2014

Influence of video food ads in digital menu boards and healthy eating decisions

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Influence of video food ads in digital menu boards and healthy eating decisions

by

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A dissertation submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Human Computer Interaction

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Ames, Iowa

2014

DEDICATION

This dissertation is dedicated to God, my husband, four daughters, my mother, my late father, my father-in-law and my late mother-in-law. My husband and oldest two daughters especially know the road travelled has not always been smooth, but they served as my motivation throughout. My two youngest adopted daughters joined us towards the end of the journey. My mom told me from a very young age to become a doctor one day, but since she did not specify what type of doctor, I hope that she is satisfied with this type of doctorate.

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ACKNOWLEDGEMENTS

I would like to thank my committee chair, Brian Mennecke, for his unwavering support, supervision and commitment to me. I would also like to thank my committee members, Laura Smarandescu, Anthony Townsend, Debra Satterfield, and Sunghyun Ryoo Kang, for their guidance and support throughout the course of this research. I also want to especially thank Andrew Luse for conducting the McNemar tests for my studies, and committee member, Laura Smarandescu, who helped in designing the studies.

In addition, I would also like to thank my friends, colleagues, and the HCI program faculty and staff for making my time at Iowa State University a wonderful experience, especially Pamela Shill and Stephen Gilbert. I also want to offer my appreciation to those who were willing to participate in my surveys and experiments; without whom, this dissertation research would not have been possible.

Finally, thanks to my family for their encouragement, especially my husband and four daughters, for their hours of patience, love and willingness to relocate to a foreign country to enable me to pursue this degree.

ABSTRACT

The affordability of plasma screens and high-speed Internet access has led to the proliferation of digital signage in public and private commercial locations over the past years. Marketers, content strategists and technologists have increasingly tried to capture the attention of consumers using digital signage, and this has led to rapid advances in the technology. Consumers, however, might be experiencing information overload characterized by exhibiting signs of display blindness, messaging fatigue and less optimal decision-making. Previous studies have shown that the use of video in digital signage can capture attention. This dissertation research examined how the use of video food ads in digital menu boards can influence more healthful eating choices. Methods included laboratory studies, eye-tracking studies and field studies where the effects of rotating images of healthful and less healthful food dishes were compared. Main and interaction effects were found for the use of rotating images as well as healthfulness of food choices. Factors influencing the healthfulness of choices are elaborated on in the findings.

CHAPTER 1. INTRODUCTION

Digital signage is predicted to grow by 8.9% compounded annual growth rate (CAGR) over the next six years (Hastings, 2014), with fast food restaurants leading the way. Fast food restaurants are replacing their stationary menu displays with digital menu boards both inside and at drive-through venues which are expected to become standard in less than three years (Kelso, 2014). This is due to customers' emerging expectations, which has been a hot topic over the last few years since 2008 (Kelso, 2014). In 2010, it was estimated that at least 155 million people have noticed these displays in the U.S. alone in 2010 (Jackson, 2010). Vendors are also opting for these boards because of cheaper costs to install and maintain it (Kelso, 2014).

Thus, what is the hype? Digital menu boards are capable of displaying full-motion video in menu offerings, and real-time updating of content and prices at single or multiple locations (NEC, 2014). The boards are typically liquid crystal displays (LCD), light emitting diodes (LED) or plasma displays, and are found both inside and outside private and public spaces (MarketsandMarkets, 2014). Digital menu boards are driven by real-time sales data. In other words, vendors can view them in real time enabling them to determine which menu offerings are slow-selling and move these particular times to be featured on boards affecting consumer decisions to increase sales and reduce waste (The Buzz, 2009; Hastings, 2014; Jay, 2012). Fast food vendors claim a high turnover rate for items featured on their digital menu boards. Dairy Queen reports that in 80% of cases where an item is featured on the menu board, sales exceed expectations (The Buzz, 2009; Jay, 2012). In particular, the use of video food ads on the boards had been cited as the biggest influencer in increasing sales turnover because of its attention-capturing features (Invodo, 2012).

Another factor that might be indirectly responsible for the uptake of digital menu boards is the 2010 Health Care Reform Act that requires vendors to display nutritional information with their offerings (Rosenbloom, 2010). This means that, if vendors are to update their stationary menu boards, they might rather invest in the digital versions in order to make required updates easier.

Vendors are starting to realize that they need to focus more on content quality rather than content quantity for these new boards in order to influence consumer decisions (Ventura, 2014). Except for targeted messaging and providing more information about food choices, the boards can also be used to introduce more healthful choices and have even been included as part of advertising the value of the boards to restaurants (Displays2Go, 2014). Not only restaurants, but also school cafeterias have realized the benefits of digital menu boards and use them to encourage students to make healthier decisions (BusinessWire, 2012). Recently a Pennsylvania-based healthy fast food chain also joined the digital menu board bandwagon to reap its benefits (Digital Signage Today, 2014).

Problem

The problem that arises with this pervasiveness of digital signage is information overload and, consequently, inefficient consumer decision-making. Consumers simply ignore digital signage – dubbed as "display blindness" – because they perceive the information to be irrelevant or that it is only advertising (Mueller et al., 2009). However, video used in digital signage in commercial retailing sectors has also been cited as an effective attention-capturing tool (Huang et al., 2008; Invodo, 2012).

Since the roll-out of digital menu boards, fast food restaurants have reported an increase in sales of food items that are featured in the video food ads (Jay, 2012, The Buzz,

2009). However, fast food restaurants are negatively associated with less healthful eating and thus the video food ads might cause consumers to adopt even unhealthier eating.

Despite this ubiquity of the medium, there is not much academic research being conducted in the field of digital signage and its influence on human behavior and choice (Burke, 2009). Chandon and Wansink (2012) also identified the consumption environment as an understudied area, but important influencer of choices. The emerging interdisciplinary field of Visual Marketing, where many eye-tracking studies are conducted to understand the influence of the visual environment on choice, also lacks sufficient academic theoretical foundations (Wedel & Pieters, 2008). Thus, in light of these calls for more research, the problem the current research has addressed is whether the use of video or moving imagery in digital signage can, indeed, influence healthy eating choices.

Research Questions

In order to answer the overall research question, the current studies were designed to investigate dynamic imagery on digital menu boards and its correlation with more healthful eating choices. Dynamic images refer to images that incorporate some video elements, one of which is movement that can either be camera movement (rotation, zooming, panning) or food movement (falling, steaming, time-lapse movements, etc.). Images showing a rotating plate with food as moving imagery were used in these studies.

The following research questions were addressed:

1. Do rotating food images have an effect on food choices?
2. Do rotating food images have an effect on more healthful food options?
3. Does the position of the rotating image on the board have an effect on choice?

Three experiments were conducted to answer the questions:

1. Pilot field study conducted at a campus dining facility;
2. Experimental laboratory study (within-subjects and a between-subjects); and an
3. Eye-tracking study.

CHAPTER 2. LITERATURE REVIEW

This research is positioned predominantly within the interdisciplinary fields of Human Computer Interaction (HCI), Visual Marketing. HCI relies on adaptations of theories and methods from a wide variety of fields as understanding is sought for human function and behavior in order to build interactive systems and add to its own knowledge base. The emerging field of Visual Marketing has limited theoretical foundations (Wedel & Pieters, 2008) and, thus, also relies on various disciplines for methods and theories, while seeking to build its own. Both HCI and Visual Marketing have several areas of overlap and one such example is Vision Science. Palmer (as cited in Wedel & Pieters, 2006) described Vision Science as an interdisciplinary field of Psychology, Neuroscience, Computer Science, Optometry, Aesthetics and others. For this research, HCI contributes a rich user experience, design considerations and digital platforms, whereas Visual Marketing brings marketing and consumer behavior insights.

Since the current research is a continuation of a previous research study (Peters, 2011; Peters & Mennecke, 2011, 2013), the research focuses on the search, pre-purchase alternatives evaluation, and purchase stages of the Engel, Blackwell & Miniard (1995) model of consumer decision-making. The model outlines seven stages of consumer decision-making as need recognition, search, pre-purchase alternative evaluation, purchase, consumption, post consumption evaluation and divestment (Engel, Blackwell & Miniard, 1995). According to the model, individual differences, environmental influences and psychological processes influences consumer decision-making through information processing, learning and attitude and behavior change. However, we recognize that not all consumers go through all the decision-making stages and decision rules as it depends very much on the degree of

complexity and involvement levels of the purchase. (Engel, Blackwell & Miniard, 1995; Hoyer, 1984; Wright, 1975). For a more comprehensive overview of the consumer decision making model phases and reasons for selecting only a subset, one may refer to Peters (2011).

Digital Displays and Consumer Overload

Digital signage are networked inter-connected flat or plasma display panels that are located in retail and public spaces and capable of displaying multi-media content via high speed internet (Burke, 2009; Dennis, Newman, Michon, Brakus, & Wright, 2010). In an effort to capture the attention of consumers who are already faced with unlimited amounts of information displayed in different formats and on different media that need to be interpreted and processed, digital signage has experienced rapid technological advancements and much commercial attention over the past few years. Bettman, Luce, and Payne (1998) found that information display formats could either aid or hinder optimal decision-making by increasing/decreasing decision complexity. Digital signage can greatly increase decision complexity because the consumers have little or no control over such sources. These increasing amounts of information sources compete for the consumer's limited working memory capacity, time, and money and, thus, the consumer might experience "information overload" (Bettman, Johnson, & Payne, 1991; Malhotra, 1984). Eppler and Mengis (2004) described information overload as: "…when too much information affects a person and the person is unable to recognize, understand or handle this amount of information…" This not only results in sub-optimal decision-making (Eppler & Mengis, 2004; Jacoby, Speller, & Kohn 1979), but also causes consumers to simply ignore the digital displays in what is known as "display blindness" (Mueller et al., 2009). However, previous studies have shown that video in display boards can cut through display blindness and capture attention more so

than animated content or slideshows (Huang, Koster, & Borchers, 2008; Invodo, 2012; Mueller et al., 2009).

Digital signage capabilities include 3D auto-stereoscopic screens; interactive 3-D screens utilizing hand gesture interaction (Allan, 2008); multimodal interaction modes; mobile interactions; audience measurement tools using anonymous video analytics to detect viewer demographics such as age, gender, ethnicity (Intel, 2009); facial recognition software (Mennecke & Peters, 2013), and digital menu boards (Kelso, 2014).

Fast food restaurants are increasingly trading their static menu boards made of printed color posters mounted in backlit frames, still menu boards displaying text only or chalk boards for digital menu boards because of cheaper costs to install and maintain (Kelso, 2014). Vendors understand that quality of content is better than quantity of content (Ventura, 2014) and, thus, digital signage and, in particular, digital menu boards' content should be planned in such a way to not overwhelm the consumer but rather draw attention to targeted items. In addition, integration of digital signage with social media, mobile apps and devices, and promotion of interactivity is key to capture audience attention (Ventura, 2014).

Digital Displays and Healthy Eating

Obesity in the United States is a worrying factor with obesity rates of about two thirds (35.7%) for adults and 17% for children and adolescents (Raghunathan, Naylor, & Hoyer, 2006). These figures have increased significantly from 1990 to 2010, and also morality and medical expenses have increased to such an extent that obesity-related medical expenditure was $1,429 higher than for people of normal weight (CDC, 2014).

Obesity in the United States has been linked negatively to fast food consumption and fast food restaurants (Drewnowski & Darmon, 2005). Story, Kaphingst, Robinson-O'Brien,

and Glanz (2008) reported that, over the past three decades, there has been a decrease in grocery stores but an increase in fast-food restaurants in low-income urban areas.

Fast-food restaurants typically sell more less healthful energy-dense food that is high in calories. According to French, Story, and Jeffery (2001), foods that are consumed most are those that are most advertised and typically include confectionaries and snacks, prepared convenience foods, soft drinks and alcoholic beverages, whereas fruits and vegetables are least advertised and, thus, least consumed. A literature review of the effects of advertising directed to children confirmed that such food advertisements do, indeed, increase preference and purchases for the products concerned (Harris, Bargh, & Klingner, 2005). Raghunathan, Naylor, and Hoyer (2006) examined the notion that consumers consider less healthful food tastier and found that there is, indeed, a correlation and that consumers enjoy less healthful food more when a hedonic goal is present. This taste perception is influenced by both explicit and implicit beliefs about less healthful food.

Advertising plays a major role in influencing and promoting healthy or unhealthy eating habits, and several studies have been conducted to investigate the role that television commercials play in influencing children's eating habits. Harris, Bargh, and Klingner (2005) conducted one such study on priming effects of television food advertising on eating behavior and found that both adults and children consumed more snack items after exposure to television food ads. Social-cognitive theories suggest that food advertising may have a trigger an unconscious effect on eating behavior such as automatic over-consumption and longer consumption times and priming methods provide a means to test for such behavior. Real-life sources of priming influences can be observed in media such as television advertisements and also Point-of-Purchase information environments. Furthermore, a

literature review conducted by Harris et al. (2005) also highlighted a causal link between food advertising and less healthful eating. Brownell and Horgen (2004) reported that health authorities cited less healthful food advertising messages that are targeted at children as a leading cause of less healthful food consumption.

Another study by Mills and Clay (2001) found that visual presentation of menu items was one of the most important factors for consumers in deciding what to choose. They further reported that visual presentations on menus stimulate the taste buds of consumers and are rated higher than nutritional claims. Hence, why is it so important for visual presentations to mirror the final product? Previous studies indicated that the information environment, such as Point-of-Purchase advertising, is a significant contributor to promote more healthful items and influencing eating patterns (Glanz & Hoelscher, 2004; Glanz, Sallis, Saelens, &Frank, 2005).

Several campaigns to promote more healthful eating using Point-of-Purchase advertising, multi-media campaigns and community interventions in schools and work sites have been highly successful. Examples of such successful campaigns are the "5-A-Day for Better Health" campaign promoting increased fruit and vegetable intake (Story et al., 2008) and the "Healthy Picks Logo" campaign, whereby a healthy logo was displayed next to more healthful food options in vending machines and cafeteria (Jensen, Webb, Mandel, Hudes, &Crawford, 2009). Results of a study conducted at Kaiser Permanente hospital cafeterias revealed a significant increase of more healthful item purchases after menu items were labeled with calorie and nutrient content at the Point-of-Purchase (Jensen et al., 2009). The aforementioned campaign also increased the availability of healthier items in vending machines and cafeteria.

Likewise, a study of Richard, O'Loughlin, Masson, and Devost (1999) revealed that there is a demand for more healthful menu options in fast-food and family-style restaurants, and that visual information highlighting more healthful items promoted purchases of more healthful items. The study also revealed that increasing the availability and visibility of more healthful items through menu labeling is effective. Citeria for selecting items were: appetizing, healthy, not expensive, and try something new. They also revealed that environmental interventions, such as menu item visualizations of more healthful food, were effective in reaching males in family-style restaurants and regular customers in fast-food restaurants who were more likely to purchase such items.

The environment that the current study addressed was the Point-of-Purchase digital menu systems incorporating video food ads and, thus, this medium provides a rich information environment for displaying more healthful food options. Recently school cafeterias have been following suit by rolling out digital signage to their dining centers. School-dining centers such as those in the Philadelphia School District (BusinessWire, 2012) and Glasgow (OneLan, 2014) want to disseminate mostly nutritional values to reach their overarching goal of influencing students to make healthier food decisions. Recently, a fast food vendor selling more healthful food also rolled out digital menu boards (DigitalSignageToday, 2014).

Chandon and Wansink (2012) compiled a comprehensive review of literature examining food marketing and its influence on consumption. The review evaluated pricing, marketing strategies including health claims, quality and quantity of products, and environmental factors for consumption. The review also highlighted certain issues such as "health halos", which is described as when one feature or ingredient of the food is portrayed

as healthy, the entire food dish is viewed as healthy and this leads to underestimation of its calories. Consumers subsequently believe they can consume more of the more healthful food dish without any adverse effects. This review informs the current study by highlighting three aspects that were examined: (a) the effects of television advertising as corresponding to the comparative video or moving imagery; (b) the health beliefs and expectations; and (c) the consumption environmental factors influencing consumer decision-making.

Digital Displays and Eye-tracking Studies

Eye-tracking has gained popularity in recent years, especially in the field of Human Computer Interaction (HCI). Eye-tracking studies have been used in the Psychology (Wedel & Pieters, 2008) and Marketing fields for quite some time. For example, Russo and Rosen (1975) conducted an eye-tracking study for a choice-task of car descriptions already in 1975. However, there have been many more such studies conducted recently in the emerging domain of visual marketing and, in particular, vision science (Wedel & Pieters, 2008).

Orquin and Loose (2013), Russo (2010), Wedel and Pieters (2008), and Pieters (2008) reviewed eye-tracking studies in the decision-making domain. Reutskaja, Nagel, Camerer, and Rangel (2011) provided an overview of eye-tracking studies for a variety of marketing studies such as locating brands in a display, choices of familiar products, advertising features.

