Changing the Context of Experience: Applying Designed Sensory Elements Towards Mindful Eating

by

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A thesis submitted to the Faculty of Graduate and Postdoctoral Affairs in partial fulfillment of the requirements for the degree of

Master of Design

in

Industrial Design

Carleton University
Ottawa, Ontario

Abstract

Designers are broadening their practice to encompass the field of food and food consumption. Food design has expanded from food itself to include the environment surrounding food, as it found to impact eating behaviour. In the field of design, interactions with a product can be considered multisensory activities; they can invite the user to engage all of their senses. This research draws from expertise in food design research to create sensory-heightened food products that may evoke positive emotional responses and mindfulness. To investigate this, a methodological triangulation was utilized: interviews with experts in the field of sensory design and food research, experiment and interview with participants. The findings resulted in: establishing a preliminary framework for studying sensory responses to edible containers, and identifying unexpected sensory relationships. The contributions include recommendations for creating sensory incongruity in the design of edible containers.

Key Words: *Design Research, Sensory Design, User Experience, Eating Behaviour, Edible Vessels.*

Acknowledgments

I alone must do it, but I cannot do it alone. This thesis would never have seen the light of day without the tremendous support of family and friends. This document represents two and a half years worth of black coffee, cheap shiraz, pink hairdye, and running after the O-Train. It also represents the unwavering optimism, encouragement and motivation from those who rooted for me since the very start.

I would like to express my deepest appreciation to my supervisors, Professors Lois Frankel and Michael Mopas for their hours of dedication, years of expertise and unwavering patience throughout my academic journey.

My deepest gratitude goes to my parents and brother for their unconditional love, support and understanding. You're a M.O.M. now, Ma!

To all my friends near and far, thank you for always believing in me when I didn't believe in myself. You are all precious gems.

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1 Chapter: Introduction

The act of eating is not only a way to take in nutrients; it is also important socially. Food frequently defines social events: it is present during rites of passage and during ceremonial events such as funerals or weddings. Social context also often defines which foods are appropriate: not every food is appropriate for everyone, at all times, or in every circumstance and context (Lalonde, 1992).

In contemporary Western culture, food choices and consumption patterns are changing dramatically. According to Bisson (2010, p. 22), the consumption of food has become "more individualized and less structured around the home-cooked meal." Due to this societal shift, people consume food throughout the day, rather than at set mealtimes, and often eat rapidly. This has led to less mindful eating behaviours and a lack of sensitivity to biological cues that notify people when to eat and how much to consume. 'Mindless eating' refers to the automatic repetitive routine of everyday food consumption in which little attention is focused on the eating experience (Hong et al., 2011), and it can contribute to obesity and other health problems. Mindful eating may be a solution to these problems.

Since the social and physical constructions of what constitutes a meal are changing, the contexts in which one consumes food should also change as consequence. This is especially the case because research demonstrates that where we eat and the tools with which we eat impact eating behaviour. For example, people at a social gathering will eat 51 percent more ice cream when given bigger utensils and bowls (van Kleef, Shimizu, & Wansink, 2012). Emerging

interests in the field of food design are beginning to attend to the contexts of eating, as designers no longer engage only with the foodstuff itself, but have broadened their practice to include other elements that shape users' experiences of food products (Schifferstein, 2010). One area of interest is the role of sensory elements in food design in evoking emotional responses from users; several designers and design groups, such as Fernando Laposse, Diane Bisson, Jinhyun Jeon, and "The Way We See The World" Studio, have begun to implement sensory elements into their designs. This indicates an increasing awareness and interest in how sensory experiences affect consumers' food choices and consumption behaviour.

Some designers incorporate multisensory elements, inviting users to engage all of their senses. Manipulation of the sensory modalities of a product can involve changes in shape, colour, weight, or texture. Creative manipulations might produce 'sensory incongruity', the effect produced when one sensory attribute does not match another. For example, if a user sees what they perceive to be a wooden bench, they will assume it has a hard surface. If the user then finds that it has an unexpectedly soft, rubbery surface, the discovery of the sensory incongruity might produce a range of emotions from surprise to playfulness, delight, or disgust (Hekkert, 2006; Ludden, Schifferstein, & Hekkert, 2007; Schifferstein, 2010). Sensory features are thus an important tool for enriching the relationships between the user and the environment and the product.

Edible vessels are a potential method by which designers can create

incongruities, as they involve the combination of multiple distinct concepts in the eating experience. Up until the 19th century, naturally occurring items such as shells, leaves and gourdes were utilized to hold food, as well as baskets made from grass, wood and bamboo. Paper, pottery and glass were early materials that allowed shaped containers for food containers (Risch, 2009). As the practice of consuming food changed, the development of food packaging evolved with it. Today, everyday common edible containers such as taco shells, pita breads, bread bowls, and ice cream cones are actively consumed by a variety of cultures and cuisines.

This study investigates how to contribute to the process of enhancing mindful food consumption through design, in order to address the issue of mindless eating. It draws from expertise in food design research in order to create sensory-heightened food products that may evoke positive emotional responses and mindfulness. This research specifically examines the role of sensory stimuli in edible vessels in eliciting positive emotional responses, and how these interactions contribute to creating effective sensory products. It also presents descriptive narratives as an outcome of this qualitative research approach. These descriptive narratives provide a resource for others interested in this design direction.

1.1 Scope of Research

This exploratory study seeks to gain insight into the design of food packaging. The aim is to understand how design details of edible vessels can

encourage mindful eating through the sensory experiences they generate. The senses are categorized into distance (visual, olfactory, auditory) and proximity (gustatory, tactile) groupings. The distance senses produce our expectations and assumptions about products, and the proximity senses either confirm or contradict these expectations. The interaction between distance and proximity sensory experience is therefore crucial to this investigation, since sensory incongruity might encourage mindful interaction with edible vessels. This research explores if and how sensory features can enhance and affect user experiences.

1.2 Rationale

The sensory modalities of a product can help define, shape, and enhance the user-product relationship and are essential aspects of the design process. For example, scratch-and-sniff samples in magazines are frequently used to introduce consumers to new fragrances, as odorants "can be used to communicate the scent and taste of products prior to purchase" (Ludden & Schifferstein, 2009, p. 1). While most sensory design features do not lead to incongruity, designers can choose to use these samples to create incongruity, and thereby to produce a reaction, attract attention, and contribute to changes in users' habits.

The goal of this investigation is to provide evidence that the designer's role is essential to creating mindful eating experiences. Designers may be able to contribute to mindful eating by designing both the food itself and the environment in which it is presented. The premise of this study is that designers can enhance people's sensory experiences while they are eating.

1.3 Hypothesis

The study investigates how edible vessels can help create mindfulness through an exploratory case study. It also considers whether attributes of sensory incongruity contribute to mindfulness, and whether the design of visual and tactile sensory modalities affects habitual behaviours toward food. The hypothesis of this study is that when in contact with an edible vessel that includes sensory incongruity via particular visual or tactile attributes, the user will respond emotionally to the experience. Introducing incongruity during consumption may break the pattern of habitual mindless behaviour. When participants interact with or consume unusual edible vessels, their behaviour could become more mindful.

To further investigate the hypothesis, two sub-questions were created:

How can designers benefit from awareness about sensory interactions?

How does one design suitable sensory edible food products?

