The Categorization and Preferences of Vegetables Among Adults

by

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This thesis aims to gain a stronger understanding of the under-consumption of vegetables among adults. Food neophobia, food skills and categorization were suggested as three potential variables that predict vegetable preferences. Preferences were gathered by observing the ranking of ten vegetables and analysing the vegetables that were categorized in five categorization tasks. 50 University of Guelph students & faculty and 220 M-Turkers participated in an online study conducted using Qualtrics. The results demonstrated a positive statistically significant relationship at the .05 level between all five of the categorization tasks & vegetable preferences (p<.001). Additionally, the relationship between food neophobia (FN) and vegetable preferences was found to be statistically significant (p<.001). However, there was no relationship observed between food skills & vegetable preferences (p>.05). These findings indicate that food neophobia and categorization influence vegetable preferences.
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Chapter 1 Introduction

A vegetable is defined as “an herbaceous plant of which all or a part is eaten, raw or cooked” (The Canadian Encyclopedia, *Vegetables*, 2015, para. 1) and a fruit demonstrates “a sweet fleshy product of a tree or other plant which contain seeds that can be consumed” (Merriam Webster, n.d. np, para. 1). While these definitions appear to be mutually exclusive, the treatments of fruits as vegetables, such as; tomatoes in culinary proceedings has created a grey area that has conflicted individuals in determining what food items belong to which group (Appleton et al., 2018; Glasson, Chapman, & James, 2011).

Dietary guidelines treat fruit and vegetables (FV) as a single category, when discussing recommended serving suggestions (Canada Health, 2007). However, academics suggest that motivations for consuming one or the other are quite different (Glasson et al., 2011). Fruit are typically consumed in a raw state and have a sweeter taste, and for these reasons, could be viewed as more appealing, convenient and easier to prepare for consumers (Vizireanu & Hruschka, 2018).

Vegetables are rarely consumed in the same way as fruits. They involve more knowledge about how to prepare correctly, require significantly more time and tend to have a more bitter taste (Gaillard & Urdapilleta, 2011; Raghunathan, Naylor, & Hoyer, 2006), which according to consumers, “is less pleasurable” (Bisogni, Jastran, Seligson, & Thompson, 2012; Paisley, Sheeshka, & Daly, 2001).

For these reasons, some researchers have recommended that fruits and vegetables (FV) should treated separately, in food & nutrition communications (Black & Billette, 2013; Glasson et al., 2011). The partition would allow individuals to understand the different benefits and importance of both food categories (Black & Billette, 2013; Glasson et al., 2011). Moreover,
dietary research has suggested that a much larger percentage of the population meets their daily fruit requirements, but significantly less achieve this for vegetables (Black & Billette, 2013). The difference of intake demonstrates that there is a critical need to improve the existing nutrition messaging surrounding the vegetable category and there is currently minimal research that explores consumers perception of vegetables, independently from fruit. (Blatt, Roe, & Rolls, 2011; Drewnowski, 1996; Loebnitz & Grunert, 2018; Robinson, Blissett, & Higgs, 2011; Stewart & Harris, 2005; Yi, Kanetkar, & Brauer, 2015).

Lay health perceptions have been studied extensively (Dohle, Rall, & Siegrist, 2014; Huang & Wu, 2016; Poelman et al., 2018; Proserpio, Laureati, Invitti, & Pagliarini, 2018; Raghunathan et al., 2006; Vidgen & Gallegos, 2014; Vizireanu & Hruschka, 2018) by researchers in nutrition, health psychology and marketing to understand how people determine their food choices and what criteria individuals use to determine what food to consume. This question has been ongoing and current literature is fragmented with no clear answers (Bisogni, Jastran, Seligson, & Thompson, 2012; Jun & Arendt, 2016; Poelman et al., 2018).

The health benefits of consuming fruits and vegetables are well documented in health and nutrition research. Many consumers claim to know that vegetables are good for their health and part of living a balanced lifestyle (Paisley, Sheeshka, & Daly, 2001; Slater & Mudryj, 2016). However, 73% of Canadians fail to meet the daily recommended five servings of fruits and vegetables (Black & Billette, 2013; Glasson et al., 2011).

Previous research suggests that individuals consume less fruits and vegetables because of low affordability of healthier options (Stewart & Harris, 2005), they do not enjoy the taste (Raghunathan et al., 2006), they fear new/unfamiliar foods (Rioux, Picard, & Lafraire, 2016) or
they lack the knowledge of selecting, purchasing and preparing fresh products, demonstrating lack of food skills (Engler-Stringer, 2010; Slater & Mudryj, 2016).

This difference in FV consumption demonstrates that individuals view fruits and vegetables differently, and their psychological associations about each category vary significantly (Bisogni et al., 2012). Many individuals demonstrate a very strong avoidance towards certain vegetables from ages as young as two years old (Rioux et al., 2016). Most commonly, vegetables that have bright colors are avoided during childhood. Neophobia (FN); defined as the fear of trying new and unfamiliar foods ((Pliner & Hobden, 1992) has been shown to be a strong influence on food preferences using primarily small data sets. This has limited the explanatory power of FN and the extent to which it can be related to other factors that influence food choice.

Swan and Bouman (2018) found that individual and context related factors both contributed to the development of healthy eating habits and that key life events appear to have played a significant role in developing healthy eating habits among participants. These experiences appear to have an ongoing learning effect over the course of a participant's life (Swan et al., 2018). Positive relationships with parents have been demonstrated as predictive measure of positive well-being, which has a direct relationship with a healthy lifestyle (Swan et al., 2018).

Positive food relationships with parents have been reported to prevent the fear of vegetables in their children, and reduce the likelihood of the child becoming a picky eater (Rioux et al., 2016). Rejection has been documented as a critical factor in the context of food, to understand the development of healthy food consumption (Rioux et al., 2016; Rozin & Fallon,
1980). Understanding the significance of rejection in relation to FV consumption, will be discussed in-depth later.

Neophobia also helps explain why males are more reluctant to eat healthy foods, compared to females (Galloway, Lee, & Birch, 2003; Paisley et al., 2001) as demonstrated in previous research males who live alone are at significantly higher risk of health-related diseases associated with poor eating habits (Paisley et al., 2001). In addition, neophobia may also explain why certain individuals (who demonstrate neophobic behaviour) may consume a limited number of foods, because of their fear, and for this reason they lack critical food skills that are acquired over time. Moreover, neophobic individuals would be unlikely to have the cooking skills necessary to prepare healthy food, especially vegetables (Engler-Stringer, 2010).

This could also suggest that high prevalence of neophobia could explain poor eating habits. Neophobic individuals may be less inclined to try new food, demonstrate creativity in the kitchen or have an interest in preparing meals of their own (Proserpio et al., 2018). This reluctance to explore is likely passed on to children, as research has demonstrated that parents’ food habits directly affect their children’s future food behaviors (Galloway et al., 2003).

Below average cooking ability has been found to be negatively associated with food skills (Hartmann, Dohle, & Siegrist, 2013; Wilson, Matthews, Seabrook, & Dworatzek, 2017). Food skills encompasses knowledge of food; selection, purchasing, storage & preparation (Engler-Stringer, 2010). Another, less common measure of food skills involves ways of categorizing foods. The ways people categorize items reveals their knowledge and knowledge is related to preferences. FV knowledge has been measured previously by simply asking participants to sort items into the two food categories (Gaillard & Urdapillete, 2011).
The current study will contain an in-depth literature review reviewing evidence for the relationship and importance of food neophobia, food skills and vegetable categorization. The review will also discuss the recent developments in categorization research and the established relationship with neophobia, by the works of Rioux et al (2016).

The goals of the current research are to better understand how people consume and perceive different vegetables, based on their level of food skills & food neophobia, understand how their level of food skills & food neophobia influence their ability to categorize and rank vegetables and, observe differences in how categorization and ranking is related to vegetable preferences. What is less certain is, how do people categorize vegetables and is the ability to categorize/sort influenced by neophobia and or food skills? To the best of our knowledge, we will be the first to observe the categorization of the vegetable category, in isolation from fruit.

The thesis research question and hypotheses will be presented, followed by methodology, data analysis approach, results, discussion, limitations, managerial implications and recommendations for future research.
2.0 General Discussion About Fruits & Vegetables

In 2016, vegetable exports contributed 1.2 billion dollars to the Canadian economy (Agriculture & Agri-Food Canada, 2016). This significant sum included both field and greenhouse grown vegetables and mushrooms. Tomatoes were the highest exported vegetable, followed by cucumbers and peppers which represented 20%, 19%, and 12% of the country’s total vegetable exports (Agriculture & Agri-Food Canada, 2016). There are approximately 53 different vegetable varieties grown in Canada, the potato is the most cultivated vegetable in the county (The Canadian Encyclopaedia, 2015). However, the number of vegetables that exist worldwide has yet to be determined, as the variety of vegetables consumed varies drastically in different countries (Lusk & Briggeman, 2009).

The 2007 Canada’s food guide recommended males aged 18-50 should consume 8-10 servings of fruits and vegetables a day and females of the same age range should consume 7-8 (Canada’s Food Guide, 2007). The nutrition content of vegetables varies by each type, however; few consumers know nutrients content of vegetables (Bucher, Müller, & Siegrist, 2015; De Vlieger, Collins, & Bucher, 2017). Regardless of this lack of literacy, nutrition labelling is used in health education communications by dieticians and government to encourage consumers to increase their consumption (Appleton et al., 2018).

When looking at the category, vegetables are sold for consumption using different preservation techniques such as canning, freezing and drying. Because we are interested in perceptions of whole vegetables, we are only interested in the varieties of vegetables that are sold as fresh or raw, that would be purchased from the produce section of the grocery store. In
addition, frozen vegetables typically contain a mix, which consumers could avoid if they displayed neophobic behaviour towards a certain vegetable.

Moreover, the present study argues that the vegetables in a consumer’s consideration set would differ vastly, depending on the person’s skill set or dish the individual was making. These two considerations can be addressed by measuring an individual’s level of food skills. For example, a person who has very limited interactions with vegetables would have lower awareness of a wide variety of vegetables. This low awareness would be the result of the person having low food skills, compared to someone who prepares and consumes vegetables daily. Based on these statements, it could be suggested that the way an individual categorizes a wide variety of vegetables, would be greatly influenced by their food skills. Their food skill level would also influence their ability to categorize vegetables based on a specific recipe or context. (C.E. Blake, Bisogni, Sobal, Devine, & Jastran, 2007; Christine E. Blake, 2008).

As demonstrated, the more complicated factors in the vegetable category are the diverse and wide range of food items that exist in the group. Other taxonomic categories, such as fish; are simpler to define and feature attributes can be easily identified. Regardless of context, an item that has a fin and gills is always a fish. For vegetables, it is a bit more complicated as some vegetables that look very similar on the outside are actually very different, such as a cucumber and zucchini. The same can be said for fish, although they have the same attributes these animals can be very different; such as a goldfish vs a shark. Individuals who have a very low understanding of the vegetable category may rely on perceptual information to interpret the item, such as colour and shape (Riouxs et al., 2016). Using this information, consumers rely on similarities between the known and unknown items to then place the unknown item in the category.
By relying solely on similarities between the two items, vegetables could be prepared in ways that would be very unpleasant. For example, a cucumber and a zucchini look very similar on the outside but on the inside the textures are very different and each have ideal preparation methods that enhance the flavour and texture of each vegetable. The possibility of classifying a vegetable incorrectly, could result in a negative experience which could result in future avoidance, due to lack of knowledge (Gregan-Paxton & Moreau, 2003; Paisley et al., 2001; Proserpio et al., 2018). Although, taxonomic categorization of vegetables is not of direct interest to consumer researchers, how consumers categorize vegetables in different ways could provide valuable insight about individuals’ perceptions of vegetables, depending on their food skills. These perceptions could also help explain how their current knowledge influences their categorization ability. This lack of knowledge is likely to influence an individual’s lack of vegetable consumption throughout their life time if there is no attempt to expand their knowledge after childhood, for most people (Jaeger, Rasmussen, & Prescott, 2017).

Previous research has also shown that there appears to be a concerning gap in young adults’ food knowledge about how to prepare basic foods, which has been suggested to be an explanation for the decrease in cooking (Bernardo et al., 2018; De Vlieger et al., 2017; Larson, Perry, Story, & Neumark-Sztainer, 2006; Lavelle et al., 2017; Slater & Mudryj, 2016). Research has identified that the lack of preparation skills has been found to be a significant barrier to FV consumption. In addition, providing nutritional information can further increase the negative impacts on FV consumption, as demonstrated by Raghunathan et al’s (2008) unhealthy = tasty intuition (Glasson et al., 2011; Larson et al., 2006; Raghunathan et al., 2006; Yi et al., 2015).
To better understand the connections between preparation & cooking knowledge and vegetable consumption, Hartman, Dohle & Siergist (2013) analysed questionnaire data about how often their participants cooked, how much time they spend cooking, their barriers to cooking meals at home and their level of food frequency for food groups such as fruits and vegetables. The questionnaire consisted of seven questions for each variable. Their dependent variables were cooking skills, health consciousness, willing to invest in: time, physical effort, mental effort and cooking enjoyment. The researchers conducted multiple regression to observe the relationship between cooking skills, food frequency and socio-demographics (gender and age).

Their findings revealed that cooking skills were higher for females than males. Moreover, females reported being more health conscious, enjoying vegetables more and had higher FV consumption (Hartmann et al., 2013). Over the average lifetime; cooking frequency in females decreased at 70-79 years old while for males the decrease started much earlier at 40-49 years old (Hartmann et al., 2013). Most important, their findings also suggested that cooking skills are directly related to health consciousness and long term FV intake. The most frequently mentioned barriers to cooking among the participants was lack of time and cooking knowledge.

To observe long term intervention in food choice, Utter et al, (2018) wanted to observe eating behaviours and adult nutrition ten years after intervention, based on perceived cooking skills. Perceived cooking skills data were analysed for young adults (18-23) and then participants reported their nutrition outcomes (changes in FV consumption) approximately ten years later (age 30-35 years old). Regression models for each age set were employed to identify possible relationships between cooking skills in the young adults (independent variable) and their subsequent intake outcomes ten years later (dependant variable). Their results showed that self-
reports of adequate cooking skills in "young adulthood predicted more frequent preparation of meals including vegetables and reduced intake of fast-food" (Utter et al., 2018, p.497).

Based on the findings demonstrated by Utter et al (2018) those who choose not to cook are dining outside of the home for an average of five meals per week (Paisley et al., 2001; Slater & Mudryj, 2016; Utter et al., 2018). The research conducted by Utter et al (2018) sheds light on the issue of studying the complicated activity of cooking (Engler-Stringer, 2010). Measuring cooking skills requires consideration of many factors and the results usually have minimal long-term impact (Bernardo et al., 2018).

Utter et al’s (2018) research is one of few to be able to psychologically document long term change in health habits. Their findings demonstrate that young adults who reported higher than average adequacy in cooking skills had better nutrition related food intake compared to young adults who reported cooking abilities that were adequate or below (Utter et al., 2018).

Utter et al’s (2018) findings exemplify the importance of cooking skills as a subset of food skills in adults. Unfortunately, cooking skills appear to be declining within young adults at a staggering rate (Bernardo et al., 2018; Engler-Stringer, 2010; Lavelle et al., 2017). The desire to change long term behaviours of FV consumption has been seldomly successful in past research attempts (Appleton et al., 2016), most were only successful of demonstrating short term results (under 3 months) rather than long term lifestyle changes. Food skills have been reported to contribute to overall FV consumption, cooking skills and nutrition knowledge, however, the amount of information an average individual knows about vegetables has been studied by very few researchers (Bernardo et al., 2018; Slater & Mudryj, 2016).

To assist consumers in understanding the importance of their food choices beyond healthy and unhealthy foods, Krebs-Smith & Kantor (2001) aimed at addressing the challenges
of separating fruits and vegetables from grains. Their survey data consisted of FV intake and food frequency. Their data analysis suggests that average Americans were consuming fruits and vegetables at below minimum recommendations according to the current dietary guidelines (7-8 fruits and vegetables a day for men and 6-7 for women) (Krebs-Smith & Kantor, 2001). To meet the recommended servings, the average person would need to eat at least two more servings of FV per day.

Krebs-Smith & Kantor (2001) found that sales in broccoli increased by over two thirds when fresh, pre-cut package broccoli was introduced. This increase in sales suggests that the pre-packaged item was more convenient compared to the whole floret. This approach of ready-made vegetables has been used to increase consumption of more uncommon foods such as such as kale, spinach and cauliflower (Yi et al., 2015). Recent studies have also taken note of consumers desire for convenience and its potential to positively increase FV consumption (K. Chapman et al., 2017; Krebs-Smith & Kantor, 2001; Yi et al., 2015).

When observing fruits and vegetables consumed, dark green and deep yellow vegetables were drastically underrepresented, this finding was also found in the research conducted by Yi et al (2015). While vegetables are often studied as one food group, global measures may mask variation in the types and forms of vegetables preferred by different individuals based on different regions and cultures. Overall, recent research demonstrates that over two-thirds of the population do not meet their daily recommended FV servings (Slater & Mudryj, 2016; Teschl, Nössler, Schneider, Carlsohn, & Lührmann, 2018).

### 2.1 Variables Influencing Vegetable Consumption

The literature on vegetable consumption offers many of these explanations to understand individuals’ influences of vegetable consumption. Vegetable consumption research is of mutual
interest to health care professionals, marketers and government organizations because of the negative health consequences that can result from a poor diet (Health Canada, 2007). To understand how to increase consumers vegetable consumption, perceived consumer barriers must be discussed.

Low vegetable consumption is suggested to be related to level of income (Ekwaru et al., 2017), differences in gender and age, lay health perceptions such as unpleasant taste (Raghunathan et al., 2006), lack of food skills (Engler-Stringer, 2010; Hartmann et al., 2013; Lavelle et al., 2017) and fear of new/unknown foods (Galloway et al., 2003; Pliner & Hobden, 1992). The factors that influence vegetable consumption can be divided into three themes; external and demographic & psychological.

2.1.1 External Factors

Time has been discussed as a significant barrier in relation to FV intake, as many respondents have reported that they “lack the time to prepare fresh food and instead opt for something to eat that involves less effort” (Paisley et al., 2001, p.205). The desire for convenience in food items has been demonstrated over the last two decades (Chen, Legrand, & Sloan, 2009; Drewnowski, 1996; Hartmann et al., 2013; Paisley et al., 2001; Yi et al., 2015) and increasing the convenience factor of healthy food was found to have a positive relationship on sales (Paisley et al., 2001; Yi et al., 2015).

Additionally, vegetables are influenced by many extraneous factors outside of the consumers control such as seasonality, accessibility, region and variety (The froze et al., 2015). Seasonality refers to certain vegetables being at peak ripeness certain times a year (Merriam Webster, n.d.). Accessibility has been discussed as being a significant barrier of the access to fresh vegetable consumption, specifically in areas of low SES (socioeconomic status), or dry
areas where access is very limited and for this reason, prices are exponentially higher (Bernardo et al., 2018; K. Chapman et al., 2017; Ekwaru et al., 2017).

2.1.2 Demographic & Psychological Factors

Krebbbs-Smith & Kantor (2001) discussed the economic barriers to access to FV, especially for low-income families who may live in areas where limited access to food supply means they pay a higher price for their food compared to others, the suggestion that economic barriers influence FV intake has been supported by previous research (Paisley et al., 2001; Stewart & Harris, 2005; Yi et al., 2015). In summary there are many complicated factors that influence an individual’s vegetable consumption and everyone’s factors are different. Simply making vegetables more accessible and affordable will not address all of the factors that influence vegetable consumption.

The goal of the Stewart & Harris’s (2005) research was to identify consumers’ perceived barriers to purchasing a variety of vegetables (dependant variable). Their data consisted of purchasing behaviour from food retail purchases, using a scanner over a twelve-month period. To measure variety the researchers measured participants’ household purchases and vegetable expenditure. The results demonstrate that if households are spending more money on vegetables, they may already be increasing their variety in vegetable consumption (Stewart & Harris, 2005).

Their findings demonstrated that the access to disposable income is the main predictor of variety purchases. This finding is in line with previous research that has mentioned financial restraints as a common barrier to purchasing vegetables regularly, especially enough to feed a large family, with a limited budget (Bernardo et al., 2018; K. Chapman et al., 2017; Stewart & Harris, 2005). Children were also mentioned as an influence that contributes to the variety of vegetables consumers purchase (Galloway et al., 2003).
In addition, Stewart & Harris’s (2005) findings demonstrated a significant positive effect for age and variety of vegetables purchased, which has been demonstrated in other studies (Larson et al., 2006; Rioux et al., 2016). The difference in variety could be because of differences in generations and vegetables trends, average household income or changes in family structure. Alternatively, some researchers have failed to find a significant difference between vegetable consumption between different age groups (Galloway et al., 2003; Paisley et al., 2001; Yi et al., 2015). Previous research on food rejection demonstrates support that young adults who purchase less variety justify their purchase decision based on the psychological factors of uncertainty, fear or disliking (Galloway et al., 2003; Rioux, Leglaye, & Lafraire, 2018).

Paisley, Sheeska & Dalys (2001) wanted to understand the differences in vegetable and fruit consumption, among couples using qualitative semi-structured interviews. The purpose of these interviews was to identify main events that impacted the participants’ lives. The results did not display any relationship between gender or age and cooking ability. The mention of vegetables in their childhood during their interviews was categorized into three themes, low status of FV, food wars (obeying food rules outlined by adult), and vegetables being viewed as the “new focus” in later years (Paisley et al., 2001). When Paisley et al conducted their interviews with couples and discussed their healthy eating habits, they failed to find a significant difference between the age group.

Their findings are quite surprising considering the many studies that did find a relationship between age (Proserpio et al., 2018; Slater & Mudryj, 2016; Utter et al., 2018), gender and cooking ability (Wilson et al., 2017). Based on respondents’ answers, eating more vegetables was a more significant task than consuming more fruits (Paisley et al., 2001). According to Paisley et al (2001) unhealthy food choice is a multidimensional problem and
research demonstrated that economic, political, psychosocial, environmental factors all play a role in determining individuals food choice (Lusk & Briggeman, 2009; Paisley et al., 2001; Provencher & Jacob, 2016; Stewart & Harris, 2005).

The reality is academics know little about consumers’ understanding of vegetables and few have attempted to understand perceptions of vegetables beyond intake (Blatt et al., 2011; Drewnowski, 1996; Loebnitz & Grunert, 2018; Stewart & Harris, 2005; Yi et al., 2015). Many academics have looked at fruit and vegetables together to measure consumption (Black & Billette, 2013; Krebs-Smith & Kantor, 2001; Paisley et al., 2001; Pollard et al., 2002), but these studies do not account for the layered complexities, varieties and large number of contributing factors that exist within the vegetable category.