Orquin and Loose's (2013) review of eye-movement research on the role of attention on decision-making found that attention actively influences decision-making. Visual saliency plays a big role in information uptake, in particular: (a) saliency, (b) surface size, (c) visual clutter, and (d) position. They also found that attention-capturing alternatives or attributes were more likely to be chosen.

Reutskaja et al. (2011) used eye-tracking to examine three dynamic search models that consumers might employ to search and decide under conditions of extreme time pressure and overload. Images without text descriptions were placed randomly on digital displays. The current study differed because the images had descriptions underneath the images like looking a restaurant menu board. Similar to Reutskaja et al. (2011), the current research offered a choice among familiar items that subjects regularly eat. Their findings included: (1) subjects search was dependent on the items' value and then choosing the best-seen item; (2) under additional pressure, subjects increase their number of options by shortening their fixation duration and extending their search time, and (3) a display bias exist where subjects looked and chose items placed in certain screen locations more often.

Velazquez and Keryn (2014) used eye-tracking studies to examine the association between food and beverage advertising and less healthful food and beverage preferences and choices of children and adolescents. Although they found no association between attention to advertising and choices when controlling for demographics, the length and number of times looking at less healthful options within advertisements were significantly associated with such choices otherwise. They only analyzed the data from still advertisements.

Armel, Beaumel, and Rangel (2008) investigated the influence of the amount of visual attention on binary choices. They tested the prediction that a bias exist for items first seen, as well as for items fixated longer on. Items were presented one at a time of two food items. They found that only appetizing items were more likely to be chosen when fixated on longer. Krabich, Armel, and Rangel (2010) found that there is a left choice bias that correlates with a left-looking bias. Krabich, Armel, and Rangel (2011) used eye-tracking in a follow-up study to determine whether visual fixations have an effect on comparisons in

value-based decision-making of binary choices. They offered subjects two food items to choose from without any time restriction. Their study helps to explain biases for top-left computer screen space for choice.

Guo, Smith, Powell, and Nicholls (2012) provided an overview of several studies confirming a left gaze bias for faces and some reasons for the bias. During their review, Guo et al. (2012) cited some reasons for this left gaze bias as spatial attention to the left, left to right reading in Western cultures, and a right hemisphere advantage. Foulsham, Gray, Nasiopoulos, and Kingstone (2013) also confirmed the left gaze bias for pictures. Like Krabich, Armel, and Rangel (2010), Reutskaja et al. (2011) found this left gaze bias especially true for computer screens. However, in other environments like retail spaces, consumers are more likely to look horizontally central and choose items in the center of the display or shelf termed a "horizontal centrality effect" (Atalay, Bodur, & Rasolofoarison, 2012). Findings by Chandon, Hutchinson, Bradlow, and Young (2008) revealed that consumers attend more to the center of the shelf. Shimojo, Simion, Shimojo, and Scheier (2003) found a "gaze cascade effect, which means that visual attention is concentrated and focused on the item around two seconds before a choice is made.

CHAPTER 3. METHODS

Study Design

This chapter describes the studies conducted with respect to the subjects, procedures, materials and measures. This research was divided into three studies: a pilot field study, two experimental laboratory studies consisting of a within subjects and between subjects design, and an eye-tracking study. Since these studies were a continuation of research conducted earlier for the author's Master of Scienc degree, survey items were taken from the previous study to inform the new studies where necessary (Peters, 2011).

Pretests

Two pretests were conducted prior to the series of experimental and eye-tracking studies. The first pretest measured the presentation styles of the images where 30 subjects were asked to rate the appeal, health and presentation style of the various food images. Choice options consisted of images of raw vegetables and dip (carrots, broccoli, cauliflower and celery sticks) on a white plate, or placed on a clean white perspex surface, or in packaging. Various presentation styles of soup were also tested. Subjects preferred the plate presentation and rated it higher on appeal. Subjects also described the food on the plate as more healthful, and described healthfulness among others as fresh and germ free as opposed to the sanitary worries of the perspex surface or staleness of packaged food. Subjects also commented that plate made the food looked like a meal as opposed to a snack. The food was then always styled on a plate for the main study's images.

A second pretest on health and appeal rating were run with 48 subjects. Six target food items were identified as being equally appealing but differed significantly on health perceptions. Three sets of more healthful/less healthful combination dishes that light in

calories and three sets of high calorie dishes were chosen. These dishes were vegetable-based (baked potatoes/fries, veggies/veggies with dip, and salad/salad with cheese and dressing) and meat-based (grilled chicken/breaded chicken, grilled chicken sandwich/breaded chicken sandwich, chicken pizza/pepperoni pizza).

Other factors considered in producing the images were equal portion sizes, similar lighting conditions, food arrangement on similar white plates, and direction and speed of rotation to be kept similar throughout all images. In fact, the same food item was captured as a still image and a rotating image. The rotating image was a video recording of the food on the plate pulled by a piece of string in a similar fashion as a Lazy Susan revolving plate.

Visuals for Choice Task

Twelve target images were placed next to each other horizontally (left and right) on the screen with a descriptive label of the food underneath using Qualtrics software. Subjects had to choose one food item from two food items. The mix of treatment conditions for each subject varied according to the type of study conducted, but manipulations consisted of still/still images on the screens, then a rotating/still and finally a still/rotating. Rotating images refers to the videos produced of the same dish and at the same time as the still images. Healthfulness of the food portrayed in the images was also varied alternating between right and left side placement on the screen. Figure 1 shows a screen shot of the chicken combination as an example of the food images.

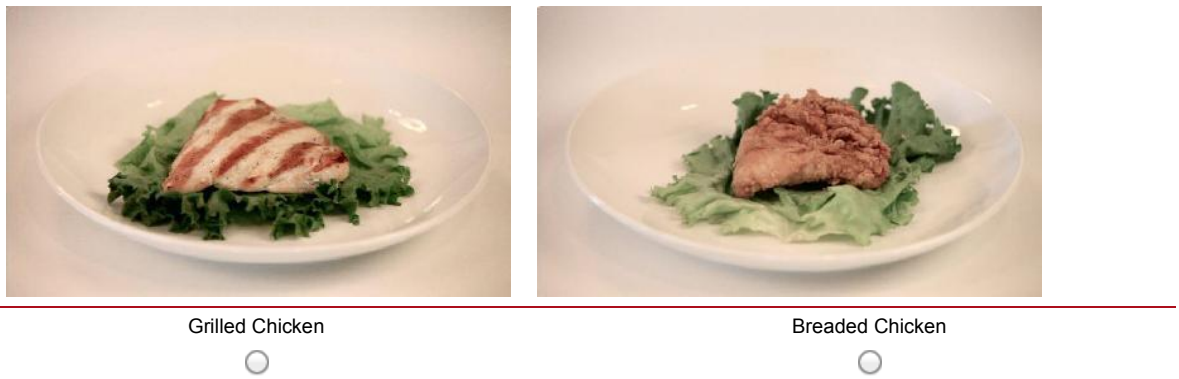

Figure 1. Screen shot of the more healthful/less health combination visual used for the choice task

The images were randomized for each subject to avoid order or screen effects. Different combination of healthful and less healthful images used in the study are shown in Table 1. Combinations were never cross-compared between vegetable-based and meat-based dishes. Filler images were displayed in-between target images to avoid fatigue.

Table 1. Combination food dishes used in the study

Calorie-light vegetable dishes		**Calorie-rich meat dishes**	
More Healthful	Less Healthful	More Healthful	Less Healthful
Baked potatoes	French fries	Chicken pizza	Pepperoni pizza
Raw vegetables*	Raw vegetables with ranch dip	Grilled chicken	Breaded chicken
Garden salad	Garden salad with cheese and ranch dressing	Grilled chicken sandwich	Breaded chicken sandwich

* Raw vegetables were baby carrots, celery, broccoli and cauliflower

Filler images were displayed in-between target images and consisted of a fruit cup, wraps, wild rice salad, soup (broccoli cheese and chicken noodle), and broiled potatoes. All food choices were available and prepared in an on-campus dining facility. Images were also shot on location at the on-campus dining facility to ensure that food was fresh. The same

images were utilized for both the experimental and eye-tracking studies. Figure 2 shows all the target images used in the study.

Experiment 1 included a liking-rating task of the images displayed were included and subjects rated a) how likely they were to consume the item, b) how appetizing the item was, c) how healthful the item was, and d) how much calories they estimated the item to have. The liking rating was on a scale of 1 ("not at all") to 5 ("very much so"). Images were randomized and displayed one at a time. This liking-rating was conducted after the choice task. This task was used as comparative measure for health versus appeal. It was also used to determine subjects individual ratings of the items that might inform their choices. Reutskaja et al. (2011) also cited studies where liking ratings were found highly correlated to subjects' willingness to pay for such items.

Figure 2. Target images showing the combinations of vegetable-based and meat-based dishes used in the studies

After the choice task with the images, liking-ratings, measurements and demographic graphics varied depending on the type of study. More details are provided under each study type.

Pilot Study: Field Study

A field study was conducted to survey real-world patrons of an on-campus dining café that also used digital menu boards. The dining cafe is the same place where the target dishes for the rest of the studies were prepared and location of the photo shoot for the images.

Visuals

The digital menu boards were placed above self-serving ordering kiosks as depicted in figure 3 and also above the serving counters at the point of purchase (POP). The digital menu boards had still images and video food ads of the café's offerings. The video ads featured mostly rotating images, but also used zooming and panning movements to a limited extend. The video food ads were rotated on a weekly basis.

Measures

An online experiment was compiled with Qualtrics software. The survey included questions about frequency of visits, and whether an item was bought that particular time prior to the survey. This was followed by 40 questions measuring the decisional influences (Peters, 2011), 50 questions on vividness and attention to images (Peters, 2011), 17 questions on cognitive absorption (Agarwal and Karahanna, 2000), a social desirability scale (Crowne & Marlowe, 1960), one item measuring health consciousness and whether they had seen a digital menu board before elsewhere. All aforementioned items were measured on a 7-point

Figure 3. Digital menu boards above the ordering kiosks at the field study site

Likert scale. 19 items measuring vividness were included in the 50 item-section of the study of which ten of these items were taken from the 10-item Babin and Burns (1998) scale, six items from Ellen and Bone (1992), three items measuring ad message involvement of Ha (1996), and items from the self-generated individual questions of Peters (2011). Items from Ha (1996) were adapted as follows: (a) "I was curious about the content of the video food ad"; (b) "the content of the video food ad attracted my attention"; and (c) "I found the video food ad was informative" (Peters, 2011).

The survey ended with health ratings for menu options served at the particular location, as well as general demographic information (age, gender, place of permanent residence). The healthfulness measurements were rated on a 7-point semantic differential scale with end points labeled "very unhealthy" and "very healthy".

Procedure

The café's patrons were randomly approached over a lunch hour while they waited in line to order food from the self-service kiosk. Subjects then signed informed consent forms and then completed the online survey on laptops that were located in a conference room adjacent to the dining café. Many of the subjects completed the task while they waited for their food order. Subjects received a $5 on-campus dining center gift card as compensation for their time while participating in the survey.

Subjects

Nineteen subjects (males 58% and females 42%) with a mean age category of 18-22 years participated in the survey. Subjects were recruited randomly.

Study 1: Experimental Laboratory Study

The first study consisted of two studies that were designed to test for the effect of movement on choice as well as healthfulness of food choices within subjects and between subjects. An online survey was compiled in Qualtrics software and subjects had to complete a choice task and complete a questionnaire consisting of various scales and demographic information.

Study 1a: Within subjects experimental study

Measures

The choice task consisted of still/still, rotate/still, still/rotate mixed with still/still filler images for each subject. This was then followed by questions that rated the single pictures on three dimensions: (a) likeliness to consume the item, (b) appeal, (c) healthfulness, and (d) calorie estimation.

Subjects then rated the following measures:

- Ten individual items measuring the influence of the images on decisions. These items were rated on a 5-point Likert scale with end points as “strongly disagree” and “strongly agree”. These items were taken from a previous study (Peters, 2011). The item “I found the moving image to be distracting” was reverse scored.
- Six scale items measuring vividness taken from the 10 item-scale of Babin and Burns (1998). These items were rated on a 5-point Likert scale with end points as “strongly disagree” and “strongly agree”. Items 4 and 5 were reverse scored .
- Ten individual items measuring attention to the images from a previous study (Peters, 2011). These items were also rated on a 5-point Likert scale with end points as “strongly disagree” and “strongly agree”). No reverse scored items were included.
- Nine items from a preference for consistency scale (Cialdini, Trost, & Newsom, 1995) with a 5-point Likert scale with end points as “strongly disagree” and “strongly agree”). Reverse scored on item “It doesn’t bother me much if my actions are inconsistent”.
- Five items from a health consciousness scale rated on a 5-point Likert scale (Gould, 1988). No reverse scored items were included.

Additional items included:

- A 5-point semantic differential rating of health consciousness with end points labeled as “definitely yes” to “definitely not”.
- A 5-point semantic differential rating of hunger with end points labeled “definitely very hungry” to “definitely not hungry”.
- A question asking how long ago they had eaten since the survey.

- A 5 point Likert-scale rating on whether they thought they made a healthy food decision in their choices.
- A question on what they thought the intent of the study was.
- A question asking if they have seen a digital menu board with video ads before.

Demographic questions included age gender, place of permanent residence, and height and weight to measure obesity.

Procedure

Subjects signed an informed consent form and then completed the online survey in Qualtrics. Computer screens were placed in such a way that subjects could not see each other's screens since the study visuals were randomized for each subject.

Subjects

Ninety-five subjects participated in study one, male (48%) / female (52%) ratio and mean age (mean 21years, SD=3.31). Subjects were mostly Management and Marketing undergraduate majors from a large Midwestern university and received class credit for their participation.

Study 1b: Between subjects experimental design

The second part of study 1 measured the effect of rotation and healthfulness for the vegetable-based and meat-based images presented between different subjects. The materials were more or less similar to the within subjects study in study 1a.

Measures

Four different treatment conditions were conducted. The treatment conditions were type of dish: vegetable-based (CL), meat-based (CR) and image movement: still/still and

rotating/still. The choice task varied per treatment condition, but each subject made 36 subjects and were as follows:

- Treatment condition 1: Vegetable-based choices, still/still images
- Treatment condition 2: Vegetable-based choices, still/rotating and rotating/still images
- Treatment condition 3: Meat-based choices, still/still images
- Treatment condition 4: Meat-based choices, still/rotating and rotating/still images

The rest of the survey was similar as described in study one except for the following:

- Only 5 items measuring the influence of the images on decisions.
- Also only 5 items measuring attention to the images.

Procedure

Similar to study one, subjects completed an informed consent form and then completed the online survey in Qualtrics. The online surveys with the different treatment conditions were spread evenly among the computers in the room. Subjects were randomly assigned to a seat in a treatment condition and could not see each other's screens.

Subjects

There were 129 subjects (male 51%, female 49%) with a mean age of 22 years (SD=2.73) who participated in the study from the same subject pool as before. The breakdown was as follows:

- Treatment condition 1: 32 (59% males, 41% females), vegetable-based choices, still/still images

- Treatment condition 2: 33 (49% males, 52% females), vegetable-based choices, still/rotating and rotating/still images
- Treatment condition 3: 32 (53% males, 47% females), meat-based choices, still/still images
- Treatment condition 4: 32 (44% males, 56% females), meat-based choices, still/rotating and rotating/still images

Study 2: Eye-tracking Study

An eye-tracking study with a retrospective think-aloud protocol was conducted and subjects completed the same online survey and identical choice task to study 1a's within subject design. The study was conducted with an Eyetech VT2 eye-tracker using the Imotions Attention Tool version 5.2 for data capturing. The eye-tracking study was conducted along with the retrospective think-aloud interview and a similar online survey as in studies 1a and 1b.

Measures

The online survey repeated the first part of the image choice task as described in Study 1a, but the single image ratings were omitted. The remaining measures of the survey was largely similar to Study 1a with the addition of:

- 12 items from the Consumer Impulsiveness Scale (CIS) (Puri, 1996) rated on a 9-point semantic differential scale with end points "almost never" and "always", and mid-point "sometimes". 1 item was reverse scored (item 8).

- 20 items an Attentional Control scale rated on a 4-point semantic differential scale with labels as “almost never”, “sometimes”, “often” and “always” (Derryberry & Reed, 2002). 8 items were reverse scored (items 3,5,6,7,8,9,10,12).

  The exit survey items included an item on whether the subject was vegetarian or not.

Procedure

Subjects were seated in front of a computer screen with an Eyetech VT2 eye-tracker, a keyboard and a mouse for interaction. A researcher was seated in the same room remotely observing the subject’s screen, but both the researcher and their screen was faced away from the subject.