1.4 Contribution

This research explores how designers can develop sensory interactions to create suitable sensory food container products for consumers. By incorporating both design and sociological perspectives, this research also demonstrates that combining different academic fields can provide meaningful outcomes for design development and thinking. This project may also contribute to the field of food design by developing a recipe for an edible vessel that uses incongruent sensory stimuli in food packaging to enhance user experiences.

1.5 Structure of Thesis

This chapter introduces the emerging field of sensory design and its recent applications and potential benefits for the field of food design. It also discusses recent shifts in eating behaviours and consumption that lead people to eat mindlessly. It concludes with the hypothesis and sub-questions and a discussion of how this project will make a contribution to research.

The second chapter is a literature review, identifying and exploring the themes that generate the research questions. Ritual behaviour, symbolism, mindless eating, and the social construct of a meal are themes drawn from the field of sociology. Research on sensory design, sensory experience, and its role in food products is also surveyed. This discussion provides a preliminary structure to support this study's methods and the subsequent analysis. Designers who implement and manipulate the senses into their food products are also discussed.

The third chapter describes the three methods of data collection used in this thesis research. It explains the use of experiment and control groups, which enabled the researcher/designer to carefully observe how participants interact with the food containers and with each other. It then describes the one- on-one interviews with participants, which allowed the researcher to collect the participants' opinions, thoughts, and experiences of the study and the experimental vessels. The procedures, settings, data collection, and approach to analysis are discussed. The creation, development, and final iteration of the edible vessels are also explained in this chapter.

The fourth chapter presents the study's findings. The data from all three

methods was organized into themes that identified key elements in the research. This chapter also presents an analysis of data collected from the experts and a narrative description of the participants' behaviours.

The fifth chapter discusses the implications of the study's findings and reflects upon the sensory aspects of design, sensory incongruities, and their relationship to mindfulness. Limitations of the methods are also acknowledged and improvements for future research are suggested.

The conclusion summarizes and emphasizes the important findings and subsequent contributions of this research. The highlights of the research are the validity of the framework, the different sensory relationships provided through the edible vessel, and the importance of the role of the designer.

2 Chapter: Literature Review

This chapter collects and critically examines knowledge from the academic fields informing the study's research questions. The main topics include the social construct of a meal, the symbolism and rituals surrounding a meal, the human senses, mindfulness, and investigations of designers who experiment with edible vessels.

2.1 Social Construct of a Meal

In every society and culture, food is heavily freighted with meaning. Not only do all societies and cultures ascribe meaning to food, they also ascribe meaning to the contexts in which it is consumed: what foods to eat, where, how, when, and with whom to eat these foods (Jones, 2007). The sociologist Roland Barthes observed that food constantly transforms itself depending on the situation. Every feature of food is symbolic, including its production and its consumption (Jones, 2007) and the planning and structuring of meals (Douglas, 1972). Food engages not just the body, therefore, but the brain. Food identification is itself a complex cognitive process. Anthropologist Claude Lévi-Strauss states that "food must not only be good to eat, but also good to think" (Fischler, 1988, p. 284).

Mary Douglas's well-known essay *Deciphering a Meal* gives a structural analysis of what makes a meal. Food can be seen as a code that expresses patterns of social relations and hierarchies. Douglas writes that, through pre-coded messages of food categories within social events, there can be symbolic

boundaries of food. She agrees with Barthes's encoding of social events as described in his book *Système de la mode*, which discusses how semantics contribute to creating and breaking these codes. She then takes a look at particular social events in order to see how they are coded in order to understand particular social systems (Douglas, 1972). She gives the example of the question "Would you like to have soup for supper?" Douglas argues that this question implies that soup is not normally considered a meal.

Douglas also observes that the construction of a meal follows strict and traditional rules (Douglas, 1972). She uses the formula of A+2B to describe what is normally considered a proper meal. A is considered the 'main course', while B is a 'lesser course'; typically, A+2B consists of an animal protein (A) and two vegetables (2B). Examples of variations on this that can still be acceptable as a meal include "vegetable soup so long as it had noodles and grated cheese would do, or poached eggs on toast with parsley" (Douglas, 1972, p. 43). Drinks are unaccounted for, however, having no formula to define their role in meal construction (Douglas, 1972).

2.2 Meal Versus Drink

Two of the major food categories in social events are meals and drinks. Douglas (1972) breaks down the difference between a meal and a drink, stating that 'meals' are a combination of different solid foods accompanied by drinks, while 'drinks' are typically consumed by themselves (Douglas, 1972, p. 41). Lalonde (1992, p. 72) expands upon this, stating that meals are "social events that involve family, close friends and special guests, whereas drinks are more

appropriate for socialising with acquaintances." While drinks by themselves lack a definitive order or physical structure, meals conversely require furniture, utensils, and a seating order:

> Drinks are for strangers, acquaintances, workmen and family. Meals are for family, close friends, honoured guests. The grand operator of the system is the line between intimacy and distance. Those we know at meals we also know at drinks. The meal expresses close friendship. Those we only know at drinks we know less intimately (Douglas, 1972, p. 41).

This creates a distinction between meals that are intimate and those that are not. Every meal is a structured social event that structures other meals in its own image. Barbeques and cocktail parties are two examples of various social events that can bridge the gap of intimacy and distance (Douglas, 1972).

The meal table has complex significance. It is associated with the presentation and consumption of food (Super, 2002), and it represents social and cultural trends. For instance, in sixteenth century Europe, power and social status were indicated by where one sat at the table and how one ate (Super, 2002). Appropriate table manners were strictly defined, forbidding those involved in the meal from licking their fingers at the table. A second example of power expression through table manners in that era was the prohibition against using a knife to cut fish. Modern versions of these rules are still prevalent today, and govern what is known as today's "family meal" (Super, 2002).

The table was the center stage upon which meals were presented and eaten. Meals are not a haphazard construction of whatever is available to eat. Meals and drinks are taken into different social contexts and adhere to varying parameters of intimacy and distance.

2.3 Ritual

People use eating as "a vehicle for ritual" (Mintz & Du Bois, 2002, p. 108), and methods of consumption frequently involve ritual behaviours. For instance, one ritual is the consumption of all the food from the given plate before asking for another serving, or cutting food into bite-sized pieces. Simple rituals are the processes people follow when they "eat wedges of cake, fried eggs on toast, corn on the cob, and Oreos" (Jones, 2007, p. 143).

In anthropological literature, food habits are subject to three different perspectives. The first perspective assumes that food habits supply a rational and practical function, where the second assumes that there is a culturally specific symbolic order. The third view is that food habits are also social markers (Cooper, 1986).

Douglas (1975) subscribes to the second perspective, noting that symbolic meaning is conveyed through food habits and social events. Social codes around food indicate "hierarchy, inclusion and exclusion, boundaries and transactions across boundaries" (Cooper, 1986, p. 179). Table manners and the knowledge of them are seen as an inventory of symbolic responses. These responses can be manipulated to communicate messages of oneself, given a basic understanding of "the structural contexts, behavioural expectations and symbolic associations of food events" (Cooper, 1986, p. 184).