2.2 Motivations & Lay Perceptions About Vegetables

2.2.1 Motivations

People consume vegetables because they are good for their health (Paisley et al., 2001; Provencher & Jacob, 2016; Slater & Mudryj, 2016), high in necessary nutrients (Appleton et al., 2018; Ares, Giménez, & Gámbaro, 2008; Bucher, Müller, & Siegrist, 2015) and low in calories, compared to other foods (De Vlieger et al., 2017; Popovich, 2014). There are multiple motivations for consuming vegetables and these motivations are suggested to be driven by the consumers health perceptions (Vizireanu & Hruschka, 2018).

Research conducted by Chen et al (2009) looked at the potential motivations for healthy eating and proposed a new conceptual framework to expand on the understanding of why people choose to eat healthy and why others do not. Chen et al (2009) analysed questionnaire data and past interviews from restaurant goers’ questionnaires to better understand the motivations for healthy eating. Results revealed two underlying components (sustainable living and personal
health) that could be combined to adequately account for the motivation of healthy eating. Sustainable living was composed of environmental consciousness, desire to live more naturally, humane treatment of animals, a plea for a sustainable lifestyle, spiritual influence and political & ethical statements. Healthy eating consisted of desire to lose weight, prevention against health problems, has a personal fitness program and cure for health problems.

This study proposes a conceptual model that demonstrates the two components that can explain the motivations of healthy eating. A plea for sustainable lifestyles is determined as the leading motivation for German consumers. A sustainable lifestyle is often referred to in European literature while North American healthy eating research refers to balance (maintaining a healthy lifestyle while allowing yourself to enjoy occasional vices) as the key motivator that best explains healthy eating motivations (Slater & Mudryj, 2016).

As previously mentioned, the challenge of influencing individuals’ long term behavior of FV consumption has not been studied extensively. However, it is well understood that influencing short-term behaviors will not result in overall changes in consumers’ diets or overall health (Pollard, Kirk, & Cade, 2002; Provencher & Jacob, 2016; Ramsay, Rudley, Tonnemaker, & Price, 2017). To better understand how to influence vegetable consumption behaviour, Yi et al, (2015) looked at multiple vegetable categories to determine preferences for different varieties and types of vegetables and mushrooms. Among main food preparers they achieved this by using self-report online surveys to better understand the drivers and barriers of vegetable consumption while measuring perceived benefits of vegetables, convenience orientation & variety seeking (Yi et al., 2015).

The researchers uncovered three different groups of vegetable preferences. The crucifier lover who represented 13% of the sample and was described as a consumer who "prepared and
consumed more brussels sprouts, broccoli & asparagus than other groups" (Yi et al., 2015, p.2755). The frozen vegetable consumer who represented 33% of the sample and described as someone who "consumed significantly more frozen vegetables than the others" (Yi et al., 2015, p.2755). Last, the average consumer who made up 54% of the sample and purchased relatively the same amount of fresh and frozen vegetables (Yi et al., 2015).

Yi et al’s (2015) research addresses the need for focus and marketing efforts on specific vegetables, as some are perceived to taste much better than others, depending on the vegetable consumption group the consumer belongs to. The drastic differences in consumption, clearly demonstrate that vegetables as a category are far from equal in the eyes of the consumer. Unsurprisingly, health perception of the vegetables was the same across all three vegetable consumption groups. However, there were observable differences in ease of preparation and tastiness between different vegetables and among each vegetable group (Yi et al., 2015).

Yi and colleagues (2015) suggest more emphasis should be placed on enhancing the flavour and texture of vegetables that appear to be consumed less and are not as well known to consumers such as brussel sprouts. These results demonstrate that vegetables are not all treated in the same way by consumers, therefore they should not be treated as a single group. To understand vegetable consumption & preferences, each vegetable needs to be looked at separately.

Moreover, they suggest that lack of vegetable knowledge could be a significant barrier that helps explain why some consumers choose to purchase some vegetables but not others. Moreover, the reasoning for purchasing more uncommon vegetables can be explained by fear/avoidance behaviour. The motivation to avoid a certain vegetable can be suggested to be
driven by the lay perception that consuming the vegetable will not result in a positive experience (Raghunathan et al., 2006).

2.3 Challenges in the Vegetable Category

2.3.1 Food Skills & Deskilling

Typically, vegetables that are consumed together tend to be purchased at the same time and for this reason, some consumers choose not to deviate from the well-known vegetables (Yi et al., 2015). Because of this purchasing behaviour, a large percentage of vegetables are neglected by most consumers (Drewnowski, 1996; Yi et al., 2015). Whether it is because they lack the knowledge, perceive other vegetables to not be as tasty or they fear trying new vegetables is unknown.

Because, vegetables have been viewed as an accompaniment on the plate, many consumers do not know how to prepare a wide variety of vegetables (Larson et al., 2006; Utter et al., 2018). After reviewing the literature, it appears that the most complicated variable of the vegetable category, are the isolated skills needed to prepare each variety. With respect to fresh vegetables the way each item is prepared will vary, depending on the type of vegetable, the other items on the plate, the type of cuisine or the skill level of the individual. The preparation methods that result in an optimal culinary experience for one vegetable is not the same for another and preference for each vegetable differs by individual. Taste is determined as one of the most important factors of any food choice, with the other being price of the food (Pollard et al., 2002; Provencher & Jacob, 2016).

According to consumers, some vegetables are more difficult to prepare such as brussels sprouts and asparagus which acts as a barrier to consumption (K. Chapman et al., 2017). Previous research has emphasized the importance of food knowledge as a necessary factor that helps
explain FV consumption. Lack of food knowledge has been referred to as food skills in consumption literature (Engler-Stringer, 2010; Hartmann et al., 2013; Wilson et al., 2017).

Moreover, the increased number of individuals who lack food skills can be attributed to the deskilling of millennials and future generations.

It has been suggested that the decrease in cooking is to blame for people’s increase in unhealthy food choices, this suggestion has been so widely studied, academics have termed this theory “deskilling” (Bernardo et al., 2018; Engler-Stringer, 2010; Wilson et al., 2017). Deskilling refers to the idea that each new generation is learning less and less about how to cook (Jones, Meckna, & Koszewski, 2018). Cooking or “home economics” is being taken from the majority of school curriculums and many young people are confronted with the reality that their food preparation skills are limited, at best (Jones et al., 2018; Wilson et al., 2017).

To observe the differences in eating habits among university students who live on and off campus; Wilson, Mathews and Seabrook (2017) wanted to discover if the food skills of Canadian university students would differ based on, gender, living conditions and having previously taken a nutrition-based school course. A self-report online cross-sectional survey was completed by 6639 individuals. The students were asked about their ability to perform certain food related tasks, once they scored all the food skill questions, the scores were summed to make a total food score (TFSS) out of 700. The survey consisted of 67 items which composed of mostly closed ended questions by use of scale or categories.

The researchers acquired their questions from social cognitive theory, to address the relationship between environmental, personal, and behavioural factors, which have been studied in previous work (Engler-Stringer, 2010; Hartmann et al., 2013). Females reported a higher total food score, and respondents who had taken a food skills & nutrition course reported higher total
food skill scores than other students. Moreover, students who reported living away from home for over a year also demonstrated higher food skills than those who lived away for less time. All variables were significantly different based on sex, food and nutrition course, and living condition (Wilson et al., 2017).

Interestingly, conceptual food skills (planning and preparing for meals ahead of time) were rated as significantly lower than mechanical food skills (knowing how to prepare cook food items). Based on the findings of Wilson's research; conceptualizing, planning and concept integration were the main causes of decreases in conceptual food skill scores. These findings clearly identify a gap that appears to be present among university students and their food skills. Previous researchers have looked directly at the relationship between the decrease in cooking skills and the increase in negative diet-related health outcomes among adults and argue that both events occurred over the same period, suggesting a negative relationship between cooking skills and the increase of negative diet-related health outcomes (Provencher & Jacob, 2016; Utter et al., 2018; Vizireanu & Hruschka, 2018).

The reality of deskilling comes from more recent generations that are learning to cook less and as those people grow up, they teach their children to cook less and so on. To combat “deskilling” many nutritionists suggest the intervention of cooking at an early age through community programs and school extra curriculars (Hartmann et al., 2013). To observe the effects of a cooking/nutrition program Bernardo et al, (2018) tested a cooking and nutrition intervention program which was used to determine if the participants had a better understanding of FV consumption and nutrition after 18 hours of intervention.

The students completed an online survey which measured FV consumption, cooking/nutrition knowledge and cooking confidence. There was two group of students who
completed the online survey at three different time periods t1 = baseline, t2= directly after program completion and t3= six months after the program was completed, the second group completed the survey during the same time periods (but participated in no cooking/nutrition program/intervention). No significant baseline differences were found between control and intervention groups.

Participants in the intervention group reported a statistically significant high self-efficacy score in all confidence of cooking measures compared to control group. Significant increases were reported for cooking confidence between baseline (t1) and directly after program group (t2) and baseline (t1) and six-month post completion (t3), but not between directly after program (t2) and six-month post completion (t3). The results suggest a more impactful effect on the students who participated in the intervention. Moreover, no significant differences were found for cooking confidence between t1 and t2 for non-intervention groups. The study presented does result in some promising support for cooking programs.

The growing societal concern of deskilling has been considered as only one suggestion that explains consumers vegetable consumption. The “deskilling” theory is a small part of a larger term that has gained recognition in the health science, nutrition & dietetics and marketing literature known as “food literacy”. Food literacy is a well documented term that describes the understanding or lack there of for food supply, storage, knowledge, preparation and nutrition information (Vidgen & Gallegos, 2014).

The relationship between higher cooking ability and increase in vegetable consumption is consistent with the literature and supports the importance of cooking skills as part of a healthy lifestyle (Bernardo et al., 2018; Engler-Stringer, 2010; Hartmann et al., 2013; Larson et al., 2006; Paisley et al., 2001). Hartmann et al (2013) found that cooking skills correlated
positively with weekly vegetable consumption and negatively with weekly convenience food consumption. Moreover, cooking skills were defined as the ability to prepare different foods. It is important to ask about food groups rather than specific food items because this knowledge could differ depending on the cultural background of the participants” (Hartmann et al., 2013) meaning this scale may not be appropriate for different countries.

Provision of cooking classes have also been measured as an intervention to understand if cooking/nutrition classes would better people’s food knowledge (Appleton et al., 2018; Bernardo et al., 2018). To better understand people’s understanding of food preparation, Jones, Mckenna & Kozewski, (2018) recruited their sample based on who had and had not taken a food related course and measured perceptions, knowledge about food and food preparation. A 19-item questionnaire about attitude, beliefs and knowledge of food and food prep was administered. The researchers found no significant difference for cooking enjoyment, perceived ability to cook, beliefs about cooking, recipe used when cooking, primary food preparation and nutrition knowledge between groups.

Jones et al's (2018) findings demonstrated that there was no change in cooking skills between the two different groups of students. Although different arguments are presented as to why this change is not observable, the more interesting observation is that the students were primarily female (80%). If this research were to be conducted using courses with a higher male enrolment, one could suggest there may have been a more observable difference between the two groups. Previous research has demonstrated consistently that there is a significant gender gap that is associated with food knowledge and food preparation skills (Hartmann et al., 2013; Paisley et al., 2001; Proserpio et al., 2018; Wilson et al., 2017).
2.3.2 Food Neophobia

Food Neophobia is defined as the fear of eating unfamiliar foods and represents one side of a two-pronged term in the food literature known as; food rejection (Riouxf et al., 2016). Food rejection is made up of two different components – neophobia (as previously discussed) and pickiness. Pickiness is the rejection or refusal to eat familiar foods (Galloway et al., 2003).

To understand the relationship of FV intake and FN, Galloway Lee and Birch (2003) wanted to see if there was a direct relationship between food neophobia and vegetable intake. They measured, neophobia, pickiness and the predictors of neophobia and pickiness in young females. The girls and their mothers were recruited via newspaper ads and flyers and asked to complete a neophobia scale and a food frequency scale (to measure vegetable intake). Vegetable intake in the girls and their mothers were below the then recommended three servings per day (Galloway et al., 2003).

The results showed a significant relationship between neophobia, pickiness and vegetable intake scores. Girls who reported mid-high neophobic scores reported eating less vegetables than girls who were in the lowest scoring group for neophobia and pickiness. They also found that hours worked by parents was directly related to percentage of parents who reported having not enough time to cook healthy meals.

The researchers introduce a compelling argument that neophobia can often be learned, the girls in their sample who demonstrated neophobic tendencies also had neophobic mothers. Children who had higher neophobia also had reduced intake of fruits and vegetables as measured by both, variety and overall quantity. Their research clearly demonstrates the relationship between neophobia and vegetable intake, within female children (Galloway et al., 2003).
Food rejection behaviors occur most often with plants, such as fruits and more commonly, vegetables. Rioux and colleagues (2016) have spent many years trying to understand how food rejection predicts FV consumption and are one of the more often cited researchers in this body of literature, in their work with children (Rioux, Picard, & Lafraire, 2016).

The researchers wanted to better understand the development of food rejection in children and how food rejection influences their categorization of food (Rioux, Picard, & Lafraire, 2016). Food neophobia is suggested to be an adaptive mechanism employed by children who have had previous negative experiences with food. Before the study took place the parents of the children were asked to fill out a questionnaire about food rejection. Parents of the children were asked to rate the typicality of three fruit and six vegetables, to indicate what FVs were considered most typical of the category.

79 children participated in a sorting task where children had to place the photos into two boxes depending on if the child felt the photo resembled a vegetable or a fruit. Second, the children had to sort the items into food they would and would not eat and last was a color sorting task.

Their findings demonstrated that highly neophobic and picky children performed worse than non-picky/neophobic children. In addition, an association between food rejection and food categorization was observed. Their findings demonstrated that severity of food rejection was negatively correlated with children’s performances in categorization tasks (Rioux et al, 2016). The researchers also suggest that "food rejection can partially predict performance of categorization tasks involving FV. Most importantly, they found that food rejection scores were not correlated with age (Rioux et al., 2018).
However, many researchers have suggested that categorization actually improves with age (Gregan-Paxton & Moreau, 2003; Rioux et al., 2016; Rozin & Fallon, 1980) but the empirical evidence behind this statement is quite divided (Appleton et al., 2018; Glasson et al., 2011; Rioux et al., 2016; Stewart & Harris, 2005).

Based on similar beliefs, the rejection of vegetables has been suggested to being related to perceived unpleasant taste; such as bitterness (Proserpio et al., 2018); which is known to be a prominent flavour in vegetables (Chapman et al., 2017). To the authors’ knowledge, this is the first study to link food neophobia and food categorization in food systems (Rioux et al., 2016).

As neophobia has been most studied in children, Jaeger and colleagues (2017) set out to better understand neophobia & FV consumption habits in adults. More specifically, the researchers set to address the gaps surrounding neophobia and food choice in adults (Jaeger et al., 2017). They also wanted to understand how the difference in FN scores influenced food intake. The researchers collected data from 1167 New Zealand adults who completed a food neophobia scale, a food preference questionnaire, a self-report food intake recall survey, and the Food Choice Questionnaire (FCQ) (Jaeger et al., 2017).

Factor analysis of FCQ was completed and food intake was defined in four factors that represented the overall dietary patterns of the individuals. Those with the SF pattern group has variety of fresh FV across time, HB = healthy breakfast low-fat drinks and yogurt. The AS group had ingredients, spices and herbs found in Asian cooking and MD group ate more Mediterranean items found in Italian and alternative European cooking styles (Jaeger et al., 2017).

Food neophobia was measured using a 10-item scale and participants scores were divided into three groups, based on their scores. The one-third of the participants resulted in having below 15< food neophobia score. 33% of the sample scored in the middle, between 23-
30. The highest group revealed neophobia behaviours with scores ranging from 31 to 68 which made up just over one-third of participants. Notably, over half of the participants resulted in a score over 35.

High FN participants resulted in the lower amount of tomatoes, salad greens, onions and cucumber. Unsurprisingly, the mean food preference for vegetables was lowest for participants who had belonged to the highest FN scores. High FN individuals reported eating less vegetables overall. Jaeger and colleagues’ findings demonstrated positive support that neophobia and vegetable intake are directly related in adults (Jaeger et al., 2017). Their findings are significant to the body of neophobia literature because they were able to establish neophobia behaviours in an adult population (Jaeger et al., 2017).

When significant associations with FN were established, both frequency of intake and preference was lower among high FN individuals. Overall, the results suggest that FN is an important barrier to dietary change and addressing diet-related health problems. The researchers found no difference by age, gender, or income (Jaeger et al., 2017).

Further understanding of adults’ neophobic behaviour is needed to better understand how to increase and improve individuals’ consumption of vegetables. As demonstrated by Galloway et al (2003), children’s food habits appear to be directly related to those of their parents. To understand this cyclical behaviour, both children’s and adults’ consumption must be observed, but for long term change to occur, the adults must be the one to set the healthy examples for their children. In summary, there is more that needs to be done to better understand FN within adults and long-term food choice over time, FN can have detrimental effects to one’s overall health. Neophobia is described as a prominent barrier to dietary variety in specifically low-calorie foods such as fruits and vegetables (Gallo, 2018; Larkin & Martin, 2016; Proserpio et al., 2018).
As the amount and variety of food we have access to changes with increased demand for more ethnic and multicultural foods and new technologies, high neophobia scores will directly influence the intake of vegetables (Jaeger et al., 2017). FN in adults is a relatively new area of study, it appears to be particularly relevant to FV promotion. To better understand FN and how it can severely influence the decrease in vegetables, one must understand how individuals perceive different vegetables which can be done through categorization studies.

3.0 Introduction to Categorization

Categorization is defined by Cohen & Lefebvre (2017) as “any systematic differential interaction between an autonomous, adaptive sensorimotor system and its world (p.24). In more accessible language, categorization is grouping items together based on perceived similarity or function. Cohen & Lefebvre suggest that the true significance of categorization is not about grouping things together, it is about understanding how to respond to specific things, depending on the category we place them. The main purpose of categorization is to know how to treat an item based on its category and this skill must be learned over time. In summary, to properly comprehend how categorization works, understanding first how humans learn is essential (Cohen & Basu, 1987; Gregan-Paxton & Moreau, 2003; Medin & Smith, 1984).

Categories that occur naturally are considered taxonomic categories, such as fruit and vegetables (Cohen & Basu, 1987; Felcher, Malaviya, & Mcgill, 2001; Medin & Smith, 1984). Alternatively, categories that are formed based on context of the situation, are defined as goal-based categories, for example, foods you eat for breakfast (Christine E. Blake, 2008; Felcher et al., 2001). Currently, it is unknown which of these classifications are preferred when observing the categorization of vegetables, and for this reason both approaches will be discussed. Both
types of vegetable categorization are reported and compared, depending on the individuals’ level of food skills and neophobia score.

Moreover, there are two different types of categorization that are used to classify objects, “simple and complex” (Medin & Smith, 1984). The former is most studied when object categorization is the goal and the latter allow for more items beyond simple objects to be categorized (Medin, 1984). A simple categorization would be “deciding that a particular object is an instance of the concept ‘boy’ (Medin, 1984, p.115). Complex categorization is “deciding that a particular object is an instance of the concept ‘rich boy’ (p.115).

In relation to simple class; Medin discusses three separate styles of concepts that arose from research that was carried out on simple categorization. These three styles are referred to as classical, probabilistic and exemplar. Medin and past researchers have demonstrated that classical style (using rules such as a strict definition to determine if the item belongs to the category or not) is not suitable for simple categorization and due to the previous support from categorization experts (Cohen & Basu, 1987; Rey, 1983; Ross & Murphy, 1999; Smits, Storms, Rosseel, & Boeck, 2002; Verheyen, De Deyne, Dry, & Storms, 2011), this style will not be mentioned further. To answer which of the two remaining views will be most relevant for our purposes, each will be thoroughly discussed.

3.0.1 Probabilistic (Prototype) & Exemplar View

The probabilistic view suggests that the item will be considered part of the category if it possesses a certain percentage of characteristics that define the concept (Medin, 1984). The placement can also be determined by a summing the weights of the congruent characteristics between the item and the category (Medin, 1984). In this view, categorization is defined by similarities between items rather than the rigidity of a definition. An individual could come
across an unfamiliar vegetable in the super market and utilize their existing knowledge of the
category to understand what group the vegetable belongs.

According to probabilistic view, the individual would compare the unfamiliar item and
evaluate the level of typicality the item has in common with each group. “In general, greater
feature overlap with common features of the category is presumed to increase a category
member’s prototypicality” (Loken, Barsalou & Joiner, 2008, pg.135) based on the prototype
theory within the probabilistic view. For example, if a food item had an green hue, was cold to
the touch, and an elongated shape, they could weigh the level of typicality between a root
vegetable or a pepper, and the individual could place the cucumber in the group that had a higher
number of similar properties, likely with the root vegetables. Typicality is defined by the authors
as what characteristics are typical (or most common) to the category (Medin, 1984).

The strength of item typicality is based on how similar the item is to the concept and how
quick it can be determined to possess the ideal level of shared characteristics (Medin, 1984).
Individuals who are familiar with the context or item group are more likely to employ narrow
categories, because “items from taxonomic categories share features that are spontaneously
accessed, without the prompt of a category context” (Medin, 1984, p. 872).

The most discussed problem with the probabilistic view is that the approach does not
include all the person’s knowledge about the concept and it does not address the range to which
people understand an item’s characteristics (Medin & Smith, 1984). Moreover, the probabilistic
view may be problematic for categories that have many known lay perceptions and
“miscategorizations” (Medin & Smith, 1984), like the vegetable category (Medin & Smith,
1984). These miscategorizations occur when an item possesses similar characteristics to multiple
categories. This creates further confusion surrounding the item and how to use it, for example “a
tomato might be viewed equally similar to a fruit or vegetable” (Medin, 1984, p. 117). Medin argues that the probabilistic view may result in too many variations of what can be a potential characteristic and category (Medin, 1984).

Based on previous research most categorization models assume that inferences are made based on similarity, but it is unclear how those judgements are formed (Medin, 1984). The way judgements are formed can either take a holistic approach; evaluating the entire item based on similarity or using “analytic accumulation of matches and mismatches of components” (Medin, 1984 pg. 119). Exemplar view theorists suggest that a novel item becomes the retrieval cue which allows the consumer to access representations of the exemplar that look alike, from their memory (Cohen & Lefebvre, 2017).

The exemplar view suggests that to some extent a concept has separate descriptions of some of it’s exemplars (Medin, 1984 p.118). While different exemplar models have been proposed their similarity is drawn from item comparison of well-known exemplars from the category (Medin, 1984). As mentioned with the probabilistic view, miscategorizations may arise when the item possesses characteristics of exemplars from two different categories or when the item is of an unlikely category based on exemplars such as a seahorse (Medlin, 1984). The more typical the item, the more represented it is in the category (Medlin, 1984).

However, the exemplar view appears to be the superior method for simple categories because “exemplars can carry the information about a range of values for an item as well as correlation among items compared to probabilistic view” (Medin, 1984, p.118). The emphasis of developing the correct exemplar is important especially when the category has many different variations of a single item, such as the vegetable category. An individual who has limited knowledge about vegetables may look at two items of similar shape and color; such as a
cucumber and zucchini and place them in the same category, but they would be quite surprised to discover that although the two items look very similar, how they are prepared and consumed couldn’t be more different.

