Table 12 below shows a question in which consumers saw a single Nutrition Facts Label and were asked to rate it. Consumers rated the product using a scale of 1(Not at All Healthy) to 5(Very Healthy). See Table 6 for reference.

**Table 12. Assume you were going to grab a snack, how healthy of a choice would this chip snack be”?**

<table>
<thead>
<tr>
<th>Set Question</th>
<th>Correlation</th>
<th>Healthfulness Mean</th>
<th>Label Types and Healthfulness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 2</td>
<td>Positive</td>
<td>2.77</td>
<td>New Healthy</td>
</tr>
<tr>
<td>Set 4</td>
<td>Positive</td>
<td>2.74</td>
<td>Old Unhealthy</td>
</tr>
<tr>
<td>Set 6</td>
<td>Positive</td>
<td>2.78</td>
<td>New Unhealthy</td>
</tr>
<tr>
<td>Set 8</td>
<td>Positive</td>
<td>2.89</td>
<td>Old healthy</td>
</tr>
</tbody>
</table>

Conclusion: The consumers were unsure about how healthy a particular product of chips was regardless of label type or actual healthfulness of the product.

**Similar Frozen Questions Results**

The following are the results from analyzing the mean value of similar question types about frozen products. The question types are distinguished by the title of the tables. **Table 3** shows the values of healthfulness.

**Table 13. Based on what you can see on the labels if you wanted to buy the healthier frozen product, which of these two would you select?**

<table>
<thead>
<tr>
<th>Set Question</th>
<th>Correlation</th>
<th>Healthfulness Mean</th>
<th>Label Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 2</td>
<td>Positive</td>
<td>2.45</td>
<td>New vs New</td>
</tr>
<tr>
<td>Set 4</td>
<td>Positive</td>
<td>2.59</td>
<td>Old vs New</td>
</tr>
<tr>
<td>Set 6</td>
<td>Positive</td>
<td>2.45</td>
<td>New vs Old</td>
</tr>
<tr>
<td>Set 8</td>
<td>Positive</td>
<td>2.60</td>
<td>Old vs Old</td>
</tr>
</tbody>
</table>

Conclusion: The consumers were always able to pick out the healthier frozen item regardless of label type.
Table 14. Which frozen product has the fewest calories per container?

<table>
<thead>
<tr>
<th>Set Question</th>
<th>Correlation</th>
<th>Healthfulness Mean</th>
<th>Label Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 2</td>
<td>Positive</td>
<td>2.77</td>
<td>New vs New</td>
</tr>
<tr>
<td>Set 4</td>
<td>Positive</td>
<td>2.75</td>
<td>Old vs New</td>
</tr>
<tr>
<td>Set 6</td>
<td>Positive</td>
<td>2.76</td>
<td>New vs Old</td>
</tr>
<tr>
<td>Set 8</td>
<td>Positive</td>
<td>2.82</td>
<td>Old vs Old</td>
</tr>
</tbody>
</table>

Conclusion: The consumers were always able to pick out the frozen item with the fewest calories per container regardless of the label types.

Table 15. Which frozen product has the fewest calories per serving?

<table>
<thead>
<tr>
<th>Set Question</th>
<th>Correlation</th>
<th>Healthfulness Mean</th>
<th>Label Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 2</td>
<td>Positive</td>
<td>2.92</td>
<td>New vs New</td>
</tr>
<tr>
<td>Set 4</td>
<td>Positive</td>
<td>2.83</td>
<td>Old vs New</td>
</tr>
<tr>
<td>Set 6</td>
<td>Positive</td>
<td>2.88</td>
<td>New vs Old</td>
</tr>
<tr>
<td>Set 8</td>
<td>Positive</td>
<td>2.88</td>
<td>Old vs Old</td>
</tr>
</tbody>
</table>

Conclusion: The consumers were always able to pick out the frozen item with the fewest calories per serving regardless of the label types.

Table 16 below shows a question in which consumers saw a single Nutrition Facts Label and were asked to rate it. Consumers rated the product using a scale of 1(Not at All Healthy) to 5(Very Healthy). See Table 6 for reference.

Table 16. Assume you were going to grab a snack, how healthy of a choice would this frozen snack be”?

<table>
<thead>
<tr>
<th>Set Question</th>
<th>Correlation</th>
<th>Healthfulness Mean</th>
<th>Label Type and Healthfulness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 1</td>
<td>Positive</td>
<td>2.08</td>
<td>Old Healthy</td>
</tr>
<tr>
<td>Set 3</td>
<td>Positive</td>
<td>1.94</td>
<td>New Unhealthy</td>
</tr>
<tr>
<td>Set 5</td>
<td>Positive</td>
<td>2.43</td>
<td>New Healthy</td>
</tr>
<tr>
<td>Set 7</td>
<td>Positive</td>
<td>1.91</td>
<td>Old Unhealthy</td>
</tr>
</tbody>
</table>

Conclusion: The consumers were unsure about how healthy a particular product of chips was regardless of label type or actual healthfulness of the product. The consumers did rate the unhealthier frozen item lower than the healthier choice, however, based on a 5-point scale the mean values are in the lower portion, which relates to healthfulness.
Overall Summary

- There was a positive correlation between those who frequently used the Nutrition Facts Label and being able to pick out the healthier product.

- Whether participants were comparing nutrition facts with the Nutrition Facts Label or the prototype label made no significant difference, participants were able to pick out the healthier product each time.

- Whether participants were using the Nutrition Facts Label or the prototype label made no difference when rating a single product based on healthfulness using a 5-point scale.
CHAPTER 5. FUTURE WORK

The prototype label done for the purposes of this thesis is only the beginning. Further testing and designs would need to be done with several considerations. The first would be to retest the prototype label using different questions focused on the visual nature of the label design. Likewise an exit survey would be added to gain feedback about issues not addressed in the testing questions. The prototype label could also be tested with eye tracking. This would be beneficial to see where participants look to determine where participants are looking when asked specific questions pertaining to the design of the labels. The structure of the any future testing would depend on resources and funding. Nevertheless the target audience would be isolated into two groups; control and experimental. The audience would include those most affected by the rising rates of obesity; more research would have to be done to identify such individuals. The last consideration takes into account the recent press release from the FDA.

On February 27, 2014 the FDA announced proposed updates to the Nutrition Facts Label. This is important as it shows the ongoing process, which started with the Lando and Lo 2013 study, similarity the process for the prototype label for the purposes of this thesis is ongoing as well. Additionally the changes in the proposed updates highlight several components which was included in the prototype label created for this thesis.

The FDA stated that,

The proposed update [to] the Nutrition Facts label for packaged foods to reflect the latest scientific information, including the link between diet and chronic diseases such as obesity and heart disease. The proposed label also would replace out-of-date serving sizes to better align with how much people
really eat, and it would feature a fresh design to highlight key parts of the label such as calories and serving sizes.”