2.4 Symbolism

Recognizing cultural and societal variation is imperative for understanding food symbolism because depending on variables of ethnicity, status, and gender, particular foods can be viewed in different ways. But while the specific symbolism varies, we can see that across cultures symbolic meaning is generated by how food is prepared, consumed, and disposed of (Carrus, Nenci, & Caddeo, 2009; Jones, 2007; Super, 2002). In many cultures, the meaning of food is determined by its colour, taste, texture, smell, or other qualities, its methods of preparation or presentation, or by the manner and order in which it is served. It may also be seen to take on the attributes of those who contributed to its preparation or production (Counihan, 1992, p.56).

What people eat has become a symbol of who they are, given that individuals "symbolically use food products to define their relations…to social reality in general" (Carrus et al., 2009, p. 66). Accordingly, the simple act of sharing food with others becomes a symbolic way of creating community (Lindenmeyer, 2006). Religious and social food taboos can help to shape and define communities by prohibiting the consumption of particular foodstuffs. Margaret Visser claims that all social groups have symbolically taboo foods, and "it is not necessary to be aware of a structural violation; one reacts simply and directly with avoidance and abhorrence" (Visser, 2008, p.121).

2.5 Mindfulness and Mindless Eating

Research shows that the environment surrounding a meal can greatly influence food choice and consumption. Visual characteristics such as size, shape, and colour can also greatly influence consumers (Sobal & Wansink, 2007; Wansink, 2004). As mentioned earlier, for instance, found that when participants were given bigger bowls and utensils, they served themselves 51 percent more ice cream (van Kleef et al., 2012). Studies have also shown that people are influenced by visual and haptic cues when consuming food, and often ignore internal cues or signals (Wansink, 2004). These visual and haptic clues are discussed in detail in the next section.

Cashman & Wansink (2006) found that individuals make up to two hundred food choices a day, and that the number of food choices is influenced by external and environmental cues. Participants in Cashman and Wansink's study did not, however, realize the number of food choices they made, and only four percent felt their surrounding environment influenced their food choices. Of the participants, 21 percent denied having eaten more because of environment, and 75 percent attributed these food choices to other reasons, such as hunger (Wansink & Cashman, 2006). When these cues are not acknowledged and recognized, mindless eating begins to become part of the daily routine of eating.

'Platescapes', a term coined by Sobal & Wansink (2007) to define the direct environment of utensils, refers to containers, utensils and receptacles that hold food. Platescapes represent "the sum of visible attributes of a particular plate or similar food container" (Sobal & Wansink, 2007, p. 131). The category

of 'platescapes' is broad enough to include items such as glasses, cups, packages boxes, wrappers, jars and cans. The overall shape and design of elements in platescapes can influence users; many elements of platescapes generate cues that "serve as landmarks to indicate how much food to consume," and "[p]late shape and size delineate norms for appropriate amounts of food to eat at a meal" (Sobal & Wansink, 2007, p. 131). Even the shape of a cup influences the volume of liquid a person perceives within said cup (Raghubir & Krishna, 1999). Platescapes are involved in most eating: other studies reveal that approximately 71 percent of the total calories of food people consume is from a container (Wansink & Cashman, 2006; Wansink, 2010).

Food items themselves are the small-scale elements of the built food environment (Sobal & Wansink, 2007). The appearance and visual presentation of the food itself is referred to as the foodscape (Sobal & Wansink, 2007). The shape of the food item is one element of the foodscape, and Sobal & Wansink (Sobal & Wansink, 2007) found that circular foods are more likely to be fully eaten than square shaped foods. Similarly, textures provide vital visual, tactile, and auditory information that can be used when making food choices for consumption. Smooth surfaces provide no pause for the gaze, while patterned surfaces offer "landmarks for eaters to use in distinguishing and dividing food items into segments or sections" (Sobal & Wansink, 2007, p. 131). Patterned and non-smooth surfaces encourage consumers to measure individual bites and determine whether to eat the item in its entirety or not. On the other hand, Khan & Wansink found that presenting people with a number of coloured food items led to greater food consumption (Kahn & Wansink, 2004).

2.6 Colour

Nestle et al. (1998) point out that individuals' perception of food is determined on "the basis of cultural values, with psychosocial factors shaping their food choices" (Nestle, Wing, Birch, DiSogra, Drewnowski, Middleton, Sobal, Economos, 1998, p. 51). Consumers visually perceive a food object as something edible, and tend to imagine its taste before consumption. Because this is largely a visual process, colour is considered one of the most influential elements as an indicator for food selection and consumption behaviour (Lee, Lee, Lee, & Song, 2013).

Perceptions of colours and tastes of food vary depending on cultural factors that can associate colour with certain flavours and taste profiles. For instance, Spence (2006) notes that consumers from Britain expect blue-coloured drinks to taste like raspberries, while consumers from Taiwan expect them to taste like mint (p.366). These results show that cultural ideas of colour may play a large role in the perception of flavour, taste, and textural characteristics of food products.

2.7 Texture

Texture is defined as a sensory attribute of surface properties of food that are detected through the senses (Lawless & Heymann, 2010). The texture of an object can be perceived and identified through visual, tactile, and auditory sensory modalities. Visual texture can also create expectations for the mouth's experience of the texture of the food item. Compared to colour and flavour, texture is primarily used by the consumer "not as an indicator of food safety, but

as an indicator of food quality" (Lawless & Heymann, 2010, p. 260). Texture can also be an indicator of food freshness, and can be used to identify and classify foods. Assessments of texture are influenced by culture: in a study by Lawless & Heymann (Lawless & Heymann, 2010), American participants associated seventy-nine texture terms with seventy-four foods, where Japanese participants used four hundred and six words to describe the textures of the same seventy-four foods.

2.8 Perception of Freshness

In numerous studies, characteristics of ostensibly refreshing foods and beverages displayed "temperature-related tactile attributes" (Fenko et al., 2009, p. 373). 'Cool', 'cold', and 'icy' were the characteristics that participants commonly identified in refreshing food and drink. Zellner & Durlach (2002) state that the characteristics of fresh and refreshing foods and drinks are related to the tactile elements of temperature (as cited by Fenko et al., 2009, p.373).

Colour is frequently used to predict how thirst quenching a beverage is. Clear and brown coloured beverages are viewed as more satisfying for quenching thirst, as they visually reference water and cola. Red and orange are viewed to be more thirst-quenching than green or purple, which might be because strawberry and orange flavours are considered to be refreshing in both food and beverages (Fenko et al., 2009, p. 373).

The visual sense is not the most important in assessing food freshness, however. When olfaction is possible, it is known to be more important that vision

for determining the freshness of food products (Fenko et al., 2009, p. 378), and studies have also hypothesized that auditory cues can also play a role in assessing freshness (Fenko et al., 2009, p. 375).

2.8.1 Perception of Freshness in Yogurt

The term "freshness sensation" is widely used in describing and characterizing dairy products, yogurt in particular. In terms of freshness and capacity to quench thirst, yogurt is a food item with specific sensory characteristics. Known characteristics include the perception of slight acidity and the lack of bitterness. Generally, consumers prefer yogurt and yogurt-like products that send very strong signals of freshness (Bouteille et al. 2013). Bouteille et al. (2013) found that the sensory determinants of perceived freshness in yogurt include the presence of acidity, a lack of bitterness, the thickness of the texture, and an oral assessment of temperature (p. 283). They further state that "Coldness, fluidity, slight acidity, the absence of bitterness and cream flavouring seem to be positive drivers of the freshness sensation" (Bouteille et al 2013). Studies cited above that found a strong perceived link between freshness and the sensation of coldness (Zellner & Durlack 2002) are therefore particularly relevant to consumer perceptions of yogurt.