A new item can be categorized based on the similarity to the exemplar of the category. By categorizing based on exemplar, the unknown or new item is categorized based on perceived similarities to the exemplar of the category. When the item is categorized, the knowledge about the known items is employed to determine the correct categorization (Ross & Murphy, 1999). Because the person is using previous knowledge of the category and exemplar to determine the acceptance of the new item, this process is known in cognitive psychology as the “schema driven affect” (Fiske, 2014).

When a person learns more products, their knowledge of a category expands (Fiske, 2014). The exemplar can develop more detail or can change completely, and new categories will form. An individual’s knowledge about a category is shaped over time and their ability to categorize new items is based on their previous knowledge of the overall category. Thus, categorization is demonstrated by continuous learning, and refinement of the category (Carvalho & Goldstone, 2014).

For consumers who are highly experienced in preparing vegetables this means that their exemplars of the category could have very specific granularities between different vegetable groups. This more experienced individual would also have a clear and elaborate exemplar for each type of vegetable which would be representative of their breadth and depth of cooking skills and versatility in the vegetable category. Conversely, individuals who have none to minimal experience preparing vegetables would have very typical exemplars and would have a difficult time categorizing vegetables that deviate from their narrow exemplars. Moreover, it could be
suggested that this narrow knowledge would inhibit their ability to categorize vegetables that do not fit an existing exemplar, such as a purple carrot.

3.2: Categorization & Consumer Psychology

Categorization is a methodology used in consumer psychology to understand “product extensions, hybrid products and unknown products (Ackermann, Teichert, & Truong, 2018). Categorization is used to observe consumers’ perceptions about existing product categories, placement of new products into existing product categories (Moreau, Lehmann, & Markman, 2001), and how consumers form new and existing consumer categories when faced with a unfamiliar product.

Moreover, a consumer category is the classification that a consumer uses to define a variety of products or services. Loken, Barsalou & Joiner (2008) define a consumer category as; “a set of products, services, brands, other marketing entities, states, or events that appear to the consumer, related in some way” (p.133). Consumer categorization is used to understand and make inferences about different products or services. These observations influence a consumer’s choice and buying behavior. According to consumer psychologists, the information used to form these observations and how to place products into certain groups is based on a person’s categorical representation.

Categorical representation is “information that becomes stored in the cognitive system for a consumer category, and that is later used to process it” (Loken, Barsalou, Joiner, 2008, p.133). Consumers’ utilize categorical representations when they are participating in categorization. This occurs when individuals use the stored information to place a product, or service into a specific category which allows them to better understand how to treat and respond to the item of interest.
Categorization is significant to consumer behavior because it allows consumers to make sense of an unknown product or service once they are able to place the item into a category.

Category inferences occur when a consumer makes a judgement about a novel item based on their existing category knowledge (Loken, Barsalou & Joiner, 2008). To better understand consumers’ category representations, Hoek Bokel & Voordouw (2011) wanted to observe how consumers categorize meat and meat replacement products. They were interested in this taxonomic category because of the existing perceptions consumers had within the meat and meat-replacement products. The researchers recruited 34 non-vegetarians to perform a free sort task, similarity and typicality ratings on meat and meat substitute food items.

As hypothesized, categorization was heavily influenced by the taxonomic category of meat and the meat products were categorized in isolation from the meat-substitutes. The previous knowledge of the taxonomic meat category made it very difficult for individuals to group meat and meat substitute products together. The authors suggest that for meat substitutes to become more widely accepted, they should resemble existing meat products based on perceptual similarities such as colour, and shape.

Consumer psychology academics have conducted research about categorization by studying the underlying item category. These categories can be related to the physical belonging of the holistic object, for example product or brand categories (Cohen & Basu, 1987; Medin & Smith, 1984). Alternatively, categories can be determined by performing a more elaborate dissection of the item, known as analytic processing which observes features between the item and category (Hutchinson & Alba, 1991; Medin, Lynch, & Solomon, 2000). The more recent work surrounding categorization in consumer psychology has looked at contextual factors that have been “reported to influence the representations retrieved from memory” (Loken, Barsalou &
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Joiner, 2008, p.131). Moreover, based on the use of memory it could be suggested that differing levels of category interaction would be influenced by the individuals existing category knowledge.

3.3: Category Knowledge & Categorization of Food

Unsurprisingly, category knowledge has been found to be directly related to exposure. This means, the more the category is accessed, the quicker the person becomes at being able to correctly place a new item into its proper category (Desmedt & Valcke, 2004; Johnson & Mervis, 1997; Medin & Smith, 1984). This continuous learning is experienced through repeated interaction with the category (Carvalho & Goldstone, 2014). Moreover, increased knowledge/expertise has been found to increase flexibility in categorization (Loken, Barsalou & Joiner, 2008; Tanaka & Taylor, 1991). This allows the individual to understand the subtle differences between sub-categories, and identify their perceptual distinctions (Johnson & Mervis, 1997).

The exemplar view suggests that our ability to categorize is restrained by our narrow or wide set of exemplars that we hold in the category (Cohen & Basu, 1987; Medin & Smith, 1984). If the exemplar view suggests that ability to categorize unfamiliar or new items is restrained by previous knowledge, one could assume that individuals who score lower on a questionnaire about the vegetable category will have more difficult time categorizing vegetables. It could also be suggested that minimal interaction with the category, such as those who consume very few vegetables, if any at all, would have a limited set of exemplars, compared to someone with much more knowledge of the category.

Previous work has demonstrated when the person is not provided the rules that show if the item belongs to a certain category, the person relies on similarities between the item they are
trying to place and the known exemplars in the category from their memory (Medin, Lynch, & Solomon, 2000; Medin & Smith, 1984). In summary, Armstrong argues while the difference between probabilistic and exemplar are important “sometimes what really matters is that the concept not contain defining properties; when this occurs, we refer to such concepts as prototype concepts” (Armstrong, 1984 pg. 119). The categorization of food is extremely complicated and there is very limited literature on the subject (Cohen & Lefebvre, 2017). This lack of literature clearly exemplifies our lack of understanding on the mental processes that underlie food perception, categorization and choice (Gregan-Paxton & Moreau, 2003; Ross & Murphy, 1999; Smits et al., 2002; Verheyen et al., 2011).

The ability to categorize food requires integration of multisensory information and semantic memory with varying contextual information that is influenced by numerous factors (Ross & Murphy, 1999). On the one hand, “food features (energy, content, level of transformation) modulate our perceptual and categorization processes” (Cohen & Lefebvre, 2017 p. 272); on the other hand, categorization processes are also modulated by the perceiver’s temporary states (such as fatigue or hunger) and more lasting characteristics such as body mass and gender. Thus, “food categorization provides a very rich test-case for any model of categorization” (Cohen & Lefebvre, 2017, p. 275).

Being able to categorize food is the basis of survival and miscategorization can result in a consequence as serious as death (Cohen & Lefebvre, 2017). “In order to know how individuals explicitly evaluate a certain food it is important to ask them directly” (Cohen & Lefebvre, 2017, p. 277). This explains why the qualitative method of in-depth interviews in categorization research are preferred (Krebs-Smith & Kantor, 2001; Paisley, Sheeshka, & Daly, 2001; Slater & Mudryj, 2016; Smits et al., 2002).
According to scientific researchers “Humans choose food by processing information about possible sources of nutrition among a large array of possible alternatives and previous research has demonstrated that one of the most significant features of food is calories or energy content” (Cohen & Lefebvre, 2017; pg 282). Food is typically sorted naturally in a taxonomic manner (vegetables, meat, milk etc) and less often, by script or context (food for breakfast, snack, lunch and dinner) (Cohen & Lefebvre, 2017). However, to the consumer food is rarely processed based on nutrient information and is much more likely to be consumed based on time of day (context) or the food group (category). This disconnect between scientists and consumers demonstrates how different the criteria they use to determine their food choice.

Moreover, the way people think about food is not a one-size-fits-all situation. Food is readily cross-classified by people and the presentation of certain food may stimulate multiple categories. Although, our knowledge of food categorization is limited, our knowledge of food overall is extensive and is accessed many times per day (Ross & Murphy, 1999). Living in a food centric world, makes many of our food choices rather effortful (Cohen & Lefebvre, 2017; (Ross & Murphy, 1999; Slater & Mudryj, 2016).

To better understand how consumers perceive vegetables, Drenowski (1996) mapped perceptual space of vegetables names to better understand what pairs of vegetables fit together best in the minds of consumers. 20 common vegetable names were gathered based on prevalence and cultural norms (Drewnowski, 1996). The participants were asked to rate the level of similarity of 190 pairs of vegetables. Drewnowski (1996) identified colour, convenience and calories for their perceptual mapping dimensions from their MDS. Their findings revealed that liking was influenced by taste and the vegetables that were reported as bitter were the most disliked.
Colour contrast was the strongest predictor of compatibility (determining two vegetables went together) and the most liked vegetable pairs were those that combined a green and non-green vegetable. In addition, colour separated deep yellow vegetables from deep leafy greens and was used to estimate nutritional value. Interestingly, perceived versatility of the vegetable influenced liking. This demonstrates, that the vegetables that were reported as most liked by the participants were vegetables that could be prepared in different ways and the least preferred vegetables appeared to have minimal preparation methods (Drewnowski, 1996).

It is plausible that results found by Drewnowski (1996) could be addressing a variety seeking behaviour as suggested by Yi et al., (2015). If a consumer has many different ways to prepare and consume a certain vegetable, they would not grow tired of their vegetable options as quickly. Moreover, people who have knowledge of how to prepare vegetables in many ways may like vegetables more compared to those with limited preparation skills.

In relation to knowledge about food preparation, previous research has suggested that lack of preparation knowledge has been identified as a barrier to vegetable consumption. The results suggest that categorization of vegetables plays a role in understanding vegetable intake. In addition, recent research has linked neophobia as a predictive indicator of FV intake and categorization of fruits and vegetables (Alley, 2018; Jaeger, Rasmussen, & Prescott, 2017; Pliner & Hobden, 1992; Proserpio et al., 2018).

To better observe the variety of ways people interact with food, Ross & Murphy (1999) observed cross-classification in food and offered an explanation to how this phenomenon is used in physical tasks. Cross classification is defined as the occurrence food that stimulates multiple categories (Ross & Murphy, 1999). They hoped to address what categories people use when they think about food, how common the alternatives are, what role do these other categorizations have
and how their cross-classifications relate to the way they interact with food (Ross & Murphy, 1999).

The authors suggest that categories discovered during this research may not be the categories that people use during food choice and judgement but instead, they are actually the generation and comparison processes involved in the categorization thought process (Ross & Murphy, 1999). The second set of studies compares the previously discovered categories to observe if these are the ones that are activated when people encounter the food stimuli. Results showed that food was categorized in a taxonomic manner 49%, script 42%, and macronutrients 9%. Interestingly, macronutrients (communicating the benefits of a food product) is how marketers and dieticians categorize food and how differences in food are explained to consumers. However, less than 10% of the population looks at food this way (Ross & Murphy, 1999). The studies conducted by Ross & Murphy (1999) emphasizes the importance of categorization in the area of food, but their research fails to address categorization beyond shallow level similarity comparisons and ignoring the importance of context and taxonomic category in their research.

To further understand how adults categorize foods in different contexts Blake et al (2007) utilized schema theory and conducted interviews with 42 adults and asked them to complete repeated card sort activities for varied consumption situations, to bring forward as many categories as possible. The participants generated 991 card sort labels which were later reduced to 12 category types after qualitative analysis. These 12 categories types were divided into three groups personal-experience-based, context-based, and food-based. The personal experience-based category types consisted of routine, preference and well-being. Context-based contained the highest number of category types consisting of; mealtime, meal component, convenience, location, source and person. The final three types in the food-based categories were food group,
nutrient composition & physical characteristics. The researchers found that context and personal experience category types were the most frequently mentioned (Blake et al., 2007). Food based taxonomic categories were used most frequently when no context was applied.

Schema theory was developed to help explain how individuals store, retrieve and use information. Schemas are defined as “general collections of knowledge constructed from experience containing organized behavior in familiar contexts” (Blake et al 2007, pg.501). Food schemas can grow through direct experience with food (cooking, shopping) or indirect (conversation, watching a cooking show). Researchers have relied on methods that allow the individual to gain access to their personal schemas, through card-sorting tasks (Blake et al., 2007; King, Jacobsen, & Labriola, 2017; Rioux et al., 2016; Ross & Murphy, 1999).

The method of card sorting assumes that the way the individual sorts the cards is representative of how the items appear in their memory, as this method has been widely used to explore cognitive mechanisms. Card sorts have been previously used to better understand food classification (Ross & Murphy, 1999). In addition, they have also been used to assess neophobia levels in children (Rioux, 2016) and adults (Jaeger et al, 2017).

While card sorting has been demonstrated as a suitable tool for understanding how food items appear in one’s memory, little inference can be drawn about perception of those food items being reviewed. Moreover, the large number of food items would encourage participants to focus on elementary characteristics such as similar color, shape or taste. Card sorting tasks also limit individuals to think about a single food item in more than one context. By forcing the individuals to sort these food items into distinct groups based on the context, they are inhibiting their ability to find multi-purposes for the same food item. In summary, Blake at al’s (2007) study demonstrates what foods may be the exemplar categories for each context, but they fail to
demonstrate the versatility and dynamism of the food category. Moreover, comparing many food groups to each other simply encourages the individuals to draw similar conclusions and does not encourage them to think in detail about the many uses of each food item.

Blake at al (2008) were hoping to gain further understanding of how people categorize their food. They did this by asking participants to engage in card-sort tasks, in different locations (work, at home), with and without other people. The goal of their research was to better explain the disconnect between how people categorize their food versus how scientists categorize food (Blake, 2008). They asked participants to engage in multiple card-sorting tasks to better understand the different ways people sort the food cards, after the sorting took place they were interviewed to explain their logic behind the card sorting task (Blake, 2008). They found that almost all participants referred to at least one food as a personal based category (preference, routine) and script based (time of day). However, only two-thirds of the participants used food-based categorization, which is the method of choice by most nutritionists and health-sciences and marketers.

Their research highlights the disconnect between how consumers and scientists categorize food. In relation to differences between types of consumers, some consumers claim they do not purchase as many vegetables due to lack of knowledge in how to prepare more uncommon varieties and they are simply unaware of more uncommon vegetables. However, understanding what vegetables are more uncommon to consumers is necessary to understand their perceptions about vegetables.

The interest in categorization goes far beyond how people place items into groups, meaning that categorizing is rarely the purpose of categorizing, it is about how to treat the item, and this allows for inferences and predictions (Armstrong, Gleitman, & Gleitman, 1983).
previously mentioned, some foods can be more difficult to categorize than others due to the ambiguity of categories (Medin et al., 2000). Verheyen & Storms (2011) termed this observation as the contrast category effect, meaning that individuals are observing not only the target item and the proposed category but also comparing the target item to the alternative category in same domain (Verheyen et al., 2011). The idea of the contrast category effect is based on Goldstone’s idea that item category membership is thought to vary on a continuum of interrelatedness (Goldstone, 1996).

Verheyen and Storms asked 221 participants to sort 109 items and categorize each as either a fruit or a vegetable label by clicking the associated key. Then in a feature generation task half of the participants were asked to list 10 characteristics about fruit and the other half were asked to do the same but with vegetables. Eight separate paid-volunteer were then asked to go through each item on an excel spreadsheet and determine if the feature was applicable to the photo, if they felt the feature was present they placed a one, if they did not they placed a zero for the feature based on the given photo. The purpose of the matrix method was to be able to compare all of the items on a single page and compare characteristics that were similar or different between items.

The eight participants’ matrices were combined into one. Both fruit and vegetable categories experienced an increased amount of positive categorization judgements when items feature overlap with target category but decrease with feature overlap of contrast category. Due to the research efforts of Verheyen et al (2011) the use of prototype categories could be especially problematic when dealing with an item that could be justified by the individual to belong in multiple categories. The binary categorization employed by Verheyen et al (2011) is a typical example of the type of method and level of categorization that have been explored in the
area of fruits and vegetables. Unfortunately, this binary method fails to encourage the individual to think about the food items within each category and only encourages similarity comparisons between food items which provides minimal insight into understanding categorization beyond separating objects into two categories.

However, the commonly used matrix method appears to be an effective way to demonstrate the different attributes that are held between two food categories. Moreover, this information appears to be of minimal significance to the vegetable categorization literature. In addition, the 109 food items may be problematic for a single participant to sort through. The large number of items encouraged the participants to only identify key features. However, when participants see a food item that has many shared features, this could give participants a false sense of security that the two items are very similar, when they very likely are not. For example, individuals could gather that a zucchini and a cucumber have many of the same features; long shape, green color and small stem on the top. However, if consumers were to assume these items could act as substitutes of each other, they would be severely mistaken.

The research conducted by Medin & Smith (1984) outlines the importance of categorization and outlines the two approaches that some individual uses when they categorize, exemplar and prototype approach. Moreover, the significance of studying categorization provides insight to marketers and explains how consumers treat items that are similar or different to each other.

3.4: Categorization of Fruits & Vegetables

Vegetables are a taxonomic category that represents many different items and types within the group. Some vegetables are deemed less vegetable like than others, and these views are evident between different people (Armstrong et al, 1983). Some vegetables such as carrots or
broccoli fit the consumers’ idea of what food item resembles a vegetable concept. However, vegetables such as tomatoes may be considered more of a fruit than a vegetable, depending on what characteristics define the concept of a vegetable. When discussing the vegetable category there are many additional conditions to consider such as; price, seasonality, selection, storage, preparation and cooking. These variables can affect how individuals can categorize vegetables, based on their previous knowledge (Cohen & Lefebvre, 2017).

Individuals who have higher than average food skills will likely be much more particular at assigning vegetables to their categories, and their justification for categories would go beyond perceived similarities. One could suggest that their ability to categorize the vegetables would be strengthened by their frequent and repeated interaction with the category. Alternatively, individuals who have limited interaction with vegetables will likely rely on more elementary perceptions such as color and shape, rather than preparation or knowledge of the category. This could be expected because they do not have strong exemplars that help them navigate the vegetable category and for this reason they will rely on more automatic perceptual cues.

To begin to understand the unique complications of categorizing vegetables, Smits et al (2002) wanted to understand how well-known and unknown fruits and vegetables may be categorized differently. The well-known fruits and vegetables were used from previous study conducted by the authors (Smits et al, 2002). 109 fruit and vegetable stimuli were photographed and made into cards.

The matrix filling task (as described previously) asked participants to determine if the feature listed belonged to the current fruit/vegetable in question. For the categorization task, participants were asked to categorize the stimuli pictures as either fruits and vegetables, they also observed recognition of each item, and asked about consumer awareness of all items. Finally, in
the similarity rating task; the participants were asked to compare the perceived similarities between the 30 "exotic" fruits and vegetables with a sample of the well-known fruits and vegetables based on highest familiarity of each food category. Multidimensional scaling (MDS) was employed to observe pairwise similarity judgements that were used to conduct the scaling process. Multi-dimensional scaling (MDS) is defined as a powerful statistical method that maps proximity data on pairs of objects (i.e., data expressing the similarity or the dissimilarity of pairs of objects) into distances between points in a multidimensional space” (Borg, Groenen, & Mair, 2018; p.v).

The generalized context model (GCM) was the best model of fit based on observing and predicting categorization proportions and in relation to statistical tests that measure "likelihood of the data", compared to the prototype model in all three analyses (Smits et al, 2002). The GCM suggests that the individual’s classification of new items is based on the similarity between the novel stimulus and the exemplar they store for the category. GCM stimuli go against the binary categorization method and places stimuli on a continuous dimension. The GCM approach assumes that individuals use exemplar style during categorization.

The authors’ findings challenge the assumption in previous literature that "prototype models result in better categorization of large categories than exemplar categories do” (Smits et al., 2002). This research directly compares the advantages of the exemplar model compared to prototype model when comparing well-known and unknown fruits and vegetables. The authors successfully demonstrated the obvious advantages of the GCM compared to the prototype model, in contrast to past research.

The area that has yet to be explored, is how these types of categorization methods differ between individuals, depending on food skills, vegetable intake or fear towards vegetables (food
neophobia). Although recent literature has demonstrated findings that neophobia and categorization are directly related (Rioux, 2016), the categorization research by Smits et al (2002), suggests that there are additional variables that can explain the individual differences in vegetable categorization.

To go beyond Rioux et al’s (2016) findings, the goal of the present research is to better understand how individuals categorize vegetables by measuring neophobia and measuring food skills and vegetable intake. As mentioned previously, Rioux’s findings successfully demonstrated how neophobia and categorization are negatively correlated. Despite these observations, a concrete conclusion can not be drawn to the present research exclusively because Rioux’s et als (2016) study was conducted on children, in Germany. For these two reasons, age and cultural differentiation we can not assume to find the same results.

Moreover, the food choice and consumption literature repeatedly demonstrates the cultural differences with food research and warns anyone of drawing parallels to countries with significantly different consumption behaviors (Chen et al., 2009; Foroni & Rothbart, 2011; Jaeger et al., 2017; Rioux et al., 2018). In addition, age has also been demonstrated to be a factor that contributes to food choice, vegetable consumption and more specifically healthy food habits.

Gaillard & Urdapilleta (2011) aimed to better understand the variability of between and within subject design of food label categorization tasks, across multiple taxonomic food categories. To observe within subject variability, the researchers observed a sorting task and a property generation task on food labels (Gaillard & Urdapilleta, 2011). The researchers observed two participant groups to observe between subject variability. The first group was asked to use the same number of categories for both sessions (1&2). However, the second group was told they could place the food items in as many categories as they wanted during the second session. Both
groups were asked to explain their rationale for their categorization of the food items during the property generation task.

Sessions 1 & 2 from group two were used to observe within subject variability and groups 1 & 2 from session 2 were used for between subject variability (Gaillard & Urdapilleta, 2011). One hundred female French university individuals formed two groups of 50 participants. The sorting task was comprised of 65 food items that were randomly presented and typical in French cuisine (Gaillard & Urdapilleta, 2011). Both sessions consisted of two activities, a sorting task and a property generation task. During the sorting task participants were asked to group the food items that they perceived were similar to each other and during the property generation task, the participants explained their reasoning for how they formed and defined each group of food items.

To observe the properties generated, 50 participants from each group was obtained to view the differences of each group. The data were transformed to analyze individual differences by using the transformation procedure. To observe all the food labels based on their similarity and dissimilarity in a multidimensional space, the dissimilarity matrix was “submitted to a traditional multidimensional scaling technique (MDS) (Gaillard & Urdapilleta, 2011).

Finally, the most relevant properties of the food items were chosen based on repetition and same meaning. MDS dimensions accounted for approximately 50 percent of the information (Gaillard & Urdapilleta, 2011). Seven category (classification) groups were identified using the four dimensions of MDS for the 55 food items regardless of condition.