This is important, as this was one of the driving forces to redesign the Nutrition Facts Label for this thesis, which was discussed in Chapter 1. Figure 40 below shows the proposed updates announced by the FDA.

![Nutrition Facts Label](image)

**Figure 40. 2014 FDA proposed Nutrition Facts Label Update.**

There were seven main changes to Figure 40 discussed in the FDA’s February 27th press release written by Theresa Eisenman:

1. “Require information about the amount of “added sugars” in a food product. The 2010 Dietary Guidelines for Americans states that intake of added sugar is too high in...
the U.S. population and should be reduced. The FDA proposes to include “added sugars” on the label to help consumers know how much sugar has been added to the product.”

2. “Update serving size requirements to reflect the amounts people currently eat. What and how much people eat and drink has changed since the serving sizes were first put in place in 1994. By law, serving sizes must be based on what people actually eat, not on what people “should” be eating. Present calorie and nutrition information for the whole package of certain food products that could be consumed in one sitting.”

3. “Present “dual column” labels to indicate both “per serving” and “per package” calorie and nutrition information for larger packages that could be consumed in one sitting or multiple sittings.”

4. “Require the declaration of potassium and vitamin D, nutrients that some in the U.S. population are not getting enough of, which puts them at higher risk for chronic disease. Vitamin D is important for its role in bone health. Potassium is beneficial in lowering blood pressure. Vitamins A and C would no longer be required on the label, though manufacturers could declare them voluntarily.”

5. “Revise the Daily Values for a variety of nutrients such as sodium, dietary fiber and Vitamin D. Daily Values are used to calculate the Percent Daily Value on the label, which helps consumers understand the nutrition information in the context of a total daily diet.”

6. “While continuing to require “Total Fat,” “Saturated Fat,” and “Trans Fat” on the label, “Calories from Fat” would be removed because research shows the type of fat is more important than the amount.”
7. “Refresh the format to emphasize certain elements, such as calories, serving sizes and Percent Daily Value, which are important in addressing current public health problems like obesity and heart disease.”

The seven points used to reason the recent updates are logical, however they do prompt discussion. The proposed update by the FDA incorporates 3 components used in the redesign for this thesis: proximity, line and hierarchy. Figures 41-45 show how the newly proposed label incorporates the aforementioned principles.

Figure 41. Proposed 2014 Label vs Nutrition Facts Label vs Prototype Label; Hierarchy of serving size and calories.

Figure 41 shows how the FDA used weight and size to increase the hierarchy of information regarding calories and serving size per package. In the redesigned label for the purpose of this thesis I created hierarchy by adding metaphor with the graphs and proximity by putting the “calories” and “servings per container” information closer together and in a separated section of the Nutrition Facts Label.
The proposed label removes “calories from fat”, as does the redesigned label for this study. The reasoning for this was discussed in the Lando and Lo 2013 study. Moreover was restated in the February 27, 2014 FDA press release that, “calories from fat” would be removed because research shows the type of fat is more important than the amount” (Eisenman). This can be seen in Figure 42.
Figure 43. Proposed 2014 Label vs Nutrition Facts Label; Vitamins and Minerals.

Figure 43 shows the addition of Vitamin D and Potassium to the “vitamins and minerals” section. The redesigned label for this study does not have Vitamin D or Potassium listed, however, moving forward it would appear logical to add the two seeing as though the FDA stated in the press release that Americans are deficient in these areas.
Figure 44. Proposed 2014 Label vs Nutrition Facts Label vs Prototype Label; Proximity and Line.

Figure 44 shows how the FDA proposed label uses a dual column to apply the proximity principle. To achieve this they add a vertical line to separate the “daily value” from the nutrients. The redesigned label for this study applied proximity principle by incorporating the “daily value” percentages into the metaphorical pie chart and placing the nutrient information within the pie chart.
Figure 45. Proposed vs Nutrition Facts Label; Added Sugars.

Figure 45 shows were the “added sugars” will be incorporated to address the fact that Americans have a high intake of added sugars. This component is not currently on the redesigned label for this thesis, moving forward it would be added to comply with the study done by the FDA to address, “the latest scientific information, including the link between diet and chronic diseases such as obesity and heart disease” (Eisenman 2014).

The success of this proposed label is currently unknown. It was not clear if the proposed label is to be printed on actual packaging and tested. The FDA did make the statement that “the agency is accepting public comments on the proposed changes for 90
days.” My personal review is that the changes are a step in the right direction especially since the FDA is taking into account the current nutritional needs of Americans, this aspect was lacking in the Lando and Lo 2013 study. I also applaud the fact that they do maintain the integrity of the current label but have taken steps to clarify and simplify the information, which is what my redesigned label also aimed to do. At the end of the day the goal of the FDA’s proposed label and of this thesis is, “to make it easier than ever for consumers to make better informed food choices that will support a healthy diet (Eisenman 2014)”.
APPENDIX E. PROTOTYPE DESIGN VERSION FIVE

- put long words on two lines
- changed line weight
- Added heading to DV section
- moved description of DV down to DV section
APPENDIX F. PROTOTYPE DESIGN VERSION SIX

Nutrition Facts

Calories
Serving Size 1 cup (228g)  Servings Per Container 2
220  
440

Daily Values
Protein 220
Total Carbohydrate 36
Total Fat 140

Daily Values
Total Carbohydrate 45
Protein 36
Total Fat 35%

Sugar 7g
Sodium 240mg
Dietary Fiber 6g
Cholesterol 5mg
Vitamin A 5%
Calcium 20%
Vitamin C 20%
Iron 8%
APPENDIX G. PROTOTYPE DESIGN VERSION SEVEN
APPENDIX I. PROTOTYPE DESIGN VERSION NINE

### Nutrition Facts

**Serving Size 1 Entree (225g) Servings Per Container 1**

<table>
<thead>
<tr>
<th>Calories</th>
<th>400 Calories from Fat 140</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>% Daily Value</strong></td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>10g</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>10g</td>
</tr>
<tr>
<td>Trans Fat</td>
<td>0g</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>40mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>840mg</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>47g</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>3g</td>
</tr>
<tr>
<td>Sugars</td>
<td>6g</td>
</tr>
<tr>
<td>Protein</td>
<td>16g</td>
</tr>
</tbody>
</table>

**Vitamin and Minerals**

- Vitamin A 15%  
- Vitamin C 2%
- Calcium 30%  
- Iron 10%

**Caloric Breakdown Per Serving**

- **Total Calorie**
- **Total Carbohydrate**
- **Protein**

**Daily Values Per Serving**

- **Total Fat**
- **Saturated Fat**
- **Trans Fat**
- **Cholesterol**
- **Sodium**
- **Total Carbohydrate**