Once subjects were seated, an eye calibration exercise was carried and then subjects viewed online instructions followed by the online survey. The eye-calibration exercise consisted of subjects following a dot on the screen and then the results of the calibration exercise was given and subjects could proceed with the online survey. The online survey was opened automatically by the Imotions Attention Tool software. Subjects were asked to limit excessive head movements during the study. The mean time for the eye-tracking task was 20 minutes. As described elsewhere the online survey was designed on Qualtrics and consisted of a choice task, some marketing scales and demographic information. The choice task was the same as for Study 1a.

Once the online survey was completed, subjects were shown their eye-gaze replays and asked what they were thinking when they looked at the images. Subjects then proceeded to say their thoughts out loud while watching their eye-gaze replays. Prompting questions were asked on why they selected the dishes, thoughts about the rotating images, salads, veggies, soups, and description labels, only if subjects did not address those already.

Afterward an exit question was asked on food preferences and an invitation extended for comments or questions.

Subject data consisted of the following sets of data:

- Eye-tracking heatmaps, areas-of-interest (AOIs), bee-swarms and individual gaze replays
- Self-report qualitative interview data of the think-aloud protocol
- Online survey consisting of click, measurement and demographic data.

Subjects

A total of 36 subjects (males 67%, females 33%), mean age 22 years (SD=3.81) participated in the study. Subjects were drawn from the same subject pool as studies 1a and 1b. For the eye-tracking data, only 28 subjects (males 75% and females 25%) had sufficient data quality of at least 80% to be included in the analysis. Only two cases of calibration difficulty were experienced, both female subjects who had heavy mascara eye makeup applied.

CHAPTER 4. RESULTS AND DISCUSSION

This chapter is organized such that for each study the results are presented first followed by a discussion of the results. The studies results are presented in the order of pilot field study, experimental laboratory studies, and the eye-tracking study.

Pilot Study: Field study

Results

There were 19 subjects (male 58%, female 42%) with a mean age range of 18-22 years participated in the study after being approached randomly in one of the on-campus dining facilities. A total of 74% of subjects had ordered food and 58% of them were daily visitors at the dining facility for the previous two weeks (mean = 1.74 SD=1.05). A total of 77% bought something between 11:00am and 1:00pm.

A total of 74% disagreed that there was too much information on the menu boards (mean=2.58 SD=1.54). While 58% felt that the food in the video food ad was more appealing than in the still pictures, 32% were unsure (mean=4.74 SD=1.24).

A total of 100% of subjects agreed that the video food ad attracted their attention (mean=5.68 SD=.67). In addition, 100% of subjects noticed the video food ad immediately (mean=5.79 SD=.63), whereas 95% noticed digital menu boards immediately when entering the facility (mean=1.05 SD=.23). 58% disagreed that they never look at the menu boards (mean=2.68 SD=1.73) with 32% strongly disagreeing.

A total of 53% did not choose an item featured in the video food ad (mean=3.47 SD=1.31). 53% felt that the video food ad influenced their decision and 26% were unsure (mean=4.37 SD=1.38). Less than half (47%)of subjects did not want to eat what was on the

video food ad, so they looked at something else and 32% were unsure (mean 3.32 SD=1.06). Only 16% felt that the video food ad did not make deciding what to eat easier, although 21% were unsure (mean=4.89 SD=1.33). 32% had a final selection different to their first thoughts (mean=3.58 SD=1.50).

A composite score for the Cognitive Absorption scale was created to measure how much subjects were involved or experienced a sense of telepresence while viewing the food ad video while standing in front of the digital menu boards in the café. The composite score is created from the 17 items on the previously validated scale (Agarwal & Karahanna, 2000) and all items had high inter-reliability (cronbach alpha=.900). Instead of using the sum, as Velazquez and Keryn (2014) did, the responses to the 17 items were averaged. The overall mean for the composite index was 3.362 (SD=2.95) and all items were reverse-scored where necessary. A higher score indicated a higher sense of cognitive absorption. A dichotomous split for the composite score divided subjects with a high composite score above the mean (53%) versus lower scores (47%). An independent samples t-test was then conducted to compare several dependent variables between subjects experiencing high and low cognitive absorption. Significant results for the t-tests are displayed in Table 2.

Subjects rated themselves as health conscious with a mean of 2.68 (SD=1.0) and 53% rating themselves as very health conscious and health conscious. The single item for health consciousness was dichotomously split into low and high health conscious subjects where all 1's and 2's were coded as 1="yes", 3 as "system missing", and 4's and 5's as 0="no"). The split was performed to determine whether there was a difference between high and low-health conscious subjects in the choice task. 71% of subjects rated themselves as health conscious versus 29% who rated themselves as not high on this scale. The mean was 2.68

Table 2. Significant dependent variables for cognitive absorption

Dependent Variable	P-value	t-value	Mean andSD
I-18. I decided to choose the item featured in video food ad	p=.005	t(15)=3.28	high mean 4.22 SD=1.30 low mean 2.50 SD=.76
I-20. When I had to make my choice, I chose the item in the video food ad	p=.001	t(15)=4.33	high mean 4.56 SD=.38 low mean 2.38 SD=.92
I-22. It seemed like a good idea to choose what was shown in the video food ad	p=.037	t(15)=2.30	high mean 5.11 SD=1.05 low mean 4.00 SD=.93
II-6. I cannot help but stare at the video food ad during the task	p=.034	t(15)=2.34	high mean 4.78 SD=.83 low mean 3.63 SD=1.19
II-11. I wish I had more time to view all the video food ads	p=.031	t(15)=2.39	high mean 4.78 SD=1.09 low mean 3.13 SD=1.73
II-21. I thought about the video food ad after it has finished	p=.011	t(15)=2.91	high mean 4.56 SD=1.33 low mean 3.0 SD=.75
II-42. I was thinking about the video food ad afterwards	p=.023	t(15)=2.54	High mean 4.78 SD=1.39 low mean 3.38 SD=.74
II-48. The video food ad was vague	p=.010	t(15)=2.30	high mean 3.67 SD=.71 low mean 2.63 SD=.84

(SD=1.0). Prior to the median split, results were “definitely yes” (5%), “probably yes” (47%), “maybe” (26%), “probably not” (15%), and “definitely not” (5%). An independent samples t-test was conducted to test for significance between subjects with high and low-health consciousness. Table 3 shows the significant items for health consciousness.

Table 3. Significant dependent variables for health consciousness

Dependent Variable	P-value	t-value	Mean and SD
I-15. I compared the other items against the item in the video food ad	p=.033	t(12)=2.41	high mean 4.5 SD=.71 low mean 3.25 SD=1.26
II-26. The video food ad was very intense.	p=.038	t(12)=2.33	high mean 4.40 SD=1.17 low mean 2.75 SD=1.26

Both gender and cognitive absorption were not significant covariates when tested in a MANOVA with health consciousness as an independent variable. A composite score was also calculated for 19 items measuring vividness taken from Peters (2011), Babin and Burns (1998), Bone and Ellen (1992) which had a high inter-item reliability (Cronbach alpha=.943).

The composite score's mean was 5.0 (SD=.87), which indicates agreement on the seven point Likert scale (anchors of 1="strongly disagree" and 7="strongly agree").

Less than half (47%) of subjects felt that they had selected a more healthful meal, but 12% were not sure and the question had a mean of 4.53 SD=1.70. The independent samples t-test revealed that there were no significant differences between high and low-health conscious subjects. Of those subjects who felt that they selected a more healthful option, two had selected grilled chicken sandwiches and the rest had meal bundles with no indication what the items were. The majority of the subjects had purchased a full meal since the study was conducted over the lunch hour. From this information, one may deduce that most subjects were hungry when they made their purchases.

The results indicate that 79% of subjects purchased something similar to what they normally choose (mean=5.26 SD=1.05) (7-point scale with 1 "strongly disagree" and 7 "strongly agree"). 84% usually liked eating the food item they chose (mean=5.47; SD=.96). 37% of subjects only decided what to eat once they arrived at the café, but 26% were not sure (mean=4.32SD=1.73). This means that the choices for a total of 63% of subjects could be influenced by the video food ad on the menu board. 42% felt that it not was difficult to decide what to choose (mean=.68 SD=1.34) with 26% of subjects being unsure. There were significant gender differences for several items with female subjects mostly giving more attention to the video food ad than male subjects. A full listing of the gender differences appears in Appendix A.

There were no significant gender differences for the vividness and cognitive absorption scale. Both scales were not significant covariates.

Discussion

Although the majority of subjects frequented the café daily and knew the menu choices, all of them still looked at the video food ads whilst the majority still felt it influenced their decision as only 11% disagreed with this statement. Subjects also seemed to be very consistent in their choices, since 80% chose something similar to what they had before. However, since the visitors were frequenting the facility often, novelty effects can be ruled out for the menu boards. Only 53% did not choose an item from the video food ad and the majority of subjects felt that the boards made decisions easier. This suggests that even frequent consumers of establishments can be influenced to purchase familiar items by video food ads on the digital menu board.

Those subjects who experienced a high sense of cognitive absorption while viewing the dynamic items on digital menu boards self-reported experiencing an influence in their choices more than subjects with a low sense of cognitive absorption, i.e. they felt persuaded to choose an item that was featured in the moving imagery.

Health conscious subjects compared choices more and rated the moving imagery as intense. However, they did not report a stronger influence or persuasion to pick the choice in the moving imagery. It was proposed that this is so because the subjects' ultimate goal was a more healthful meal, but they were also hungry as was evidenced by their purchases of full meals and given that it was over the lunch hour. Given that there were healthful options displayed on the menu board, a slightly greater percentage of subjects felt that they had selected a more healthful meal versus those who disagreed, while a small percentage were not sure. For example, of those who felt they selected a more healthful option, two had selected grilled chicken sandwiches or a meal bundle. There was a significant difference for

healthy choice between subjects who rated themselves as health-conscious (p=.045) with 70% of those who rated themselves health-conscious felt that they had selected a more healthful meal.

The digital menu boards and video food ads in particular do seem to capture attention as all subjects looked at the video food ads, and not only did it make decisions easier, but an overwhelming number (almost 90%) felt that it influenced their choices. Only a third reported sticking to their original decisions prior to seeing the video food ads. This is further evident because the majority purchased items from the video food ads.

The visual salience of the video food ad further seem to declutter the menu board as over seventy percent of subject felt that there was not too much information on the menu boards. Food in the video food ads seemed to be more appealing than the still images and subjects rated the vividness of the food ads high. The majority of subjects also experienced a high sense of cognitive absorption, which was not too surprising given that it was over the lunch hour and the video food ads were thus task-relevant. The video food ads were visually salient with features of vividness such as movement, color, brightness and others, it was positioned optimally as subjects notice it once they enter the facility, and it was task-relevant. These factors all contribute to the preferential attention that consumers pay to such stimulus-driven decisions (Orquin & Loose, 2013).

Although our sample size was small (19 subjects) and we could not manipulate the video food ads ourselves, the study results are, nonetheless, interesting given that it was a real world scenario in the wild. Our results suggest that video food ads in a digital menu board do capture attention, influence choice, and also influence healthy choices if such choices are presented in the food ads.

Study 1: Experimental Design

Study 1a) Within-subjects design

Results

A total of 56% of subjects have seen a digital menu board with video ads before. 54% of subjects were hungry ("definitely very hungry" and "somewhat hungry") ,and 42% were not hungry ("not very hungry" and definitely not hungry"). The mean rating for all subjects' hunger level was 2.94 (SD=1.41).

Composite scores were created for the health consciousness, preference for consistency and vividness scales after their inter-item reliability was assessed. No significant gender differences were found for the all of the scales. The inter-item reliability for the 6-item vividness scale (Babin & Burns, 1998) was high (cronbach alpha=.728) with a composite mean of 3.46 SD=.59 meaning that subjects experienced the images to be somewhat vivid. The composite mean for the 9-item preference for consistency scale (Cialdini et al., 1995) was 3.34, SD=.642 (cronbach alpha=.848) with no significant gender differences. A 5-item scale for health consciousness was also included and a composite mean score of 3.65 SD=.79 and inter-item reliability scored a cronbach alpha=.873. The vividness and preference for consistency scales were not significant covariates for the choice task.

The single item health conscious measurement had composite mean of 3.66, SD=.79 with 65% of the subjects voted "definitely yes" (1) and "probably yes" (2) with 15% unsure. A 5-item scale for health consciousness was also included and a composite mean score of 3.65 SD=.79 and inter-item reliability scored a cronbach alpha=.873. Health consciousness was further split into high and low-health conscious subjects.

Less than half (46%) of the subjects rated their choices as healthy. A t-test revealed a significant difference for high and low-health consciousness subjects (t(93)=2.96, p=.004) with high-health conscious subjects rating their decisions as healthier (mean=3.53 SD=.880) than low high conscious subjects (mean=2.98 SD=.927). There was also a significant difference for the need for preference for consistency scale (t(51)=2.34 p=.02) with high-health conscious subjects having a greater preference for consistency (mean=3.48 SD=.64) than low-health conscious subjects (mean=3.18 SD=.612).

Although none of the choice tasks had a significant difference for high and low-health conscious subjects, there were significant differences observed for the dish-rating task and detailed results appear under the rating task. Although there were no significant gender differences for health consciousness, females (mean=2.45, SD=1.04 showed a trend towards rating themselves slightly more health conscious than males (mean=2.22, SD=1.01).

Rating task

Subjects rated each target dish after the choice task on 3 dimensions: (1) likelihood to consume; 2) how appetizing the dish was; and (3) healthfulness. Subjects further estimated how many calories they thought were in the dishes. The images were displayed one at a time and randomized.

The mean calories estimations of the dishes are listed in Table 4. The less healthful version of the raw veggies and salad options were rated as having lower calories than the more healthful options for the rest of the dishes.

According to the image ratings of the images in Table 5, subjects were more likely to consume less healthful veggie dishes and found these to be more appetizing, but in contrast more healthful meat dishes were more likely to be consumed and were more appetizing. A

Table 4. Mean calorie estimations of the target dishes

Target Dish	Mean	SD
Grilled chicken	256.90	161.82
Breaded Chicken	388.24	245.62
Grilled Chicken Sandwich	335.23	169.70
Breaded Chicken Sandwich	462.14	266.67
Chicken Pizza	372.03	241.69
Pepperoni Pizza	453.58	287.32
Baked Potatoes	284.10	226.71
Fries	384.37	242.21
Raw Veggies	85.46	56.45
Raw Veggies with ranch dip	160.33	95.66
Garden Salad	159.44	122.61
Garden Salad with Cheese and Ranch Dressing	248.28	163.58

Table 5. Dichotomous ratings for 4's and 5's of the target item ratings

	Overall		Veggies		Meat	
	LH	H	LH	H	LH	H
More likely to consume	358	353	195	154	163	199
Appetizing	329	288	178	115	151	173
Healthy	139	344	123	208	16	136

A significant difference was found for how likely high and low-health conscious subjects would consume the chicken pizza ($t(75)=2.23$ $p=.03$) with a high-health conscious subjects more likely to consume the dish (mean=.90 SD=.30) than low-health conscious subjects (mean=.70 SD=.46). Calorie estimation also revealed significant differences for the raw veggies with ranch dip ($t(93)=2.27$, $p=.025$) high-health conscious: mean=180.59, SD=103.10 and low-health conscious: mean=136.84 SD=81.20), and the garden salad ($t(92)=2.94$, $p=.004$) high-health conscious: mean=193.00, SD=143.79 and low-health conscious: (mean=121.30 SD=78.45). This implies that high-health conscious subjects estimated the calories of both the veggies with dip and the garden salad as significantly

higher than the low-health conscious subjects. In contrast, there were no significant differences for calorie estimation of the garden salad with cheese and dressing which was at p=.08.

There were also significant gender differences for calorie estimation of three more healthful items: grilled chicken, veggies and garden salad. Male subjects (M=298.58, SD=194.46) estimated the calories of grilled chicken (t(92)=2.46, p=.016) than women subjects (M=218.63, SD=113.79). Male subjects (M=99.26, SD=66.53) also estimated the calories of veggies (t(93)=2.36, p=.020) significantly higher than women (M=72.51, SD=41.68). Likewise, male subjects (M=193.16, SD=146.63) rated the calories of the garden salad (t(92)=2.64, p=.010) significantly higher than women subjects (M=128.47, SD=85.87).

Significant gender differences were found for the question whether subjects were likely to consume certain dishes and how healthful dishes are. More female subjects (M=3.55 SD=1.24) were significantly more likely to consume the garden salad (t(93)=-2.66, p=.009) than males (M=2.85 SD=1.33). A significant gender difference was also found for the healthfulness rating of pepperoni pizza with more males (M=2.11 SD=.82) than females (M=1.80 SD=.68) rating it as more healthful (t(93)=2.03, p=.045). No significant gender differences were found for appeal.