As demonstrated by previous work by Ross & Murphy (1999) the participants grouped the food items by taxonomic categories (fruit, bread etc) and script (you eat at breakfast, lunch food etc) and a very low amount of participants referred to the food items based “dietetic effects” such as sugar, milk or calorie content, sensory (smell, taste) and hedonic (weakness, indulge)
properties” (Gaillard & Urdapilleta, 2011, p.92). For the sorting task the between subject variability was lower (better) than the within subject variability, which resulted in a Pearson’s “r” correlation of .94 compared to within subject Pearson’s of r=.98. Meaning the between subject variability was slightly more reliable than within subject variability, for the sorting task (Gaillard & Urdapilleta, 2011).

In summary the between subject variability was superior for the sorting task and property-generation task. The variability of condiments (ketchup mustard and olive oil) and complex food such as bread and sauerkraut were the highest. “The perceived similarities between exemplars were stable over the two sessions, although the properties used to describe the food items varied” (Gaillard & Urdapilleta, 2011, p. 197). The authors recommend that an individual analysis of the category and property-generation experiments could bring attention to unique categorization behaviors based on specific personality traits and not demonstrated by group agreement (Gaillard & Urdapilleta, 2011).

3.5: Context in Categorization

The issue with context in categorization, has been addressed by few researchers (C.E. Blake et al., 2007; Christine E. Blake, 2008; Smits et al., 2002). Looking at items from two categories does not allow the individual to gain deep insight about the items. Using proximity to determine two different categories tells the researcher very little about how the two items are perceived. Perception allows the researcher to understand how consumers use and purchase different items. Few researchers have looked at the context of food items, when using categorization methods. When comparing two items that differ in many ways, the differences become the primary focus to the consumer and they forget what the individual significance is of the items that they are being asked to evaluate.
Moreover, by over emphasizing the importance of physical similarity between the two items, the context is ignored. Unfortunately, the methods that have been used to explore categorization do not tell the researcher how the consumer feels about the food items and only observes similarity at a rather shallow level. Moreover, by placing two objects at the same time in front of the consumer, they assume the researcher is more interested in the relationship between the objects than each item on its own.

When comparing two items from different categories the researcher is missing the main purpose of categorization, to understand how people interact with the objects. This thesis will ask consumers to categorize items from a single category. Focusing on a single category (vegetables) will allow the consumer to think more about the category as a whole, the uses for each item and how they differ from others. Observing a variety of vegetables and asking the consumers to group items together, not only tells us how they separate vegetables in their mind, but also explains what vegetables they treat in a similar way and what vegetables could be substitutes for another in their meals or on their grocery list.

Understanding what vegetables can be substitutes of each other is information that would be useful to food producers, food marketers, grocery stores and their logistic/planning & marketing departments. To summarize, focusing on a single food category when observing categorization allows the consumer to look beyond vegetables as a single autonomous category and recognize the granularities between each vegetable sub-group.

Unlike, previous research that asks participants to focus on two (vegetables and fruit) or more categories. This approach does not address the person’s perceptions about the items in the category, it only asks them to perform comparison at the category level. By observing objects at the category level, consumers only see each object for a single purpose and they do not realize
the multiple purposes for a single item or that some items could be preferred more depending on the purpose or context.

Context in the vegetable category is important when observing consumers perceptions about vegetables and understanding that categorization works within the context. Context can be broken into two different processes. The context of comparing fruits and vegetables, as done by previous researchers offers minimal insight about vegetable perceptions or consumption. Alternatively, relying on the basis of similarity between different objects within a single category can result in more detailed explanations of categorization. As previously discussed, similarity in categorization research is referred to as typicality in prototype categorization. The question appears in the literature as “how typical is this feature to the category”? In exemplar categorization, similarity is compared between the unknown item and the exemplar of the category (Medin & Smith, 1984).

When a researcher asks a participant “how similar are these vegetables to each other?” the researcher receives similarity-based criteria that shapes the participants’ evaluation of the vegetable. This could include; content (what is the object made of), look (shape, color, etc), cooking method, taste, etc. When there is no criterion provided to the participants on what type of similarity inferences they should be making, the results could drastically differ. Moreover, when the participants are asked to draw similarities from two objects, the reasoning for drawing similarities for each participant could differ widely.

Therefore, when the basis of similarity is undefined, the results offer a very wide range of explanations about how the two items are in fact, like one another. Each distinction of similarity has important marketing implications and depending on the objective they offer different benefits. It could be suggested that these differences in similarity methods could be employed by
individuals with different levels of food skills. Moreover, neophobic individuals with limited exposure to a variety of vegetables may struggle more with the categorization tasks.

Chapter 3 Research Overview

3.1 Research Gap

The research conducted by Gaillard & Urdapilleta (2011) demonstrates the superiority of between subject’s design (compared to within subject) on sorting (categorization) tasks. The present research will aim to utilize a majority of Gaillard & Urdapilletas’ methodology for the present study. However, we will not measure instruction as this is not a focus of our research. Instead, we will utilize the categorization tasks demonstrated by the previous authors and introduce two scales that will measure food neophobia and food skills which will allow us to observe the impacts these variables could have on vegetable categorization. The hypothesized relationship between these two scales and categorization will be discussed in the proposed hypotheses section (p. 61).

In addition, the present research will observe how these categorization tasks influence participants vegetable preferences. The addition of preferences, is to strengthen the generalizability of the present research and ensures that the outputs of categorization tasks, are in fact reflective of the sample’s likes/dislikes. Vegetable preferences will be measured using a categorization task that asks participants to categorize the vegetables based on which ones they like or dislike and the use of a vegetable ranking task, both will be discussed in the methodology.

Moreover, the food categorization labels will consist of only vegetables, and this will allow the present research to gain an in-depth understanding of adult vegetable preferences. We hope to see a difference in preferences that is driven by a combination of food neophobia & food skills
scores, and categorization. In addition, we also aim to see a difference in preferences between individuals low “food skills” participants and those with high “food skills”.

Once we observe that food neophobia scores & food skills scores are partially responsible for the differences in the categorization tasks, we will aim to understand how categorization influences consumers preferences of vegetables. This research will identify a relationship between the categorization vegetables, and the participants preferences for these vegetables. The present research hopes to not only better understand what vegetables people like/dislike, but also begin to explore “why” for these vegetable preferences. The first step to increasing long-term vegetable consumption is to uncover how consumers perceive certain vegetables and how they categorize them and to probe to understand why they categorize them in this way.

The gaps identified by the present research will be three-fold. First, to observe the categorization of vegetables using a single food category to add to the literature of food neophobia & categorization. While the link between categorization and food neophobia was previously observed by Rioux et al (2016). Their research used both fruit and vegetable categories in the categorization task. The present research will contribute to this connection by focusing on the novel contribution of observing vegetable categorization in isolation of fruit, while observing food neophobia. It has been well demonstrated that neophobia is significantly more prevalent in vegetables, than fruits (Gallo, 2018; Galloway et al., 2003; Jaeger et al., 2017). To the best of our knowledge, we will be the first to explore the categorization of vegetables independently from fruit.

Second, this thesis plans to measure food skills to better understand individuals’ knowledge of vegetables and observe how this skill influences participants categorization and preferences of vegetables. Previous research suggests that lack of food skills, can partially explain why people
do not consume enough vegetables in their daily diet. This idea has been supported by the research findings of Hartmann et al (2013) and Slater & Mudryj (2016) who both found that individuals with higher food skills consumed less convenience food, and more healthy food such as vegetables and fruits.

The third contribution will explore the output of categorization and linking this output to actual preferences. By observing physical preferences, we aim to observe noticeable differences between individuals with varying food neophobia and food skill scores. These variables will then influence their categorization and, as a result their vegetable preferences. As demonstrated, the varying level of a person’s knowledge of an item category has been linked to their ability to categorize items (Johnson & Mervis, 1997).

To summarize our gap, we hope to observe that food neophobia and food skills will influence the participants categorization, and categorization will then display differences in the participants vegetable preferences. We will be introducing the novel additions of single label (category) categorization, food skills and the introduction of preferences as an output of categorization.

3.2 Research Questions

1. Does Food Neophobia/Food Skills influence people’s ability to categorize vegetables?
2. Does categorization of vegetables influence adults’ vegetable preferences?
3. How does categorization differ between individuals with high and/or low food skills and/or food neophobia scores?
4. How are vegetable preferences different between individuals with varying food skills/food neophobia scores?
To address the research questions, frequency analysis, multinomial logistic regression and multidimensional scaling were conducted to understand whether food skills and food neophobia moderate categorization and, if categorization influences vegetable preferences. The independent variables under investigation are food skills, food neophilia and categorization. The dependant variable is vegetable preferences. Vegetable preferences was measured based on the preference categorization task & vegetable ranking tasks. Categorization was measured based on five categorization tasks. Multidimensional Scaling will be used to analyze the vegetable rankings to compare differences between the two sample groups.

3.2.1 Background of Multidimensional Scaling

“Multi-dimensional scaling (MDS) is a powerful statistical method that maps proximity data on pairs of objects (i.e., data expressing the similarity or the dissimilarity of pairs of objects) into distances between points in a multidimensional space” (Borg, Groenen, & Mair, 2018; p.v). Traditionally the space is two dimensional but there have also been demonstrations using three dimensions, and rarely, greater than three. A similar method referred to as unfolding is used for consumer preference data, such as ratings of consumer products.

The main function of MDS scaling is so the researcher is able to more easily visualize the data which allows the person to investigate the coordinates and understand their dispersion (Borg et al., 2018). The coordinates on the map are referred to in MDS as distances and the distances indicate the level of similarity or dissimilarity each item has to another. The closer the items are, the more similar the individual determines the two items to be and objects that individuals view as very far apart from one another (such as a lettuce and squash) are plotted far away from each other.
Moreover, for the purposes of categorization research, MDS is used to visualize clusters on the map. Clusters of items imply a group, meaning the larger number of clusters, the more groups the individual has identified. MDS has been widely used to observe categorization (sorting) experiments by analyzing differences between groups, time periods and individuals. When observing the MDS map, the clusters of items are of priority for the current research. Previous analysis of categorization with food items has used metric multidimensional scaling which shows that the “food labels often grouped by participants had similar coordinates” (Gaillard & Urdapilleta, 2011, p.192).

According to Abdi, (2007) MDS transforms a distance metric into a set of coordinates such that the Euclidean distances derived from the coordinates are approximated. The purpose of metric MDS is to “adapt the distance matrix into a cross-product matrix and then find the eigen-decomposition which gives a principal component analysis” (PCA) (Abdi, 2007, p.1). The dimensions were used to compose a “perceptual map” of the ten vegetables for each sample, the maps can be viewed in appendix J.

3.3 Conceptual Model

The following conceptual model is provided to demonstrate the hypothesized relationship between food neophobia, food skills, categorization and vegetable preferences. A Multinomial logit model (MNL) is being used to understand how food neophobia, food skills and categorization may predict vegetable preferences. The consumers’ utility for each vegetable selection in the vegetable tanking task is assumed to maximize their utility; based on this assumption the vegetable a consumer ranks as their number one choice, provides them the highest utility compared to the other vegetables.
Moreover, the researchers assume that the ranking data represents the consumers preferences for each vegetable. For example, if a consumer ranked asparagus as their number one ranked vegetable, this means they prefer the asparagus compared to the other nine alternative vegetables, based on the model. This assumption is appropriate, because one of the goals of this thesis is to understand the preference of certain vegetables over others and understand how food neophobia, vegetable skills and categorization influence consumer’s preferences.

*Figure 1: Conceptual Model*

3.4 Proposed Hypotheses

3.4.1 Food Skills

The relationship between higher cooking ability and increase in vegetable consumption is consistent with the literature and supports the importance of cooking skills as part of a healthy lifestyle (Bernardo et al., 2018; Engler-Stringer, 2010; Hartmann et al., 2013; Larson et al., 2006; Paisley et al., 2001).

Hartmann et al (2013) found that cooking skills correlated positively with weekly vegetable consumption and negatively with weekly convenience food consumption. Moreover,
cooking skills were defined as the ability to prepare different foods. Provision of cooking classes have also been measured as an intervention to understand if cooking/nutrition classes would better people’s food knowledge.

Lavelle et al (2017) found that cooking skills was found to be highly correlated with food skills in the development of two independent measures ($r=0.76$, $P<0.0001$). This high correlation suggests that many of the cooking skills observations found by previous researchers, can be extended to food skills. Slater & Mudryj (2016) found that individuals consume less healthy food because they lack the knowledge of selecting, purchasing and preparing fresh products, demonstrating lack of food skills. Based on the studies above, it is hypothesized that:

\[ H_1: \text{Food Skills influences vegetable preferences} \]

3.4.2 Food Neophobia

Galloway et al (2003) found a significant relationship between neophobia, and vegetable intake scores among female children and their mothers. They found that the girl who displayed food neophobia, all had neophobic mothers, and vegetable intake was significantly lower for children with neophobic mothers.

Rioux and colleagues demonstrated in their 2016 research that neophobia was negatively correlated with the children’s’ ability to categorize fruit and vegetables. They found that children who had high food neophobia scores performed significantly worse on the categorization tasks, compared to children with low food neophobia scores. Therefore, the present research hypothesizes that

\[ H_2: \text{Food Neophobia influences vegetable preferences} \]
3.4.3 Categorization

It has been suggested that categorization can demonstrate an individual’s preferences or opinions about food (Rioux et al., 2016). Jaeger et al. (2017) observed that one third of their adult sample revealed neophobic behaviors and high food neophobia scores, these individuals consumed less tomatoes, salad greens, cucumber and onions compared to the other participants and they reported to consuming less vegetables overall. Therefore, it is hypothesized that:

H3: Categorization predicts vegetable preferences

Chapter 4 Research Methodology

4.1 Pre-Test

As a self-administered questionnaire was planned, a pre-test was conducted using a convenience sampling of current students within the Lang Business School at the University of Guelph. The pre-test method consisted of ten cognitive interviews with students from the university. The participants were asked to express their thoughts and opinions as they moved through the study and discuss any concerns or questions they had. The purpose of the cognitive interviews was to be able to ensure that all study components were easy to comprehend and that the task was an acceptable length (Geiselman, Fisher, MacKinnon, & Holland, 1986). Based on the results, the questionnaire was revised to reduce the amount of confusion or lack of comprehension during questionnaire completion.

4.1.1 Pre-Test: Questionnaire Development

The Pre-test consisted of 10 participants that participated in cognitive interviews. During these interviews they verbally discussed any issues or questions they had about the main study questionnaire. To engage with the participants, a list of probes was used when appropriate. These probes were to encourage the individuals to speak freely about what was going through their mind
as they moved through the survey. The methodology was replicated using the table constructed by Peterson, Peterson & Powell (2017). A table of potential issues and probes are listed below.

*Table 1: Cognitive Interviewing Potential Issues & Probes*

<table>
<thead>
<tr>
<th>Potential Issue/ Source of Confusion</th>
<th>Potential Probes</th>
</tr>
</thead>
</table>
| Understanding: Is the item wording, terminology and structure clear and easy to understand? | - Can you repeat the question I just asked you in your own words?  
- Was there anything confusing about this question?  
- What does this <term> mean to you as it is used in the equation?  
- Tell me what you were thinking about when I asked about <topic of question> |
| Retrieval: a) Has the respondent ever formed an attitude about this topic?  
b) Does this respondent have the necessary knowledge to answer the question? | - How much do you feel you know about <topic>  
- How easy or difficult is it to remember <topic> |
| Judgement: Is this question relevant to the respondent? Is it too sensitive? | - How comfortable did you feel answering this question?  
- Did this question feel awkward?  
- How well does this question apply to you? |
| Response: Is the desired response available and/or accurately reflected in the answer options? Are the response options clear? | - Were there response options that did not make sense to you?  
- How did you feel your response reflected the answer you wanted to give? |
| Adequacy of Content: Do all the items represent the construct? Are there items that do not belong? | - What did you think about this questionnaire?  
- Did you think there was anything missing from that questionnaire, that you felt was important? |

The cognitive interview responses were used to improve the comprehension of the questionnaire and to test the feasibility of the categorization sorting tasks. The responses were recorded from the interviews and changes to the questionnaire were implemented after each interview to improve the overall flow, logic and comprehension of the questionnaire.
4.2 Methodology of Main Study

The main study was designed as a cross sectional self-administered survey that was administered through “Qualtrics” an online questionnaire platform commonly used in the social sciences. The study took approximately 15 minutes for the participant to complete. The study consisted of an awareness task, ranking task, five sorting tasks and 25 Likert scale and open-ended questions that measured the participants food neophobia, food skills and vegetable intake (last two questions).

The purpose of an e-survey is to reduce the amount of errors from manual entry. These errors can be greatly reduced by Qualtrics “automated data checking”. Moreover, the access to the data is immediate after the questionnaire completion.

The Study was conducted April 2019 and two convenience sample groups were obtained. Group one comprised of University of Guelph students and faculty, the second group was Amazon MTurkers. The participants were invited to participate in the study via website request (group one) and invitation in the MTurk website (group two). Group one was compensated with a ten-dollar amazon gift card and group two was paid $1.87 CAD upon receiving their MTurk completion code at the end of the survey. The study took approximately, 15 minutes to complete for both groups.

4.3 Population and Sample

4.3.1 Participants

For comparison purposes, two groups of individuals were drawn from the population to observe differences among groups. The average age of participants ranged from 18-69 years old in both groups. The gender distribution for group one was 28% males & 72% females, for group two there were 62% males and 38% females. The participants took part in the study by accepting
the invitation and completing the consent form. There were nine people omitted from the study due to incomplete submissions and all participants received either a 10-dollar Amazon gift card (Group1) or $1.65 (MTurk sample).

Two sample groups were collected because the present research wanted to be able to observe potential differences in vegetable preferences and different levels of food neophobia and food skills between the Guelph and MTurk samples. In addition, the Guelph sample provided the researchers control in terms of survey completion, but there was concern about the homogeneity of the sample. To address the concerns of homogeneity, a second sample was collected using MTurk.

4.3.2 Sample Size

The sample size was determined by comparing the sample sizes in the previous categorization literature. The desired sample size for the study was N=50. The larger sample of MTurkers was obtained to observe differences between the two groups.

4.3.3 Stimuli

The ten vegetables were decided upon based on the top ten vegetables with the highest export numbers in Canada (Agriculture Canada, 2016). Using national export or sales data has been used to determine the appropriate stimuli for sorting tasks consisting of everyday people (Johnson & Mervis, 1997). The ten vegetables (in no particular order) were as follows: Asparagus, Zucchini, Broccoli, Cucumber, Carrot, Peas, Potato, Lettuce, Brussels Sprout & Tomato. The vegetables were obtained from the Google images website and each photo was 130 x 150mm in size. The vegetable stimuli can be viewed in appendix C (p. 131).
4.4 Measures

4.4.1 Awareness

Awareness was measured by conducting an awareness task to observe the awareness level of ten vegetables. The awareness task asked the participants their level of awareness for each of the ten vegetables, from 1= Know well, 2=Know by name and 3=First time seeing vegetable. For an example of the awareness task, please refer to appendix K (p.116). This awareness task was followed by the vegetable ranking task.

4.4.2 Ranking Task

The participants were asked to rank the 10 vegetables from their top choice, to last choice. After the ranking task was completed the sample groups completed the five categorization (sorting) tasks. The categorization tasks were adapted from Jaeger et als’ (2017) methodology. Please refer to appendix K for an example of the online sorting task. Participants had to complete a vegetable awareness task, a ranking task, five categorization (sorting) tasks and then the 30 questions to measure FN, Food Skills and Intake.

4.4.3 Food Neophobia

Food Neophobia was measured by the food neophobia scale (FN) developed by Pliner & Hobden (1992). Food neophobia measured individuals’ level of fear towards food items that are unfamiliar/unknown to the participant, their level of openness to try new foods and their degree of acceptance of new foods. The food neophobia scale included eight items. An example of the FN scale was “If I don’t know what is in a food, I won’t try it”. For all questions the participants were asked to choose the appropriate value for each question on a 7-point scale that ranged from 1 (strongly disagree) to 7 (strongly agree). The reliability of the FN scale was demonstrated with a Cronbach’s alpha of 0.7 (Pliner & Hobden, 1992). Based on the moderate Cronbach’s alpha,
the present research decided to modify the scale by not including the general neophobia subscale that was included by Pliner & Hobden (1992). The full scale can be viewed in appendix D.

4.4.4 Food Skills

Food Skills was assessed by adopting the scale made by Lavelle et al (2017). The food skills scale was composed of four attributes; meal planning and preparing, shopping, budgeting & resourcefulness and each question was presented in the format “how often do you”. For the meal planning and preparing attribute there were three questions. An example of a question for this subscale would be “how often do you follow recipes when cooking?”.

For the shopping attribute there were three questions, and an example would be “how often do you shop with a grocery list”. The four-item budgeting attribute measured individual’s knowledge about food costs and seasonality. An example of a question from the budgeting subscale was “how often do you compare prices when you buy food?”.

The resourcefulness attribute contained five items, an example question from the attribute would be “how often do you prepare or cook a healthy meal with only few ingredients on hand?”. Participants were asked to select the value that represents their behavior for each question on a 7-point scale that will range from 1 (rarely) to 7 (always). The reliability of the Food Skills scale was demonstrated with a Cronbach’s alpha of .89 (Lavelle et al., 2017). The Food Skills scale can be viewed in appendix E.

4.4.5 Categorization Tasks

The categorization tasks were adopted from the methodologies of Ross & Murphy, (1999), Blake et al., (2007), Gaillard & Urdapilleta (2011) & Rioux et al., (2016). The categorization methodologies used by the previous researchers consisted of similarity tasks (asking participants
to group items based on perceived similarity), feature generation tasks (asking participants if the item has a certain feature) and sorting tasks (asking participants to sort items based on a goal).

For the categorization tasks in the present study, participants were asked to categorize 10 vegetables in five different tasks. These tasks involved a free sort task (task #1), a familiarity task (task #2), a preference task (task #3), an ease of preparation task (task 4) and a cooking method task (task 5), each task will now be explained in detail.

During categorization task #1 participants were asked to “observe the 10 vegetables and sort them into groups any way that makes sense to you”. The participants could sort the vegetables in a maximum of six groups. After this task was completed the participants were asked to explain the reasoning behind their categorization, using an open-ended question “can you explain how you decided to sort the vegetables into groups?”. The goal of this task was to observe how individuals categorized the vegetables and how they decided to define their categories.

Categorization task #2 asked participants to sort the vegetables based on their level of familiarity from “extremely familiar to not familiar at all” into a maximum of six categories. Categorization task #3 asked about their vegetable preference, from “prefer a great deal to do not prefer”. Categorization task #4 asked participants to sort vegetables based on ease of preparation, from “very easy to prepare to very difficult to prepare”. Categorization task #5 asked participants to sort the vegetables based on how they would cook each vegetable from “bake/roast, boil, pan fry, eat raw, microwave and stir-fry”. The purpose of these categorization tasks was to observe if vegetable categories and preferences were different for those with high and low levels of food skills or food neophobia.