**Dietary Fiber**

- **Protein**

**Carbohydrate**

- **Vitamin A 15%**
- **Vitamin C 2%**
- **Calcium 30%**
- **Iron 10%**

**Ingredients:** Organic macaroni (organic semolina flour, organic wheat flour, water), organic lowfat milk, Cheddar cheese (pasteurized milk, culture, salt, annatto, enzymes [without animal enzymes or rennet]), grade A A butter (cream, salt, annatto), organic wheat rice flour, sea salt, organic annatto. Contains wheat and milk.
### Nutrition Facts

**Serving Size:** 1 oz (28g) (About 15 chips)

<table>
<thead>
<tr>
<th>Amount Per Serving</th>
<th>Servings Per Container 3 (About 15 chips)</th>
<th>% Daily Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories 140</td>
<td>Calories from Fat 60</td>
<td></td>
</tr>
<tr>
<td>Total Fat 6g</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>Saturated Fat 1g</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Trans Fat 0g</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Cholesterol 0mg</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Sodium 210mg</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Total Carbohydrate 18g</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>Dietary Fiber 2g</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Sugars 2g</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Protein 2g</td>
<td>9%</td>
<td></td>
</tr>
</tbody>
</table>

**Daily Values**

- *Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

<table>
<thead>
<tr>
<th>Total Fat</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturated Fat</td>
<td>4%</td>
</tr>
<tr>
<td>Trans Fat</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cholesterol</th>
<th>0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>6%</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>6%</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>8%</td>
</tr>
<tr>
<td>Sugars</td>
<td>N/A</td>
</tr>
<tr>
<td>Protein</td>
<td>1%</td>
</tr>
</tbody>
</table>

**Calories**

<table>
<thead>
<tr>
<th>Calories</th>
<th>1,500</th>
<th>2,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat</td>
<td>Less than 48g</td>
<td>48g</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>Less than 25g</td>
<td>25g</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Less than 300mg</td>
<td>300mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>Less than 2,400mg</td>
<td>2,400mg</td>
</tr>
<tr>
<td>Total Carb</td>
<td>37g</td>
<td>37g</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>15g</td>
<td>20g</td>
</tr>
</tbody>
</table>

**Vitamins and Minerals**

- Vitamin A 0%  •  Vitamin C 0%
- Calcium 0%  •  Iron 2%

**Ingredients:** Whole corn, sunflower oil, whole wheat, rice flour, whole oat flour, sugar, maltodextrin, salt, cheddar cheese (cultured milk, salt, enzymes), whey, buttermilk solids, romano cheese from cow's milk (cultured pasteurized part skim milk, salt, enzymes), whey protein concentrate, partially hydrogenated soybean and cottonseed oil, sodium caseinate, natural and artificial flavors, disodium phosphate, monosodium glutamate, water, wheat gluten, garlic powder, lactic acid, artificial colors (including yellow 6), disodium inosinate and disodium guanylate. Contains Milk and Wheat Ingredients.
APPENDIX J. FINAL PROTOTYPE DESIGN

Nutrition Facts

Calories

Serving Size: 1 oz. (28g)
About 16 Chips

Calorie Breakdown Per Serving

Total Fat 160 calories

Saturated Fat 9g

Trans Fat 1.5g

Cholesterol 0mg

Sodium 260mg

Total Carbohydrate 0g

Dietary Fiber 1g

Sugars 1g

Protein 2g

Daily Values Per Serving

*Percent Daily Values (DV) are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your caloric needs.

Total Fat 14%

Saturated Fat 7%

Trans Fat 0%

Cholesterol 0%

Sodium 4%

Total Carbohydrate 6%

Dietary Fiber 6%

Sugars 6%

Protein 8%

Vitamins and Minerals

Vitamin A 0%  Vitamin C 10%

Calcium 0%  Iron 2%

Ingredients: Potatoes, Vegetable Oil (Sunflower, Corn and/or Canola Oil), and Sea Salt.
Appendix K: IRB Approval Form

Iowa State University
Of Science and Technology

Institutional Review Board
Office for Responsible Research
Vice Presidents for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515-294-3566
FAX 515-294-2287

Date: 10/31/2013
To: Jessica Palo
3624 Westlaw Dr
Ames, IA 50010

CC: Dr. Paul R Bruski
158 College of Design

From: Office for Responsible Research

Title: Making healthful decisions: A redesign of the Nutrition Facts Label using principles of graphic user interface.

IRB ID: 13-500

Study Review Date: 10/31/2013

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects’ responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- You do not need to submit an application for annual continuing review.

- You must carry out the research as described in the IRB application. Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Human Subjects will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. Only the IRB or designee may make the determination of exemption, even if you conduct a study in the future that is exactly like this study.

Please be aware that 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. An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.
APPENDIX L. ONLINE CONSENT FORM

Attachment 4. Informed Consent Document for Online Survey

Informed Consent Document for Online Survey

Title of Study: Redesigning the Nutrition Facts Label for Healthful Decision Making
Participants: Principle Investigator: Jessica Palo, BA, MFA Candidate
Co-Investigators: Paul Bruski, BFA, MFA

This is a study about the redesign of the Nutrition Facts Label. Please take your time in deciding if you would like to participate. Please feel free to ask questions at any time. No items will be purchased during the session. No personal or financial information will be collected during the session.

INTRODUCTION
This study aims to test how effective the redesigned Nutrition Facts Label is at helping consumers age 18 and older decide how healthy foods products are. The information gathered will contribute to redesigning the Nutrition Facts Label that will aid consumers in making healthful decisions.

You are being invited to participate in this study because you are an adult age 18 or older capable of making decisions. You should not participate if you are under age 18.

Participants will not get direct benefits. However, this knowledge can be expected to ultimately provide significant opportunities to improve the Nutrition Facts Label redesign.

DESCRIPTION OF PROCEDURES
If you agree to participate in this study, participation will last for approximately 40 minutes.

During the study you may expect the following study procedures to be followed:

1) You must be at least 18 years old on the date of this survey
2) If you agree to participate, click the “I Agree” box at the bottom of this page
3) You will be asked to complete questions about your demographic information
4) You will be asked to complete questions about your familiarity with the Nutrition Facts Label
5) You will be asked to complete a survey asking you to rate the healthfulness of food products using the current Nutrition Facts Label and the redesigned Nutrition Facts Label

RISKS
There are no foreseeable risks in this study. However, you may leave the study at any time without penalty.

BENEFITS
Participants will not get direct benefits. However, this knowledge can be expected to ultimately provide significant opportunities to improve the redesign of the Nutrition Facts Label

COSTS AND COMPENSATION
You will not have any costs from participating in this study. There will not be any compensation to participate in this study.
PARTICIPANT RIGHTS
Your participation in this study is completely voluntary and you may refuse to participate or leave the study at any time. You can skip any questions that you do not wish to answer. If you decide to not participate in the study or leave the study early, it will not result in any penalty or loss of benefits to which you are otherwise entitled. During the testing, if you feel uncomfortable at anytime you can quit.