2.9 The Senses

Humans possess at least five sensory modalities: vision, touch, audition, olfaction, and gustation. These modalities can be grouped into two categories:

proximity and distance senses (Ludden, 2006; Ludden et al., 2007). Gustation and tactility are proximity senses, whereas audition, olfaction, and vision are distance senses. In other words, people can "see, hear, and smell things from a distance, but in order to touch and taste an object, they need to be physically in contact with it" (Ludden et al., 2007, p. 355). Taken together, sensory modalities often receive and identify large "amounts of information when a product is experienced" (Schifferstein & Cleiren, 2005, p. 295).

Vision, olfaction, and audition are often the first three senses that a person uses to identify and recognize objects. Among these, vision is often considered to be the most dominant sense (Fenko, Schifferstein, & Hekkert, 2009), given that it is used to identify weight, colour, and texture very quickly, providing a large amount of information in the shortest time frame (Blackwell, 1995; Fenko, Schifferstein, & Hekkert, 2009, p. 5; Ludden et al., 2006, p. 4; Schifferstein & Cleiren, 2005).

While olfaction and audition are, like vision, quickly activated, these senses have a lesser role in assessment of products. The information received through sound is less detailed and harder to identify. And while an individual can initially perceive a product through olfaction, olfaction was the least detailed, and the ability to identify the product through smell was the most difficult (Ludden, Schifferstein, & Hekkert, 2006, p. 4).

After vision, the second-most dominant sense that consumers use to perceive products is touch (Balaji, Raghavan, & Jha, 2011, p. 514). Tactile stimuli require users to exert more effort, however, than when using visual stimuli to

extract and interpret information (Balaji et al., 2011, p. 516). A study conducted by Schifferstein and Cleiren (2005) showed that users received the majority of their information about products through vision and touch. They noted that the information users received was detailed, and participants were confident of their judgment (p. 305). Touch is a sense that can convey both meaning and content more easily through haptic information (Spence, 2011, p. 268), which includes 'utilitarian' and 'hedonic' touch. Balaji et al. (2011) state that individuals who purchase a product based on haptic/non-haptic information use utilitarian touch. Conversely, hedonic touch refers to instances in which consumers touch a product for general exploration or as a sensory experience (p.515).

Using this knowledge of the different roles of the senses, designers can influence and manipulate the way consumers interact with and experience products by changing the sensory modalities (Ludden et al., 2007). Schifferstein et al. (2007) affirm that a successful user-product interaction occurs when the visual, tactual, auditory, and olfactory senses are all engaged. In addition, the product becomes more interesting to interact with when it provides an emotional sensory experience for the user, especially when something new is learned about some aspect of the product, such as its material (p.354). Sensory experience varies depending on the degree of stimulation from the senses, emotions, and values that people associate with and attach to the product (Schifferstein, 2009, p. 269).

2.10 Sensory Incongruity

The operation of multiple senses simultaneously can, however, produce conflicting information. Schifferstein describes how this happens:

> Sensory information forms the basis for all interactions between people and their surrounding environment. Each of the senses is most sensitive to a different type of stimulation. Because each sensory modality may be considered as a separate information channel, not all of the incoming sensory information from a product will necessarily communicate the same message (2010, p. 1060).

This process can be described as 'sensory incongruity', which is what occurs when users perceive discrepancies between the information received via two or more sensory modalities (Ludden & Kudrowitz, 2012, p. 287). The most common types of incongruities found in designed products are visual-tactual incongruity, visual-auditory incongruity, and visual-olfactory incongruity. These are the most common because people are most likely to recognize, perceive, and construct expectations at a distance through visual characteristics (Ludden & Schifferstein 2007, 2009; Ludden et al. 2009). There are usually two different product characteristics involved in both visual-olfactory and visual-auditory incongruities, which make them less direct than visual-tactual incongruities. Visual-olfactory incongruities are also less direct, due to the learned associations and cultural conventions of colour and smell (Ludden & Kudrowitz, 2012). Research suggests that applying the element of surprise through visual-tactual incongruity is the most effective manner of creating surprise and production appreciation. Visual-tactual incongruities are noteworthy in that certain elements of the product, such as shape or texture, can be both seen and felt (Balaji, Raghavan, & Jha, 2011; Ludden, 2006; Ludden et al., 2007; Schifferstein

& Desmet, 2007). Tactile/visual sensory incongruities have been researched extensively, as noted above, whereas fewer studies have been conducted on visual-gustatory incongruity.

2.10.1 Smell/Taste Sensory Interactions

The olfactory sense is considered a dual sense because it can both sniff the air and savour food. The receptors for olfaction are stimulated by sniffing through the nose and through the mouth. Auvray & Spence (2008) explain these receptors in detail:

> As a consequence, the same olfactory receptors can be incorporated into two different perceptual systems, one for sniffing (i.e., inhaling) and the other for eating (and exhaling through the nose). Smelling would be restrained to its main function, that is, the detection of stimuli at a distance by means of their odours (p.1018).

Most of what people naturally assume as the taste "of foodstuffs actually originates from the nose (i.e., from the sense of smell)" (Auvray & Spence, 2008, p. 1017). In physiological terms, gustation is considered a minor sense that only channels a small amount of sensation. These sensations are: sweet, sour, bitter, salty and, more recently recognized, umami (Auvray & Spence, 2008, p. 1018).

Numerous studies have found that participants would use terms that are normally associated with the gustatory sensory system (e.g., sweet and sour) to evaluate and describe odours, even though the olfactory system does not consist of taste receptors (Auvray & Spence, 2008, p. 1018). However, the common attribution of gustatory qualities to odours brings up the complex sensory interactions of smell and taste.

In Western cultures, the odour of vanilla is repeatedly reported to be sweet smelling, even though "sweetness is normally associated with the stimulation of another sense, that of taste" (Auvray & Spence, 2008, p.1017). Other odours, such as caramel, mint, and artificial strawberry, are often associated with sucrose, so that people perceive sweetness. What is especially noteworthy, however, is that this is culturally specific: non-Western people do not describe these odours as sweet, possibly because those scents do not tend to be associated with sweet foods in their food culture (Auvray & Spence, 2008). Taste buds do not respond to sweet odours, as odours cannot be detected by taste receptors. Sweetness is then added as a flavouring to food products that users need to taste in order to increase the perceived sweetness of those products (Auvray & Spence, 2008).

2.10.2 Surprise & Humour

When sensory incongruity causes surprise, it can be viewed as positive: funny, comfortable, and pleasant. Indeed, theorists in emotion and humour, "agree that humour is a phenomenon that relies on incongruity" (Ludden & Kudrowitz, 2012, p.286). That said, surprise and humour do not necessarily rely on sensory incongruity specifically: surprise can result from "unexpected product characteristics alone rather than from an incongruity between sensory elements" (Ludden & Kudrowitz, 2012, p. 290).