4.4.6 Intake
Intake was addressed by measuring two questions to understand the participants intake of healthy food. The first question asked them about their enjoyment of consuming vegetables from “strongly agree to strongly disagree”. The second question was to identify their self perception of healthy eating, “I would consider myself someone who eats healthy” using “strongly agree to strongly disagree”. Research has demonstrated that individuals typically report themselves as healthier than they actually are, during self-reports (Larkin & Martin, 2016). These questions were used to observe if there were baseline differences in vegetable consumption between the two sample groups.

4.5 Procedure of Coding for Ranking Task

Based on the rankings of the ten vegetables, probability equations were constructed to predict the likelihood of each vegetable, for each preference ranking. The choice rankings were gathered from the ranking task that took place at the beginning of the study. The purpose of constructing probability equations for each preference rankings was to understand the participant’s vegetable preferences, using the ranking data. The ranking task was used in our context to understand the vegetable preferences of each individual.

The ranking task asked the participants to “please rank the vegetables from 1-10 based on your preference (liking), with 1 being your most preferred to 10 being your least preferred. Please use your computer mouse to move each vegetable around in the list”. To explain how these rankings can be used to understand preferences, an example will be provided. There are four vegetables (A, B, C, D) that the respondent must sort in order of preference, from most preferred to least. The participant provides the following ranking B, A, C, D. Based on the probability equation outlined below, this would suggest that the individuals preferred B over A,
A over C and C over D. Although there are 4 vegetables, the participant only had made 3 choice rankings, and vegetable D was “leftover”.

If we denote $U_A$ as utility of A and $U_B$ to denote utility of B and so on, then:

$$U_B > U_A > U_C > U_D$$

$$\text{Prob} (B > A > C > D) = \frac{U_B}{U_A + U_B + U_C + U_D} \times \frac{U_A}{U_A + U_C + U_D} \times \frac{U_C}{U_C + U_D}$$

For our probability equation that has ten vegetable choices, there would be nine equations. The following ranking equations assume that all decision makers rank their preferences in the same way, using the top down method. According to Chapman & Staelin (1982) the estimation of parameters of the stochastic utility model requires the availability of the following data from the decision makers:

1. The alternative in each decision makers choice set
2. The actual alternative chosen
3. The numerical value of each quantifiable attribute associated with the choice alternatives

The model operates on the principle of revealed preference: the alternative chosen by the decision maker is assumed to be preferred to all other alternatives in the decision maker’s choice set. To keep each utility positive, utility is equal to systematic effect and random error, that is $U_A = \exp(b_A + \text{error})$ and one vegetable b is set to zero for identification purposes. Under suitable assumptions about error distribution (R. G. Chapman, 1982) resulting model states that:

Rank 1: First Choice means this vegetable is preferred over all the other nine vegetable choices

$$\text{Prob(Top Rank)} = \frac{\exp(veg_1)}{\sum_{j=1}^{10} \exp(veg_j)}$$
Rank 2: Second choice means this vegetable is preferred over the eight other vegetable choices

\[ \text{Prob(Second Rank)} = \frac{\exp(v_{e}g_2)}{\sum_{j=2}^{10} \exp(v_{e}g_j)} \]

\[ \vdots \]

\[ \vdots \]

Rank 9: The ninth choice means this vegetable is preferred over the one other vegetable

\[ \text{Prob(Rank = 9)} = \frac{\exp(v_{e}g_9)}{\exp(v_{e}g_9) + \exp(v_{e}g_{10})} \]

The \( v_{e}g_1 - v_{e}g_9 \) coefficients were estimated using the maximum likelihood method. The maximum likelihood method is used to estimate the parameters of the model (Fields, 2009). The coefficients were used to predict the ranking of each vegetable and predict the samples’ vegetable preferences. This method is ideal for the present study because it is not susceptible to bimodally distributed variables.

Data analysis was conducted using SAS and R-Studio software. Before the analysis was conducted the data were reviewed to identify missing values and normality was observed. Multinomial logit regression (MNL) does not assume that the data is normally distributed. In addition, MNL does not assume linearity or homoscedasticity (Starkweather & Moske, n.d).

Multinomial logit regression is used when the dependant variable is a nominal scale of measure and there are more than two independent variables that could influence the outcome. Multinomial logistic regression is used to predict the probability of a problem that has more than two possible outcomes (Starkweather & Moske, n.d). The variables must be nominally distributed, this means that the distribution of the discrete probability variable has K number of potential groups (R. G. Chapman, 1982).
Assumptions:

1. Individuals use the same decision rule to rank the vegetables from 1-10.

2. There are individual differences between participants, assuming heterogeneity. This simply means that there are assumed differences between individuals’ rankings. These differences are based on personal likes or dislikes. However, the assumption can be made that food neophobia and food skills are predicting some part of vegetables preferences. In the interest of the present research, individual differences are ignored.

To demonstrate support for our research hypotheses our research approach began with the analysis of the five categorization tasks to understand what information these tasks were able to capture, we then focused on capturing the measures from our two scales (Food Neophobia & Food Skills). Once this was completed, we were able to analyze the ranking data. When all of the necessary variables were analyzed we were then able to propose a series of models, to discover which one would best predict vegetable preferences. Last, to be able to visually compare the ranking data between the two sample groups we were able to employ Multidimensional Scaling (MDS). The model development will be briefly discussed.

4.6 Model Development

Alternative multivariate techniques were considered, based on the number of independent variables & the characteristics of the dependant variables a multinomial logit model (MNL) was decided as the superior model to use for the present study. The model consisted of three independent variables (food neophobia, food skills & categorization) and one dependant variable (vegetable preferences) as revealed through the vegetable ranking task. The number of parameters, and additional variables added will be discussed.
Chapter 5 Results of Data Analysis

The results observed from the data analysis are threefold. First, the results obtained from the five categorization tasks yielded significance observed between all tasks and FN. However, there was no significance observed between the five categorization tasks and Food Skills. These results were obtained from observing Pearson correlations between variables and conducting five one-way analyses of variances (ANOVAs) to observe if the mean score between each categorization task, FN and Food Skills was statistically significant (p<.05).

Second, the ranking task was analyzed by constructing nine choice equations that reflected each individuals’ nine vegetable ranks. The results that were observed from the ranking data revealed that the most preferred vegetables for the sample group was the Potato and the least preferred was the Brussels Sprouts.

Third, six models were estimated to observe the best fit to predict vegetable preferences. Chi Square and Log Likelihood was observed from all models, and the results demonstrated that the null hypotheses were able to be rejected for Model 4, 5 & 6 which demonstrates that each models’ additions added effect that is statistically significant (p<.05). When Log Likelihood was observed, Model 6 was selected as the superior model to predict vegetable preferences.

5.1 Sample Characteristics

Guelph sample: The gender distribution for group one was 28% males & 72% females. The majority of participants were between the ages of 18-39. This age distribution is unsurprising considering most university students are between the ages of 18-25 years old. Among the 50 participants, 86 percent somewhat agreed to strongly agreed that they would consider themselves someone who eats healthy, and 96% percent of participants somewhat to strongly agreed that they enjoy eating vegetables.
**MTurk sample:** Group two consisted of 62% males and 38% females. The majority of participants were between the ages of 18-39. Interestingly, the gender distribution for each sample is almost opposite of each other. Among the 221 participants, 76 percent somewhat agreed to strongly agreed that they would consider themselves someone who eats healthy, and 88% percent of participants somewhat to strongly agreed that they enjoy eating vegetables. The sample characteristics of both sample groups can be viewed in appendix B.

5.2 Food Neophobia and Food Skills Scales Summary

5.2.1 Reliability of Scales

Reliability analysis was conducted using SPSS, the purpose of this analysis was to assess the validity of the scales used in the current study. To understand if the eight items were all measuring the same latent variable (FN), a Cronbach’s alpha was conducted on the sample of 270 participants (cases). All eight items were selected for the reliability analysis, a Cronbach’s alpha of 0.84 was observed. The high Cronbach’s alpha means that the inter-item correlation of the FN scale is also high. To observe of the twelve items were all measuring the same latent variable (Food Skills), a Cronbach’s alpha of 0.77 was observed. The Cronbach’s alpha for the Food Skills Scale was not as high as the Food Neophobia but was still deemed acceptable (.70 or higher). The lower Cronbach’s alpha for Food Skills could suggest that these twelve items do not fully capture Food Skills.

**Table 2: Reliability Statistics**

<table>
<thead>
<tr>
<th>Scale Name</th>
<th>Cronbach’s Alpha</th>
<th>Cronbach’s Alpha based on standardized Items</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Neophobia Scale</td>
<td>0.7</td>
<td>0.841</td>
<td>8</td>
</tr>
<tr>
<td>Food Skills Scale</td>
<td>0.767</td>
<td>0.767</td>
<td>12 of 15</td>
</tr>
</tbody>
</table>

Table 2 Interpretation: Cronbach’s alpha measures inter-related correlation between scale items between 0 and 1.
5.2.2 Descriptive Data: Food Neophobia & Food Skills

Table 3: Descriptive Statistics of Food Neophobia Items

<table>
<thead>
<tr>
<th>#</th>
<th>Food Neophobia Scale Items</th>
<th>Reversed</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Min</th>
<th>Max</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I am constantly sampling new foods</td>
<td>yes</td>
<td>2.85</td>
<td>1.86</td>
<td>7</td>
<td>1</td>
<td>268</td>
</tr>
<tr>
<td>2</td>
<td>I do not trust new foods</td>
<td>no</td>
<td>4.83</td>
<td>1.75</td>
<td>1</td>
<td>7</td>
<td>265</td>
</tr>
<tr>
<td>3</td>
<td>If I do not know what is in a new food, I won't try it</td>
<td>no</td>
<td>4.32</td>
<td>1.76</td>
<td>1</td>
<td>7</td>
<td>268</td>
</tr>
<tr>
<td>4</td>
<td>I like eating food from different countries</td>
<td>yes</td>
<td>2.5</td>
<td>1.43</td>
<td>7</td>
<td>1</td>
<td>267</td>
</tr>
<tr>
<td>5</td>
<td>Ethnic food looks too weird to eat</td>
<td>no</td>
<td>4.75</td>
<td>1.84</td>
<td>1</td>
<td>7</td>
<td>270</td>
</tr>
<tr>
<td>6</td>
<td>At dinner parties, I will try a new food</td>
<td>yes</td>
<td>2.54</td>
<td>1.45</td>
<td>7</td>
<td>1</td>
<td>267</td>
</tr>
<tr>
<td>7</td>
<td>I am very particular about the foods I will eat</td>
<td>no</td>
<td>3.88</td>
<td>1.76</td>
<td>1</td>
<td>7</td>
<td>264</td>
</tr>
<tr>
<td>8</td>
<td>I will eat almost anything</td>
<td>no</td>
<td>3.79</td>
<td>1.8</td>
<td>1</td>
<td>7</td>
<td>267</td>
</tr>
<tr>
<td></td>
<td>Scale Summary</td>
<td></td>
<td>28.54</td>
<td>6.18</td>
<td>8</td>
<td>56</td>
<td>260</td>
</tr>
</tbody>
</table>

The mean score of the FN scale for the sample was 28.54 with a standard deviation of 6.18.

This standard deviation can be used to define the number of participants in the sample that had low and high FN scores. Using the first standard deviation from the mean, (28.54 ± 6.182), any participant with a score between of 28 or lower would have a low FN score, and any one
participant with a score of 29 and above would be considered to have a high score. The
distribution of scores can be viewed in table 3.

*Table 4: Descriptive Statistics of Food Skills Items*

<table>
<thead>
<tr>
<th>Food Skills</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Min</th>
<th>Max</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 How often do you plan meals ahead? (e.g. for the day/week ahead)</td>
<td>2.97</td>
<td>1.1</td>
<td>1</td>
<td>5</td>
<td>268</td>
</tr>
<tr>
<td>2 How often do you prepare meals in advance?</td>
<td>3.29</td>
<td>1.1</td>
<td>1</td>
<td>5</td>
<td>267</td>
</tr>
<tr>
<td>3 How often do you follow recipes when cooking?</td>
<td>3.01</td>
<td>1.08</td>
<td>1</td>
<td>5</td>
<td>270</td>
</tr>
<tr>
<td>4 How often do you shop with a grocery list?</td>
<td>2.68</td>
<td>1.22</td>
<td>1</td>
<td>5</td>
<td>266</td>
</tr>
<tr>
<td>5 How often do you shop with specific meals in mind?</td>
<td>2.78</td>
<td>1.1</td>
<td>1</td>
<td>5</td>
<td>267</td>
</tr>
<tr>
<td>6 How often do you compare prices before you buy food?</td>
<td>2.58</td>
<td>1.13</td>
<td>1</td>
<td>5</td>
<td>265</td>
</tr>
<tr>
<td>7 How often do you know what budget you have to spend on food?</td>
<td>2.37</td>
<td>1.12</td>
<td>1</td>
<td>5</td>
<td>268</td>
</tr>
<tr>
<td>8 How often do you buy food in season to save money?</td>
<td>2.88</td>
<td>1.12</td>
<td>1</td>
<td>5</td>
<td>269</td>
</tr>
<tr>
<td>9 How often do you buy cheaper cuts of meat to save money?</td>
<td>3.08</td>
<td>1.17</td>
<td>1</td>
<td>5</td>
<td>270</td>
</tr>
<tr>
<td>10 How often do you cook more or double recipes which can be used for another meal?</td>
<td>2.96</td>
<td>1.14</td>
<td>1</td>
<td>5</td>
<td>268</td>
</tr>
<tr>
<td>11 How often do you prepare or cook a healthy meal with only a few ingredients on hand?</td>
<td>3.01</td>
<td>1.02</td>
<td>1</td>
<td>5</td>
<td>269</td>
</tr>
<tr>
<td>12 How often do you keep basic items in your cupboard for putting meals together?</td>
<td>2.49</td>
<td>1.12</td>
<td>1</td>
<td>5</td>
<td>270</td>
</tr>
<tr>
<td>Scale Summary</td>
<td>37.52</td>
<td>7.10</td>
<td>12</td>
<td>60</td>
<td>260</td>
</tr>
</tbody>
</table>
The mean score of Food Skills for the sample was 37.5 with a standard deviation of 7.1. Based on the maximum scale score of 60, the maximum score achieved by the sample was a 57, although this was only achieved by a few participants, these high scores influenced the mean ($\bar{X} = 37.5$) to be significantly higher, compared to the FN mean score ($\bar{X} = 28.5$).

### 5.3 Categorization Tasks

The categorization data that was analyzed composed of the first category of the five categorization tasks and the categorization of the ten vegetables. The analysis was conducted using SPSS software. The first category of the categorization tasks was used to observe if there was a relationship between the number of vegetables mentioned in the first category and the participants food neophobia scores or food skills.

The decision of using the first category of each task was decided because these were likely the vegetables that were the most “top of mind” for the participants. Moreover, by analyzing only
the first category this allowed for in-depth analysis of what vegetables were placed most
frequently, in each categorization task. This link is suggested by the present author based on the
idea that, if people listed a higher number of vegetables as “prefer a lot”, “easy to prepare” or
“very familiar” they would have a lower food neophobia or higher food skills score compared to
people who listed very few vegetables as “very familiar” “or easy to prepare”.

A decrease in the number of vegetables that are placed in the first category, for these
categorization tasks would exemplify an individual who has low food skills or high food
neophobia. Understanding that our approach (using only the first category) slightly deviates from
traditional analysis of categorization variables, our approach is exploratory in nature.

The purpose of these categorization tasks was to understand the different ways people
categorize vegetables. Despite the many differences between the participants, the analysis of the
sorting tasks was able to identify similarities between which vegetables were perceived by the
group as the most familiar, preferred and easiest to prepare. For the purposes of comparing the
overall perception of the ten vegetables, the two sample groups were combined after determining
that their means were not statistically different (N=270).
5.3.1 First Category Descriptive Statistics

Table 5: Free Sort Categorization Task – First Category

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Percent of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td>61*</td>
<td>7%+</td>
<td>24%≠</td>
</tr>
<tr>
<td>Zucchini</td>
<td>127</td>
<td>15%</td>
<td>49%</td>
</tr>
<tr>
<td>Broccoli</td>
<td>159</td>
<td>19%</td>
<td>61%</td>
</tr>
<tr>
<td>Cucumber</td>
<td>109</td>
<td>13%</td>
<td>42%</td>
</tr>
<tr>
<td>Carrots</td>
<td>82</td>
<td>10%</td>
<td>32%</td>
</tr>
<tr>
<td>Peas</td>
<td>73</td>
<td>9%</td>
<td>28%</td>
</tr>
<tr>
<td>Potato</td>
<td>63</td>
<td>7%</td>
<td>24%</td>
</tr>
<tr>
<td>Lettuce</td>
<td>64</td>
<td>8%</td>
<td>25%</td>
</tr>
<tr>
<td>Brussels Sprouts</td>
<td>57</td>
<td>7%</td>
<td>22%</td>
</tr>
<tr>
<td>Tomato</td>
<td>56</td>
<td>7%</td>
<td>22%</td>
</tr>
<tr>
<td>Total</td>
<td>851</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Table 5 Interpretation: * 61 individuals considered Asparagus to be top category.  
+ This represents 7% of all 851 vegetables  
≠ 24% of 272 (number of respondents)

The frequencies in table 5 show which vegetables were placed in the first category of the free sort categorization task. The frequency of each vegetable is the amount of times each vegetable was placed in the first category by the 270 participants. The percentage column represents the frequency as a percentage (dividing the frequency for each vegetable by the frequency total). The percent of cases column explains the percentage of participants that placed the vegetable in their first category.
Because the free-sort task was open-ended (the vegetables could be sorted any way) the frequencies do not provide very much information. However, broccoli contributed to nearly 20% of the total frequency. This means that broccoli was the vegetable that was most frequently placed in the first category, for the free sort task. This observation is interesting considering broccoli was not mentioned as the most preferred or familiar vegetable. This could suggest that many consumers thought that categorizing broccoli (a vegetable that is quite familiar) was a good place to start, before they tried to tackle vegetables that they were either less familiar with or did not like.

The free sort categorization task (task #1) was followed by an open-ended question asking the participants to explain how they sorted the vegetables into their prospective categories. The explanations for the open-ended question in the free sort categorization task were analyzed individually for words that explained the participant’s categorization strategy. The frequency of each theme can be viewed in table 6. The analysis revealed five major themes that described how people categorized their vegetables. The themes that arose from the free sort explanations were as follows.

The first theme was identified as “Health”. Health was defined as any mention of calories or nutrition content in the participants explanation. The second theme was “preference”, this theme was defined as any mention of personal likes or dislikes. The third theme was defined as natural categories, this was coded based on any mention of how vegetables grow to describe their categories. The fourth theme was “meal type”, this theme was defined as any mention of categorization based on time of day, or type of meal each vegetable would be used for. The final theme was identified as any mention of color or shape to explain their categories. If a participant mentioned two themes to explain their categorization strategy, the theme that was explained first
was selected. The themes were coded as 1=Health, 2=Preference, 3=Natural Categories, 4=Meal Type and 5=Color/Shape.

*Table 6: Frequency of Five Categorization Themes*

<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency</th>
<th>Most Commonly Used Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theme 1: Health</td>
<td>26</td>
<td>Calories, Starch, Vitamin</td>
</tr>
<tr>
<td>Theme 2: Preference</td>
<td>120</td>
<td>Like, Dislike, Prefer</td>
</tr>
<tr>
<td>Theme 3: Natural Categories</td>
<td>46</td>
<td>Root, Soil, Tubular, Fruit</td>
</tr>
<tr>
<td>Theme 4: Meal Type</td>
<td>38</td>
<td>Salad, Snack, Dinner, Boil</td>
</tr>
<tr>
<td>Theme 5: Color/Shape</td>
<td>40</td>
<td>Green, Red, Long, Round</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td></td>
</tr>
</tbody>
</table>

By analyzing the open-ended question, the results demonstrated that 44% of participants used their preferences to explain their categorization strategy. This finding suggests that focusing on the sample’s preferences would aid in understanding their relative FN and Food Skill scores.
Table 7: Familiarity Categorization Task – First Category: Most Familiar Vegetables

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Frequency</th>
<th>Percent</th>
<th>Percent of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td>96</td>
<td>6%</td>
<td>37%</td>
</tr>
<tr>
<td>Zucchini</td>
<td>104</td>
<td>7%</td>
<td>40%</td>
</tr>
<tr>
<td>Broccoli</td>
<td>174</td>
<td>11%</td>
<td>67%</td>
</tr>
<tr>
<td>Cucumber</td>
<td>169</td>
<td>11%</td>
<td>65%</td>
</tr>
<tr>
<td>Carrots</td>
<td>195</td>
<td>12%</td>
<td>75%</td>
</tr>
<tr>
<td>Peas</td>
<td>159</td>
<td>10%</td>
<td>61%</td>
</tr>
<tr>
<td>Potato</td>
<td>201*</td>
<td>13%+</td>
<td>78%≠</td>
</tr>
<tr>
<td>Lettuce</td>
<td>186</td>
<td>12%</td>
<td>72%</td>
</tr>
<tr>
<td>Brussels Sprouts</td>
<td>89</td>
<td>6%</td>
<td>34%</td>
</tr>
<tr>
<td>Tomato</td>
<td>191</td>
<td>12%</td>
<td>74%</td>
</tr>
<tr>
<td>Total</td>
<td>1564</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Table 7 Interpretation: *201 individuals considered Potato to be top category.
+ This represents 13% of all 1564 vegetables
≠ 78% of 272 (number of respondents)

Table 7 demonstrates which vegetables were perceived as the most familiar to the participants. Unsurprisingly, the potato was considered the most familiar vegetable among the sample with 78% of participants placing the vegetable in the most familiar category. Carrots and Tomatoes were the second (75%) and third (74%) most familiar vegetables. Conversely, Brussels Sprouts occurred the least in the highly familiar category, accounting for only 6% of the total frequency. These results are slightly unsurprising considering the widespread acceptance of the potato, compared to other vegetables (Paisley, Sheeshka, & Daly, 2001; Yi, Kanetkar, & Brauer, 2015). Moreover, the low occurrence of Brussels Sprouts in the highly familiar category is in line with the sample’s vegetable preferences obtained from the ranking task, which can be viewed in
Table 8. Disregarding Brussels Sprouts, Asparagus & Zucchini, familiarity for the remaining seven vegetables is quite high (70%) for the whole sample group.

Table 8 (below) revealed which vegetables were perceived as the most preferred vegetables according to the sample. The most preferred vegetable was the potato which accounted for 17% of the total frequency and 67% of the participants placed this vegetable in the “prefer the most” category. The least preferred vegetable was Brussels Sprouts and Zucchini was second-least preferred. The values in the “percent of cases” column demonstrates that there are a significant number of people who do not prefer Asparagus, Zucchini & Brussels Sprouts, which is in line with vegetable intake reports of larger populations (Teschl et al., 2018; Yi et al., 2015).