CONFIDENTIALITY
Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy your records for quality assurance and data analysis. These records may contain private information.

To ensure confidentiality to the extent permitted by law, the following measures will be taken:

The participant’s identity will be anonymous all throughout the survey. Only the researcher will have access to the data. The data will be entered and kept in a password-protected computer located on the PI’s computer. All data files will be destroyed once transcribed and entered in the computer for analysis.

QUESTIONS OR PROBLEMS
You are encouraged to ask questions at any time during this study. For further information about the study contact Jessica Fulco, Principal Investigator, phone 515-231-6382, email jecspalo@iastate.edu

If you have any questions about the rights of research subjects or research related injury, please contact IRB Administrator, (515) 294-4566, irb@iastate.edu, or Director, Office for Responsible Research, (515) 294-3115, 1138 Pearson Hall, Ames, IA 50011.

SUBJECT SIGNATURE
By checking the “I Agree” box below, it indicates that you voluntarily agree to participate in this study, that you have been given the time to read the document and that you are ready to begin the survey. You may leave the survey anytime without penalty.

I Agree

I do not wish to continue the survey
APPENDIX M. DEMOGRAPHICS FORM

1. Age
   - 18
   - If older than 18 please enter age here

2. Gender
   - Male
   - Female

3. Race/Ethnicity
   - White, non-Hispanic
   - Black/African American
   - Hispanic Latino
   - Asian, American Indian, Pacific Islander
   - Other/no answer

4. Education
   - Less than high school
   - Completed high school
   - Some college
   - Completed college

5. How frequently do you use the Nutrition Facts Label?
   - Never
   - Rarely
   - Sometimes
   - Often
APPENDIX N. COMPLETE ONLINE SURVEY

Set 1

Please use the Nutrition Facts labels below to answer the following questions:

Based on what you can see on the labels, if you wanted to buy the healthier product, which of these two products would you select?

LABEL A  □  LABEL B  □

Which product has the fewest calories per CONTAINER?

LABEL A  □  LABEL B  □

Which product has the fewest calories per SERVING?

LABEL A  □  LABEL B  □

<table>
<thead>
<tr>
<th>Nutrition Facts</th>
<th>Nutrition Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amount Per Serving</strong></td>
<td><strong>Amount Per Serving</strong></td>
</tr>
<tr>
<td>Calories 140</td>
<td>Calories from Fat 60</td>
</tr>
<tr>
<td>Total Fat 5g</td>
<td>% Daily Value</td>
</tr>
<tr>
<td>Saturated Fat 1g</td>
<td>4%</td>
</tr>
<tr>
<td>Trans Fat 0g</td>
<td></td>
</tr>
<tr>
<td>Cholesterol 0mg</td>
<td>0%</td>
</tr>
<tr>
<td>Sodium 210mg</td>
<td>9%</td>
</tr>
<tr>
<td>Total Carbohydrate 18g</td>
<td>6%</td>
</tr>
<tr>
<td>Dietary Fiber 0g</td>
<td>0%</td>
</tr>
<tr>
<td>Sugars 3g</td>
<td>9%</td>
</tr>
<tr>
<td>Protein 2g</td>
<td></td>
</tr>
<tr>
<td>Vitamin A 5%</td>
<td>- Vitamin C 10%</td>
</tr>
<tr>
<td>Calcium 0%</td>
<td>+ Iron 2%</td>
</tr>
</tbody>
</table>

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Serving Size: 1 oz (30g) serves per container. Contains 100% whole wheat, rice flour, white corn flour, sugar, vegetable oil, dried onion, dried garlic, dried onion juice, natural and artificial flavors, hydrolyzed wheat gluten, monosodium glutamate, and fruit and vegetable extracts. Contains milk and wheat.
Assume you were going to grab a snack, how healthy of a choice would this snack be?

Please rate using a 5-point scale (1= Not At All Healthy, 5=Very Healthy)

Not At All Healthy | 1 | 2 | 3 | 4 | Very Healthy | 5

---

**Nutrition Facts**

Serving Size 1 Entree (325g)

Serving Per Container 1

**Amount Per Serving**

- **Calories**: 400
- **Calories from Fat**: 140

**%Daily Value**

- **Total Fat**: 16g (28%)
- **Saturated Fat**: 10g (48%)
- **Trans Fat**: 0g
- **Cholesterol**: 40mg (13%)
- **Sodium**: 640mg (27%)
- **Total Carbohydrate**: 47g (16%)
- **Dietary Fiber**: 3g (12%)
- ** Sugars**: 6g
- ** Protein**: 16g

- **Vitamin A**: 15%
- **Vitamin C**: 2%

- **Calcium**: 30%
- **Iron**: 10%

*Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs.*

<table>
<thead>
<tr>
<th>Total Fat</th>
<th>Less than</th>
<th>Less than</th>
<th>Less than</th>
<th>Less than</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>65g</td>
<td>80g</td>
<td>20g</td>
<td>25g</td>
</tr>
<tr>
<td></td>
<td>300mg</td>
<td>300mg</td>
<td>300mg</td>
<td>300mg</td>
</tr>
<tr>
<td></td>
<td>300g</td>
<td>375g</td>
<td>375g</td>
<td>375g</td>
</tr>
<tr>
<td></td>
<td>25g</td>
<td>30g</td>
<td>30g</td>
<td>30g</td>
</tr>
</tbody>
</table>

**Ingredients:** Organic macaroni (organic semolina flour, organic whole wheat flour, water), organic lowfat milk, Cheddar cheese (pasteurized milk, culture, salt, annatto, enzymes [without animal enzymes or rennet]), grade AA butter (cream, salt, annatto), organic sweet rice flour, sea salt, organic annatto. Contains wheat and milk.
Set 2

Please use the Nutrition Facts labels below to answer the following questions.

- Based on what you can see on the labels, if you wanted to buy the healthier product, which of these two products would you select?

[Options: LABEL A, LABEL B]

- Which product has the fewest calories per container?

[Options: LABEL A, LABEL B]

- Which product has the fewest calories per serving?

[Options: LABEL A, LABEL B]
Assume you were going to grab a snack, how healthy of a choice would this snack be?