Because incongruity produces a pleasant sense of surprise, consumers particularly enjoy sensory incongruity when they are in an environment that lacks stimuli or interest, such as a waiting room or a public space (Ludden,

2006; Ludden et al., 2007). In these contexts, sensory incongruity is an effective antidote to boredom. Correspondingly, then, surprise can be used to overcome the "habituation effect caused by people encountering many, similar products every day" (Ludden, Schifferstein, & Hekkert, 2008, p. 28).

Understanding the different reactions users have to surprise is valuable for designers, as the element of surprise can attract attention and stimulate word-of-mouth about designed products (Derbaix & Vanhamme, 2003). Designers can therefore use surprise to stimulate product recognition and to provide users with increased opportunities to interact with products and elicit meaningful experiences. Surprise also allows for "updating, extending, or revising the knowledge the expectation was based on" (Ludden et al., 2008, p. 28), and the user can subsequently learn something new about the product. Despite the benefits of incorporating surprise in design, though, The International Design Yearbooks estimates that roughly one to six percent of designs have visual-tactual incongruities implemented in their design (Ludden, Schifferstein, & Hekkert, 2008, p. 29). This is an area, therefore, with enormous potential for designers.

2.11 Designers Experimenting with Food and Design

The following section discusses contemporary designers who are working with edible vessels and applying sensory design and sensory incongruity to their work.

2.11.1 Diane Bisson

One of Canadian designer Diane Bisson's projects involved the creation of edible food nests. Her food nests are a part of the 'Taste No Waste' initiative, where she explores the potential for edible containers to replace disposable food packaging made from inedible materials such as plastic and cardboard (Bisson, 2011).

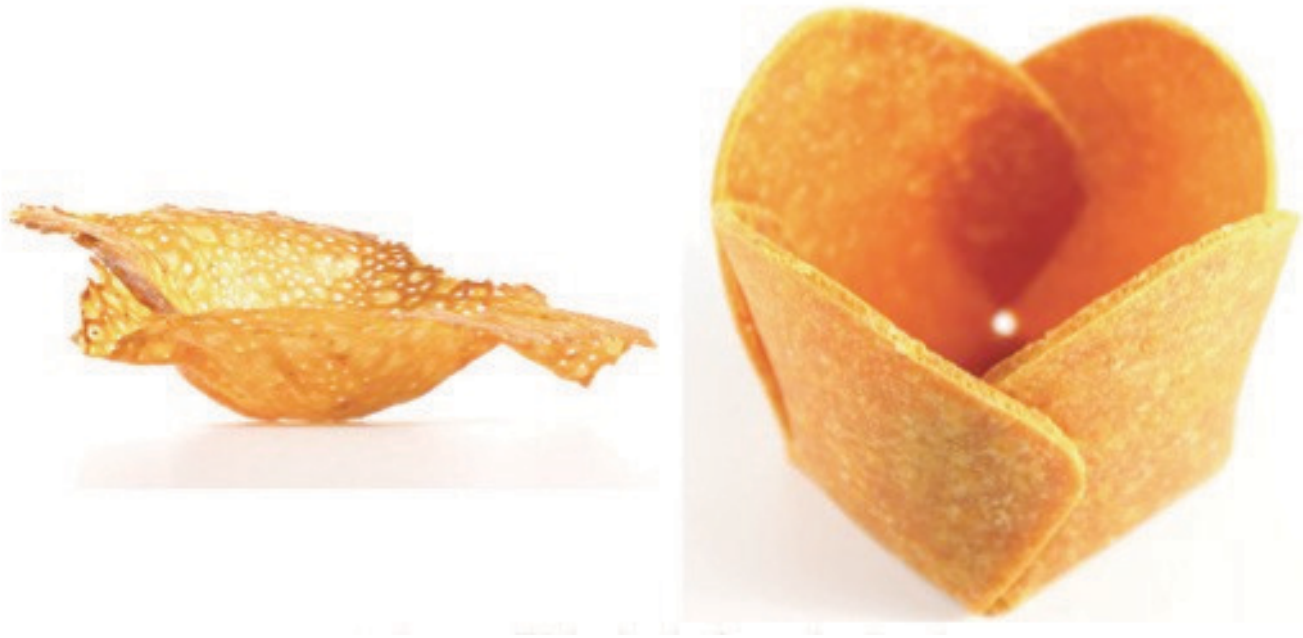

Figure 1. Edible vessels made of tomatoes by Diane Bisson. "Food Nests" come in various sizes; bigger ones for communal sharing and smaller ones for personal consumption (Bisson, 2011)

The nests come in different shapes and sizes, and are inspired by individual consumption and communal food sharing practices in Italy. The vessels are primarily made of tomatoes, to complement Italian cuisine, with textures ranging from soft and gelatinous to hard and crispy. Her preliminary

prototypes were made with a variety of fruit and vegetables baked in silicone moulds (Kushins, 2012). Through sensory stimuli, the consumer can experience a new visual-tactile sensory experience when consuming the edible food containers. Her work balances sustainability and sensory stimuli through ephemerality in the vessels.

Figure 2. Globules (Bisson, 2009)

Bisson's more recent creations, shown in her book *Edible: Food as Material*, include a variety of food vessels that were made of unorthodox combinations of ingredients, such as beets and parsley. She created over thirty

prototypes in her experiments with different cooking methods and techniques, resulting in different textures, colours, and tastes. One of these prototypes is Globules (see Figure 2). This container's ingredients include goat's cheese, white pepper, white flour, kamut flour, egg, salt, natural yogurt, and carrot juice. Created using a two-part mould, it was then assembled together and cooked again to create a hollow space. The carrot juice is responsible for the intense bright yellow colour (2009).

2 .11 .2 Jinhyun Jeon

Jinhyun Jeon is a South Korean-born, Eindhoven-based designer. Her work seeks to enhance an "intuitive dining experience by sensory stimuli, exploring with the synaesthesic effect" (Jeon, 2013). Jeon explores sensorial

Figure 3. Collection of red spoons; red is said to increase appetite (Jeon, 2013)

Figure 5. Series of plastic spoons with different tactual surface treatments; meant to imitate glass (Jeon, 2013)

Figure 4. Metal spoon with a rough texture (Jeon, 2013)

perceptions and the behaviours of individuals to produce emotional experiences with her products (Jeon, 2013).

"Tableware as Sensory Stimuli" was inspired by synaesthesia, the neurological condition in which stimuli are affected and triggered by each other.

The most common example of synaesthesia is a person who has the ability to taste sound or to perceive colour as numbers. Jeon's collection of spoons and forks are made of plastic, stainless steel, and ceramics. The different materials enable users to interact with variations in weight, temperature, texture, and colour. Each utensil invites the interaction of various sensory stimuli through tangible and tactile elements, and is shaped to stimulate a unique feel in the mouth (Chalcraft, 2013).

Figure 6. Loliware cups

2 .11 .3 "The Way We See The World" Studio

"The Way We See The World" is a New York based firm founded by three Parsons School of Design alumni (Briganti, Tucker, & Zweifel, 2011). They

created Loliware, a set of edible and biodegradable cups made of agar and fruit pectin, sweetened with evaporated cane sugar crystals (Hainer, 2013).

The cups, which were originally created for a Jell-O competition, come in five flavours: bitter bitters, salty lime, sour lemon, sweet vanilla, and spicy pepper. The diversity of the cups in flavour and colour enables the individual to mix and match flavours of the edible container and the liquid inside to create a new flavour profile that touches upon each basic taste (Briganti et al., 2011).