Table 8: Preference Task – First Category: Most Preferred Vegetables

<table>
<thead>
<tr>
<th>Vegetables</th>
<th>Frequency</th>
<th>Percent</th>
<th>Percent of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td>73</td>
<td>7%</td>
<td>28%</td>
</tr>
<tr>
<td>Zucchini</td>
<td>57</td>
<td>6%</td>
<td>22%</td>
</tr>
<tr>
<td>Broccoli</td>
<td>116</td>
<td>11%</td>
<td>45%</td>
</tr>
<tr>
<td>Cucumber</td>
<td>100</td>
<td>10%</td>
<td>39%</td>
</tr>
<tr>
<td>Carrots</td>
<td>121</td>
<td>12%</td>
<td>47%</td>
</tr>
<tr>
<td>Peas</td>
<td>85</td>
<td>8%</td>
<td>33%</td>
</tr>
<tr>
<td>Potato</td>
<td>172</td>
<td>17%</td>
<td>67%</td>
</tr>
<tr>
<td>Lettuce</td>
<td>108</td>
<td>11%</td>
<td>42%</td>
</tr>
<tr>
<td>Brussels Sprouts</td>
<td>53</td>
<td>5%</td>
<td>21%</td>
</tr>
<tr>
<td>Tomato</td>
<td>133*</td>
<td>13%+</td>
<td>52%≠</td>
</tr>
<tr>
<td>Total</td>
<td>1018</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Table 8 Interpretation: *133 individuals considered Tomato to be top category. + This represents 13% of all 1018 vegetables ≠ 52% of 272 (number of respondents)
According to the sample, a notable percentage of the participants did not categorize the majority of the vegetables as easy to prepare. Consistent with the familiarity and preference tables, Brussels Sprouts were rated as easiest vegetables to prepare by only 18% of the sample. It could be suggested that the significantly low value is reflective of the vegetable’s low familiarity and preference frequency, compared to the other nine vegetables.

Cucumber, Tomato and Lettuce were most frequently considered the easiest vegetables to prepare. These three vegetables were also most frequently mentioned as the vegetables that would be “Eat Raw” in the meal method task and included in a “Salad” for the meal task. Because there is minimal work involved when preparing a salad and a salad is typically made with raw vegetables, the findings in table 9 are consistent.

Table 9: Preparation Task – First Category: Extremely Easy to Prepare

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Percent of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td>72</td>
<td>6%</td>
<td>28%</td>
</tr>
<tr>
<td>Zucchini</td>
<td>77</td>
<td>6%</td>
<td>30%</td>
</tr>
<tr>
<td>Broccoli</td>
<td>114</td>
<td>10%</td>
<td>44%</td>
</tr>
<tr>
<td>Cucumber</td>
<td>145</td>
<td>12%</td>
<td>56%</td>
</tr>
<tr>
<td>Carrots</td>
<td>135</td>
<td>11%</td>
<td>52%</td>
</tr>
<tr>
<td>Peas</td>
<td>121</td>
<td>10%</td>
<td>47%</td>
</tr>
<tr>
<td>Potato</td>
<td>134</td>
<td>11%</td>
<td>52%</td>
</tr>
<tr>
<td>Lettuce</td>
<td>169</td>
<td>14%</td>
<td>65%</td>
</tr>
<tr>
<td>Brussels Sprouts</td>
<td>46*</td>
<td>4%+</td>
<td>18%≠</td>
</tr>
<tr>
<td>Tomato</td>
<td>173</td>
<td>15%</td>
<td>67%</td>
</tr>
<tr>
<td>Total</td>
<td>1186</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Table 9 Interpretation: *46 individuals considered Brussels Sprouts to be top category.
+ This represents 4% of all 1186 vegetables
≠ 18% of 272 (number of respondents)
The findings in table 10 outline what vegetables the sample would “bake/roast” as a cooking method. Due to the specific method of baking/roasting, there are few vegetables that standout over others. Consistent with the preference table, Potato was the vegetable most frequently mentioned as most acceptable for “roasting/baking”, which made up over 20% of total frequency. Moreover, two-thirds of the sample placed potato in the bake/roast category. The vegetable with the second highest frequency was the zucchini, which was 14% of the total frequency. Although Zucchini was not mentioned in top vegetables that were most preferred, it could be suggested that “baking/roasting” is the desired cooking method of the people who enjoy the vegetable.

Table 10: Cooking Method Task – First Category: Bake/Roast

<table>
<thead>
<tr>
<th>Vegetables</th>
<th>Frequency</th>
<th>Percent</th>
<th>Percent of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td>95</td>
<td>12%</td>
<td>37%</td>
</tr>
<tr>
<td>Zucchini</td>
<td>109*</td>
<td>14%+</td>
<td>42%≠</td>
</tr>
<tr>
<td>Broccoli</td>
<td>106</td>
<td>13%</td>
<td>41%</td>
</tr>
<tr>
<td>Cucumber</td>
<td>60</td>
<td>7%</td>
<td>23%</td>
</tr>
<tr>
<td>Carrots</td>
<td>79</td>
<td>10%</td>
<td>30%</td>
</tr>
<tr>
<td>Peas</td>
<td>32</td>
<td>4%</td>
<td>12%</td>
</tr>
<tr>
<td>Potato</td>
<td>171</td>
<td>21%</td>
<td>66%</td>
</tr>
<tr>
<td>Lettuce</td>
<td>24</td>
<td>3%</td>
<td>9%</td>
</tr>
<tr>
<td>Brussels Sprouts</td>
<td>89</td>
<td>11%</td>
<td>34%</td>
</tr>
<tr>
<td>Tomato</td>
<td>40</td>
<td>5%</td>
<td>15%</td>
</tr>
<tr>
<td>Total</td>
<td>805</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Table 10 Interpretation: *109 individuals considered Zucchini to be top category.
+ This represents 14% of all 805 vegetables
≠ 42% of 272 (number of respondents)
To summarize the findings of the categorization analysis, there appears to be a high preference, familiarity and use of baking/roasting cooking method for the potato. Additionally, there appears to be a strong agreement for the low familiarity, preference and ease of cooking frequencies for Asparagus, Zucchini & Brussels Sprouts. Although the percentage of each vegetable’s frequency that contributed to the total has a small distribution, all three tables displayed the smallest frequency values for these three vegetables.

Despite the individual differences in the categorization tasks, the seven other vegetables were considered highly familiar by over 70% of the sample. Based on the three tables, the preference of the ten vegetables was consistent with the first category of perceived familiarity and ease of cooking categorization tasks. These tables also demonstrate that the categorization tasks were able to successfully predict the preferences of the sample. The results of the five tables demonstrate support that categorization can help determine individuals’ vegetable preferences. Table 11 outlines how many vegetables were in the first category for all five categorization tasks.

Table 11: Frequency of Vegetables in First Category: All Categorization Tasks

<table>
<thead>
<tr>
<th>Categorization Task</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>+2 Standard Deviations</th>
<th>-2 Standard Deviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free sort</td>
<td>272</td>
<td>2.85</td>
<td>1.71</td>
<td>3.67</td>
<td>2.03</td>
</tr>
<tr>
<td>Familiarity</td>
<td>272</td>
<td>5.89</td>
<td>3.07</td>
<td>9.31</td>
<td>2.50</td>
</tr>
<tr>
<td>Preference</td>
<td>272</td>
<td>3.27</td>
<td>1.77</td>
<td>4.03</td>
<td>2.51</td>
</tr>
<tr>
<td>Ease of Preparation</td>
<td>272</td>
<td>4.48</td>
<td>2.69</td>
<td>6.61</td>
<td>2.35</td>
</tr>
<tr>
<td>Cooking Method</td>
<td>272</td>
<td>2.10</td>
<td>1.38</td>
<td>2.64</td>
<td>1.56</td>
</tr>
</tbody>
</table>

For Categorization task #1, an average of three and a standard deviation of less than two vegetables were in the first category. This means that the majority of participants used more then
one category to sort their vegetables, in the first categorization task. Task #2 had an average of six and a standard deviation of three vegetables in the first category. This high mean demonstrated that of the ten vegetables that were presented, the majority of the participants found most of the vegetables highly familiar. For task #3 there were an average of three and a standard deviation of two vegetables in the first category. This low standard deviation could suggest that there was a low number of people in the sample who highly preferred more than half of the vegetables.

During task #4 there was an average of four and standard deviation of 3 vegetables in the first category. This high mean shows that some people (over half) thought the vegetables were easy to prepare, and there were about a quarter of individuals who felt that less than two to three vegetables or more than seven were easy to prepare. Finally, during task #5 there were only an average of two and a standard deviation of one vegetable in the first category. The low mean could suggest that only a small number of vegetables were considered appropriate to roast/bake as a preparation method.

Overall, the familiarity task (task 2) had the highest number of vegetables in the first category. This demonstrates that the majority of participants were very familiar with the ten vegetables that were selected. Moreover, this difference in vegetables placed in the first category between different categorization tasks could suggest that another variable, such as food neophobia or food skills could be driving these differences in means, between categorization tasks. For example, if the majority of the sample was familiar with most of the vegetables but they did not prefer the majority of the vegetables, what could be the reasoning behind their preferences?
5.3.2 Categorization Tasks, Food Neophobia & Food Skills

To measure the strength of the linear relationship between the categorization tasks, FN and Food Skills, Pearson correlation coefficients were observed between each variable. Observing the first row (free sort) it appears that there is no strong or moderate linear relationship between any of the variables, all variables have a low positive correlation. Moving to the second row (familiarity), there is a strong positive correlation with ease of preparation ($r = 0.64$). This relationship suggests that as familiarity of a vegetable increased, so did the ease of preparation. A moderate positive relationship was also observed between familiarity and FN. This relationship suggests that individuals with familiarity was moderately determined by their FN score. Those who sorted more items in task 1 sorted more in familiar task. Most important, the extremely weak correlation between FN & Food Skills, demonstrates support that the two variables are independent of each other ($r=0.003$).

To understand if there was a positive correlation between food neophobia and the five categorization tasks, descriptive statistics were employed. The results demonstrated that there was a strong positive correlation between the familiarity categorization task (task 2) and food neophobia scores ($r=0.52$). The preference categorization task (task 3) & food neophobia scores were found to be positively correlated ($r=0.23$). The ease of preparation categorization task (task 4) & Food Neophobia scores were found to be positively correlated ($r=0.40$). Last, the scores from the vegetable preparation method categorization task (task 5) and food neophobia scores were found to be positively correlated ($r=0.20$).

Conversely, the positive correlations found between Food Skills and the five Categorization were very weak. Interestingly, the preference Categorization task (task 3), was found to have a negative correlation with Food Skills. This finding is consistent with the researcher’s idea that,
The categorization & preferences of vegetables

Individuals with higher neophobia scores would have less vegetables in category one. This would mean the person would have less vegetables that they highly prefer. A summary table of the categorization tasks, food neophobia and food skills correlations can be viewed in table 12.

Table 12: Means, Std Deviations and Correlations of FN, Food Skills and Categorization Tasks

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Free Sort</th>
<th>Familiar Preference</th>
<th>Ease</th>
<th>Cook</th>
<th>FN</th>
<th>Food Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free Sort</td>
<td>2.85</td>
<td>1.71</td>
<td>1.00</td>
<td>0.34</td>
<td>0.23</td>
<td>0.26</td>
<td>0.10</td>
<td>0.19</td>
</tr>
<tr>
<td>Familiar</td>
<td>5.89</td>
<td>3.07</td>
<td>1.00</td>
<td>0.43</td>
<td>0.64</td>
<td>0.23</td>
<td>0.52</td>
<td>0.05</td>
</tr>
<tr>
<td>Preference</td>
<td>3.27</td>
<td>1.77</td>
<td>1.00</td>
<td>0.48</td>
<td>0.10</td>
<td>0.23</td>
<td>-0.007</td>
<td></td>
</tr>
<tr>
<td>Ease</td>
<td>4.48</td>
<td>2.69</td>
<td>1.00</td>
<td>0.25</td>
<td>0.40</td>
<td>0.009</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cook</td>
<td>2.10</td>
<td>1.38</td>
<td>1.00</td>
<td>0.20</td>
<td>0.003</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FN</td>
<td>28.54</td>
<td>6.18</td>
<td></td>
<td></td>
<td>1.00</td>
<td>0.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Skills</td>
<td>37.52</td>
<td>7.10</td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 12 Interpretation: # of items in the first category of free sort task and familiarity have a low positive correlation of 0.34.

The values in tables 12 demonstrate that FN had a significant impact on the free sort task. If the participant had a higher FN score, this would add one extra vegetable to the first category of the free sort task. Conversely, if the participant had a low food neophobia score, this would minus one vegetable from their first category of the free sort task. These values were obtained by using a regression equation that contained the intercept of the dependant variable, the intercept for FN & Food Skill scores and the mean number of items for the FN & Food Skills scores. These regressions equations were calculated to explain how much each coefficient contributed to the overall effect of each categorization tasks.

To summarize, the results in table 12 demonstrate that the categorization tasks were associated with food neophobia but not food skills. Neophobia scores significantly influenced all the five categorization tasks. The way the vegetables were categorized by the participants were
influenced by their neophobia scores. These results demonstrate support for the idea that food neophobia influences the categorization of vegetables. Using this information, the next section will discuss the analysis of the vegetable ranking task and how categorization, food neophobia and food skills were suggested to predict vegetable preferences.

To observe if there were noticeable difference between the categorization tasks, FN and Food Skills, five one-way analyses of variance were conducted to observe the differences in means. These ANOVAs were conducted to observe if the means of the five categorization tasks, FN and Food Skills were statistically different from each other.

The first analysis of variance was to test the null hypothesis that there was no difference in adults’ number of vegetables in the first category of their free-sort categorization task based on their Food Neophobia (FN) and Food Skills scores (N=272). The second analysis of variance was to test the null hypothesis that there was no difference in adults’ number of vegetables in the first category of their familiarity categorization task based on their FN and Food Skills scores (N=272).

The third analysis of variance was to test the null hypothesis that there was no difference in adults’ number of vegetables in the first category of their preference categorization task based on their FN and Food Skills scores (N=272). The fourth analysis of variance was to test the null hypothesis that there was no difference in adults’ number of vegetables in the first category of their ease of preparation categorization task based on their FN and Food Skills scores (N=272). The fifth analysis of variance was to test the null hypothesis that there was no difference in adults’ number of vegetables in the first category of their cooking method categorization task based on their FN and Food Skills scores (N=272). Table 13 summarizes the findings from the five ANOVAs.
Table 13: Impact of Food Neophobia & Food Skills on Categorization

<table>
<thead>
<tr>
<th></th>
<th>Intercept</th>
<th>FN</th>
<th>Food Skills</th>
<th>R Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free sort</td>
<td>0.64*</td>
<td>0.35**</td>
<td>0.19</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>(0.11)</td>
<td>(0.22)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Familiarity</td>
<td>-2.89</td>
<td>1.74**</td>
<td>0.22</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>(0.17)</td>
<td>(0.34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preferences</td>
<td>1.37</td>
<td>0.44**</td>
<td>-0.06</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>(0.11)</td>
<td>(0.22)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of Prep</td>
<td>-0.90</td>
<td>1.17**</td>
<td>-0.03</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>(0.16)</td>
<td>(0.32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooking</td>
<td>0.74</td>
<td>0.29**</td>
<td>-0.01</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
<td>(0.18)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Interpretation: * found to be statistically sig at .05 level and ** found to be statistically sig at .01 level
- Number of items in top free sort categories is equal to 0.64 + 0.35(FN) + 0.19(Food Skills)

The results of the table 13 demonstrate the five categorization tasks were found to have means that were statistically different from the means of FN and Food Skills scores. Significance of the ANOVAs was determined at the .05 level. For the free sort task, there is a significance value of .005, and therefore the null hypotheses can be rejected (p<.01). For the familiarity task, there is a significance value of 0, which means there is a high difference between the mean scores (p<.01) and the null hypothesis can be rejected. For the preference task, a significance level of .001 can be observed, which means the null hypothesis can be rejected. For the ease of preparation task, the p value is significant and therefore the null hypothesis is rejected and the mean scores between the ease of preparation task, FN & food Skills, are statistically different (p=.025). The cooking method task revealed a significance level of .004 and therefore the null hypothesis can be rejected (p<.01).
5.3 Analysis of Ranking Data

The dependant variable of interest is vegetable preferences which was measured using the vegetable ranking data. The hypotheses were tested using the ranking data of each vegetable and ranking placement, to observe overall preference for each vegetable, according to the sample group. The ranking data is based on the rank each participant gave for each vegetable and total ranking score were observed and based on each vegetable’s ranking, vegetable preferences were obtained.

Table 14: Vegetable Preference Ranking Table (n=270)

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Asparagus</th>
<th>Zucchini</th>
<th>Broccoli</th>
<th>Cucumber</th>
<th>Carrots</th>
<th>Peas</th>
<th>Potato</th>
<th>Lettuce</th>
<th>Brussels Sprouts</th>
<th>Tomato</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44</td>
<td>12</td>
<td>20</td>
<td>18</td>
<td>37</td>
<td>13</td>
<td>77</td>
<td>12</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>20</td>
<td>40</td>
<td>37</td>
<td>29</td>
<td>20</td>
<td>34</td>
<td>20</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td>15</td>
<td>45</td>
<td>26</td>
<td>32</td>
<td>20</td>
<td>39</td>
<td>27</td>
<td>16</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>22</td>
<td>22</td>
<td>38</td>
<td>39</td>
<td>30</td>
<td>30</td>
<td>24</td>
<td>10</td>
<td>35</td>
</tr>
<tr>
<td>5</td>
<td>22</td>
<td>29</td>
<td>38</td>
<td>31</td>
<td>35</td>
<td>34</td>
<td>17</td>
<td>27</td>
<td>14</td>
<td>23</td>
</tr>
<tr>
<td>6</td>
<td>18</td>
<td>27</td>
<td>25</td>
<td>30</td>
<td>30</td>
<td>32</td>
<td>17</td>
<td>40</td>
<td>22</td>
<td>29</td>
</tr>
<tr>
<td>7</td>
<td>27</td>
<td>40</td>
<td>32</td>
<td>25</td>
<td>26</td>
<td>26</td>
<td>18</td>
<td>33</td>
<td>29</td>
<td>14</td>
</tr>
<tr>
<td>8</td>
<td>31</td>
<td>33</td>
<td>24</td>
<td>33</td>
<td>19</td>
<td>29</td>
<td>16</td>
<td>34</td>
<td>37</td>
<td>14</td>
</tr>
<tr>
<td>9</td>
<td>28</td>
<td>47</td>
<td>16</td>
<td>21</td>
<td>13</td>
<td>36</td>
<td>11</td>
<td>29</td>
<td>52</td>
<td>17</td>
</tr>
<tr>
<td>10</td>
<td>31</td>
<td>25</td>
<td>8</td>
<td>11</td>
<td>10</td>
<td>30</td>
<td>11</td>
<td>24</td>
<td>75</td>
<td>45</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>270</td>
<td>270</td>
<td>270</td>
<td>270</td>
<td>270</td>
<td>270</td>
<td>270</td>
<td>270</td>
<td>270</td>
</tr>
</tbody>
</table>

Table 14 Interpretation: Asparagus was ranked as the first choice by 44 participants

Table 14 shows the ranking of each vegetable and the number of times each vegetable received a 1-9 ranking. Vegetable preference was used as a binary variable to explain consumer choice and these choices would reflect the consumer’s preferences. The first choice represents the most preferred option or ranked choice compared to all other options, the second choice would represent the preferred choice, over all left-over choices, and this choice task would continue until the last two vegetable remain and result in the final choice, choice nine with one option (vegetable) left over. As shown in table 14, the potato was the vegetable that was most
frequently participants first choice, over the other nine vegetables. By observing the frequency of
ranked choice for each vegetable preference for each vegetable can be derived.

By understanding the distribution of each vegetable, the preferences can be observed
(figure 2). The frequency of ASPARAGUS is bimodal, in relation to vegetable preference, this
means that the sample either strongly prefers or strongly dislikes ASPARAGUS. These
preferences can be inferred by observing the highest frequencies for the first & second or eighth
& ninth ranking choice. CUCUMBER has a unimodal distribution and the highest frequencies
for the fourth and second choice. This means that CUCUMBERS are liked but there are other
vegetables that are preferred more. TOMATO has a unimodal distribution and the frequencies
are highest for the second and tenth rank choice. This means that the preferences for TOMATO
are polarizing, meaning that people either strongly like or dislike TOMATO.

The distribution of POTATO is unimodal, and frequency is highest for the first choice.
This means that a over 33% of the sample ranked POTATO as their first choice. This high
preference for the POTATO is not surprising, especially for individuals who do not consume
vegetables daily. BRUSSELS SPROUTS has a unimodal distribution and the highest
frequencies for the ninth and tenth rank choices. This is not surprising considering the notorious
mentions of BRUSSELS SPROUTS being the least preferred vegetable by the sample. The low
ranking means there is a very low preference for BRUSSELS SPROUTS, and it would be the last
choice for 28% of the sample. CARROTS have a slightly normal distribution, with the highest
frequencies for the fourth choice, but frequency overall is quite high. This means that people in
the sample generally like CARROTS and many people ranked them as their first choice.

PEAS have a bimodal distribution and the highest frequencies are in the middle and end
choice ranks. This means that the preference for PEAS in the sample is mediocre. An additional
set of the sample show a strong dislike for PEAS, based on the high frequency for the ninth rank choice. The frequency of ZUCCHINI is unimodal and choice ranking is the highest for the seventh choice. Based on this ranking, ZUCCHINI appears to be not overly liked, but also not strongly disliked. BROCCOLI appears to have a unimodal distribution and the choice ranking is highest for the third and second choice. Based on the choice ranking, BROCCOLI is well liked based on the sample. LETTUCE has a normal distribution, and the highest frequency is the sixth rank choice. In relation to preference, this means that people are more indifferent about lettuce. Preference could be explained by lettuce’s neutral taste or it’s limited number of preparation methods.

Figure 2: Comparing the Distribution of Ten Vegetables
To summarize, the ranking data was analyzed for the ten vegetables, and the 9 possible rankings. The rankings can be seen in appendix G. The most preferred vegetable (the vegetable that was ranked as number one the most) for both samples groups was the Potato. The second most preferred vegetable was different for the two sample groups. For the Guelph sample the cucumber was ranked second and for the MTurk sample, broccoli was ranked second. The least preferred vegetable for both samples was the Brussels Sprout.

5.4 Model Specifications

This section will describe the specifications of the models that are proposed to predict vegetable perceptions. Multinomial logit model (MNL) was inspired by the Stochastic Utility
Model or the economies choice model (Chapman & Staelin, 1982). The Stochastic Utility model assumes that all choice makers have a goal of maximizing their utility. Based on this assumption, these choices reflect the person’s choice and demonstrates their most preferred items, and each choice states that the person prefers choice I over all other possible options.

5.4.1 Index Construction & Technique

To include these FN & Food Skills numbers in the MNL model, multiplicative variables were constructed and each vegetable dummy coding of 0 and 1 variable was multiplied by value of FN and value of FS score. This dummy coding explains the set of nine parameters for each sample, as Asparagus was the base vegetable.

There is no index created when we are using categorization variables. For each vegetable, we constructed a variable that indicates whether that vegetable was in the top category or not. If the vegetable was in the top category for the task, it was coded with as (1), vegetables that were not in the top category of the tasks were coded as (0).