Please rate using a 5-point scale (1=Not All Healthy, 5=Very Healthy)

Not At All Healthy

1

2

3

4

Very Healthy

5

Nutrition Facts

Calories
Serving Size: 1 oz (28g / About 18 Chips)

160 calories

450 calories

Calorie Breakdown Per Serving

Total Fat

14g

Total Carbohydrate

11g

Protein

7g

Daily Values Per Serving

% Daily Value

Total Fat

14%

Saturated Fat

7%

Trans Fat

0%

Cholesterol

6mg

Sodium

250mg

Total Carbohydrate

11g

Dietary Fiber

6g

Sugars

10g

Protein

2g

Vitamins and Minerals

Vitamin A 1%  
Calcium 0%  
Vitamin C 10%  
Iron 2%

Ingredients: Potatoes, Vegetable Oil (Sunflower, Corn and/or Canola Oil), and Sea Salt.
Set 3

Please use the Nutrition Facts labels below to answer the following questions:

Based on what you can see on the labels, if you wanted to buy the healthier product, which of these two products would you select?

LABEL A  

LABEL B  

Which product has the fewest calories per CONTAINER?

LABEL A  

LABEL B  

Which product has the fewest calories per SERVING?

LABEL A  

LABEL B  

**LABEL A**

**LABEL B**

**Nutrition Facts**

**Amount Per Serving**

<table>
<thead>
<tr>
<th>Calories</th>
<th>140</th>
<th>Calories from Fat 80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat (g)</td>
<td>8g</td>
<td>8g</td>
</tr>
<tr>
<td>Saturated Fat (g)</td>
<td>2g</td>
<td>2g</td>
</tr>
<tr>
<td>Trans Fat (g)</td>
<td>0g</td>
<td>0g</td>
</tr>
<tr>
<td>Cholesterol (mg)</td>
<td>35mg</td>
<td>35mg</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>2,100mg</td>
<td>2,100mg</td>
</tr>
<tr>
<td>Total Carbohydrate (g)</td>
<td>11g</td>
<td>11g</td>
</tr>
<tr>
<td>Dietary Fiber (g)</td>
<td>2g</td>
<td>2g</td>
</tr>
<tr>
<td>Sugars (g)</td>
<td>5g</td>
<td>5g</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>3g</td>
<td>3g</td>
</tr>
</tbody>
</table>

**% Daily Value**

- Vitamin A 6%  
- Vitamin C 6%  
- Calcium 5%  
- Iron 2%  

- Sugar: Less than 10g  
- Trans Fat: Less than 2g  
- Cholesterol: 300mg  
- Sodium: 2,400mg  
- Total Carbohydrate: 11g  
- Dietary Fiber: 2g  
- Sugars: 5g  
- Protein: 3g  

Ingredients: Water, corn, rice, wheat, artificial flavors, milk, sugar, vegetable oil (soybean), sugar, salt, artificial color, corn syrup, natural flavor, natural colors, hydrogenated soybean oil, hydrogenated cottonseed oil, propylene glycol, natural flavor, sodium azide, natural color, natural flavors, monoglycerides, calcium carbonate, citric acid, sorbic acid, and coloring.

**Calcium and Magnesium**

- Calcium 0%  
- Magnesium 0%  

**Nutrition Facts**

**Amount Per Container**

<table>
<thead>
<tr>
<th>Calories</th>
<th>140</th>
<th>Calories from Fat 80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat (g)</td>
<td>8g</td>
<td>8g</td>
</tr>
<tr>
<td>Saturated Fat (g)</td>
<td>2g</td>
<td>2g</td>
</tr>
<tr>
<td>Trans Fat (g)</td>
<td>0g</td>
<td>0g</td>
</tr>
<tr>
<td>Cholesterol (mg)</td>
<td>35mg</td>
<td>35mg</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>2,100mg</td>
<td>2,100mg</td>
</tr>
<tr>
<td>Total Carbohydrate (g)</td>
<td>11g</td>
<td>11g</td>
</tr>
<tr>
<td>Dietary Fiber (g)</td>
<td>2g</td>
<td>2g</td>
</tr>
<tr>
<td>Sugars (g)</td>
<td>5g</td>
<td>5g</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>3g</td>
<td>3g</td>
</tr>
</tbody>
</table>

**% Daily Value**

- Vitamin A 6%  
- Vitamin C 6%  
- Calcium 5%  
- Iron 2%  

- Sugar: Less than 10g  
- Trans Fat: Less than 2g  
- Cholesterol: 300mg  
- Sodium: 2,400mg  
- Total Carbohydrate: 11g  
- Dietary Fiber: 2g  
- Sugars: 5g  
- Protein: 3g  

Ingredients: Water, corn, rice, wheat, artificial flavors, milk, sugar, vegetable oil (soybean), sugar, salt, artificial color, corn syrup, natural flavor, natural colors, hydrogenated soybean oil, hydrogenated cottonseed oil, propylene glycol, natural flavor, sodium azide, natural color, natural flavors, monoglycerides, calcium carbonate, citric acid, sorbic acid, and coloring.

**Calcium and Magnesium**

- Calcium 0%  
- Magnesium 0%  

**Ingredients:** Water, corn, rice, wheat, artificial flavors, milk, sugar, vegetable oil (soybean), sugar, salt, artificial color, corn syrup, natural flavor, natural colors, hydrogenated soybean oil, hydrogenated cottonseed oil, propylene glycol, natural flavor, sodium azide, natural color, natural flavors, monoglycerides, calcium carbonate, citric acid, sorbic acid, and coloring.
Assume you were going to grab a snack, how healthy of a choice would this snack be?

Please rate using a 5-point scale (1 = Not At All Healthy, 5 = Very Healthy)

Not At All Healthy  | 1 | 2 | 3 | 4 | Very Healthy 5

---

### Nutrition Facts

#### Calories
- Serving Size: 1 Cup (250g)
- Calories Per Container: 350

#### Calorie Breakdown Per Serving
- Total Fat: 16g
- Total Carbohydrate: 39g
- Protein: 6g

#### Daily Values Per Serving
- Total Fat: 21%
- Saturated Fat: 11%
- Trans Fat: N/A
- Cholesterol: 550mg
- Sodium: 920mg
- Total Carbohydrate: 25%
- Dietary Fiber: 3g
- Sugars: 9g
- Protein: 6g

#### Vitamin and Minerals
- Vitamin A: 100%
- Vitamin C: 4%
- Calcium: 30%
- Iron: 6%

---

Ingredients: Cheddar Shredded Cheese, Cheddar, Egg White, Niacin, Iron (Ferrous Sulfate), Thiamine Mononitrate, Riboflavin, Folic Acid, Water, Cheddar Cheese (Milk, Cheese Culture, Salt, Enzymes, Annatto [Color]), Heavy Whipping Cream, Contains 2% Or Less Of: Cheese, Salt, Enzymes), Sunflower Oil, Milk, Cholesterol, Salt, Sodium Phosphates, Citric Acid, Lactic Acid, Modified Corn Starch, Butter (Cream, Salt), Soybean Oil, Sodium Phosphates, Carrageenan, Sea Salt, Beta Carotene (Color), Contains Egg, Milk and Wheat.
Please use the Nutrition Facts labels below to answer the following questions:

Based on what you can see on the labels, if you wanted to buy the healthiest product, which of these two products would you select?