Decision and attention to rotating image

Decision questions were rated on a 5-point scale with 1 “strongly disagree” and 5 “strongly agree”. Results from the decision questions showed that 86% of subjects felt they had enough time to their selections with an overall mean of 1.79 SD=0.78. A total of 85% of the subjects noticed the rotating image immediately with the mean score overall was 4.14 SD=0.90 which was in the agreement range. Only 27% felt that the image made it easy to

compare choices and 28% were unsure (mean=2.76 SD=1.13). Even less subjects (22%) felt that the rotating image made deciding what to eat easier (mean=2.63 SD=1.13) and 34% were unsure. More than half (53%) agreed with the item "I imagined what it would be like to eat the item shown in the moving image" and 21% were unsure (mean=3.27 SD=1.27). Only 19% felt that their final selection was different from their first thoughts (mean=2.25 SD=1.07) and 16% were unsure. 84% were confident in their choices (mean=4.14 SD=0.87) and about the same percentage (80%) felt happy with their final selection (mean= 2.49 SD=1.25). Less than a third (31%) felt that the rotating image influenced their decisions (mean=2.49 SD=1.25) with 13% unsure.

Subjects were asked additionally specific questions about the attention grabbing features and attractiveness of the rotating images and these questions were also rated on a similar 5-point scale as the previous set of questions. More than half (56%) of subjects felt that the food in the moving image looked attractive (mean=3.43 SD=1.10) and 25% were unsure. A total of 43% percent of subjects felt the food in the moving image looked more appealing than in pictures and 19% were unsure (mean=2.96 SD=1.25). More than half (53%) were thinking of the rotating image afterwards and 25% were unsure (mean=3.01 SD=1.22). Very few subjects felt that the rotating image made them forget to look at other choices (4%, mean=1.83 SD=.88).

Choice Task

McNemar tests were chosen for the within subjects experiment since comparisons were done between related or paired samples as we were testing for between two different manipulations. The results of the MaNemar's tests (N=95) are displayed in Table 6.

Table 6. Results of MaNemar's tests for the within-subjects experiment

Rotation			
Rotate	1221	Still	1059
Healthfulness			
More healthful	995	Less healthful	1285
Rotation by healthfulness			
Rotating more healthful	538	Still more healthful	457
Rotating less healthful	683	Still less healthful	602
Rotation by healthfulness, for meat vs. vegetable-based dishes			
Meat: Rotating more healthful	343	Meat: Still more healthful	316
Meat: Rotating less healthful	254	Meat: Still less healthful	227
Veggies: Rotating more healthful	195	Veggies: Still more healthful	141
Veggies: Rotating less healthful	429	Veggies: Still less healthful	375
Rotation by healthfulness for potato vs. salad			
Potatoes: Rotating more healthful	103	Potatoes: Still more healthful	71
Potatoes: Rotating less healthful	119	Potatoes: Still less healthful	87
Salad: Rotating more healthful	82	Salad: Still more healthful	35
Salad: Rotating less healthful	155	Salad: Still less healthful	108
Rotation by healthfulness, for meat vs. veggie images for those preferring meat vs. veggies			
Meat-based images for those preferring meat			
Meat: Rotating more healthful	142	Meat: Still more healthful	119
Meat: Rotating less healthful	151	Meat: Still less healthful	128
Meat: Rotate overall	293	Meat: Still overall	247
Meat: More healthful overall	261	Meat: Less healthful overall	279
Vegetable-based images for those preferring meat			
Veggies: Rotating more healthful	89	Veggies: Still more healthful	61
Veggies: Rotating less healthful	209	Veggies: Still less healthful	181
Rotation by hunger			
Rotating by hungry (only 1's vs. 5's)			
Hungry: Rotating	180	Hungry: Still	156
NotHungry: Rotating	224	NotHungry: Still	208
Healthfulness by hungry (1's and 2's vs. 4's and 5's)			
Hungry: More healthful	434	Hungry: Less healthful	790
NotHungry: More healthful	503	NotHungry: Less Healthful	457

A significantly higher number of subjects chose the rotating image as compared to the still image ($z = 3.39$, $p = 0.003$). We are 95% confident that 52 to 56 percent of the subjects chose the rotating image as opposed to the still image. A significantly higher number of subjects chose the less healthful food as compared to the more healthful food ($z = 6.07$, $p <$

0.001). We are 95% confident that 54 to 58 percent of the subjects chose the less healthful food as opposed to the more healthful food.

When comparing rotating and still images for healthfulness, the McNemar's test shows that there is a significant difference in population proportions ($S = 44.80$, $p < 0.001$). We are 95% confident that the proportion of subjects choosing the less healthful food option would be 0.07 to 0.13 greater had the image been rotating instead of still.

When controlling for meat-based dishes, the McNemar's test shows that there is a significant difference in population proportions ($S = 6.74$, $p = 0.01$). We are 95% confident that the proportion of subjects choosing the more healthful food option would be 0.01 to 0.10 greater had the image been rotating instead of still when viewing two meat-based dishes.

When controlling for vegetable-based dishes, the McNemar's test shows that there is a significant difference in population proportions ($S = 145.52$, $p < 0.0001$). We are 95% confident that the proportion of subjects choosing the less healthful food option would be 0.21 to 0.29 greater had the image been rotating instead of still when viewing two vegetable-based dishes.

When comparing the potato dishes for rotation and healthfulness, the McNemar's test shows that there is a significant difference in population proportions ($S = 12.13$, $p = 0.005$). When comparing salad pictures for rotation and healthfulness, the McNemar's test shows that there is a significant difference in population proportions ($S = 75.79$, $p < 0.0001$). Subjects significantly choose the rotating less healthful image for both the potato and the salad. They also still choose the still more healthful image the least for both. But in the potato one they choose the rotating more healthful second most while in the salad one they choose

the still less healthful option second most. Also, the effect size is quite a bit bigger in the salad condition.

We analyzed rotation by healthfulness, but controlling for the likelihood of eating meat dishes rather than vegetable-based dishes. For subjects who preferred meat, the McNemar's test shows that there is NOT a significant difference in population proportions ($S = 3.79$, $p = 0.052$) between rotation and healthfulness.

A significantly higher number of subjects chose the rotating image overall as compared to the still image overall ($z = 1.98$, $p = 0.024$) for subjects who prefer meat when viewing meat pictures. We are 95% confident that 50 to 58 percent of the subjects chose the rotating image as opposed to the still image. No significant difference was found between the number of subjects who chose the more healthful image as compared to the less healthful image ($z = 0.77$, $p = 0.22$) for subjects preferring meat when viewing meat dishes. The MaNemar's test shows that there is a significant difference in population proportions ($S = 81.13$, $p < 0.0001$) for subjects preferring meat when viewing vegetable-based dishes.

MaNemar's tests were also conducted for a hunger effect. Hunger was measured on a 5-point scale with 1 "not hungry" and 5 "very hungry". When comparing the rotation effect for subjects who were at the extreme ends being either not hungry or very hungry, the MaNemar's test shows that there is a significant difference in population proportions ($S = 12.17$, $p = 0.0005$). Overall, there is a significant hunger effect for rotation for those at extreme ends (1 vs. 5) with subjects who were not hungry more likely to choose the rotating images. The MaNemar's test shows that there is a significant difference in population proportions ($S = 63.70$, $p < 0.0001$) when comparing the upper and lower hungry groups (1

and 2 vs. 4 and 5) for healthfulness. Subjects who are very hungry were more likely to choose the less healthful images.

Discussion

The results show significant main effects for rotation and healthfulness and a significant interaction effect for rotation and healthfulness. The main effects are interesting because only a third of the subjects judged that the rotating image influenced decisions and felt that the rotating image looked more appealing than the still image. However, almost ninety percent of subjects rated that they noticed it immediately and coupled with the main effect for rotation, thus, we suggest that the rotating image was attention grabbing.

Less healthful food options were picked significantly more than the healthful options, but a closer look reveals that it was the vegetable based dishes that drove the less healthful choices. Healthful meat dishes were picked more often in the rotating images and subjects preferring meat dishes chose almost equally between the healthful and less healthful meat choices. However, they were more likely to pick the less healthful vegetable-based choices. We suggest that meat-preferring subjects might choose the less healthful vegetable-based options because it is more calorie rich. Low-health conscious subjects estimated that the less healthful raw veggies dish as well as the more healthful garden salad had significantly less calories than high-health conscious subjects. Overall, the image rating task results show that, in contrast to meat dishes, the less healthful vegetable based options were rated more likely to be consumed, although these were considered to be less healthful. This rating is likely explained by findings from previous studies that consumers intuitively associate tastiness with less healthful food (Raghunathan, Naylor and Hoyer, 2006).

Study 1b) Between subjects experimental design

Results

A total of 129 subjects participated in a between subjects experiment with four different treatments carried out simultaneously. Subjects were assigned randomly to a condition.

Data preparation

The analysis was conducted in SPSS. First, data for treatment conditions 1 and 2 were merged and choices matched with healthful and less healthful choices summed for each. Scale items were reverse scored where necessary. Mean composite scores were also created for the multi-item scales health consciousness, preference for consistency, and vividness by averaging all item scores after high inter-item reliability was established. A median split of mean composite scores was then used to group subjects according to low and high conditions. A median split based on mean score also split subjects into a low/high hunger condition. This procedure is similar to the one used by Velazquez and Keryn (2014), where the composite scores were summed and then a median split created. T-tests were carried out to test differences between the groups and MANOVAs were used to test the composite scales as covariates. Then, data for treatment conditions 3 and 4 were merged and the same procedures and tests carried out.

Treatment conditions 1 and 2

Treatment condition 1 had 32 subjects comprising 59% males and 41% females with an overall mean age being 22. Treatment condition 2 had 33 subjects comprising 49% males and 52% females with an overall mean age=22).

Treatment 1 compared rotating and still image of light calorie vegetable-based food. A mix of rotating, still and combination images were randomly presented to subjects. Rotating were presented on both left and right of the screen to avoid screen positioning effects.

Treatment 2 showed the same manipulation of light calorie vegetable-based food with only still images. No rotating images were included and questions at the end of the choice task were the same as for those with rotating images.

Results show that 60% of subjects in treatment 1 had seen a digital menu board while 49% of those in treatment 2 had seen these boards previously; however, these means are not significantly different across the two groups.

In treatment 1, 63% (mean=3.35 SD=.92) felt that they made a more healthful decision (19% unsure) in comparison to the 48% (mean=3.18 SD=1.04) in treatment 2 (18% unsure). There were no significant differences for the healthful decisions between the groups.

A total of 59% (mean=2.41 SD=1.103) of subjects were hungry in treatment 1 and 44% (2.94 SD 1.223) of subjects in treatment 2 were hungry. There were no significant differences for hunger between the two groups.

A total of 66% of subjects in treatment 1 rated themselves as health conscious (mean 2.28 SD=.92) while 61% (mean=2.42, SD=1.0) in treatment 2 did so, which is not a significant difference. There were no significant differences for the composite health consciousness, preference for consistency, vividness and hunger and none of the composite scales were found to be significant covariates. However, there are a few significant differences across the two treatment groups for low/high-health consciousness, preference for consistency, and hunger. These results are discussed in a subsequent section.

High-health conscious subjects in treatment 1 (mean=3.56 SD=.46) had significantly higher preference for consistency (t(31)=3.01, p=.005) than the high-health conscious subjects in treatment 2 (mean=3.08 SD=.45).

Choice task

There were significant differences between the treatment conditions for less healthful choices overall (t(61)=2.28, p=.026), with subjects in treatment 1 (i.e., the rotating condition) making less healthful choices (mean=16.63 SD=1.50) than subjects in treatment 2 (mean=15.58 SD=2.11). Subjects who were not very hungry in treatment 1 (mean=17.24 SD=1.44) chose less healthful dishes significantly more (t(30)=2.07, p=.047) than similar subjects in treatment 2 (mean=15.60 SD=2.87).

No significant differences were found for the choice task between subjects with a high and low preference for consistency and health consciousness.

Rating task

An analysis of rating task of the target food dishes on 1) likelihood to consume, 2) appetizing, and 3) calories estimation revealed significant differences for two of the dishes. Subjects in treatment 2 (mean=4.21 SD=1.05) found the baked potatoes dish significantly more appetizing (t(63)=-2.08, p=.042) than subjects in treatment 1 (mean=3.84 SD=1.14). The less healthful raw veggies with dip dish was also rated significantly more likely to be consumed (t(63)=-2.62, p=.026) and more appetizing (t(63)=-2.62, p=.011) by subjects in treatment 2 (mean=4.21 SD 1.11 and mean=3.88 SD=1.05) than subjects in treatment 1 (mean=3.50 SD=1.39 and mean=3.16 SD=1.17).

Low-health-conscious subjects in treatment 2 (mean=4.56 SD=.81) found the baked potatoes significantly more appetizing (t(30)=-2.04, p=.05) than subjects in treatment 1

(mean=3.88 SD=1.09) who preferred the fries. Low-health conscious subjects with a low preference for consistency in treatment 2 (mean=4.71 SD=.756) found the baked potatoes significantly more appetizing (t(16)=-2.99, p=.009) than similar subjects in treatment 1 (mean=3.36 SD=1.03). The same subject set as above in treatment 2 (mean 4.71 SD=.756) were also more likely to consume the baked potatoes (t(16)=-2.23, p=.04) than such subjects in treatment 1 (mean=3.64 SD=1.12).

Low-health conscious subjects with a high preference for consistency in treatment 1 (mean=4.80 SD=.45) found the less healthful fries more appetizing (t(12)=4.70, p=.001) than the same subjects in treatment 2 (mean=3.22Ds=.67). Subjects with a low preference for consistency in treatment 2 (mean=4.25 SD=.72) also rated the less healthful veggie with dip dish significantly more appetizing (t(32)=-3.29, p=.002) than such subjects in treatment (mean=3.21 SD=1.40). The more healthful veggie dish was rated as significantly more likely to be consumed (t(32)=-2.27, p=030) by subjects with a low preference for consistency in treatment 2 (mean=4.20 SD=1.11) than in treatment 1 (mean=3.21 SD=1.42).

High-health-conscious subjects in treatment 2 (mean=4.24 SD=.75) found the less healthful veggies with dip significantly more appetizing (t(31) =-3.97, p=.000) than subjects in treatment 1 (mean=3.06 SD=.93). Although not significantly different, high-health conscious subjects in treatment 1 (mean=16.79 SD=1.48) seemed to prefer less healthful food than health conscious subjects in treatment2 (mean=15.24 SD=2.51), (t(29)=2.03, p=.051).

Subjects with a low preference for consistency in treatment 1 (mean=4.0 SD=.68) rated the less healthful garden salad with cheese and dressing as significantly more healthful (t(32)=2.17, p=.038) than subjects with a low preference for consistency in treatment 2

(mean=3.45 SD=.76). Also the more healthful baked potatoes dish was rated as more appetizing (t(32)=-2.31, p=0.28) by subjects with a low preference for consistency in treatment 2 (mean=4.30 SD=.98) than in treatment 1 (mean=3.50 SD=1.02).

Decision and attention to images

Subjects in treatment 1 (mean=3.72 SD=.89) with the rotating images thought significantly more about the images (t(63)=3.16, p=.002) afterwards than did subjects in treatment 2 (mean=2.94 SD=1.088). No other significant differences were found for decision items. Subjects with a low-health consciousness in treatment 1 (mean=3.75 SD=.93) also thought significantly more about the images afterwards (t(31)=3.42, p=.002) than did subjects in treatment 2 (mean=2.56 SD=1.03). Subjects who had high hunger levels in treatment 2 (still/still) (mean=3.33 SD=.77) felt that the images were much more vivid (t(29)=-2.47 p=.02) than similar subjects in treatment 1 (mean=2.69 SD=.63) with the rotating images.

Treatment conditions 3 and 4

Results

Treatment 3 compared rotating and still image of calorie rich meat-based food. Rotating images placed on the left next to still images were shown to subjects to make a choice. To avoid screen effects, another set of still images and then rotating images were included similar to treatment 1. Treatment 4 showed the same manipulation of calorie rich meat-based food with only still images as was done in treatment 2.

Treatment condition 3 had 32 subjects with 53% males and 47% females with an overall mean age of 22. Treatment condition 4 had 32 subjects with 44% males and 56% females with an overall mean age of 21.

Composite scales were calculated for the multi-item health consciousness (mean=3.52 SD=.81, Cronbach alpha=.906), vividness (mean=3.54 SD=.58, Cronbach alpha=.747) and preference for consistency (mean=.3.32 SD=.61, Cronbach alpha=.837). Subjects were again split into high and low-health consciousness, preference for consistency, and hunger level.