Figure 7. Early prototypes of loliware, originally called jelloware. The taste was pink grapefruit and yuzu, sweet Japanese lemon.

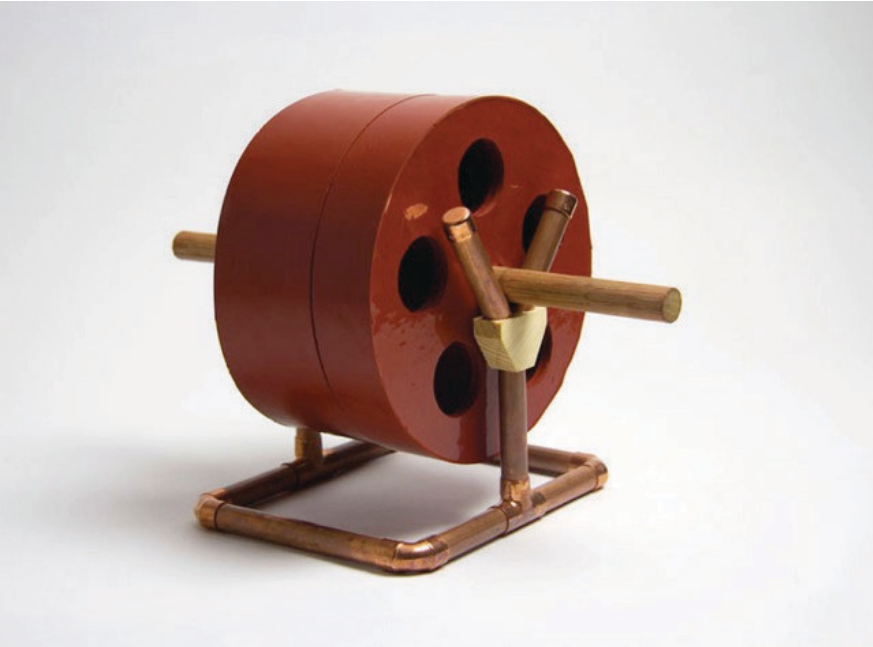

Figure 8. Silicone rotation mould

2 .11 .4 Fernando Laposse

Laposse is a Mexican born, London-based designer who created sugar glasses for containing beverages. He took inspiration from glass-blowing techniques, as he wanted to replicate glassblowing within “a domestic environment” (Fine Dining Lovers, 2014). Laposse’s creation of sugar glass cups uses a combination of industrial design methods and culinary knowledge. Using a roto-mould and molten sugar, Laposse created hollow drinking vessels that slowly melted with the drink.One development challenge was to determine how to allow users to hold the vessel without having sugar melting over their hands. His first model used a lollipop stick, and the second used a mesh holder (Chin, 2013). The third and final model was made entirely of sugar, without any non-food material between the vessel and users’ hands.

Figure 9. Detail of Laposse's sugar glass cups

2.12 Summary

The literature review covers multiple issues that are relevant to this project's research questions. The review begins by surveying crucial sociological research on food in general, and on the growing trend of mindless eating in particular. A brief discussion of how meals are defined and how symbolism and rituals shape food's cultural role helps to lay the groundwork for examining the act of eating today. In addition, understanding the human senses and the characteristics of different sensory attributes provides insight into how incongruous sensory relationships can work, especially in relationship to humour and surprise during product interaction.

The case studies shed light on recent practical experiments with incongruous sensory relationships. In this work, designers have used sensory

incongruity to help produce and foster heightened user experiences with their products. Each of the designers discussed here focuses on a different aspect of sensory design to create a new interaction for the consumer.

The literature review reveals crucial research gaps in the field of sensory design for food, however. While various studies examine the manipulation of the senses in incongruent sensory relationships, there are too few applications of sensory incongruity in the design of food containers. This area of study could provide valuable insights into designing and researching methods for better understanding how people interact with both their food and their environment.

The research questions of this study therefore aim to address the weaknesses found in the review of literature and to fill in gaps within the field of sensory design.

3 Chapter: Methods

3.1 Introduction

The research phase of this thesis aimed to observe and record the details of participants' experiences when faced with sensory incongruity in designed edible vessels. The investigation used methodological triangulation, primarily consisting of qualitative research methods because of the importance of the details of participants' reactions, not all of which could necessarily be anticipated or easily quantified. The qualitative methods were largely exploratory in terms of design research, borrowing from psychology and the natural sciences.

The term 'exploratory research' describes research that resists establishing

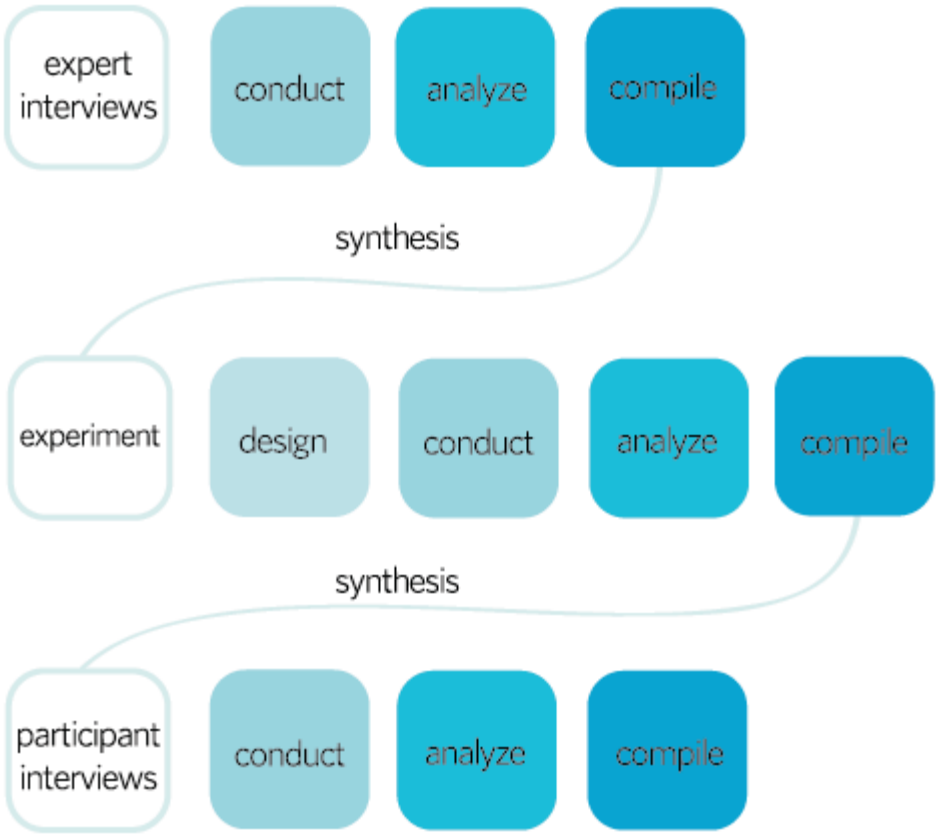

Figure 10. Research steps and approach

a rigid methodology in order to avoid missing out on potentially critical avenues of thought. Figure 10 demonstrates the steps taken in the different stages of research, which built upon findings from prior stages in order to gather more meaningful outcomes:

Each step was planned only after the previous step had been completed, analysed, and synthesized. This meant that unanticipated factors and data that emerged over the course of the study could be incorporated at every stage of the project.