**LABEL A**

**LABEL B**

Which product has the fewest calories per CONTAINER?

**LABEL A**

**LABEL B**

Which product has the fewest calories per SERVING?

**LABEL A**

**LABEL B**

**LABEL A**

**LABEL B**

---

**Nutrition Facts**

**LABEL A**

- **Calories per Serving**: 350
- **Total Fat**: 16g
- **Saturated Fat**: 8g
- **Cholesterol**: 35mg
- **Sodium**: 350mg
- **Total Carbohydrate**: 42g
- **Dietary Fiber**: 3g
- **Sugars**: 9g
- **Protein**: 14g


**Nutrition Facts**

**LABEL B**

- **Calories per Serving**: 200
- **Total Fat**: 10g
- **Saturated Fat**: 5g
- **Cholesterol**: 25mg
- **Sodium**: 300mg
- **Total Carbohydrate**: 25g
- **Dietary Fiber**: 2g
- **Sugars**: 5g
- **Protein**: 9g

Assume you were going to grab a snack, how healthy of a choice would this snack be?

Please rate using a 5-point scale (1= Not At All Healthy, 5=Very Healthy)

Not At All Healthy 1  2  3  4  Very Healthy 5

![Nutrition Facts]

Ingredients: Whole corn, sunflower oil, whole wheat, rice flour, whole oat flour, sugar, maltodextrin, salt, cheddar cheese (cultured milk, salt, enzymes), whey, buttermilk solids, romano cheese from cow's milk (cultured pasteurized part skim milk, salt, enzymes), whey protein concentrate, partially hydrogenated soybean and cottonseed oil, onion powder, natural and artificial flavors, disodium phosphate, autolyzed yeast, citric acid, hydrolyzed wheat gluten, garlic powder, lactic acid, artificial colors (including yellow 6), disodium inosinate and disodium guanylate. Contains Milk and Wheat Ingredients.
Set 5

Please use the Nutrition Facts label(s) below to answer the following questions.

Based on what you can see on the labels, if you wanted to buy the healthier product, which of these two products would you select?

<table>
<thead>
<tr>
<th>LABEL A</th>
<th>LABEL B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Which product has the fewest calories per CONTAINER?

<table>
<thead>
<tr>
<th>LABEL A</th>
<th>LABEL B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Which product has the fewest calories per SERVING?

<table>
<thead>
<tr>
<th>LABEL A</th>
<th>LABEL B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

### Nutrition Facts

#### Serving Size (1 c of 25g/About 1 chip)

| Amount Per Serving | Calories 140 | Calories from Fat 0%
|--------------------|--------------|------------------|
|                    |  | 19%
| Total Fat (4g)     | 19%          | Saturated Fat (1g) 4% |
|                  |              | Trans Fat (0g)  |
|                   |              | Cholesterol (0mg) 0% |
|                   |              | Sodium (110mg) 6% |
|                   |  | 0%
| Total Carbohydrate (18g) 0% | Dietary Fiber (2g) 8% |
|                   |              | Sugars (7g)  |
|                   | 2g           | Protein (2g)  |

Vitamin A 0%  | Vitamin C 0%
Calcium 0%  | Iron 2%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Calories 2,000  | 2,500

#### Diet fiber (0g) 6g

Ingredients: rice, corn, wheat, sorghum, soy, corn flour, white and red rice flour, tapioca, potato, sunflower oil, sugar, salt, spices, monoglycerides, and ethoxylated soybean, lecithin, color, and natural flavor.

---

### Nutrition Facts

#### Serving Size (1 c of 25g/About 1 chip)

| Amount Per Serving | Calories 150 | Calories from Fat 0%
|--------------------|--------------|------------------|
|                    |  | 19%
| Total Fat (6g)     | 19%          | Saturated Fat (1g) 4% |
|                  |              | Trans Fat (0g)  |
|                   |              | Cholesterol (0mg) 0% |
|                   |  | 0%
| Total Carbohydrate (18g) 0% | Dietary Fiber (2g) 8% |
|                   |              | Sugars (7g)  |
|                   | 2g           | Protein (2g)  |

Vitamin A 0%  | Vitamin C 0%
Calcium 0%  | Iron 2%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Calories 2,000  | 2,500

#### Diet fiber (0g) 6g

Ingredients: rice, corn, wheat, sorghum, soy, corn flour, white and red rice flour, tapioca, potato, sunflower oil, sugar, salt, spices, monoglycerides, and ethoxylated soybean, lecithin, color, and natural flavor.

---

### Ingredients

- Rice
- Corn
- Wheat
- Sorghum
- Soy
- Corn flour
- White and red rice flour
- Tapioca
- Potato
- Sunflower oil
- Sugar
- Salt
- Spices
- Monoglycerides
- Ethoxylated soybean lecithin
- Color
- Natural flavor
Assume you were going to grab a snack, how healthy of a choice would this snack be? Please rate using a 5-point scale (1 = Not At All Healthy, 5 = Very Healthy)

Nutrition Facts

Calories
Serving Size 1 Entree (225) Servings Per Container 1

- Total Fat
- Total Carbohydrate
- Protein

Calorie Breakdown Per Serving

Total Fat
- Saturated Fat
- Trans Fat

Sodium

Total Carbohydrate

Dietary Fiber

Sugars

Protein

Daily Values Per Serving

- Total Fat
- Saturated Fat
- Trans Fat
- Cholesterol
- Sodium
- Total Carbohydrate
- Dietary Fiber

Ingredients:
- Organic mozzarella (organic part skimesture, organic whole wheat flour, water), organic lowfat milk, Cheddar cheese (pasteurized milk, culture, salt, annatto, enzymes), without animal enzymes or rennet), grade AA butter (cream, salt, annatto), organic sweet rice flour, sea salt, organic annatto. Contains wheat and milk.
Please use the Nutrition Facts labels below to answer the following questions:

Based on what you can see on the labels, if you wanted to buy the healthier product, which of these two products would you select?

LABEL A

LABEL B

Which product has the fewest calories per CONTAINER?

LABEL A

LABEL B

Which product has the fewest calories per SERVING?

LABEL A

LABEL B
Assume you were going to grab a snack, how healthy of a choice would this snack be?