There was a significant difference for subjects in treatment 3 (mean=2.16 SD=.99) who thought that time was too short to make a selection ($t(62)=2.06$, $p=.043$) than for subjects in treatment 4 (mean=1.72 SD=.68). 69% in treatment 3 have seen a digital menu board before versus 53% in treatment 4. 59% (15% unsure) rated themselves as hungry in treatment 3 (mean=2.63 SD=1.31) and 41% (19%) in treatment 4 (mean=2.97 SD=1.31). Low-health conscious subjects with a low preference for consistency in treatment 4 (mean=3.83 SD=.408) rated themselves as significantly hungrier ($t(11)=-4.23$ $p=.001$) than similar subjects in treatment 3 (mean=2.14 SD=.90).

There was a significant difference for the single item on health consciousness ($t(62)=2.11$, $p=.039$) with subjects in treatment 3 (2.56 SD=1.08) considering themselves as more health conscious than subjects in 4 (mean=2.03 SD=.933). Subjects rated themselves health conscious as follows: treatment 3=59% (16% unsure), and treatment 4=75% (16% unsure).

More than a third 34%) of subjects in treatment 3 thought they had made healthy food decisions in their selections (345 unsure) (mean=3.03 SD=1.03) and 47% in treatment 2 agreed (255 unsure) (mean=3.28 SD=1.09). No significant differences were found between

subjects with a low/high-health conscious or low/high preference for consistency in either treatment condition.

Choice task

There were no significant differences for choices based on healthfulness of meat-based dishes between the treatment groups. However, there was a significant difference for low-health conscious subjects with a high preference for consistency in treatment 3 (mean=29.67 SD=6.62) who chose more healthful dishes ($t(13)=2.31$, $p=.038$) than similar subjects in treatment 4 (mean=25.86 SD=6.44).

Rating task

There were no significant differences between the treatment groups overall except between high and low-health conscious groups. Further analysis based on high/low-health consciousness and preference for consistency reveals significant differences for the calorie estimation task for both the grilled chicken sandwich and the breaded chicken sandwich. High-health consciousness subjects with a high preference for consistency in treatment 4 (mean=458.46 SD=148.372) estimated the calories significant higher for the grilled chicken sandwich ($t(21)=-2.27$, $p=.034$) than similar subjects in treatment 3 (mean=332.00 SD=107.06). The same set of subjects in treatment 4 (mean=606.54 SD=182.93) also estimated the calories of the breaded chicken sandwich ($t(21)=-2.32$, $p=.030$) as significantly higher than the same subjects in treatment 3 (mean=440.00 SD=152.39).

Decision and attention to images

Low-health conscious subjects in treatment 3 (mean=3.69 SD=1.01) rated that they imagined significantly more what it was like to eat the food in the images ($t(26)=2.19$

p=.038) than the same subjects in treatment 4 (mean=2.83 SD=1.03). There were no other significant differences between the groups.

Discussion

It was interesting to note that subjects in treatment 1 chose the less healthful options significantly more than subjects in treatment 2, who only saw still images. However, high-health conscious subjects seem to be especially susceptible to choose the less healthful options when rotating images are present. Subjects who were significantly hungrier made less healthful choices and rated the still images in the still/still treatment condition as significantly more vivid than their counterparts in the rotating/still images condition.

The potatoes, and particularly the fries, are the drivers for subjects choosing less healthful dishes because fries were also rated as more appetizing than the baked potatoes and high-health conscious subjects in the rotating condition preferred fries. Subjects also rated the less healthful veggie dish as more appetizing and likely to be consumed, especially low-health conscious subjects who viewed still images.

Generally subjects with a low preference for consistency in the still images condition seemed to find the more healthful baked potatoes and less healthful raw veggies dish more appetizing, but were more likely to consume the more healthful raw veggies version. Perhaps this is an indication that subjects with a low preference for consistency are more easily influenced by food ad.

There were no significant differences in choices for meat-based dishes. Subjects only differed on estimating the calories of the breaded and grilled chicken sandwiches.

Overall, both within subject and between subject study results suggest that consumers tend to choose higher calorie, less healthful vegetable-based dishes when they are hungry,

especially high-health conscious consumers who override their goal of eating healthy to satisfy their immediate active goal of satisfying their hunger (Gollwitzer, 1999). The results of the rating task showed that subjects rated less healthful dishes more appetizing than more healthful ones, which is similar to Raghunathan et al.'s (2006) finding that less healthful dishes are tastier. However, subjects who reported low-health consciousness and a low preference for consistency were more likely to consume more healthful versions of the dishes. The results also suggest that consumers are more likely to be influenced by rotating images when they are not hungry regardless of health conscious levels. So, overall rotating images seem to influence subjects with low-health consciousness and a low need for consistency more than they do subjects in other treatment conditions.

More subjects in the vegetable-based treatment groups 1 and 2 (55%) rated their decisions healthier for selections made than did subjects in the meat-based treatment groups 3 and 4 (41%). We suggest that subjects rated less healthful versions of the choice tasks as also more healthful because of the presence of some aspects of healthfulness and because the calories were rated as lower. Chandon and Wansink (2012) referred to this phenomena as "health halos", when consumers rate an entire dish as healthy when there is any one ingredient healthy in the dish.

Study 2: Eye-tracking Study

Results

Online survey click data

A total of 36 subjects (males 53% versus females 47%) participated in the eye-tracking study. 53% of subjects had seen a digital menu board with video ads before. None of

the subjects were vegetarians. 11% of our subjects were obese, scoring 30 or more for their Body Mass Index (BMI). The majority of subjects rated themselves as not hungry (47%) rather than hungry (25%) and scored a mean of 3.28,SD=1.09. On average, they had eaten 3.5 hours prior to the session (SD=1.77).

Subjects rated themselves as health conscious with a mean of 2.19 (std. dev.=.856) with 69% selecting "definitely yes" (1) or "yes" (2) on the rating scale. Subjects scored themselves as more neutral on the composite health consciousness scale (mean=3.54,SD=.13).

Of those subjects who rated themselves as being health-conscious, 52% thought they had made a more healthful choice and 16% were unsure. Of those rating themselves not health-conscious, 100% thought they did not make a healthy decision. Overall, 42% subjects thought they made a healthy decision and 22% were unsure (mean 3.08,SD=1.11).

There was a significant gender difference for whether subjects thought they made a healthy decision during the study (p=.008), with females rating their choices healthier than males. However, there were no significant gender differences for health consciousness. The more healthful garden salad (CL3) had a significant gender difference with males preferring the less healthful salad with cheese and ranch dressing. All combinations of manipulations of the garden salad scored p=.017, except for the manipulation with the image of the less-healthful image rotating on the left side of the screen (p=.000).

A total of 86% of subjects noticed the rotating image immediately. However, a higher percentage of subjects were not sure whether the rotating image made it easy to compare choices (39%) while 25% thought that it did help make comparisons. A total of 45% disagreed that the rotating image made deciding what to eat easier and only 50% felt that the

rotating image influenced their decisions. The results showed that 56% of subjects imagined what it would be like to eat the food shown in the rotating image and 67% of subjects changed their decisions on what to eat in the final selections.

McNemar tests were conducted because the study is a within-subjects design comparing different choices of the same subjects. The McNemar's test results are displayed in Table 7 and elaborated on as follows.

Table 7. Results of the McNemar's tests for the eye-tracking study

Rotation			
Rotate	493	Still	395
Healthfulness			
More healthful	349	Less healthful	539
Rotating by healthfulness			
Rotating more healthful	204	Still more healthful	145
Rotating less healthful	289	Still less healthful	250
Rotation by healthfulness, for meat vs. veggie dishes			
Meat-based dishes			
Meat: Rotating more healthful	122	Meat: Still more healthful	93
Meat: Rotating less healthful	123	Meat: Still less healthful	106
Vegetable-based pictures			
Veggies: Rotating more healthful	82	Veggies: Still more healthful	52
Veggies: Rotating less healthful	166	Veggies: Still less healthful	144
Hunger			
Rotation by hungry (1's and 2's vs. 4's and 5's)			
Hungry: Rotating	128	Hungry: Still	112
NotHungry: Rotating	237	NotHungry: Still	171
Healthfulness by hungry (1's and 2's vs. 4's and 5's)			
Hungry: More healthful	78	Hungry: Less healthful	161
NotHungry: More healthful	161	NotHungry: Less Healthful	247
Rotation and healthfulness by hungry (only 1's and 5's)			
Hungry: Rotating more healthful	97	Hungry: Still more healthful	64
Hungry: Rotating less healthful	140	Hungry: Still less healthful	107
NotHungry: Rotating more healthful	48	NotHungry: Still more healthful	30
NotHungry: Rotating less healthful	80	NotHungry: Still less healthful	82
Rotation by healthfulness for health-conscious (HC) versus not health-conscious (NHC)			
HC: Rotating more healthful	130	HC: Still more healthful	104
HC: Rotating less healthful	198	HC: Still less healthful	192
NHC: Rotating more healthful	16	NHC: Still more healthful	7
NHC: Rotating less healthful	29	NHC: Still less healthful	20

The McNemar's test shows a significantly higher number of subjects chose the rotating image as compared to the still image ($z = 3.28$, $p < 0.001$). We are 95% confident that 52 to 59 percent of the subjects chose the rotating image as opposed to the still image.

A significantly higher number of subjects chose the less healthful food as compared to the more healthful food ($z = 6.38$, $p < 0.001$). We are 95% confident that 57 to 64 percent of the subjects chose the less healthful food as opposed to the more healthful food.

When comparing rotation by healthfulness, the McNemar's test shows that there is a significant difference in population proportions ($S = 47.78$, $p < 0.001$). We are 95% confident that the proportion of subjects choosing the less healthful food option would be 0.12 to 0.21 greater had the image been rotating instead of still.

When comparing meat-based dishes for rotation by healthfulness for meat versus vegetable-based dishes, the McNemar's test shows that there is a (barely) significant difference in population proportions ($S = 4.17$, $p = 0.04$). We are 95% confident that the proportion of subjects choosing the less healthful food option would be 0.00 to 0.13 greater had the image been rotating instead of still when viewing two meat-based dishes. The MaNemar's test shows that there is a significant difference in population proportions ($S = 59.61$, $p < 0.0001$) for vegetable-based dishes when compared for rotation by healthfulness. We are 95% confident that the proportion of subjects choosing the less healthful food option would be 0.19 to 0.32 greater had the image been rotating instead of still when viewing two vegetable-based dishes.

To determine the effect of hunger on rotation, the McNemar's test shows that there is a significant difference in population proportions ($S = 44.77$, $p < 0.0001$). We are 95% confident that the proportion of subjects choosing the rotating food option would be 0.14 to

0.25 greater had they been not hungry instead of hungry. When determining the effect of hunger on healthfulness, the MaNemar's test shows that there is NOT a significant difference in population proportions (S = 0.00, p = 1.000).

When determining the effect of rotation and healthfulness on hungry subjects, the MaNemar's test shows that there is a significant difference in population proportions (S = 28.31, p < 0.0001). We are 95% confident that the proportion of subjects choosing the less healthful food option would be 0.12 to 0.25 greater had the image been rotating instead of still for subjects who are hungry. For not hungry subjects, the MaNemar's test shows that there is a significant difference in population proportions (S = 22.73, p < 0.0001) for rotation and healthfulness. We are 95% confident that the proportion of subjects choosing the less healthful food option would be 0.12 to 0.29 greater had the image been still instead of rotating for subjects who are not hungry.

The effect of rotation and healthfulness was also tested for health-conscious versus not health-conscious subjects. The MaNemar's test shows that there is a significant difference in population proportions (S = 29.26, p < 0.001) for rotation and healthfulness on health-conscious subjects. We are 95% confident that the proportion of subjects choosing the less healthful food option would be 0.10 to 0.20 greater had the image been rotating instead of still for subjects who are health conscious. For subjects who are not health-conscious, the MaNemar's test shows that there is a significant difference in population proportions (S = 13.44, p < 0.001) for rotation and healthfulness. We are 95% confident that the proportion of subjects choosing the less healthful food option would be 0.15 to 0.45 greater had the image been rotating instead of still for subjects who are not health conscious.

Inter-item reliability and composite scores were calculated scales included in the survey and the results were:

- Health consciousness (5 items: mean=3.54SD=.13, Cronbach alpha=.876)
- Impulsiveness (12 items: mean=4.19SD=.17, Cronbach alpha=.504)
- Preference for consistency (9 times: mean=3.23SD=.11, Cronbach alpha=.875)
- Attentional control (20 items: mean=2.40,SD=.27, Cronbach alpha=.592)
- Vividness (6 items: mean=3.68SD=.10, Cronbach alpha=.731)

Al scale items were measured on a 5-point scale with anchors of 1="strongly disagree" and 5="strongly agree". Items were reverse scored where necessary to have positive responses represented by higher numbers.

Eye-tracking data

Eye-tracking data was exported from Imotions Attention Tool and analyzed in Qualtrics. The Areas-of-Interest (AOI) and heatmap statistics were manually captured for each picture. The analysis was carried out on the AOIs since the heatmaps had almost 50% of people focused equally on the left picture and its descriptive text below (as one heatmap area with equal attention), thereby distorting the length of time and fixations captured. The latter occurrences are dealt with in the Results and Discussion Sections.

Although 36 subjects completed the eye-tracking study and its associated online survey, data for only 28 subjects (males 75%, females 25%) were of sufficient quality to be included in the eye-tracking analysis. Heavy eye make-up, e.g. mascara, influenced the gaze capture for female subjects. At least two female subjects' eyes could not be properly calibrated due to the presence of mascara on their eyelashes.

The analysis also excludes data for two choice screens, namely the first and last choice screens since only one subject's data was suitable for inclusion. Filler images were also excluded from the analysis unless where comparisons are made with filler data. According to the Imotions Attention Tool product description (2014), descriptions of the statistics that were analyzed included:

- TTFF (Time-to-first-fixation): Average of each respondents' first fixation in the area.
- Time spent: Average time spent in an attention point out of the total exposure time.
- Ratio: number of fixations recorded within the area
- Revisitors: Number of respondents who had at least one fixation in the attention point
- Revisits: Number of respondents who revisited an attention point out of those who had at least one visit.
- Fixations: How many times respondents revisited an attention point on average.

Fixations are further described as a measure of attention because the subject pauses to examine or interpret the stimuli and is thus thought to be an indicator of cognitive processing, with the greater the number of fixations indicating greater cognitive processing (Velazquez & Keryn, 2014).

Analysis by Left and Right images

a. The results in Table 8 shows the left image (option 1) always attracted the most heat regardless of rotation or not. There were significant differences between left and right

Table 8. Comparisons of eye-gaze data for left/right and still/rotating images

Type	N	TTFF		Time Spent		Ratio		Revisitors		Revisits		Fixations	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Rotation and still images: Left vs right images													
Rotate_left	24	2.2	0.36	0.6	0.21	62%	0.09	59%	0.17	2.9	0.4	45	13.27
(all images)													
Rotate_right	*24*	*3.2*	*0.35*	*0.3*	*0.13*	*0.42*	*0.12*	*0.5*	*0.17*	*2.8*	*0.43*	*25*	*8.44*
(all images)													
P-value		.000*		.000*		.000*		5%		0.423		.000*	
Rotate_right	12	3.2	0.37	0.31	0.12	42%	0.12	48%	0.2	2.8	0.57	24	7.82
Rotate_left	*12*	*2.1*	*0.32*	*0.7*	*0.27*	*0.66*	*0.08*	*0.64*	*0.22*	*2.8*	*0.42*	*49*	*16.54*
P-value													
Still_left	12	2.3	0.39	0.533	0.09	59%	0.09	54%	0.07	2.9	0.38	41	8.09
Still_right	12	3.2	0.34	0.308	0.14	42%	0.12	51%	0.14	2.8	0.23	26	9.3
P-value		*.000**		*.000**		*.000**		*0.438*		*0.28*		*.000**	
Still_right													
Rotate_right	12	3.2	0.37	0.3	0.12	42%	0.12	48%	0.2	2.8	0.57	24	7.82
P-value		*1*		*1*		*99%*		*72%*		*0.889*		*0.69*	
Still_left	*12*	*2.3*	*0.39*	*0.5*	*0.09*	*0.59*	*0.09*	*0.54*	*0.07*	*2.9*	*0.38*	*41*	*8.09*
Rotate_left													
P-value		0.219		0.139		6%		16%		0.483		0.182	
Veggies: Left vs Right images													
Veggies_Left	6	2	0.33	0.7	0.25	68%	0.09	68%	0.22	2.7	0.38	50	16.45
Veggies_Right	6	3	0.35	0.3	0.07	48%	0.06	47%	0.21	2.6	0.31	26	5.91
P-value		*.000**		*.008**		*.001**		*0.121*		*0.935*		*.008**	
Meat: Left vs Right													
CR_rotate_Left	6	2.2	0.3	0.7	0.31	64%	0.08	60%	0.23	3	0.44	48	18.14
CR_rotate_ rght	6	3.3	0.37	0.3	0.16	35%	0.14	49%	0.21	2.9	0.76	23	9.7
P-value		*0.0008*		*.032**		*.002**		*0.414*		*0.82*		*.014**	
Less Healthful: Left vs Right images													
LH-Left-rotate	6	2.3	0.34	0.7	0.29	69%	0.07	64%	0.17	2.8	0.47	53	16
LH-Right-rotate	5	3.14	0.38	0.3	0.08	43%	0.09	54%	0.27	2.7	0.58	24	6.18
P-value		*.004**		*.010**		*.000**		*0.443*		*0.64*		*.004**	
Healthful: Left vs Right													
H-Left-rotate	6	2	0.2	0.6	0.26	63%	0.09	64%	0.28	2.8	0.41	45	17.48
H-Right-rotate	*7*	*3.2*	*0.39*	*0.3*	*0.14*	*41%*	*0.15*	*44%*	*0.15*	*2.8*	*0.6*	*25*	*9.29*
P-value		*.000**		*.035**		*.010**		*0.131*		*0.917*		*.024**	
Control Group: Left vs Right images													
Left_control	11	2.4	0.49	0.6	0.2	61%	0.11	57%	0.1	2.7	0.33	41	12.79
Right_control	11	3.3	0.5	0.2	0.09	40%	0.14	44%	0.17	2.8	0.55	21	6.59
P-value		*.000**		*.000**		*.001**		*.044**		*0.745*		*.000**	

images across all conditions including control scenes for TTFF, time spent, ratio, revisitors and fixations.