3.2 Rationale

The interview questions were developed for qualitative data collection (see Appendix A). The next stage was to test the study's hypothesis by planning, designing, and creating edible prototypes. In order to inform that process, the researcher interviewed experts in the fields of food, material culture, and design. These interviews were of help in developing a framework for data collection and analysis.

Specifically, these interviews allowed the researcher to collect ideas about how to approach sensory stimuli through food and how to attend to the nuances of sensory incongruity in the context of food design. The iterative design and development of the prototype edible vessels sought to manipulate the visual/ tactile and visual/gustatory sensory stimuli for purposes of the experimental study, and information gleaned from the interviews was vital to achieving these goals.

Figure 11. Utilizing different methods of data collection

Using an experimental study involving close observation of the participants enabled the researcher to see how the participants interacted with both edible and non-edible vessels. This was the most effective way to document the participants' emotional responses, which could contribute to better product development within the realm of food design.

3.3 Triangulation

In order to achieve rich multi-layered data, information was gathered from a variety of sources that built upon and complemented each other. In the study of social sciences, 'methodological triangulation' entails the use of more than one method. This approach, which "involves corroborating evidence from different sources to shed light on a theme or perspective" (Creswell, 1998, p.202), is important in qualitative research in order to compile extensive and dimensional data (Bryman & Teevan, 2005, p.325). For the purposes of this study, the three

methods of data collection were expert interviews, an observational study, and face-to-face participant interviews.

3.4 Interviews with Experts

In quantitative research, interviews are structured to "maximize reliability and validity of measurement of key concepts" (Bryman & Teevan, 2005, p. 183). Qualitative interviewing is considerably less structured, emphasizing flexibility and the ability to adjust initial research ideas. Subsequently, qualitative interviewing is adaptable, open-ended, and accommodating of changes in direction during the interview (Bryman & Teevan, 2005, p. 183).

The first step in this project was to interview two experts in order to lay the foundation for the subsequent stages of research. Six interview questions were used (see Appendix A). These questions were semi-structured in order to encourage the experts to range widely in their responses. The research questions did not seek absolute equations or results, but instead encouraged participants to share their subjective perspectives on their work and their fields of research.

3.4.1 Participants

The researcher conducted two expert interviews to create the fundamental framework for the study. The two experts were Dr. Rhona Richman Kenneally and Mr. David Szanto of Concordia University. Dr. Rhona Richman Kenneally is an associate professor in the department of Design and Computational Arts, and her current research, funded by the Social Sciences and Humanities Research

Council of Canada, investigates “domestic foodscapes … in mid-twentieth-century households in Ireland” (School of Canadian Irish Studies, n.d.). David Szanto is a PhD candidate in gastronomy whose work focuses on the relationship between food, people, and the experience of eating (Centre for Sensory Studies,n.d.).

3.4.2 Ethics

A minimal risk ethics application was submitted to Carleton University’s Research Ethics Board. Both experts were invited to participate in the interview via email correspondence, and were asked to sign consent forms giving permission to use the interview data. The experts determined the location and time of the interview, and voluntarily consented to answer the interview questions. The ethics application can be found in Appendix F, and it was approved on March 10, 2014.

3.4.3 Data Collection

Individual interviews with each expert were audio-recorded for purposes of transcription and analysis. The interview with Dr. Richman Kenneally took place in her office at Concordia University, while Mr. Szanto chose to host an online interview using Google Hangouts. Each interview took approximately one hour to complete.

3.4.4 Data Analysis

The researcher manually transcribed each interview. The analysis highlighted important notes and quotes from the interviews to construct a framework for the experimental phase of the project. The results of the analysis determined the project's experimental methods. The interviews also yielded relevant codes, which were analyzed to create a framework for the experiment study.

3.5 Experiment Study

This study sought to investigate sensory incongruity in the consumption of designed edible vessels. To that end, the research involved an experiment in which two sets of participants, one experimental and one control, were to be presented with a snack. The experimental group would receive snacks designed to evoke sensory incongruity, while the control group would receive more conventional snacks. The purpose of this was to allow the researcher to observe and qualitatively examine the differences between each group's experiences in order to address the study's overarching research questions.

3.5.1 Design of Edible Vessels

After researching designers who apply sensory elements to food products to create edible vessels, the researcher began to develop edible vessels in order to facilitate the experiment on the effects of sensory incongruity. An in-depth discussion of the development of the edible vessel is included in the next chapter.

Prior to the experiment, three prototypes were created using different ingredients. Based on the interview with David Szanto, the researcher explored different gels to create a firm, edible cup: one cup was made with soymilk, gelatine, and taro jelly powder, while another was made with agar-agar and pomegranate juice, and the third was made with margarita juice and agar-agar.

The first two iterations were unsuccessful and therefore were rejected. The soymilk, gelatine, and taro jelly powder combination created a pale lavender grey colour, which was visually reminiscent of rot, while the taste ended up being creamy and sweet. While this could have created an incongruous experience, the recipe was ultimately rejected because of its weak structure. The pomegranate juice version produced a deep ruby red colour, but the taste was discernably like fruit juice, which would dramatically reduce the likelihood of evoking an incongruous experience. Refer to Chapter 4 for images of these two iterations.

The researcher chose to proceed with the recipe using a margarita mix, as it enabled a variety of colours while providing a strong and sweet lemon-lime flavour. Unlike gelatine, agar-agar is plant-based, derived from seaweed commonly found in Asia. When solid, it is firmer than gelatine, and does not melt at room temperature.

The preliminary prototypes were created using a silicone baking cup and an ice cube tray for producing ice cube shot glasses. After initial testing with both the ice cube tray and the baking cup, the researcher determined an ideal wall thickness of 1/8th of an inch, as a thicker wall would increase the density of the agar jelly and reduce pliability, rendering the vessel too firm. A special silicone

mould was created using both silicone baking cup and ice moulds to create the ideal shape and wall thickness.

Manipulating the colour of the edible cups allowed the researcher to create a variety of vessels that clashed with conventional western colour-flavour assumptions. The edible cups were dark emerald green, bright blue, and light pink because each of these colours bears strong flavour associations. Greens are typically associated with a lime or green apple flavour, while pink colours are associated with a synthetic strawberry flavour (Mariot & Jacquot, 2013). Raspberry flavours are commonly associated with blue colours (Spence, 2006).

The final recipe used for the agar cups can be found in Appendix H.

3.5.2 Participants

The participants were six undergraduate students in the Industrial Design program at Carleton University. Three female and three male students between the ages of twenty and twenty-three years were invited to participate in the study, and were randomly assigned into groups. Before participating in the study, the students confirmed they did not have any major food allergies.

Industrial Design undergraduates were selected to be a part of the study due to the nature of the education they have received so far at Carleton University. Five of the six participants were second-year undergraduate students from a class in Carleton University's Industrial Design program. The class focused on the sensory elements of design, thereby giving the students a basic understanding of the concepts of sensory design. The course material learned

in the class enabled the students to use appropriate language to discuss sensory design, which was helpful to the researcher in assessing their reactions. One first-year undergraduate student also participated.