Please rate using a 5-point scale (1=Not At All Healthy, 5=Very Healthy)

<table>
<thead>
<tr>
<th>Not At All Healthy</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Very Healthy</th>
</tr>
</thead>
</table>

### Nutrition Facts

**Calories**

*Serving Size 1 oz (25g) About 15 chips*  
140 calories

**Calorie Breakdown Per Serving**

- **Total Fat**: 14g
- **Total Carbohydrate**: 17g
- **Protein**: 9g

**Daily Values Per Serving**

- **Total Fat**: 10% of DV
- **Saturated Fat**: 4% of DV
- **Trans Fat**: 0% of DV
- **Cholesterol**: 0% of DV
- **Sodium**: 0% of DV
- **Total Carbohydrate**: 6% of DV
- **Dietary Fiber**: 2% of DV
- **Sugars**: 0% of DV
- **Protein**: 2% of DV

**Vitamins and Minerals**

- **Vitamin A 0%**
- **Vitamin C 0%**
- **Calcium 0%**
- **Iron 2%**

**Ingredients:** Whole corn, sunflower oil, white wheat, non fat, whole wheat fiber, sugar, molasses, salt, cheddar cheese (cultured milk, salt, enzymes), whey, buttermilk solids, tomato paste, lactic acid, monosodium glutamate, dehydrated onion, lecithin, partially hydrogenated soybean oil, salt, sodium benzoate, and natural and artificial flavors. содержит молоко и пшеницу.
Please use the Nutrition Facts labels below to answer the following questions:

Based on what you can see on the labels, if you wanted to buy the healthier product, which of these two products would you select?

LABEL A  □  LABEL B  □

Which product has the fewest calories per CONTAINER?

LABEL A  □  LABEL B  □

Which product has the fewest calories per SERVING?

LABEL A  □  LABEL B  □
Assume you were going to grab a snack, how healthy of a choice would this snack be?

Please rate using a 5-point scale (1= Not At All Healthy, 5=Very Healthy)

<table>
<thead>
<tr>
<th>Not At All Healthy</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Very Healthy</th>
</tr>
</thead>
</table>

### Nutrition Facts

- **Serving Size**: 1 cup (239g)
- **Servings Per Container**: about 2

<table>
<thead>
<tr>
<th>Amount Per Serving</th>
<th>Calories 350</th>
<th>Calories from Fat 190</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Fat</strong> 21g</td>
<td>32%</td>
<td>% Daily Value*</td>
</tr>
<tr>
<td>Saturated Fat 11g</td>
<td>56%</td>
<td></td>
</tr>
<tr>
<td>Trans Fat 0.5g</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cholesterol</strong> 45mg</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td><strong>Sodium</strong> 690mg</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td><strong>Total Carbohydrate</strong> 26g</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Dietary Fiber 2g</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Sugars 2g</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Protein</strong> 14g</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Vitamin A 100%** | **Vitamin C 4%**
**Calcium 30%** | **Iron 6%**

*Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs:

<table>
<thead>
<tr>
<th>Calories:</th>
<th>2,000</th>
<th>2,500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat</td>
<td>Less than 20g</td>
<td>Less than 25g</td>
</tr>
<tr>
<td>Sat Fat</td>
<td>Less than 20g</td>
<td>Less than 25g</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Less than 300mg</td>
<td>Less than 300mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>Less than 2,400mg</td>
<td>Less than 2,400mg</td>
</tr>
<tr>
<td>Total Carb</td>
<td>300g</td>
<td>375g</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>25g</td>
<td>30g</td>
</tr>
</tbody>
</table>

**Ingredients**: Cooked Enriched Pasta (Water, Durum Wheat Semolina, Egg White, Niacin, Iron [Ferrous Sulfate], Thiamine Mononitrate, Riboflavin, Folic Acid), Water, Cheddar Cheese (Milk, Cheese Culture, Salt, Enzymes, Annatto [Color]), Heavy Whipping Cream, Contains 2% Or Less of: Cheese, Salt, Enzymes), Sunflower Oil, Maltodextrin, Salt, Sodium Phosphates, Citric Acid, Lactic Acid, Modified Corn Starch, Butter (Cream, Salt), Soybean Oil, Sodium Phosphates, Datem, Sea Salt, Beta Carotene (Color). Contains Egg, Milk and Wheat
Please use the Nutrition Facts labels below to answer the following questions.

Based on what you can see on the labels, if you wanted to buy the healthier product, which of these two products would you select?

LABEL A  ☐  LABEL B  ☐

Which product has the fewest calories per CONTAINER?

LABEL A  ☐  LABEL B  ☐

Which product has the fewest calories per SERVING?

LABEL A  ☐  LABEL B  ☐
Assume you were going to grab a snack, how healthy of a choice would this snack be?

Please rate using a 5-point scale (1= Not At All Healthy, 5=Very Healthy)

Not At All Healthy  2  3  4  Very Healthy

---

Nutrition Facts

Serving Size 1 oz (28g/About 16 chips)
Servings Per Container 3

Amount Per Serving
- Calories 160
- Calories from Fat 80
- %Daily Value
  - Total Fat 9g 14%
  - Saturated Fat 1.5g 7%
  - Trans Fat 0g
  - Cholesterol 0mg 0%
  - Sodium 90mg 4%
  - Total Carbohydrate 16g 5%
  - Dietary Fiber 1g 5%
  - Sugars less than 1g
  - Protein 2g

Vitamin A 0%  -  Vitamin C 10%
Calcium 0%  -  Iron 2%

* Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your caloric needs:
- Calories: 2,000 2,500
- Total Fat: Less than 65g 80g
- Sat Fat: Less than 20g 25g
- Cholesterol: Less than 300mg 300mg
- Sodium: Less than 2,400mg 2,400mg
- Total Carb: 380g 375g
- Dietary Fiber: 25g 30g

Ingredients: Potatoes, Vegetable Oil (Sunflower, Corn and/or Canola Oil), and Sea Salt.
APPENDIX O. DATA MEAN DESCRIPTIVES