- There were also significant differences between left and right for both rotation and still images for TTFF, time spent, ratio and fixations. No significant differences were observed for revisitors and revisits in these. Exactly the same

results were observed for veggies, meat, healthfulness as well as the control group consisting only of still images

- There were, however, no significant differences for still images on the right vs rotating images on the left and the same applied to right images.
- There were also no significant differences observed for left and right images when comparing still images to rotating images.

b. A total of 17 out of 35 (49%) or 19 out of 40 (48% with fillers included) had equal heat for both the first option image and its associated text description. This was followed by the image for option 2. These results were observed regardless of whether it was the still or rotation condition.

c. There were 3 types of heat movement patterns discernable. The first pattern of gazing is from top-left, bottom-left, top-right and then bottom-right. The second pattern of gazing is from top-left, top-right, bottom-left, bottom and bottom-right. The third pattern is a simultaneous fixation on top-left-bottom-left, top-right and bottom-right. Figure 4 provides examples of these patterns.

d. More time was spent looking at left images (option 1) (0.6s vs 0.3s) with more total visitors (62% vs 41%), more revisitors (59% vs 48%) and more fixations (44 vs 24), but revisits were equal (2.8). Significant differences for TTFF, time spent, ratio, revisitors and fixations were observed.

e. In total, 5 heat regions were highlighted across all images.

f. Subjects generally only experienced fatigue from the 38th screen onwards (out of 43 screens) and this was observable on the heatmaps when they stared at the progress bar and next button more frequently.

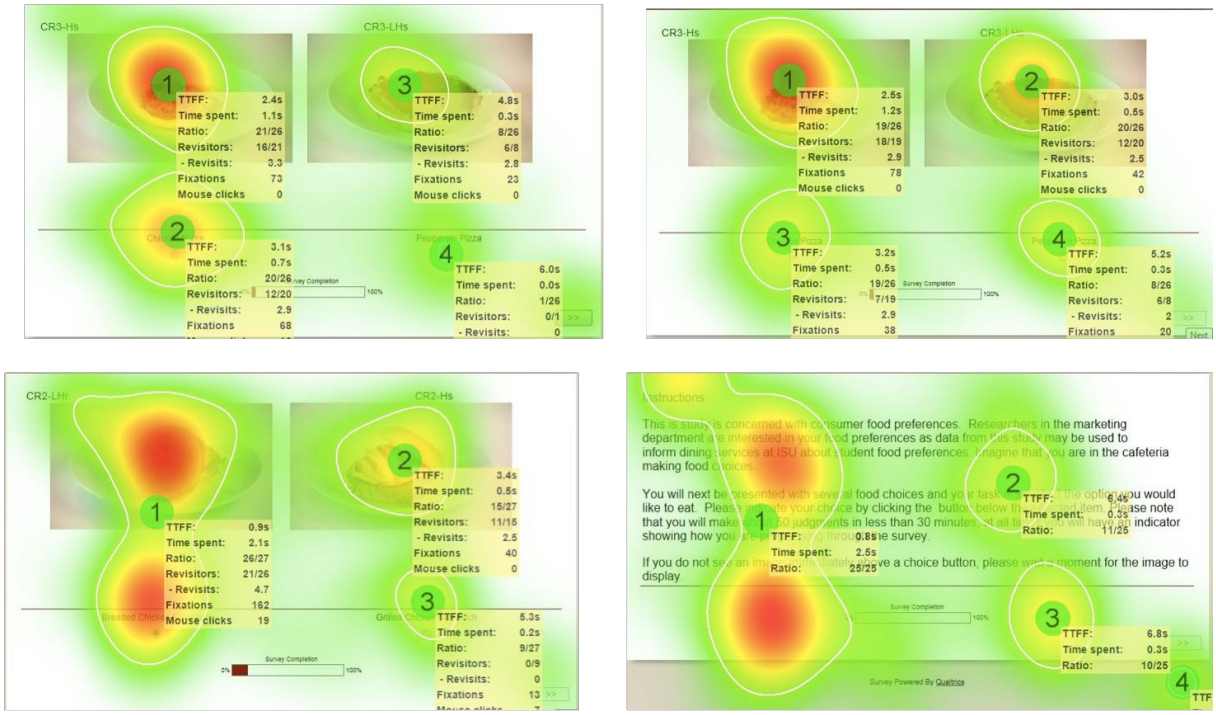

Figure 4. Heatmaps for three different eye-gaze patterns observed

Rotation

a. As show in Table 9, none of the factors were significant different when comparing all rotating and still images. Rotating images had a pattern of subjects fixating faster on them (2.7 vs 2.8) spending more time on them (0.5 seconds vs 0.4 seconds), having more visitors (54% vs 50%), more revisitors (56% vs 52%), and more fixations (36 vs 33).

- There were also no significant differences observed between rotating and still images in target scenes.
- As shown in Table 9, subjects spent more time on filler images because these were unique compared to the rest of manipulations and were non-repeating images.

Table 9. Comparing eye-gaze data for rotating, filler and still images

Type	N	TTFF	Time Spent	Ratio	Revisitors	Revisits	Fixations
		Mean	Mean	Mean	Mean	Mean	Mean
Comparing all scenes							
Rotation scenes	48	2.7	0.5	52%	54%	2.80	35
Control_scenes	22	2.8	0.4	50%	50%	2.80	31
P-value		*0.396*	*0.365*	*0.675*	*0.367*	*.64*	*0.337*
Comparing filler vs all other images							
Filler	10	2.7	0.6	58%	55%	2.90	41
Overall	70	2.7	0.4	52%	53%	2.80	34
P-value		*0.857*	*0.031**	*0.191*	*0.716*	*.42*	*0.166*
Rotation (Scenes that had a rotating image)							
Rotating images	24	2.7	0.5	54%	56%	2.80	36
Still images	24	2.7	0.421	50%	53%	2.90	34
P-value		*0.601*	*0.337*	*0.426*	*0.49*	*.56*	*0.497*

b. There were significant differences observed between veggie dishes and meat dishes for revisits ($p=.020$) in the target scenes as observed in Table 10. Specifically, these significant differences were observed for the amount of revisits between meat and veggie dishes for still images with more revisits observed for meat pictures. No other significant differences were observed.

Table 10. Comparing eye-gaze data for rotation of veggies and meat dishes

Type	N	TTFF		Time Spent		Ratio		Revisitors	Revisits		Fixations	
		Mean	SD	Mean	SD	Mean	SD	Mean	Mean	SD	Mean	SD
Rotation: Veggies vs Meat												
Veggies (still/rotate)	24	2.6	.54	0.5	.21	54%	.13	55%	2.7	.29	35	14.47
Meat (still/rotate)	24	2.8	.65	0.4	.24	50%	.16	54%	3	.47	35	15.61
P-value		*0.446*		*0.656*		*0.276*		*0.78*	*.020**		*1*	
Veggies_Still	12	2.7	.46	0.442	.16	51%	.14	52%	2.7	.25	33	11.56
Meat_Still	12	2.8	.68	0.4	.17	50%	.13	53%	3	.33	34	12.19
P-value		*0.945*		*0.546*		*0.867*		*0.934*	*.041**		*1*	
Veggies– Rotate	12	2.5	.62	0.5	.25	58%	.12	58%	3	.33	38	17.08
Meat– Rotate	12	2.8	.65	0.5	.30	50%	.19	55%	3	.59	35	19.00
P-value		*0.346*		*0.884*		*0.209*		*0.728*	*0.162*		*1*	
Veggies_Rotate	12	2.5	.62	0.5	.25	58%	.12	58%	2.64	.33	38	17.08
Veggies_Still	12	2.7	.46	0.442	.16	51%	.14	52%	2.7	.25	33	11.56
P-value		*0.928*		*0.455*		*0.964*		*0.805*	*0.768*		*1*	
Meat_Rotate	12	2.8	.65	0.5	.30	50%	.19	55%	2.92	.59	35	19.00
Meat_Still	12	2.8	.68	0.4	.17	50%	.13	53%	3	.33	34	12.19
P-value		*0.36*		*0.571*		*0.196*		*0.498*	*0.496*		*0*	

c. Table 11 shows that there were no significant differences observed between rotating healthful and less healthful as well as for still images. There was a trend that healthful images attracted more visitors and revisitors than less healthful images; however, the effect is reversed for rotating images where less healthful images attracted more attention. Compared to less healthful rotating images, the trend was that healthful rotating images were fixated on more quickly, more overall time was spent looking at them, and there were fewer total visits, revisitors, and fixations observed.

- When comparing rotating meat dishes for healthfulness, there were significantly more revisitors (p=.010) and fixations (p=.046) for more healthful meat dishes.
- When comparing still versus rotating images for healthfulness of veggie dishes, there was a significant difference for revisitors (p=.033) with more revisitors for less healthful veggies.
- There was a significant interaction effect observed for amount of time spent (p=.026), revisitors (p=.020) and fixations (p=.032) for rotating veggies/meat and healthfulness (healthful/less healthful).

d. There were no significant differences for healthful/less healthful or veggie/meat dishes for the control still/still images as per Table 12.

Retrospective think-aloud protocol

Themes

1) The rotating image contributes additional features for choice consideration:

A total of 75% of subjects mentioned or commented on the rotating images when asked what their thought processes were, although some referred to the images as moving or spinning images. Generally, the rotating images were seen as enhancing the features of the

Table 11. Comparing eye-gaze data for healthfulness

Type	N	TTFF		Time Spent		Ratio		Revisitors	Revisits		Fixations	
		Mean	SD	Mean	SD	Mean	SD	Mean	Mean	SD	Mean	SD
Rotation: Healthfulness												
H_Rotate	13	2.6	.72	0.5	.24	51%	.17	53%	2.8	.50	34	16.61
LH-Rotate	11	2.7	.56	0.5	.31	57%	.15	59%	2.76	.50	40	19.25
P-value		*0.827*		*0.572*		*0.373*		*0.517*	*0.861*		*0*	
Still_H	11	2.9	.58	0.418	.18	51%	.14	53%	2.8	.26	33	12.21
Still_LH	12	2.6	.54	0.423	.15	50%	.13	52%	2.9	.36	34	11.62
P-value		*0.217*		*0.944*		*0.939*		*0.747*	*0.617*		*1*	
*CL/CR*H/LH-Rotate*		*0.798*		*.026**		*0.409*		*.008**	*0.316*		*.032**	
Less healthful: Veggies vs Meat												
Veggies-LH-Rotate	6	2.6	.57	0.4	.22	58%	.13	49%	2.5	.32	33	14.80
Meat-LH-Rotate	5	2.8	.59	0.7	.37	56%	.20	72%	3	.57	48	22.30
P-value		*0.618*		*0.177*		*0.851*		*0.069*	*0.096*		*0*	
Healthful: Veggies vs Meat												
Veggies-H-Rotate	6	2.5	.72	0.5	.27	58%	.14	67%	2.8	.33	43	19.05
Meat-H-Rotate	7	2.8	.74	0.3	.15	45%	.18	42%	2.8	.64	26	3.87
P-value		*0.444*		*0.069*		*0.173*		*0.053*	*0.754*		*0*	
Healthful Veggies:												
Veggies-H-Rotate	6	2.5	.72	0.5	.27	58%	.14	67%	2.8	.33	43	19.05
Veggies-LH-Rotate	6	2.6	.57	0.4	.22	58%	.13	49%	2.5	.32	33	14.80
P-value		*0.696*		*0.227*		*0.985*		*0.2*	*0.278*		*0*	
Veggies-H-(still/rotate)	12	2.9	.70	0.4	.13	47%	.15	47%	2.9	.49	29	9.36
Veggies-LH-(still/rotate)	12	2.6	.58	0.5	.29	53%	.17	61%	3	.45	41	18.68
P-value		*0.206*		*0.072*		*0.377*		*.033**	*0.371*		*0*	
Healthfulness: Meat												
Meat-H (still/rotate)	12	2.5	.59	0.525	.25	55%	.15	60%	2.8	.29	38	17.42
Meat-LH (still/rotate)	12	2.7	.51	0.408	.16	54%	.13	50%	2.6	.29	32	10.83
P-value		*0.585*		*0.179*		*0.876*		*0.194*	*0.272*		*0*	
Meat_Rotate: H_LH		*0.983*		*0.063*		*0.337*		*.010**	*0.594*		*.046**	
Veggies_rotate:H_LH		*0.724*		*0.617*		*0.85*		*0.765*	*0.765*		*1*	

Table 12. Comparing eye-gaze data for the control condition (still/still)

Type	N	TTFF		Time Spent		Ratio		Revisitors	Revisits		Fixations	
		Mean	SD	Mean	SD	Mean	SD	Mean	Mean	SD	Mean	SD
Control_group												
CL_control	12	2.7	.77	0.4	.26	50%	.18	55%	2.8	.38	33	17.01
CR_control	10	3	.50	0.4	.16	51%	.15	45%	2.7	.53	29	10.74
P-value		*0.349*		*0.446*		*0.832*		*0.11*	*0.792*		*1*	
H_control	11	2.9	.62	0.4	.21	50%	.13	47%	2.6	.32	30	12.54
LH_control	11	2.8	.73	0.4	.24	51%	.20	54%	2.9	.53	33	16.38
P-value H_LH		*0.876*		*0.851*		*0.925*		*0.346*	*0.167*		*1*	

dish by providing more information on the dish. Subjects described the dishes in the rotating images as more appetizing and appealing, more vivid, more informative, attention grabbing/distracting and subjects reported waiting for the images to rotate before making a choice. A list with actual subjects' descriptions of attributes of the rotating images appears in Table 13.

Table 13. Subjects' descriptions about the rotating image during the think-aloud session

Features of the rotating image	**Choice influencers**
More appealing	Tastier
Sharper	Colorful
Clearer	Ingredients
Waited for rotation	Appeal
Brightness	Appetizing
Attracting attention	Quality of ad
Distracting	Moving
Annoying	Health
Different lightning	Looks
Gave better idea of what dish looked like	Distraction
Higher quality image	Sounded better
Looked better	Read better
Appetizing	Lots of stuff
Preferred still image, but still waited for rotating image	Attract attention
Pictures to rotate	

2) Choice influencers were identified: A total of 47% of subjects mentioned which attributes of the food or images influenced their choices. These influencers were rotation, appetizing, appeal, health, quality of the ad/image, ingredients, text description, and attention attraction/distraction. A complete list of actual descriptions is provided in Table 13.

3) Salad is associated with dressing: A total of 58% of subjects mentioned that they associated eating salad with a dressing and they would find it strange to eat the salad dry. However, 11% commented that the dressing choice was too limited, since only ranch

dressing was offered. 6% did not like the cheese on it, but still associated salad with dressing and thus chose it. Only 11% said that they do not associate dressing with salad.

4) Raw veggies are associated with dip: A total of 44% of subjects associated raw veggies with dip and would not eat it without dip. Only 17% said that they do not associate dip with raw veggies.

5) Habitual choices: A total of 42% of subjects said that they chose dishes that they usually eat because they had a preference for it. However, only 6% explicitly said that they wanted to make consistent choices.

6) Health consciousness as influencer on choice: A total of 33% mentioned healthfulness of dishes as influencing their decisions, although on subject reflected that s/he should have made healthier choices in retrospect.