The models were estimated to find the superior predictor of vegetable preference. To estimate our base model, we looked at the ranking preferences from both groups. Next, we added both of the scales, food neophobia and food skills. We did this in alternate order because the order could affect the significance levels. We then decided to add awareness to the model to see if there was an improvement in fit. Next, to capture the significance of the five categorization tasks, we began by adding the first two tasks to the model (free-sort & familiarity tasks). We wanted to see the difference that these two tasks would have in the significance levels. Finally, we added the remaining three categorization tasks (ease to prepare, cooking method & preference). The Preference categorization variable represents how much the vegetable was preferred. This effect was quite different from the preference effect that was being captured by
the preference ranking task, which asked participants which vegetables they preferred out the choices available. Based on these differences, it was decided to include both preference variables in the final model.

5.4.2 Models

Model 1 looked at the vegetable ranking preferences of the Guelph sample. Model 1 consisted of 9 parameters. This model demonstrates that it would accurately predict the vegetable preferences of the University of Guelph sample (p < 0.001).

Model 2 looked at vegetable ranking preferences for both groups. Model 2 consisted of 18 parameters, with the addition of 9 parameters for ranking position of MTurk sample. This model more accurately predicted the vegetable rankings for both sample groups. However, it did not predict the model better than model 1, it provides rankings for both sample groups (p < 0.001).

Model 3 looked at the addition of the Food Skills items for each vegetable ranking, which consisted of 9 additional items. Model 3 had 27 parameters consisting of nine food skills items and 18 parameters for ranking positions for the two sample groups. Model 3 was able to more accurately predict vegetable rankings, with the addition of the Food Neophobia items, although it does not predict the model better than model 2, model 3 provides more information because of the additions of the Food Skills items (p < 0.001).

Model 4 looked at only the addition of Food Neophobia items for each vegetable ranking, this scale consisted of 9 items to measure FN. Model 4 was constructed to observe the effect that FN had on the ranking positions. Model 4 had 27 parameters, 9 FN scale items and 18 for the ranking positions of the two sample groups. Although model 4 does not predict the model better than model 3, model 4 allows for the observation of changes in vegetables ranks that can be attributed to FN.
Model 5 looked at the addition of Food Skills items, Food Neophobia items & an additional item to capture awareness of individual vegetables. Model 5 had 37 parameters consisting of nine Food Neophobia items, nine Food Skills items, one parameter for awareness of individual vegetables, and 18 parameters for ranking positions for the two groups. Model 6 was not able to more accurately predict vegetable rankings compared to model 5. Although the model did not predict better, it added additional information because of the addition of the awareness variable. Despite the unimproved fit, model 5 was able to predict vegetable preferences \( (p < 0.001) \).

Model 6 looked at the addition of two variables that captured the first (free-sort) and second (familiarity) categorization tasks. Model 6 had 39 parameters consisting of two Categorization items, one parameter for awareness of individual vegetables, nine Food Neophobia items, nine Food Skills items, and 18 parameters for ranking positions for the two groups. Model 6 was not able to more accurately predict vegetable rankings compared to model 5. Although the model did not predict better, it added additional information because of the addition of the two categorization tasks. Despite the unimproved fit, model 6 was still able to predict vegetable preferences \( (p < 0.001) \).

Model 7 looked at the addition of the three variables that captured the third (preference), fourth (ease of preparation) and fifth (cooking method) categorization tasks. Model 7 had 42 parameters consisting of five Categorization items, nine Food Neophobia items, nine Food Skills items, one parameter for awareness of individual vegetables, and 18 parameters for ranking positions for the two groups. Despite the unimproved fit, model 7 was not able to better predict vegetable preferences \( (p<0.001) \). Due to the improved fit and ability to capture the categorization tasks that were significant, model 6 was accepted as the superior model for predicting vegetable preferences, \( (p < 0.001) \). A summary of the seven models can be viewed in table 15.
Table 15: Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>Log-Likelihood</th>
<th>Number of Estimates</th>
<th>Chi-Square Observed</th>
<th>Chi-square critical at 0.05</th>
<th>Accept/Reject</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1: Base (intercepts)</td>
<td>-3913</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>M2: M1 + MTurk</td>
<td>-3904</td>
<td>18</td>
<td>18</td>
<td>16.92</td>
<td>reject</td>
</tr>
<tr>
<td>M3: M2 + Food Skills</td>
<td>-3900</td>
<td>27</td>
<td>8</td>
<td>16.92</td>
<td>accept</td>
</tr>
<tr>
<td>M4: M2 + FN</td>
<td>-3891</td>
<td>27</td>
<td>26</td>
<td>16.92</td>
<td>accept</td>
</tr>
<tr>
<td>M5: M3 + FN + Aware</td>
<td>-3869</td>
<td>37</td>
<td>44</td>
<td>18.31</td>
<td>reject</td>
</tr>
<tr>
<td>M6: M5 + Free Sort +</td>
<td>-3767</td>
<td>39</td>
<td>204</td>
<td>3.84</td>
<td>reject</td>
</tr>
<tr>
<td>M7: M6 + Preference +</td>
<td>-3509</td>
<td>42</td>
<td>516</td>
<td>7.81</td>
<td>reject</td>
</tr>
</tbody>
</table>

Table 15 Interpretation: Observe differences between Log likelihoods to determine if there is improved fit, * .05 significance level observed, ** .01 significance level observed

To compare the variables added in each model, in efforts to improve the fit, please refer to appendix I. The Chi-squared test $X^2$ takes the log likelihood difference between the two models multiplied by 2. The purpose of the Chi-Square test is to observe goodness of fit between the observed value and critical value (Fields, 2009). The null hypotheses for Chi-Square are based upon normal distribution, therefore if the null is rejected, there is not normal distribution. When the observed Chi-Square is greater than critical value, the null hypothesis can be rejected. This means that the added effect from Model 5, 6 & 7 are statistically significant to our model.

5.4.3 Sensitivity Analysis:

To demonstrate the use of our model a sensitivity analyses was conducted to observe potential changes in utility of certain vegetables, when significant variable values are changed. If
the average awareness score was added to the estimate score of each vegetable, the change in utility for each vegetable would remain unchanged. However, by conducting a brief sensitivity analysis there are noticeable changes in utility based on the change in awareness, in certain vegetables. This analysis was conducted to see if there would be noticeable changes, based on changing the awareness cell value for certain vegetables.

\[
\frac{\exp(a)}{\exp(a) + \exp(b)} = P_0
\]

\[
\frac{\exp(a + c)}{\exp(a + c) + \exp(b + c)} = P_1
\]

Base Condition: \[
\frac{\exp(a+\text{average})}{\exp(a+\text{average})+\exp(b+\text{average})} = P_0
\]

In the present study there was a choice of three awareness levels to select for each vegetable. 1 = know well, 2 = know by name only and 3 = first time seeing name. Table 16 demonstrates the changes that would occur in the utility scores, based on the participants awareness level of asparagus. For example, if the MTurk sample knew asparagus well (column one), this would increase the utility of the asparagus significantly (9%). However, if the sample only knew the vegetable by name (low awareness), the utility of asparagus would decrease significantly to under 5%. This change in utility is the most noticeable for vegetables with low overall awareness among the MTurk sample.
Table 16: Effect of Awareness on First Choice of Asparagus

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Guelph sample)</td>
<td>9%</td>
<td>6.5%</td>
<td>4.6%</td>
</tr>
<tr>
<td>Asparagus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(MTurk sample)</td>
<td>8.4%</td>
<td>8%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Asparagus</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 15 Interpretation: Changes in utility for asparagus, based on change in participants’ awareness
1 = know well, 2 = know by name, first time seeing vegetable

The difference in awareness score for asparagus could be partially explained by seasonality and accessibility. Asparagus are typically a seasonal vegetable and have a significantly shorter season compared to other vegetables (Tanis, 2016). However, by observing the similar difference in utility with the Guelph sample, seasonality does not appear to be an issue.

5.7 Hypotheses Findings

The multinomial logistic regression was conducted to model the relationship between food neophobia, food skills, categorization and vegetable preferences. The traditional .05 criterion of statistical significance was used for all model testing. The fit between the model and the data was significantly improved by the addition of the intercepts. The hypotheses will be analyzed from three diverse perspectives. The first, looks at the hypotheses from a viewpoint of the overall model. This view will help uncover if the attribute adds any additional insight to the consumers vegetable preferences. The second will look at each individual attribute and see if it is statistically significant predictor of vegetable preferences. The third view will observe the level of importance each attribute provides to the proposed model.

Hypothesis 1: Food Neophobia influences vegetable preferences (Supported)

H1: Food Neophobia influences vegetable preferences

From the overall model perspective, hypothesis 1 is supported. The relationship between Food Neophobia and the five categorization tasks were all found to be statistically significant. Based on the MNL model, the inclusion of food neophobia scores significantly helped predict
vegetable preferences as seen in appendix H (p.112). When the importance of the attribute is observed, similar results are revealed, Food Neophobia appears to contribute significantly to the fit of the model. Moreover, when looking at the five categorization tasks, all tasks were found to be significant. When looking from the importance of an attribute viewpoint, food neophobia is one of the most critical attributes when predicting vegetable preferences from the two sample groups. The third viewpoint, these observations are consistent when hypothesis 1 is viewed from a specific attribute perspective.

**Hypothesis 2: Food Skills influence vegetable preferences (not supported)**

_H2: Food Skills influence vegetable preferences_

From the overall model perspective, hypothesis 2 is not supported. There was no statistically significant relationship observed between food skills and any of the five categorization tasks. Based on the model, the inclusion of food skill scores did not help predict vegetable preferences as seen in appendix H (p.112). When the importance of the attribute is observed, similar results are demonstrated. When looking from the importance of an attribute viewpoint, food skills is not recognized as an important-attributes when predicting vegetable preferences. From the third viewpoint, these observations are not consistent when hypothesis 2 is viewed from a specific attribute perspective. The attributes had a high reliability, despite not reaching statistical significance in the present study.

**Hypothesis 3: Categorization influences vegetable preferences (supported)**

_H3: Categorization influences vegetable preferences_

From the overall model perspective, hypothesis 3 is supported. A statistically significant relationship was observed between all five categorization tasks and vegetable preferences. Based on the model, familiarity (task #2) and ease of preparation (task #4) appear to contribute the most
to the Categorization effect. When the importance of the attribute is observed, similar results are demonstrated. When looking from the importance of an attribute viewpoint, all of the categorization tasks are recognized as important-attributes when predicting vegetable preferences. From the third viewpoint, these attributes had a high reliability, which was supported by all five tasks reaching statistical significance.

5.8 Multidimensional Scaling

The ranking data was analyzed by using the nine ranking measures obtained by each participant. These ranking measures formed a matrix for each participant. These matrices were formed using SAS software and the numbers in this matrix were used to compute the coordinates for the MDS task. To construct the MDS map, each vegetable had a ranking for each participant. Coordinates were calculated by taking the average ranking for the vegetable for each of the 10 vegetables. The vegetable ranking distance from first rank and ninth (last) rank acted as coordinates on the map and the Euclidean distance between each item was calculated using indirect distance approach. The two maps can be found in appendix I.

5.8.1 MDS Interpretation

The Euclidean distance model for the MTurk sample, can be interpreted in a few different ways. The dimensions of the graph appear to be preference on the vertical axis and awareness on the horizontal. First, looking at the vertical axis there is TOMATO in the very top and BSprouts slightly below, the placement of these vegetables resembles the preference ratings of these vegetables. The horizontal axis shows POTATO in the far-left corner, demonstrating a strong awareness level and ZUCCHINI, BSPROUTS and ASPARAGUS on the far right, demonstrating that the awareness level for these vegetables was the lowest.
Observing the Euclidean distance model for the Guelph sample, it appears that dimensions of the graph appear to be preference on the vertical axis and ease of preparation on the horizontal. When observing the vertical dimension, ASPARAGUS & POTATO appear to be the most preferred and TOMATO AND BRUSSELS SPROUTS are the least. Looking at the horizontal dimension, CUCUMBER, TOMATO and POTATO are considered the easiest to prepare and B'SPROUTS appear to be the most difficult.

Comparing the two maps, there are some interesting differences. CUCUMBER appears to be on the far left for the Guelph sample, but for the MTurk sample it is almost directly in the middle of the map. Although there are some small changes in the vegetable coordinates, the maps look quite similar.

5.9 Summary

Data analysis was performed using multiple techniques and steps. Each scale was tested for reliability. This was followed by an analysis of the categorization tasks by observing frequency of each vegetable and conducting five one-way ANOVAs. Next, a rank logit was computed to compare the ranking of the ten vegetables with both sample groups. The fourth step of the data analysis was to conduct a multinomial logit model to observe which model best predicted vegetable preferences. The final step was to utilize multidimensional scaling (MDS) to observe the differences in vegetable preferences between the two sample groups. Nine people were omitted from MTurk data because their completion time was below three minutes, meaning they could have provided unreliable responses.

Chapter 6 Discussion

The following section will discuss the results found in the present study and how they compare to the findings in previous literature.
Food Neophobia was able to successfully predict vegetable preferences. This finding was in line with the research conducted by Rioux et al (2016) & Jaeger, Rasmussen & Prescott (2017). The former author’s results demonstrated that food neophobia effects individual’s ability to categorize food items. The findings of the present study extend this research by demonstrating that food neophobia was able to successfully predict, vegetable preferences. These results contribute to the food neophobia literature that focuses on the importance of adults, rather than children.

Moreover, the positive relationship between Food Neophobia and vegetable preferences in an adult sample is consistent with the findings in Jaeger, Rasmussen & Prescott’s (2017) study. In addition to the works of Jaeger, Rasmussen & Prescott (2017), the present study was able to find a positive relationship between categorization & preferences and food neophobia & preferences. These findings provide a novel contribution to the food neophobia, categorization & preferences literature.

In addition, the results of the present study emphasize that food neophobia does not only influence how consumers treat vegetables that they perceived to be similar or alike (categorization). The present research was able to observe how FN influences physical vegetable preferences. By going beyond observing categorization, and linking this variable to preferences, this link allows us to suggest that food neophobia physically influences consumers preferences and intake of vegetables.

The results of the present research were able find a positive correlation between Food Neophobia and all five Categorization tasks. Previous research that has measured food neophobia as an independent variable of categorization has rarely performed more than one or two categorization tasks Rioux et al (2016).
Categorization task #1 (familiarity task) contributed significantly to the improvement of the model. This result is unsurprising considering that the majority of vegetables were regarded as highly familiar by over 2/3 of the sample. Categorization task #4 (ease of preparation) also contributed significantly to the vegetable prediction model. It is possible that the ease of preparation task could also be capturing some of the effect that would have been observed if cooking skills was considered in the model. The results of the present research demonstrate that food neophobia and categorization both play a significant role in predicting vegetable preferences. The present research was also able to demonstrate the categorization outputs captured in the first category of each Categorization task were able to predict vegetable preferences.

The familiarity task (task 2) was greatly influenced by food neophobia. Meaning that individuals with higher food neophobia scores, categorized less of the ten vegetables as “very familiar”, compared to individuals with low food neophobia scores. The relationship was also observable for the ease of preparation task (Task #4), which demonstrated that individuals with high neophobia scores categorized less vegetables as “very easy to prepare” compared to individuals with low neophobia scores. This finding is based on the idea that categorization improves as knowledge increases (Johnson & Mervis, 1997). The research demonstrated in the present study were able to indirectly demonstrate a positive link between categorization and knowledge, through the task of vegetable preparation, which is a skill that involves knowledge about the category.

The findings from the ranking task were able to reflect vegetable preferences from a considerably large sample size, which improves the external validity of the present research. The findings of the ranking task demonstrated that there were many differences in the sample’s
vegetable preferences. Despite these differences, there were some notable similarities. The vegetables that was ranked #1 the greatest number of times in the ranking task was the Potato, for both sample groups.

This preference for the potato can be interpreted in a few ways. First, potatoes are a very widely available vegetable and they are relatively inexpensive compared to other vegetables. This high availability and low cost could be a partial reason for the high preference of that potato. Second, there is many ways consumers can prepare potatoes and this could simply mean that a consumer could have a higher awareness for the potato, which reflects their high preference. Third, the white color could be perceived as more of a neutral tasting vegetable, compared to a green vegetable which could suggest that consumers are more likely to try it, in the first place. As demonstrated by Drewnowski (1996), he found that the color of the vegetables was highly influential consumers preferences.

The vegetable that was ranked #2 the most was the Cucumber for Guelph sample and Broccoli for MTurk sample. The differences in these vegetable rankings could be explained because of awareness levels, or ease to prepare or a higher consumption of fresh vegetables. Cucumber being the vegetable that was ranked second the most often could mean that this sample group prefers vegetables that are very easy to prepare, or they could consume more vegetables in their “raw” state, compared to MTurk sample. Moreover, the higher preference for cucumber could also suggest that Guelph sample may have a higher desire for convenience, compared to sample 2. The high preference score for broccoli could likely be explained by awareness. Broccoli is a vegetable that is used in a wide number of cuisines, can be consumed “raw” or cooked and can be purchased fresh or frozen. This higher preference for broccoli could
suggest that participants in MTurk sample may consume more frozen vegetables, compared to Guelph sample.

Both groups came to a clear agreement when the last vegetable rank was analyzed. Brussels Sprouts were selected by both groups as the vegetable that was leftover (after the 9th rank), and least preferred. The explanation for the strong dislike for Brussels Sprouts could be explained by awareness, ease to prepare or familiarity. The majority of the sample (68%) felt that Brussels Sprouts were “somewhat to very difficult” to prepare. This finding demonstrates that there is a strong barrier to Brussels Sprout consumption, because people do not know how to prepare them. In addition to this finding, the sample also found that Brussels Sprouts were mentioned as “highly familiar” the least amount of times, compared to the other nine vegetables. Based on these categorization results, it was unsurprising that the Preference Categorization task (Task #3) resulted in over 46% of the sample selected “prefer slightly less to do not prefer at all” for Brussels Sprouts. Based on these explanations, Food Neophobia, Categorization, awareness and ease of preparation each played a critical role in determining the vegetable preferences of the sample groups.

The models estimated in the present research were able to better predict vegetable preferences. The model that was estimated using the vegetable intercepts, MTurk rankings, FN, Food Skills, Awareness, Free sort categorization and familiarity task was able to best predict vegetable preferences (M6). The addition of preference, ease of preparation and cooking method tasks appeared to have a statistically significant effect but when the Log Likelihood was observed after these additions, it did not result in an improved fit.

Unfortunately, food skills were not able to predict vegetable preferences. There are several potential reasons why this variable did not reach significance. Based on the MNL model, it could
be suggested that the effect of food skills was primarily driven by the knowledge of the vegetable. This knowledge portion of the effect may have already been captured with the addition of the awareness variable, therefore the remaining effect of food skills was not strong enough to reach statistical significance.

Chapter 7 Contributions & Limitations

7.1 Theoretical & Methodological Contributions

The theoretical contributions of the present study are fourfold. First, the present study contributes to the categorization literature by introducing the first study to focus on solely vegetables. The findings of the present study demonstrate support that ranking tasks can be used to predict consumer preferences. In addition, the present study aimed to address a single category to understand the underlying perceptions of the single food group (vegetables).

The findings of the present study also support the research conducted by Jaeger, Rasmussen & Prescott (2017) on food neophobia and adults. Demonstrating positive findings that food neophobia being a predictive variable of vegetable preferences helps to highlight the significance of avoidant behavior. The findings build on the literature about vegetable consumption barriers.

Third, the present study was able to demonstrate that categorization plays a significant role in predicting consumers vegetable preferences. This link that has been observed between categorization and preferences, is novel contribution to the categorization literature. Moreover, the results obtained from the present study emphasize the importance of categorization tasks, and how the results from them reflect consumers preferences. By going beyond vegetable intake, the present research was able to uncover vegetable preferences and has started to understand why some vegetables are more liked/disliked than others.
Moreover, the present research was able to successfully capture categorization using an online methodology. Previous categorization research typically used in-person experiments to observe how people categorize. The online methodology was able to observe categorization and understand the participant’s underlying strategy. The use of the online method reduced significant amount of time and potential errors that can be a result of in-person interventions. The findings of the present research demonstrate a positive outcome for the use of online categorization in future research.

The final contribution is the approach of the present study. The current research took a novel approach of understanding the under consumption of vegetables, looking beyond intake to be able to understand the psychological underpinnings of what motivates or does not motivate people to consume vegetables. Moreover, the methodology of the present research demonstrates an alternative way to uncover consumer preferences. The utilization of ranking data allowed the researchers to measure preferences in a way that was drastically more discrete, compared to alternative methods such as multiple-choice questions, or self-report surveys.

7.2 Managerial Implications

The present study helps marketers understand how food neophobia influences consumers perception of vegetables. The present study can provide recommendations to retail stores on how to better market vegetables that may have lower awareness to consumers. Moreover, expanding marketers understanding of food neophobia helps them be able to understand how to market vegetables to people who may be more averse to eat them, (introduce convenience packaging, and include more education-based labelling on how to prepare and shop for fresh vegetables).

Furthering the study of food neophobia helps marketers to understand the barriers to consumption for healthy foods, for people whom demonstrate high levels of food neophobia,
intervention needs to begin as early as possible. Past research such as Galloway, Lee & Birch’s 2003 research showed that Food Neophobic parents tend to raise neophobic children. For food neophobia to be reduced, adult intervention is crucial to prevent an increase of food neophobia in the next generation.

The results of the free-sort (task 1) open-ended questions revealed that the majority of the sample categorizes their vegetables based on preference. This is a significant disconnect between how consumers think about vegetables and how dietitians and marketers communicate the benefits of vegetables to consumers. Currently, the benefits of vegetable consumption are communicated by using nutrition and health-based messaging, however this appears to be the least used strategy that participants used to categorize their vegetables.

Based on the findings from the current study, preference and meal (context) based messaging that emphasizes convenience would be significantly more effective. Instead of “Asparagus are part of a healthy diet” the marketers could use “Asparagus can be cooked in under 10 minutes” or “Dislike the bitter taste of Brussels Sprouts? Instead of boiling, try oven-roasting”. These messages not only communicate the way a vegetable can be cooked but also highlights the convenience factor that consumers desire.

In addition, the methodology of the present study helps to uncover vegetable preferences, which can influence their purchase intentions. In addition, ranking tasks offer a short and cost-effective way to gather preference-based data on consumers, that is more accurate than self-report questionnaires. To reduce time and costs, marketing professionals can use ranking tasks to understand consumer perceptions in a way that is also less time consuming for their participants.
7.3 Limitations

Limitations of the present study will now be discussed. First, there is room for improvement with the scales used in this study. The food neophobia scale contained 12 items. However, due to the high correlation between items it is unknown which items were the most significant to the model.

Moreover, the food skills scale did not reach statistical significance in the proposed model. It is unknown if the addition of the attributes impacted the significance of the food skills scale. The present study added the food neophobia items first and then the food skill items. It could be suggested that if the food skills scale was added prior to the food neophobia scale, significance could have been achieved. Moreover, a factor analysis may have identified significance within the sub-scale and this could have improved the scale used by the present study.