<table>
<thead>
<tr>
<th>Descriptives</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td></td>
</tr>
<tr>
<td>Data</td>
<td>C:/Users/ahay/Desktop/jessica_clhan/17.sav</td>
</tr>
<tr>
<td>Active Dataset</td>
<td>DataSet1</td>
</tr>
<tr>
<td>Filter</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>Weight</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>Split File</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>N of Rows in Working Data File</td>
<td>947</td>
</tr>
<tr>
<td>Missing Value Handling</td>
<td>User defined missing values are treated as missing.</td>
</tr>
<tr>
<td>Cases Used</td>
<td>All non-missing data are used.</td>
</tr>
<tr>
<td>Syntax</td>
<td>DESCRIBES VARIABLES=egg freq mult choc_healthy choc_container choc_serving Q10_RateFrost frozen_healthy frozen_container frozen_serving Q95_RateFrost chips_healthy2 chips_container2 chips_serving2 Q95_RateFrost2 healthy_frost2 frozen_container2 frozen_serving2 Q95_RateFrost3 healthy_frost3 chips_container3 chips_serving3 Q95_RateFrost32 healthy_frost32 frozen_container3 frozen_serving3 Q95_RateFrost4 healthy_frost4 chips_container4 chips_serving4 Q95_RateFrost42 healthy_frost42 frozen_container4 frozen_serving4</td>
</tr>
<tr>
<td>Resources</td>
<td>Processor Time: 00:00:00.126</td>
</tr>
<tr>
<td></td>
<td>Elapsed Time: 00:00:00.126</td>
</tr>
<tr>
<td>Variable</td>
<td>N</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----</td>
</tr>
<tr>
<td>age</td>
<td>812</td>
</tr>
<tr>
<td>age_cat</td>
<td>981</td>
</tr>
<tr>
<td>sex</td>
<td>812</td>
</tr>
<tr>
<td>sex_cat</td>
<td>980</td>
</tr>
<tr>
<td>race</td>
<td>812</td>
</tr>
<tr>
<td>race_cat</td>
<td>981</td>
</tr>
<tr>
<td>ethnicity</td>
<td>812</td>
</tr>
<tr>
<td>ethnicity_cat</td>
<td>981</td>
</tr>
<tr>
<td>education</td>
<td>812</td>
</tr>
<tr>
<td>education_cat</td>
<td>981</td>
</tr>
<tr>
<td>income</td>
<td>812</td>
</tr>
<tr>
<td>income_cat</td>
<td>981</td>
</tr>
<tr>
<td>marital_status</td>
<td>812</td>
</tr>
<tr>
<td>marital_status_cat</td>
<td>981</td>
</tr>
<tr>
<td>employment</td>
<td>812</td>
</tr>
<tr>
<td>employment_cat</td>
<td>981</td>
</tr>
<tr>
<td>income_educ</td>
<td>812</td>
</tr>
<tr>
<td>income_educ_cat</td>
<td>981</td>
</tr>
<tr>
<td>health_status</td>
<td>812</td>
</tr>
<tr>
<td>health_status_cat</td>
<td>981</td>
</tr>
<tr>
<td>smoking_status</td>
<td>812</td>
</tr>
<tr>
<td>smoking_status_cat</td>
<td>981</td>
</tr>
<tr>
<td>alcohol_use</td>
<td>812</td>
</tr>
<tr>
<td>alcohol_use_cat</td>
<td>981</td>
</tr>
<tr>
<td>exercise</td>
<td>812</td>
</tr>
<tr>
<td>exercise_cat</td>
<td>981</td>
</tr>
<tr>
<td>dietary</td>
<td>812</td>
</tr>
<tr>
<td>dietary_cat</td>
<td>981</td>
</tr>
<tr>
<td>physical_activity</td>
<td>812</td>
</tr>
<tr>
<td>physical_activity_cat</td>
<td>981</td>
</tr>
<tr>
<td>mental_health</td>
<td>812</td>
</tr>
<tr>
<td>mental_health_cat</td>
<td>981</td>
</tr>
<tr>
<td>SES</td>
<td>812</td>
</tr>
<tr>
<td>SES_cat</td>
<td>981</td>
</tr>
<tr>
<td>socioeconomic</td>
<td>812</td>
</tr>
<tr>
<td>socioeconomic_cat</td>
<td>981</td>
</tr>
<tr>
<td>income_educ_educ</td>
<td>812</td>
</tr>
<tr>
<td>income_educ_educ_cat</td>
<td>981</td>
</tr>
<tr>
<td>income_educ_income_educ</td>
<td>812</td>
</tr>
<tr>
<td>income_educ_income_educ_cat</td>
<td>981</td>
</tr>
</tbody>
</table>

**Note:** The descriptive statistics include variables such as age, sex, race, education, income, marital status, employment, health status, smoking status, alcohol use, exercise, dietary habits, physical activity, mental health, socioeconomic status, and various educational and income-related factors. The data is summarized in terms of N, minimum, maximum, mean, and standard deviation for each variable.
APPENDIX P. DATA CORRELATIONS

Correlations

<table>
<thead>
<tr>
<th>Input Created</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-Mar-2014 17:42:22</td>
<td>947</td>
</tr>
</tbody>
</table>

Comments:

- **Active Dataset**: C:sers\julie\Desktop\jessica_clean11.sav
- **Filter**: max
- **Weight**: max
- **Split File**: max

**N of Rows in Working Data File**: 947

**Missing Value Handling**: User-defined missing values are treated as missing.

**Cases Used**: Statistics for each pair of variables are based on all the cases with valid data for that pair.

**Syntax**:

```
CORRELATIONS
/VARIABLES=chip_container chip_serving ori_Rule Frozen
/frozen_frozen_container frozen_HF2_RuleFrozen
/healthy_frozen_container
/frozen_serving D65 RareChips
/chips_healthy2 chips_container2
/healthy_frozen2 Frozen_container2
/Frozen_serving2
/G740_Rulechips2 chip_healthy3
/CHips_container3 chips_serving3
/G81_walkchips_frozen_frozen_container3 frozen_serving3
/G88_random3 chips_healthy4
/CHips_container4 chips_serving4
/G83_random4_frozen_healthy4
/frozen_container4
/frozen_serving4 G120_random4
/PRINT=TOTIAL AVGSIG
/MISSING=PARWISE.
```

**Resources**:

- **Processor Time**: 00:00:00.327
- **Elapsed Time**: 00:00:00.327
<table>
<thead>
<tr>
<th>Record</th>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
<th>Column 6</th>
<th>Column 7</th>
<th>Column 8</th>
<th>Column 9</th>
<th>Column 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Row 1</td>
<td>Value 1</td>
<td>Value 2</td>
<td>Value 3</td>
<td>Value 4</td>
<td>Value 5</td>
<td>Value 6</td>
<td>Value 7</td>
<td>Value 8</td>
<td>Value 9</td>
<td>Value 10</td>
</tr>
<tr>
<td>Row 2</td>
<td>Value 11</td>
<td>Value 12</td>
<td>Value 13</td>
<td>Value 14</td>
<td>Value 15</td>
<td>Value 16</td>
<td>Value 17</td>
<td>Value 18</td>
<td>Value 19</td>
<td>Value 20</td>
</tr>
<tr>
<td>Row 3</td>
<td>Value 21</td>
<td>Value 22</td>
<td>Value 23</td>
<td>Value 24</td>
<td>Value 25</td>
<td>Value 26</td>
<td>Value 27</td>
<td>Value 28</td>
<td>Value 29</td>
<td>Value 30</td>
</tr>
</tbody>
</table>

*Note: The table continues with more rows and columns.*
<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
<th>Column 6</th>
<th>Column 7</th>
<th>Column 8</th>
<th>Column 9</th>
<th>Column 10</th>
<th>Column 11</th>
<th>Column 12</th>
<th>Column 13</th>
<th>Column 14</th>
<th>Column 15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

130
BIBLIOGRAPHY