7) Variety seeking in choices: A total of 19% of subjects made mention of changing their choices because of:

a. repetitiveness of pictures,
b. choosing too much of one foodstuff,
c. wanted to pick something different to usual choice,
d. had already that dish during the day and wanted something else.

8) Influence of Dietary Restrictions on Choice: Only 11% had dietary restrictions being one subject practicing the Muslim faith, two subjects were dieting and one subject could not eat tomatoes and filtered out all images that contained tomatoes.

9) Picture quality influences on choice: A total of 11% mentioned picture quality and of 8% of those mentioned that the pepperoni pizza looked "disgusting" in the image.

Although most of the subjects also referred to the rotating image as making the dish look better.

10) Repetitiveness of pictures influencing choice: A total of 22% complained of the repetitiveness of the images and another 22% (different subjects) mentioned that they no longer looked at pictures, but only read text descriptions once images started repeating.

11) Food preferences: Food preferences were mentioned by 81% of subjects. However, these preferences were mostly expressed for soup that was a filler image. Of those subjects who expressed food preferences, 14% mentioned not eating soup in general, and 8% mentioned that they do not like broccoli / broccoli cheese soup. Three subjects mentioned that they did not like pizza, salad and veggies each respectively.

12) Images as driver for choices/slowness of loading: A total of 61% said that they first looked at the picture and then at the text description, whereas 42% said that they looked first at the text description. However, the primary driver for the choices was the pictures, because only 17% said that the pictures did not influence them.

Discussion

Dietary limitations did not affect our study as the comparative choices were either meat/meat and vegetable/vegetable and even tomatoes would appear in both images. A strong left gaze bias (LGB), which exists for Western cultures that read text from left to right, was observed in the eye-tracking study (Guo, Smith, Powell, & Nicholls, 2012). Guo et al. (2012) further explained it as a spatial attention bias to the left visual field and in addition to being present in reading, it is also observed when processing faces given that the observer first looks to the left side of a face as seen from their perspective. (Guo et al, 2012). The LGB effect was observed to be the same for the instructions page, which was where subjects were

asked to read information prior to the imagery being displayed. Both Reutskaja et al. (2011) and Krabich et al. (2011) used a blank screen with a fixation point in the middle. Despite this, Reutskaja et al. (2011) also found in their eye-tracking studies of food choices that a left gaze display bias exists for computer screens, where subjects looked and chose items placed in the left region more often. This study's results confirm these findings. However, when subjects were presented with a dynamic menu board, a "horizontal centrality effect" was be present, where subjects visual attention was in the center of the display (Atalay et al., 2012; Chandon et al. 2008).

Despite the observed LGB effect in the heat maps, we were able to use the AOI information because our study was designed in such a way to account for screen effects. Rotation and healthfulness were shown equally on both the left and right sides of the choice screens.

Approximately half of the subjects (49%) first looked at the left image and then read the text description of the images before moving to the second image. This is evidenced in the heat maps showing equal heat for both left image and textual contents. There were 3 types of heat movement patterns discernable as was presented in Figure 4 and a simplified eye-movement flow in presented in Figure 5. The first pattern of gazing is from top-left, bottom-left, top-right and then bottom-right. The second pattern of gazing is from top-left, top-right, bottom-left, bottom and bottom-right. The third pattern is a simultaneous fixation on top-left-bottom-left, top-right and bottom-right. While these patterns were interesting, no commonalities could be isolated and it is recommended that future studies examine the conditions under which these occur.

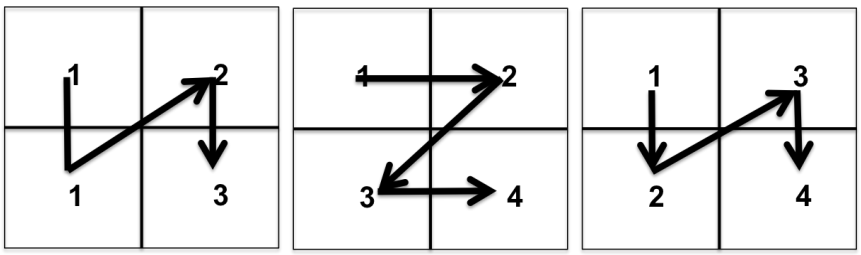

Figure 5. Different eye-gaze patterns observed from the heatmaps

Rotating versus Still Images

Overall, the AOIs show that although rotating images showed a trend toward attracting more attention, there were no significant differences when comparing all rotating and still images. There was however a significant interaction effect between rotation and healthfulness.

Overall, subjects made decisions in shorter time periods as the total time spent per item were mostly in the range of 400ms, but this does not necessarily indicated sub-optimal decision-making because the food items were familiar to subjects. This is consistent with findings from previous studies where subjects can make choices in less than 400ms and fixations at 350ms (Reutskaja et al., 2011)

Healthfulness of choices

More healthful meat dishes received more attention and less healthful veggie dishes attracted more attention regardless of rotation. Subjects chose less healthful vegetable-based dishes regardless of whether images were rotating or not, thus rotation appears to have little influence on choice.

This is consistent with our click choice data that reveals that less healthful veggie dishes in particular salad and raw veggies were chosen more often. The think-aloud data

revealed that subjects associated dressing with salad and veggies and were not likely to choose the dry version regardless of whether they thought it was healthier. This finding is discussed in more detail in the general Discussion Section below.

For meat-based dishes, rotating images had an influence on choice as significant differences were observed for rotating healthful versus less healthful meat dishes. Healthful rotating meat dishes attracted significantly more revisitors and fixations than less healthful dishes. The click data confirm that subjects were more likely to choose the dish in the rotating image. According to Velazquez and Keryn (2014), the greater fixations means that subjects stop to process information for longer periods. Armel, Beaumel and Rangel (2008) found that long fixations for appetizing items had an important influence on choice. The results from this study show that there were indeed greater fixations on rotating images, which indicates that subjects spent more time processing this information.

Influence of hunger

The effect of hunger on the subjects was also measured. Subjects who were not hungry were more likely to choose the rotating images than when they were hungry. The McNemar's test shows that there is not a significant difference for healthfulness choice regardless of whether they were hungry or not. Subjects were likely to pick less healthful items when they were not hungry and also the less healthful items when they were hungry.

More subjects would choose non-healthful options when images were rotating than still. Non hungry people would choose less healthful items when the image was still rather than rotating. However, this shows a tendency to choose less healthful option regardless of whether images were rotating or whether subjects were hungry.

We propose that subjects would make choices to satisfy their hunger and thus higher calorie dishes such as the salad or veggies with dressing would be chosen. We also suggest that subjects would make familiar choices when they are hungry and might not be susceptible to new information. Another reason for choosing less healthful non-rotating dishes when hungry would be the "tasty equals unhealthy" heuristic (Raghunathan et al., 2006) that comes into play when consumers do not have sufficient will-power to pursue their health goals.

Influence of health-consciousness

Subjects were more likely to choose non-healthful dishes if the image was rotating irrespective of whether or not they rated themselves as health conscious. However, the eye-tracking data shows that more consideration was given to healthful meat dishes than is reflected in the choice study.

The survey data shows that almost an equal number of subjects thought they made more healthful choices, but half of the subjects who rated themselves as health conscious did not think they made healthy decisions. We found gender differences for the less healthful garden salad, with males preferring the dressing and cheese on the salad.

During the self-report retrospective think-aloud session, 33% (12/36) subjects related that healthfulness drove their choices, but the likely reason why it is not evident in the survey data is due to the characteristics of the vegetable-based dishes such as the salad and veggie. Specifically, salads and veggies are generally associated with dressing and dips and no additional healthful alternative dressing/dip were offered.

What are the drivers for non-healthful choices?

Our findings suggest that the salad and dressing association and vegetables and dip association is the main influencer for the non-healthful choices. During the think-aloud

sessions, subjects expressed not only this association (58%), but also mentioned that there were no healthful alternative dressings and dip offered.

Habitual choice was another factor associated with this finding and 42% of subjects mentioned during the think-aloud session that they chose something that they usually eat. Only 19% of subjects mentioned that they sought variety in their choices and this is confirmed with the composite mean score for "need for consistency" scale, which was slightly higher than the "neither agree nor disagree" (mean = 3.25 SD=.57). However, the composite mean score for "impulsiveness" was high and the "attentional control" was rated lower than the neutral score.

Overall drivers influencing choice?

Although the still and rotating images were taken at the same time of the same dish, subjects perceived the rotating image to be more appealing and attention grabbing than the still image. Even negative descriptions such as annoying and distracting lend support to the notion that the rotating images drew more attention.

Subjects felt that the rotating image gave more information about the dish and that images were sharper, clearer, more colorful and brighter and the different lightning gave a better idea of the dish and thereby making it look more appetizing. Subjects described vividness factors of the rotating images as driver, but it is interesting to note that the composite vividness score was in the neutral to agree range (mean=3.68 SD=.10). Subjects also reported waiting for the rotating images to load and start rotating although there was a slight delay in rotation and they could deduce from the text description what the image's content was.

In fact the majority of subjects (61%) listed the images as primary driver for their choices and only 17% mentioned that images did not influence their choice at all. However, descriptions of the dishes were mentioned as explicitly also influencing choices (42%) and some subjects reported that they chose the dishes that sounded or read better in the description. Wedel and Pieters (2008) emphasized that influences from textual descriptions along with pictorial information is important to understand since it might influence pictorial processing by cooperating or conflicting with it, which might change consumer's memory of the picture (Gentner & Loftus, 1979).

According to the self-report think-aloud interviews, subjects also chose the dishes that had more ingredients, which is in line with Chandon and Wansink's (2012) "more is more" effect. Specifically, this effect occurs when consumers choose the bigger dish or associate more ingredients with better value. This was particularly so for the raw veggies with dip and salad with dressing and cheese (more add-ons). Chandon and Wansink (2012) also suggested that consumers would rate a dish as being more healthful when there is any type of more healthful item present. Compensatory effects also partially explain our findings because in previous studies, salad dishes were rated as being significant less in caloric content even when dressing is included. Although subjects did not mention this, we suspect that subjects might also have experienced a sense of self compensation or reward when they chose dressing on their salad when they chose healthier meat dishes.

Tastier dishes were also indicated as an influencer for choice and we suggest that Raghunathan et al.'s (2006) "tasty equals unhealthy" heuristic played a role. Subject might have implicitly believed that less healthful dishes, especially veggies and salads, tasted better.

CHAPTER 5. CONCLUSIONS

This research examined whether rotating images on digital menu boards can be used to influence consumers to make more healthful food choices. In particular, decision-making was studied in the search, alternatives evaluation, and purchase stages of the consumer decision-making model.

The first research question of whether rotating images have an effect on food choices is confirmed. Across all the studies, i.e., the field study, the experimental study, the eye-tracking, and self-report think-aloud data lend support to the findings that video elements such as rotation do attract attention and can influence decision-making. Even when over 50% of the field study subjects were daily visitors of the dining facility, all of them still looked at the video food ads, and almost ninety percent felt that the moving images on the menu boards influenced their choices. Only a third of the subjects did not alter their original purchase decision and almost half of them ordered an item displayed in the video food ad. Decisions were rated as easier even though health conscious subjects still made several comparisons between items on the menu board to satisfy both their hunger and health goals. Our results, especially our pilot field study, confirm Dairy Queen's study results that show that over 80% of items displayed in the video on the digital menu board increase sales beyond expectations (Jay, 2012).

Orquin and Loose (2013) identified four major influencers for stimulus-driven attention during eye-tracking studies: (a) saliency, (b) surface size, (c) visual clutter, and (d) position. In the eye-tracking study, support was found for saliency and position. In the pilot field study, support was found for saliency, visual clutter and position since the menu boards and video food ads were noticed immediately when subjects entered the dining facility.

Another factor that is important for this study is that the images displayed were task-relevant and, thus, already attracted more attention than less task-relevant items. The rotating image was considered as being salient for subjects as described in their self-report think-aloud interviews and all studies confirmed that the rotating images were more likely chosen. Although the still image was a static replica of the rotating image, subjects still perceived the rotating images to have more vividness characteristics and, thus, more desirable. Orquin and Loose (2013) described visual saliency as having different attributes such as contrast, color, edge orientation and movement and our rotating images possessed these attributes. Chandon and Wansink (2012) suggested that color might even be more important than brand or taste information. Subjects rated the vividness of the moving imagery high across all studies. In the field study, subjects rated the video food ad as de-cluttering the menu board due to its visual saliency.

The second research question asked whether rotating food images have an effect on more healthful food options, and this was not about to be conclusively confirmed. Although there were main effects for healthfulness in our studies as well as interaction effects with rotation, the healthfulness effect was for less healthful vegetable-based dishes. This finding is further complicated by the many factors that influenced the decision beyond the presence of rotating images. However, in the pilot field study, almost half of our subjects felt that they made a healthy choice; nevertheless, the study's sample size was too small to make substantial inferences. For the eye-tracking study, almost an equal number of subjects thought they made more healthful choices, but half of the subjects who rated themselves as health conscious did not think they made healthy decisions. In fact, quite the opposite behavior was seen because we found that subjects made less healthful choices, especially for

vegetable-based dishes, and these were driven by the rotating images more than the still images. While consumers do seem to keep their health goals in mind when making decisions, healthier choices are influenced by several factors that interplay with rotation.

The studies revealed that such factors include the consumer's hunger level, because hungrier consumers will most likely opt for calorie-rich, less healthful dishes implicitly believed to be tastier. They might also ignore rotating images and settle for more familiar choices when they are hungry. Value for price also plays a role, because consumers are likely to choose dishes that have more ingredients or bigger sizes (Chandon & Wansink, 2012). In study 1b, subjects were more likely to consume less healthful vegetable-based dishes and found these to be more appetizing, but these were less healthful in contrast to meat-based dishes. For meat-based dishes, on the other hand, subjects were more likely to consume more healthful dishes and rated them to be more appetizing as well. This result is partially in line with the finding that less healthful dishes are tastier than healthier versions (Raghunathan et al., 2006) for veggie dishes. Consumers also consider a dish as more healthful if there are at least some healthful aspects to it. In our studies, subjects rated the garden salad with cheese and ranch dressing as much healthier and lower in calories than veggies and dip. This phenomenon was referred to as "negative calorie" estimations in Chandon and Wansink (2012), which suggests that people are more likely to choose the salad with its add-on ingredients compared to another more healthful dish containing fewer items.

It is also suggested that there might have been a compensatory effect at play. This effect occurs when people eat a calorie-light dish (e.g., a salad) to compensate for eating some other less healthful item (e.g., a dessert). Significant gender difference were found for salad preference, with more male subjects preferring the salad with the dressing. The study 1

subjects also showed significant gender differences for the veggies, garden salad and pepperoni pizza.

Nevertheless, the findings suggest that consumers do keep their health in mind when making choices and offering more healthful choices such as a lighter calorie dressing. However, the findings also suggested that low-health conscious consumers with low preference for consistency are most likely to be influenced by more healthful dishes being advertised in moving imagery on digital menu boards.

The study's results suggest that that more healthful dishes advertised in a vivid moving image such as a video on digital menu boards will influence purchase and consumption rates. This is because stimuli with moving visual images, color, and vividness attract consumers' attention and are processed more often since people have limited cognitive resources (Li & Bukovac, 1999). This is exactly what the eye-tracking results showed and is in agreement with existing commercial research which indicates that digital menu boards drive up return on investment (ROI) (The Buzz, 2009; Invodo, 2012; Jay, 2012,; Richard et al., 1999). These findings also lend support to research findings showing that healthful options that are displayed prominently on menu boards will increase consumption of more healthful foods (Chandon & Wansink, 2012; Mills & Clay, 2001; Richard et al., 1999).

The third research question asked whether the position of the rotating image on the menu board would have an effect on choice and, although these results were confirmed, the results are limited to computer screens and not digital menu boards. The data and especially the eye-tracking data confirm that position is important with left positioned images on the computer screen attracting the most attention. However, this does not cannot conclusively confirm the horizontal centrality effect or positioning of the digital menu boards or video

food ads since positioning could not be controlled in the field study. However, the video food ads on the digital menu boards did attract and capture all of the subjects' attention.

Implications of the Research

The predicted growth rates for digital menu boards will likely spark much more research in this domain over the next few years. This studycontributes to the research literature in the HCI and Visual Marketing fields and to a limited extend to the field of Nutrition. It also contributes to research examining the eating environment and information overload.

Although fast food restaurants have already realized the cost benefit of these menu boards, this researcher perceives that consumers do want to be presented with healthier choices and consumers will purchase healthier dishes. In this study, it is suggested that consumers keep their health goals in mind when making decisions and it has been elaborated on how healthier choices are influenced by several factors that interplay with rotation. By encouraging consumption of healthier food using menu boards, fast food restaurants can start to reverse the negative association with more healthful fast food eating and contribute to a healthier nation.