An additional limitation could be the small number of items in the category. The present study only accounted for 10 vegetables and it is possible that this not enough to get a full picture of the entire vegetable category. Moreover, allergies and diet patterns were not addressed in the survey, this may have influenced rankings. Last, the design of the ranking task did not allow for any ties in preference, which may limit the accuracy of the rankings.

7.4 Future Research

There are several areas that could be considered for future research to further understand adult’s vegetable perceptions. The most obvious topic area to further investigate is awareness of vegetables. Although this variable was measured, it was not mentioned in the hypotheses of the current study. For next steps, awareness of vegetables should be more thoughtfully considered as a significant predictor of vegetables preferences.
A potential area that could be explored could be looking at vegetable preferences beyond, only fresh vegetables. As the research conducted by Yi, Kanetkar & Brauer (2015) demonstrated, many consumers who consume less vegetables, on average purchase more frozen than fresh (Yi et al., 2015). By exploring the perception of frozen vegetables, this could provide more insight about why people choose to consume or not consume certain vegetables.

The final area for potential in future research is understanding the value of ranking task to better understand how this reflects preferences. The present study assumed that all participants utilized the same decision rule when performing the ranking task, however this is not necessarily true. This methodology question should be addressed by looking at how ranking method can change for different individuals, through qualitative approach.
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https://doi.org/10.1016/j.appet.2016.10.011

Appendix A: Consent Form

(ELECTRONIC CONSENT FORM)
CONSENT TO PARTICIPATE IN RESEARCH

Vegetable Intake Study

You are invited to participate in research studies conducted by:
Dr. Vinay Kanetkar (Associate Professor, Marketing & Consumer Studies)
Allison Abernethy (MSc Student, Marketing & Consumer Studies)
The results of these studies will be used towards a master's thesis.

If you have any questions or concerns about the research, please feel free to contact Allison Abernethy, MSc Student, Marketing and Consumer Studies at 902-670-0410 or qtan@uoguelph.ca. You can also contact the principal investigator, Dr. Vinay Kanetkar at vkanetka@uoguelph.ca.

This is an online study that will be completed in person
By providing consent for this research session, you will complete the following online study

PURPOSE OF STUDY

The purpose of this study is to understand eating habits of Ontario adults and how they purchase and prepare their daily meals.

PROCEDURES

If you volunteer to participate in this study, the following will be applicable to you:
1. You will be compensated with a 10-dollar amazon gift card (Guelph sample) or 1.65 CAD (MTurk sample)
2. You will be asked to complete a survey about your food habits, vegetable consumption and food preparation knowledge

Overall, it is expected that this study will take around 20 minutes to complete. You will not be contacted in the future for follow-up sessions; however, if you have any further questions or concerns about the research project, you can contact Dr. Vinay Kanetkar at vkanetka@uoguelph.ca or student investigator Allison Abernethy at aabernet@uoguelph.ca.

If participants wish to access the report they can visit the atrium portal on the University of Guelph website. The atrium portal can be accessed via the University of Guelph’s website at www.lib.atrium.uoguelph.ca. Click the side bar to search for the Graduate Researcher “Allison Abernethy” and they will be able to read and download the printed report after it is approved in May 2019. The table of contents will guide the individuals to the results.

EXCLUSION/INCLUSION CRITERIA

Inclusion:
1. You are at least 18 years old
2. Capacity to Consent – We will not allow any individuals to participate in our study if they are not physically able to understand the purpose of the study and therefore are not able to provide informed consent.

POTENTIAL RISKS AND DISCOMFORTS

There is a potential to feel a slight discomfort when being asked about food habits or vegetable consumption, please understand there is no right answer, simply be as honest as you can in your responses. Your answers will remain anonymous and individual results will not be disclosed. If you start participating in the study and feel uncomfortable at any point, you are free to withdraw without penalty.

POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

You will have a better understanding of your own food habits by participating in this study, you may also be exposed to new/unfamiliar foods. In addition, this research will help to advance knowledge in the field of marketing and consumer studies.

PAYMENT FOR PARTICIPATION

You will receive a 10-dollar amazon gift card for your participation

CONFIDENTIALITY

Every effort will be made to ensure confidentiality of the participants. All information will be stored on a password protected,
encrypted computer which will remain locked when not in use. The two researchers will be the only individuals who will have access to the data. All electronic data will be deleted after 5 years. Please note that confidentiality cannot be guaranteed while data is in transit over the internet. During dissemination, participants will be identified indirectly.

**PARTICIPATION AND WITHDRAWAL**
Participation in this study is voluntary and you are under no obligation to participate. Should you choose to withdraw during the study, your data will not be saved, and there will be no record of it. However, once you have completed the study, you are able to withdraw your data 24 hours after your study completion by emailing the researcher. You may also refuse to answer any questions you do not want to answer and will still remain in the study and receive your compensation.

**RIGHTS OF RESEARCH PARTICIPANTS**

i. This project has been reviewed by the University of Guelph Research Ethics Board for compliance with federal guidelines for research involving human participants.

ii. If you have any questions regarding your rights and welfare as a research participant in this study, please contact: Director, Research Ethics; University of Guelph; reb@uoguelph.ca; 519-824-4120 ext. 56606.

iii. You do not waive any legal rights by agreeing to take part in this study.

I have read the information provided for the study entitled “Vegetable Intake Study” as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study.
### Appendix B: Sample Characteristics Guelph & MTurk

**Guelph Sample:**

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 - 29</td>
<td>20</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>30 - 39</td>
<td>10</td>
<td>20%</td>
<td>60%</td>
</tr>
<tr>
<td>40 - 49</td>
<td>4</td>
<td>8%</td>
<td>68%</td>
</tr>
<tr>
<td>50 - 59</td>
<td>9</td>
<td>18%</td>
<td>86%</td>
</tr>
<tr>
<td>60 - 69</td>
<td>4</td>
<td>8%</td>
<td>94%</td>
</tr>
<tr>
<td>70 plus</td>
<td>3</td>
<td>6%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>14</td>
<td>28%</td>
</tr>
<tr>
<td>Female</td>
<td>36</td>
<td>72%</td>
</tr>
<tr>
<td>Prefer not to say</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**MTurk sample:**

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 - 29</td>
<td>116</td>
<td>52%</td>
<td>52%</td>
</tr>
<tr>
<td>30 - 39</td>
<td>74</td>
<td>33%</td>
<td>85%</td>
</tr>
<tr>
<td>40 - 49</td>
<td>19</td>
<td>9%</td>
<td>94%</td>
</tr>
<tr>
<td>50 - 59</td>
<td>4</td>
<td>2%</td>
<td>96%</td>
</tr>
<tr>
<td>60 - 69</td>
<td>8</td>
<td>4%</td>
<td>100%</td>
</tr>
<tr>
<td>70 plus</td>
<td>0</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>136</td>
<td>62%</td>
</tr>
<tr>
<td>Female</td>
<td>85</td>
<td>38%</td>
</tr>
<tr>
<td>Prefer not to say</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
# Appendix C: Stimuli List of Ten Vegetables

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td><img src="image1.jpg" alt="Asparagus Image" /></td>
</tr>
<tr>
<td>Zucchini</td>
<td><img src="image2.jpg" alt="Zucchini Image" /></td>
</tr>
<tr>
<td>Broccoli</td>
<td><img src="image3.jpg" alt="Broccoli Image" /></td>
</tr>
<tr>
<td>Cucumber</td>
<td><img src="image4.jpg" alt="Cucumber Image" /></td>
</tr>
<tr>
<td>Carrots</td>
<td><img src="image5.jpg" alt="Carrots Image" /></td>
</tr>
<tr>
<td>Peas</td>
<td><img src="image6.jpg" alt="Peas Image" /></td>
</tr>
<tr>
<td>Vegetable</td>
<td>Image</td>
</tr>
<tr>
<td>---------------</td>
<td>------------</td>
</tr>
<tr>
<td>Potato</td>
<td><img src="image1.png" alt="Potato" /></td>
</tr>
<tr>
<td>Lettuce</td>
<td><img src="image2.png" alt="Lettuce" /></td>
</tr>
<tr>
<td>Brussels Sprouts</td>
<td><img src="image3.png" alt="Brussels Sprouts" /></td>
</tr>
<tr>
<td>Tomato</td>
<td><img src="image4.png" alt="Tomato" /></td>
</tr>
</tbody>
</table>
## Appendix D: Food Neophobia Scale

<table>
<thead>
<tr>
<th>Food Neophobia</th>
<th>Item Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am constantly sampling new and different foods</td>
<td>1</td>
</tr>
<tr>
<td>I don’t trust new foods</td>
<td>2</td>
</tr>
<tr>
<td>If I don’t know what is in a food, I wont try it</td>
<td>3</td>
</tr>
<tr>
<td>I like foods from different countries</td>
<td>4</td>
</tr>
<tr>
<td>Ethnic foods look too weird to eat</td>
<td>5</td>
</tr>
<tr>
<td>At dinner parties, I will try a new food</td>
<td>6</td>
</tr>
<tr>
<td>I am very particular about the foods I will eat</td>
<td>7</td>
</tr>
<tr>
<td>I will eat almost anything</td>
<td>8</td>
</tr>
</tbody>
</table>

### General Neophobia Scale

<table>
<thead>
<tr>
<th>General Neophobia</th>
<th>Item Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whenever I’m away, I want to get home to my familiar surroundings</td>
<td>1</td>
</tr>
<tr>
<td>I am afraid of the unknown</td>
<td>2</td>
</tr>
<tr>
<td>I am very comfortable in new situations</td>
<td>3</td>
</tr>
<tr>
<td>Whenever I am on vacation, I can’t wait to get home</td>
<td>4</td>
</tr>
<tr>
<td>I avoid speaking to people I do not know when I go to a party</td>
<td>5</td>
</tr>
<tr>
<td>I feel uneasy in unfamiliar surroundings</td>
<td>6</td>
</tr>
<tr>
<td>I do not like sitting next to someone I don’t know</td>
<td>7</td>
</tr>
</tbody>
</table>

(Pliner & Hobden, 1992)
### Appendix E: Food Skills Scale

<table>
<thead>
<tr>
<th>Meal Planning and Preparing</th>
<th>Item Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>How often do you…</strong></td>
<td></td>
</tr>
<tr>
<td>Plan Meals ahead?</td>
<td>1</td>
</tr>
<tr>
<td>Prepare meals in advance?</td>
<td>2</td>
</tr>
<tr>
<td>Follow recipes when cooking?</td>
<td>3</td>
</tr>
<tr>
<td><strong>Shopping</strong></td>
<td></td>
</tr>
<tr>
<td><strong>How often do you…</strong></td>
<td></td>
</tr>
<tr>
<td>Shop with a grocery list?</td>
<td>4</td>
</tr>
<tr>
<td>Shop with specific meals in mind?</td>
<td>5</td>
</tr>
<tr>
<td>Plan how much food to buy?</td>
<td>6</td>
</tr>
<tr>
<td><strong>Budgeting</strong></td>
<td></td>
</tr>
<tr>
<td><strong>How often do you…</strong></td>
<td></td>
</tr>
<tr>
<td>Compare prices before you buy food?</td>
<td>7</td>
</tr>
<tr>
<td>Know what budget you have to spend on food?</td>
<td>8</td>
</tr>
<tr>
<td>Buy food in season to save money?</td>
<td>9</td>
</tr>
<tr>
<td>Buy cheaper cuts of meat to save money?</td>
<td>10</td>
</tr>
<tr>
<td><strong>Resourcefulness</strong></td>
<td></td>
</tr>
<tr>
<td><strong>How often do you…</strong></td>
<td></td>
</tr>
<tr>
<td>Cook more or double recipes which can be used for another meal?</td>
<td>11</td>
</tr>
<tr>
<td>Prepare or cook a healthy meal with only few ingredients on hand?</td>
<td>12</td>
</tr>
<tr>
<td>Prepare or cook a meal with limited amount of time?</td>
<td>13</td>
</tr>
<tr>
<td>Use leftovers to create another meal?</td>
<td>14</td>
</tr>
<tr>
<td>Keep basic items in your cupboard for putting meals together? e.g. herbs/spices, dried/tinned goods?</td>
<td>15</td>
</tr>
</tbody>
</table>

(Lavelle, 2017)
Appendix F: Awareness First Choice Ranking – Guelph Sample

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td>0.704</td>
<td>0.496</td>
<td>0.350</td>
</tr>
<tr>
<td>Zucchini</td>
<td>0.719</td>
<td>0.724</td>
<td>0.785</td>
</tr>
<tr>
<td>Broccoli</td>
<td>0.301</td>
<td>0.321</td>
<td>0.369</td>
</tr>
<tr>
<td>Brussels Sprouts</td>
<td>0.792</td>
<td>0.804</td>
<td>0.823</td>
</tr>
<tr>
<td>Carrots</td>
<td>0.959</td>
<td>0.972</td>
<td>0.997</td>
</tr>
<tr>
<td>Cucumber</td>
<td>0.404</td>
<td>0.417</td>
<td>0.397</td>
</tr>
<tr>
<td>Peas</td>
<td>0.983</td>
<td>0.975</td>
<td>0.953</td>
</tr>
<tr>
<td>Potato</td>
<td>0.834</td>
<td>0.816</td>
<td>0.798</td>
</tr>
<tr>
<td>Lettuce</td>
<td>0.587</td>
<td>0.561</td>
<td>0.536</td>
</tr>
</tbody>
</table>

Interpretation: The row numbers demonstrate the awareness variable change for each vegetable (1, 2, or 3). For example, if the person's awareness level was a 1, (they knew the vegetable well) for lettuce - there would be a 8.6% probability of top ranking for lettuce. However, if their awareness level was a 3 (only know the vegetable by name) there could be only 6% likelihood for lettuce to be top ranked vegetable (reflected through utility score).

Awareness First Choice Ranking – MTurk Sample

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td>0.096</td>
<td>0.0693</td>
<td>0.0498</td>
</tr>
<tr>
<td>Zucchini</td>
<td>0.086</td>
<td>0.0884</td>
<td>0.0903</td>
</tr>
<tr>
<td>Broccoli</td>
<td>0.047</td>
<td>0.0482</td>
<td>0.0492</td>
</tr>
<tr>
<td>Brussels Sprouts</td>
<td>0.1419</td>
<td>0.1460</td>
<td>0.1491</td>
</tr>
<tr>
<td>Carrots</td>
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**THE CATEGORIZATION & PREFERENCES OF VEGETABLES**

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<td>0.11</td>
<td>0.65</td>
<td>0.170</td>
</tr>
<tr>
<td>Sprouts</td>
<td>0.104</td>
<td>0.1</td>
<td>0.9</td>
<td>0.090</td>
<td>0.1</td>
<td>0.8</td>
<td>0.15</td>
<td>0.11</td>
<td>1.32</td>
<td>0.111</td>
</tr>
<tr>
<td>Tomato</td>
<td>0.036</td>
<td>0.1</td>
<td>0.3</td>
<td>0.062</td>
<td>0.1</td>
<td>0.5</td>
<td>0.11</td>
<td>0.12</td>
<td>0.97</td>
<td>0.186</td>
</tr>
<tr>
<td>Awareness</td>
<td>-0.351</td>
<td>0.0</td>
<td>0.0</td>
<td>-0.31</td>
<td>0.0</td>
<td>0.1</td>
<td>-0.31</td>
<td>0.06</td>
<td>-0.51</td>
<td>-0.260</td>
</tr>
<tr>
<td>free sort</td>
<td>0.34</td>
<td>0.06</td>
<td>6.13</td>
<td>0.223</td>
<td>0.0</td>
<td>3.86</td>
<td>131</td>
<td>131</td>
<td>131</td>
<td>131</td>
</tr>
<tr>
<td>familiarity sort</td>
<td></td>
<td></td>
<td>0.81</td>
<td>0.07</td>
<td>12.4</td>
<td>0.603</td>
<td>0.07</td>
<td>8.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cooking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.229</td>
<td>0.07</td>
<td>3.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ease of preparing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.331</td>
<td>0.06</td>
<td>5.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>preference</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.298</td>
<td>0.06</td>
<td>20.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Appendix H: Multidimensional Scaling Maps

The diagram shows a two-dimensional space with variables such as "rank Bsprouts," "rank Rlack," "rank Zucchini," "rank Carrots," and "rank Asparagus." The positioning of these variables suggests a ranking or preference based on a multidimensional scaling model.

The x-axis is labeled "Dimension 1" and the y-axis is labeled "Dimension 2." The variables are plotted with their corresponding ranks, indicating a visual representation of their relationships or similarities in a multidimensional space.
Appendix I: Qualtrics Questionnaire

Vegetable Intake Study

Here is a list of vegetables that can be purchased in grocery stores, please tell me how well you know each of these vegetables.

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Know well</th>
<th>Know by name only</th>
<th>First time seeing name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zucchini</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broccoli</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumber</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrots</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potato</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Romaine Lettuce</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brussels Sprouts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tomato</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
End of Block: Consent to Participate

Start of Block: Rank Order

Please rank the vegetables from 1-10 based on your preference (liking), with 1 being your most preferred to 10 being your least preferred. Please use your computer mouse to move each vegetable around in the list.

1. Asparagus
2. Zucchini
3. Broccoli
4. Cucumber
5. Carrots
6. Peas
7. Potato
8. Lettuce
9. Brussels Sprouts
10. Tomato
Please name the vegetable you ranked the lowest (#10)?

________________________________________________________________

Page Break

Please sort the vegetables in any way that makes sense to you, there is no minimum or maximum number of categories you must use.

<table>
<thead>
<tr>
<th>Items</th>
<th>group 1</th>
<th>group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zucchini</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broccoli</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumber</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Based on the sorting task you just completed, please explain what labels you would use to define the vegetable groups

________________________________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________

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________________________________________________________________

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________________________________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________
Please sort the vegetables in groups based on your level of familiarity. From extremely familiar to not familiar at all.

<table>
<thead>
<tr>
<th>Items</th>
<th>Extremely familiar</th>
<th>Very familiar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zucchini</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broccoli</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumber</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Please sort the vegetables in groups based on your level of preference for each item.

<table>
<thead>
<tr>
<th>Items</th>
<th>Prefer a great deal</th>
<th>Prefer a lot</th>
<th>Prefer a moderate amount</th>
<th>Prefer slightly</th>
<th>Do not prefer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zucchini</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broccoli</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumber</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Carrots

Peas

Potato

Lettuce

Brussel Sprouts

Tomato
Please sort the vegetables in groups based on how easy you think/find each vegetable is to prepare for a meal (in general):

<table>
<thead>
<tr>
<th>Items</th>
<th>Extremely easy</th>
<th>Moderately easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zucchini</td>
<td>Slightly easy</td>
<td>Neither easy nor difficult</td>
</tr>
<tr>
<td>Broccoli</td>
<td>Slightly difficult</td>
<td>Moderately difficult</td>
</tr>
<tr>
<td>Cucumber</td>
<td>Extremely difficult</td>
<td></td>
</tr>
</tbody>
</table>
Please sort the vegetables in groups based on how you would prepare each vegetable for a meal. (If you would prepare that same vegetable in more than one way, please place the vegetable in the group based on which one you would likely eat/ cook.)

<table>
<thead>
<tr>
<th>Items</th>
<th>Bake/Roast</th>
<th>Boil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zucchini</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broccoli</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumber</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Pan fry/ Sautee</th>
<th>Eat raw</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Microwave</th>
<th>Stir-Fry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The categorization & preferences of vegetables

- Carrots
- Peas
- Potato
- Lettuce
- Brussel Sprouts
- Tomato
Please sort the vegetables in groups based on which vegetables you would include in each meal. (If you would use the same vegetable for more than one meal, please place the vegetable in the meal you would most likely prepare)

<table>
<thead>
<tr>
<th>Items</th>
<th>Scup</th>
<th>Salad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zucchini</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broccoli</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumber</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Stir-fry</th>
<th>Pasta Dish</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>None</th>
</tr>
</thead>
</table>
Carrots

Peas

Potato

Lettuce

Brussel Sprouts

Tomato
I would consider myself someone who eats healthy

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

I enjoy eating vegetables

- Strongly Agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree
I am constantly sampling new foods

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

I do not trust new foods

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree
If I do not know what is in a new food, I won't try it

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

I like eating food from different countries

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree
Ethnic food looks too weird to eat

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

Whenever I’m away, I want to get home to my familiar surroundings

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree
I am afraid of the unknown

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

I am very uncomfortable in new situations

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree
Whenever I am on vacation, I can't wait to get home

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

I avoid speaking to people I do not know when I go to a party

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree
I feel uneasy in unfamiliar surroundings

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

I do not like sitting next to someone I don't know

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree
How often do you plan meals ahead? (e.g. for the day/week ahead)

- Never
- Sometimes
- About half the time
- Most of the time
- Always

How often do you prepare meals in advance? e.g. packed lunch, partly preparing a meal in advance

- Always
- Most of the time
- About half the time
- Sometimes
- Never
How often do you follow recipes when cooking?

- Always
- Most of the time
- About half the time
- Sometimes
- Never

How often do you shop with a grocery list?

- Always
- Most of the time
- About half the time
- Sometimes
- Never
How often do you shop with specific meals in mind?

- Always
- Most of the time
- About half the time
- Sometimes
- Never

How often do you compare prices before you buy food?

- Always
- Most of the time
- About half the time
- Sometimes
- Never
How often do you know what budget you have to spend on food?

- Always
- Most of the time
- About half the time
- Sometimes
- Never

How often do you buy food in season to save money?

- Always
- Most of the time
- About half the time
- Sometimes
- Never
How often do you buy cheaper cuts of meat to save money?

- Always
- Most of the time
- About half the time
- Sometimes
- Never

How often do you cook more or double recipes which can be used for another meal?

- Always
- Most of the time
- About half the time
- Sometimes
- Never
How often do you prepare or cook a healthy meal with only a few ingredients on hand?

- Always
- Most of the time
- About half the time
- Sometimes
- Never

How often do you keep basic items in your cupboard for putting meals together? e.g. herbs/spices, dried/canned goods?

- Always
- Most of the time
- About half the time
- Sometimes
- Never
At dinner parties, I will try a new food

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

I am very particular about the foods I will eat

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree
I will eat almost anything

- [ ] Strongly agree
- [ ] Agree
- [ ] Somewhat agree
- [ ] Neither agree nor disagree
- [ ] Somewhat disagree
- [ ] Disagree
- [ ] Strongly disagree

I like to try new ethnic restaurants

- [ ] Strongly agree
- [ ] Agree
- [ ] Somewhat agree
- [ ] Neither agree nor disagree
- [ ] Somewhat disagree
- [ ] Disagree
- [ ] Strongly disagree
Please select your gender

- Male
- Female
- Prefer not to say

What age group are you in?

- 18 - 29
- 30-39
- 40-49
- 50-59
- 60-69
- 70 plus
Now that you have completed the study, do you have any feedback for the researcher?

________________________________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________

Page Break