Limitations and Recommendations for Future Research

These studies were conducted with some limitations. One limitation is that the vegetable based dishes such as the salad and raw vegetables had a limited choice set for dressing and dip and more healthful alternative dressings and dip were not offered. The study also did not take pricing into consideration which, according to Chandon and Wansink (2012), is a major factor of influence for purchase decisions. The quality of the images used was not on par with industry standard advertisement quality and subjects did not rate the

images as being as vivid as the field study subjects. Although the image quality was consistent throughout, it might play a bigger role in driving decisions for moving imagery. Time pressure and cognitive overload were also not considered in the study. The eye-tracking study could have benefited from displaying a blank screen with a center fixation point in an attempt to counter the left gaze bias (Krabich et al., 2011; Reutskaja et al., 2011); however, it is suspected that the left gaze bias will still be present and certainly is present in real-world settings such as fast food venues.

The results of these studies can be generalized with care to consumers beyond the undergraduate student sample. Additionally, fewer female subjects participated in the eye-tracking study because of factors such as heavy eye-makeup that hampered the eye-trackers' performance. Future research would benefit from taking into account these limitations as well as price, time pressure, cognitive overload, and familiarity bias. A wider selection of more healthful meat and vegetable dishes would broaden the generalizability of future research. We also suggest adding the nutritional information such as calories or a healthy icon to the food to determine if it would trigger more health-consciousness during decision-making.

APPENDIX A. ADDITIONAL RESULTS

Table 14. T-test results for gender differences in the pilot field study

Independent Samples Test					Group statistics			
	t-test for Equality of Means				Males		Females	
	T	df	Sig.	MDiff.	M	SD	M	SD
QI-3. I noticed the video food ad immediately.	-2.394	16	0.030	-0.580	5.55	.688	6.13	.354
QI-10. The video food ad made it easy to compare choices.	-2.313	17	0.034	-0.841	4.91	.831	5.75	.707
QI-12. It was difficult to decide what to choose.	3.198	17	0.005	1.614	4.36	1.027	2.75	1.165
QI-30. I never look at the offerings on the menu boards.	3.454	14	0.004	2.045	3.55	1.753	1.50	.756
QI-37. In the future, I will try out the items featured in the video ad.	-2.221	17	0.040	-1.080	4.55	1.214	5.63	.744
QII-1. I cannot help but look at the video food ad.	-3.547	17	0.002	-1.761	4.36	1.206	6.13	.835
QII-2. I always look at the video food ad.	-2.840	15	0.012	-1.545	4.45	1.572	6.00	.756
QII-4. Time seemed to stand still when I was looking at the video food ad.	2.190	17	0.043	0.977	3.73	.647	2.75	1.282
QII-5. I never look at the offerings on the menu boards.	3.414	17	0.003	1.739	3.36	1.286	1.63	.744
QII-8. I was curious about the content of video food ad.	-2.144	17	0.047	-1.045	4.45	1.214	5.50	.756
QII-13. I was not interested in the video food ad.	3.156	17	0.006	1.455	3.45	1.036	2.00	.926
QII-15. The motion of the video food ad attracted my attention.	-3.912	16	0.001	-1.850	4.40	1.075	6.25	.886
QII-16. The colors of the video food ad attracted my attention.	-2.499	17	0.023	-1.284	5.09	1.300	6.38	.744
QII-18. The liveliness of the video food ad attracted my attention.	-2.508	16	0.023	-1.375	4.50	1.179	5.88	1.126
QII-19. I felt persuaded to buy the items shown in the video food ad.	-2.168	17	0.045	-1.330	3.55	1.368	4.88	1.246
QII:20. I felt influenced to buy the items shown in the video food ad.	-2.117	17	0.049	-1.091	3.91	1.044	5.00	1.195
QII-21. I thought about the video food ad after it has finished.	-2.364	17	0.030	-1.261	3.36	.924	4.63	1.408
QII-23. I found the video food ad useful in making my selection.	-2.333	17	0.032	-1.148	3.73	1.009	4.88	1.126
QII-24. I felt that the video food ad was very clear.	-3.236	17	0.005	-1.273	4.73	.786	6.00	.926
QII-25. I felt that the video food ad was very concrete.	-2.818	17	0.012	-1.148	4.73	.786	5.88	.991
QII-27. The content of the video food ad attracted my attention.	-3.594	17	0.002	-1.727	4.27	1.104	6.00	.926
QII-28. The graphics in the video food ad attracted my attention.	-2.695	17	0.015	-1.307	4.82	1.168	6.13	.835
QII-32. The food in the video food ad looked so attractive.	-2.608	17	0.018	-1.261	4.36	1.120	5.63	.916
QII-34. The video food ad seemed so vibrant.	-2.302	17	0.034	-1.102	4.27	1.009	5.38	1.061
QII-36. I felt the video food ad was very appealing to the eye.	-4.236	17	0.001	-1.852	4.27	1.009	6.13	.835
QII-37. The video food ad aroused my appetite.	-2.271	17	0.036	-1.239	4.64	1.206	5.88	1.126
QII-38. The food in the video food ad looked more appealing than those in the pictures.	-3.323	17	0.004	-1.534	4.09	.944	5.63	1.061
QII-39. I found the video food ad was informative.	-2.640	17	0.017	-1.318	4.18	1.079	5.50	1.069
QII-45. The video food ad was very vivid.	-2.128	17	0.048	-0.818	4.18	.874	5.00	.756

APPENDIX B. OUTLINE OF STUDIES

Target image manipulations for study 1a: within-subjects study and Eye-tracking study

	Product 1 (left)	Product 2 (right)
	still	**still**
1	CL1 -H (Healthful)	CL1- LH (Less Healthful)
2	CL2 -H (Healthful)	CL2- LH
3	CL3 -H (Healthful)	CL3- LH
4	CL1- LH (Less Healthful)	CL1 -H (Healthful)
5	CL2- LH	CL2 -H (Healthful)
6	CL3- LH	CL3 -H (Healthful)
7	CR1-H	CR1-LH
8	CR2-H	CR2-LH
9	CR3-H	CR3-LH
10	CR1-LH	CR1-H
11	CR2-LH	CR2-H
12	CR3-LH	CR3-H
13	filler 1	filler 2
14	filler 3	filler 4
15	filler 5	filler 6
	still	**rotate**
16	CL1 -H (Healthful)	CL1- LH (Less Healthful)
17	CL2 -H (Healthful)	CL2- LH
18	CL3 -H (Healthful)	CL3- LH
19	CL1- LH (Less Healthful)	CL1 -H (Healthful)
20	CL2- LH	CL2 -H (Healthful)
21	CL3- LH	CL3 -H (Healthful)
22	CR1-H	CR1-LH
23	CR2-H	CR2-LH
24	CR3-H	CR3-LH
25	CR1-LH	CR1-H
26	CR2-LH	CR2-H
27	CR3-LH	CR3-H
28	filler 2	filler 1
29	filler 4	filler 3
30	filler 6	filler 5

	Rotate	still
31	CL1 -H (Healthful)	CL1- LH (Less Healthful)
32	CL2 -H (Healthful)	CL2- LH
33	CL3 -H (Healthful)	CL3- LH
34	CL1- LH (Less Healthful)	CL1 -H (Healthful)
35	CL2- LH	CL2 -H (Healthful)
36	CL3- LH	CL3 -H (Healthful)
37	CR1-H	CR1-LH
38	CR2-H	CR2-LH
39	CR3-H	CR3-LH
40	CR1-LH	CR1-H
41	CR2-LH	CR2-H
42	CR3-LH	CR3-H
43	filler 5	filler 3
44	filler 2	filler 4
45	filler 1	filler 6

Study 2: This study has 4 conditions: 2(Type of dish: Veggie, Meat)* 2(still, moving). Conditions 1 and 2 deal with vegetable-based options, and conditions 3 and 4 with meat-based options.

Condition 1:Vegetable-based dishes only, still vs. still 36 judgments-

Condition 1: CL still- still 36 judgments

	still	Still
1	CL1 -H (Healthful)	CL1- LH (Less Healthful)
2	CL2 -H (Healthful)	CL2- LH
3	CL3 -H (Healthful)	CL3- LH
4	CL1- LH (Less Healthful)	CL1 -H (Healthful)
5	CL2- LH	CL2 -H (Healthful)
6	CL3- LH	CL3 -H (Healthful)
7	CL1 -H (Healthful)	CL2 -H (Healthful)
8	CL1 -H (Healthful)	CL3 -H (Healthful)
9	CL2 -H (Healthful)	CL1 -H (Healthful)
10	CL2 -H (Healthful)	CL3 -H (Healthful)
11	CL3 -H (Healthful)	CL1 -H (Healthful)
12	CL3 -H (Healthful)	CL2 -H (Healthful)
13	CL1- LH (Less Healthful)	CL2- LH
14	CL1- LH (Less Healthful)	CL3- LH
15	CL2- LH	CL1- LH (Less Healthful)
16	CL2- LH	CL3- LH
17	CL3- LH	CL1- LH (Less Healthful)
18	CL3- LH	CL2- LH
19	CL1 -H (Healthful)	CL1- LH (Less Healthful)
20	CL2 -H (Healthful)	CL2- LH
21	CL3 -H (Healthful)	CL3- LH
22	CL1- LH (Less Healthful)	CL1 -H (Healthful)
23	CL2- LH	CL2 -H (Healthful)
24	CL3- LH	CL3 -H (Healthful)
25	CL1 -H (Healthful)	CL2 -H (Healthful)
26	CL1 -H (Healthful)	CL3 -H (Healthful)
27	CL2 -H (Healthful)	CL1 -H (Healthful)
28	CL2 -H (Healthful)	CL3 -H (Healthful)
29	CL3 -H (Healthful)	CL1 -H (Healthful)
30	CL3 -H (Healthful)	CL2 -H (Healthful)
31	CL1- LH (Less Healthful)	CL2- LH
32	CL1- LH (Less Healthful)	CL3- LH
33	CL2- LH	CL1- LH (Less Healthful)
34	CL2- LH	CL3- LH
35	CL3- LH	CL1- LH (Less Healthful)
36	CL3- LH	CL2- LH

Condition 2: Vegetable-based dishes: rotate vs. still and still vs. rotate orders
36 judgments:

	Rotate	**still**
1	CL1 -H (Healthful)	CL1- LH (Less Healthful)
2	CL2 -H (Healthful)	CL2- LH
3	CL3 -H (Healthful)	CL3- LH
4	CL1- LH (Less Healthful)	CL1 -H (Healthful)
5	CL2- LH	CL2 -H (Healthful)
6	CL3- LH	CL3 -H (Healthful)
7	CL1 -H (Healthful)	CL2 -H (Healthful)
8	CL1 -H (Healthful)	CL3 -H (Healthful)
9	CL2 -H (Healthful)	CL1 -H (Healthful)
10	CL2 -H (Healthful)	CL3 -H (Healthful)
11	CL3 -H (Healthful)	CL1 -H (Healthful)
12	CL3 -H (Healthful)	CL2 -H (Healthful)
13	CL1- LH (Less Healthful)	CL2- LH
14	CL1- LH (Less Healthful)	CL3- LH
15	CL2- LH	CL1- LH (Less Healthful)
16	CL2- LH	CL3- LH
17	CL3- LH	CL1- LH (Less Healthful)
18	CL3- LH	CL2- LH
	Still	**rotate**
1	CL1 -H (Healthful)	CL1- LH (Less Healthful)
2	CL2 -H (Healthful)	CL2- LH
3	CL3 -H (Healthful)	CL3- LH
4	CL1- LH (Less Healthful)	CL1 -H (Healthful)
5	CL2- LH	CL2 -H (Healthful)
6	CL3- LH	CL3 -H (Healthful)
7	CL1 -H (Healthful)	CL2 -H (Healthful)
8	CL1 -H (Healthful)	CL3 -H (Healthful)
9	CL2 -H (Healthful)	CL1 -H (Healthful)
10	CL2 -H (Healthful)	CL3 -H (Healthful)
11	CL3 -H (Healthful)	CL1 -H (Healthful)
12	CL3 -H (Healthful)	CL2 -H (Healthful)
13	CL1- LH (Less Healthful)	CL2- LH
14	CL1- LH (Less Healthful)	CL3- LH
15	CL2- LH	CL1- LH (Less Healthful)
16	CL2- LH	CL3- LH
17	CL3- LH	CL1- LH (Less Healthful)
18	CL3- LH	CL2- LH

Condition 3: Meat-based dishes: still-still
36 judgments

	Still	still
1	CR1 -H (Healthful)	CR1- LH (Less Healthful)
2	CR2 -H (Healthful)	CR2- LH
3	CR3 -H (Healthful)	CR3- LH
4	CR1- LH (Less Healthful)	CR1 -H (Healthful)
5	CR2- LH	CR2 -H (Healthful)
6	CR3- LH	CR3 -H (Healthful)
7	CR1 -H (Healthful)	CR2 -H (Healthful)
8	CR1 -H (Healthful)	CR3 -H (Healthful)
9	CR2 -H (Healthful)	CR1 -H (Healthful)
10	CR2 -H (Healthful)	CR3 -H (Healthful)
11	CR3 -H (Healthful)	CR1 -H (Healthful)
12	CR3 -H (Healthful)	CR2 -H (Healthful)
13	CR1- LH (Less Healthful)	CR2- LH
14	CR1- LH (Less Healthful)	CR3- LH
15	CR2- LH	CR1- LH (Less Healthful)
16	CR2- LH	CR3- LH
17	CR3- LH	CR1- LH (Less Healthful)
18	CR3- LH	CR2- LH
19	CR1 -H (Healthful)	CR1- LH (Less Healthful)
20	CR2 -H (Healthful)	CR2- LH
21	CR3 -H (Healthful)	CR3- LH
22	CR1- LH (Less Healthful)	CR1 -H (Healthful)
23	CR2- LH	CR2 -H (Healthful)
24	CR3- LH	CR3 -H (Healthful)
25	CR1 -H (Healthful)	CR2 -H (Healthful)
26	CR1 -H (Healthful)	CR3 -H (Healthful)
27	CR2 -H (Healthful)	CR1 -H (Healthful)
28	CR2 -H (Healthful)	CR3 -H (Healthful)
29	CR3 -H (Healthful)	CR1 -H (Healthful)
30	CR3 -H (Healthful)	CR2 -H (Healthful)
31	CR1- LH (Less Healthful)	CR2- LH
32	CR1- LH (Less Healthful)	CR3- LH
33	CR2- LH	CR1- LH (Less Healthful)
34	CR2- LH	CR3- LH
35	CR3- LH	CR1- LH (Less Healthful)
36	CR3- LH	CR2- LH

Condition 4: Meat-based dishes: still vs. rotate and rotate vs. still

	rotate	**still**
1	CR1 -H (Healthful)	CR1- LH (Less Healthful)
2	CR2 -H (Healthful)	CR2- LH
3	CR3 -H (Healthful)	CR3- LH
4	CR1- LH (Less Healthful)	CR1 -H (Healthful)
5	CR2- LH	CR2 -H (Healthful)
6	CR3- LH	CR3 -H (Healthful)
7	CR1 -H (Healthful)	CR2 -H (Healthful)
8	CR1 -H (Healthful)	CR3 -H (Healthful)
9	CR2 -H (Healthful)	CR1 -H (Healthful)
10	CR2 -H (Healthful)	CR3 -H (Healthful)
11	CR3 -H (Healthful)	CR1 -H (Healthful)
12	CR3 -H (Healthful)	CR2 -H (Healthful)
13	CR1- LH (Less Healthful)	CR2- LH
14	CR1- LH (Less Healthful)	CR3- LH
15	CR2- LH	CR1- LH (Less Healthful)
16	CR2- LH	CR3- LH
17	CR3- LH	CR1- LH (Less Healthful)
18	CR3- LH	CR2- LH
	still	**rotate**
1	CR1 -H (Healthful)	CR1- LH (Less Healthful)
2	CR2 -H (Healthful)	CR2- LH
3	CR3 -H (Healthful)	CR3- LH
4	CR1- LH (Less Healthful)	CR1 -H (Healthful)
5	CR2- LH	CR2 -H (Healthful)
6	CR3- LH	CR3 -H (Healthful)
7	CR1 -H (Healthful)	CR2 -H (Healthful)
8	CR1 -H (Healthful)	CR3 -H (Healthful)
9	CR2 -H (Healthful)	CR1 -H (Healthful)
10	CR2 -H (Healthful)	CR3 -H (Healthful)
11	CR3 -H (Healthful)	CR1 -H (Healthful)
12	CR3 -H (Healthful)	CR2 -H (Healthful)
13	CR1- LH (Less Healthful)	CR2- LH
14	CR1- LH (Less Healthful)	CR3- LH
15	CR2- LH	CR1- LH (Less Healthful)
16	CR2- LH	CR3- LH
17	CR3- LH	CR1- LH (Less Healthful)
18	CR3- LH	CR2- LH

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