3.5.3 Ethics

The research project proposal was reviewed and cleared by the Carleton University Research Ethics Board on December 4, 2013. Participants were recruited during class time and students received an emailed letter of invitation for participation (see Appendix E). Participants voluntarily consented to being video- and audio-recorded and also confirmed that they had no known major food allergies. See Appendix G for the consent form.

3.5.4 Experiment Procedure

There were two separate experiments, each involving three participants together in a room. Both experiments was set up and conducted in the Carleton University Master of Design studio on December 10, 2013. Fifteen minutes before the experiment, yogurt, clementine, kiwi, and cucumber were assembled and placed into the vessels for consumption. Experiment Group A consisted of two males and one female who were presented with snacks in agar cups that were blue, pink, or dark green. Group B, the control group that consisted of two females and one male, were presented with snacks in unlabelled plastic yogurt cups. The goal of the exercise was to consume the yogurt, clementine, kiwi, and cucumber inside the vessel, with the experimental group potentially consuming

the vessel at some point as well. Plastic spoons were offered to the participants, and the agar cups were served on paper plates.

The experiment took place in three stages. In the first stage, the participants were provided note-taking materials and presented with vessels containing yogurt, kiwi, clementine, and cucumber. Group A's food was served within edible agar vessels, while Group B's food was served in unlabeled plastic yogurt cups. During this stage, participants were explicitly instructed not to touch or consume the vessel or the food within the vessel, and were to take notes on their initial reaction to the meal. The second stage enabled the participants to touch and consume the food and vessel. At this point, the instructions were simple and brief to encourage the participants to consume the food however they liked. In the third stage, each participant participated in a semi-structured interview using questions prepared by the researcher prior to the session. Most of the questions were open-ended to encourage participants to talk as much as possible about their experiences.

The interviews were conducted individually right after the experiment, when the participants signaled they had finished consuming the food.
The interviews took place outside of the studio, out of earshot of the other participants. The interviews took from 5 to 10 minutes on average, depending on the volume of information the participants provided. During each interview, the researcher documented important notes and quotes. The interview questions can be found in Appendix C.

Participants were occasionally contacted via email after the interview to

clarify information that was unclear during the analysis phase. Each participant in Group B was contacted once for clarification.

3.6 Data Collection

During the study, the researcher set up a video camera to capture video and audio information. The researcher examined the videos and took note of particular actions and activities via timestamps.

The third-stage interviews lasted from eight to ten minutes. They were recorded using Audacity and transcribed verbatim. Hesitations and verbal pauses were omitted from the transcription. The entire transcribed wording was inputted into an Excel sheet to identify patterns from the study and establish codes.

3.6.1 Data Analysis

Data analysis followed a three-step process to configure codes, identify patterns and group the collected data into categories. The information from the coding provided the "initial categories of information about the phenomenon" (Creswell 1998, p. 57). Phrases and words were highlighted in an Excel file in a hierarchical manner to point out patterns in the participants' perceptions of the experience and process. Key words and themes were extracted from the interview analysis to isolate central concepts. The final result of this stage of data analysis was the construction of an affinity diagram with attributes and key wordings (Table 5 and Table 6) to reveal a pattern.

The researcher determined codes based on the descriptors the participants used. In particular, participants used the words “assume” and “expect” and “realize”, which would fall into the distance senses category. Words such as “texture” and “taste” were grouped together in the proximity senses category.

4 Chapter: Findings

This chapter presents the results of the qualitative data analyses for each method in chronological order. The codes identified through analytical triangulation are also discussed in this chapter in relation to the research questions and the hypothesis of the study.

First, the data analyzed from the interviews with Dr. Rhona Richman Kenneally and David Szanto produced the main codes and themes that were used to analyze the results of the study experiment. 'Thick Description', a term coined by Clifford Geertz, is then used to describe the experiences in the two experiment studies. 'Thick Description' is a method of ethnography that explains the context of user behaviour. Through these descriptive narratives, the reader can get a sense of the participants' experiences, including their particular behaviours, mannerisms, and actions. An affinity diagram based on the data collected from the participant interviews also illustrates the main ideas and attitudes expressed. Finally a section that discusses the different sensory relationships that emerged from the participant interview and study is presented.

4.1 Findings From Expert Interviews

The data gathered from the expert interviews presented codes that were used for the conceptual framework of the study, which supported the mindfulness and sensory incongruity aspects of the literature review and strengthened the experiment's methods. The researcher found several codes that overlapped from method to method, confirming points of discussion from the interviews.

The framework is created based on the data from expert interviews, to serve as a model for the study. Table 1 show the codes, overall responses, and isolated comments that were used in creating the framework. The overall framework is derived from a compilation of experience and academic knowledge across the interviewees' three categories of expertise: Food, Environment, and Experience.

BUILDING THE FRAMEWORK
FROM EXPERT INTERVIEWS

DAVID SZANTO

COMMENTS

1. "The first thing was about confusing the senses, confusing the cognitive interpretation of the senses. So we are trying to produce a lot of different sensory moments that did not have familiar cultural reference points."
2. "So in mindfulness, we're trying to figure out what's happening in the hand, in the eyes, in the mouth, and also the nose, as the food is being brough to the face, and thinking about tasting it. Trying to draw attention to not the discursive, but the material and the sensory through the destabilization of what seemed to be normal"
3. "the meal is a, because it is such an incredibly diverse ecology of actancy, of actors, you got opportunities to scale up or scale down"
4. "I'm one of the actors in that ecology, but then the food is the built environment, and all those other people."
5. "wildly sensory experiences are being had, suddenly food, just because its being penetrated, changes the environment, changes the experience nearly unexpectedly"

OVERALL RESPONSE

1. The creation of foodstuffs that is not normally found or commonly interacted with in North America.
2. Creating mindfulness by being aware of the entire body during the process of meal consumption within an environment.
3. As designer, the ability to manipulate and create as much incongruity as desired
4. Decentrializing the role of designer to observer and facilitator
5. Participants not only interacted with the food and each other, interacted with the environment as an active art installation

CODES

1. sensory incongruity
2. mindfulness
3. construct of a meal
4. empathic design
5. sensory experience

RHONA RICHMAN KENNEALLY

COMMENTS

1. "Mindless eating is basically a kind of food ingestion without thinking about the broader ramifications of food. "
2. "My method is about working in a space that people are most comfortable with, so trying to defamiliarize their immediate intimate environment."
3. "Sensory incongruity comes from making the assumption that a sense is going to respond to something a certain way and whacking it out of the field in a completely different way"
4. "Mindfulness comes from the texture of the materials so sensory responses are hugely important."
5. " And the experience of food becomes manipulated in a completely different way. Because you are changing the utensils, you are changing the way they feel, tactility, the relationship between the food and those utensils. "

OVERALL RESPONSE

1. Mindless eating is the action of eating without awareness
2. Looking at familiar spaces to create mindfulness.
3. implenting sensory incongruity brings up new ways of consumption
4. mindfulness through sensory incongruity can be created not only with foodstuffs, but with utensils
5. From mindless eating, the cues from sensory experience are not picked up as often.

CODES

1. mindless eating
2. habitual behaviour
3. sensory incongruity
4. mindfulness
5. sensory experience

Table 1. Example of framework creation from interview data

The following illustration shows the initial coding that structured the data analysis of the expert interviews (Figure 12).

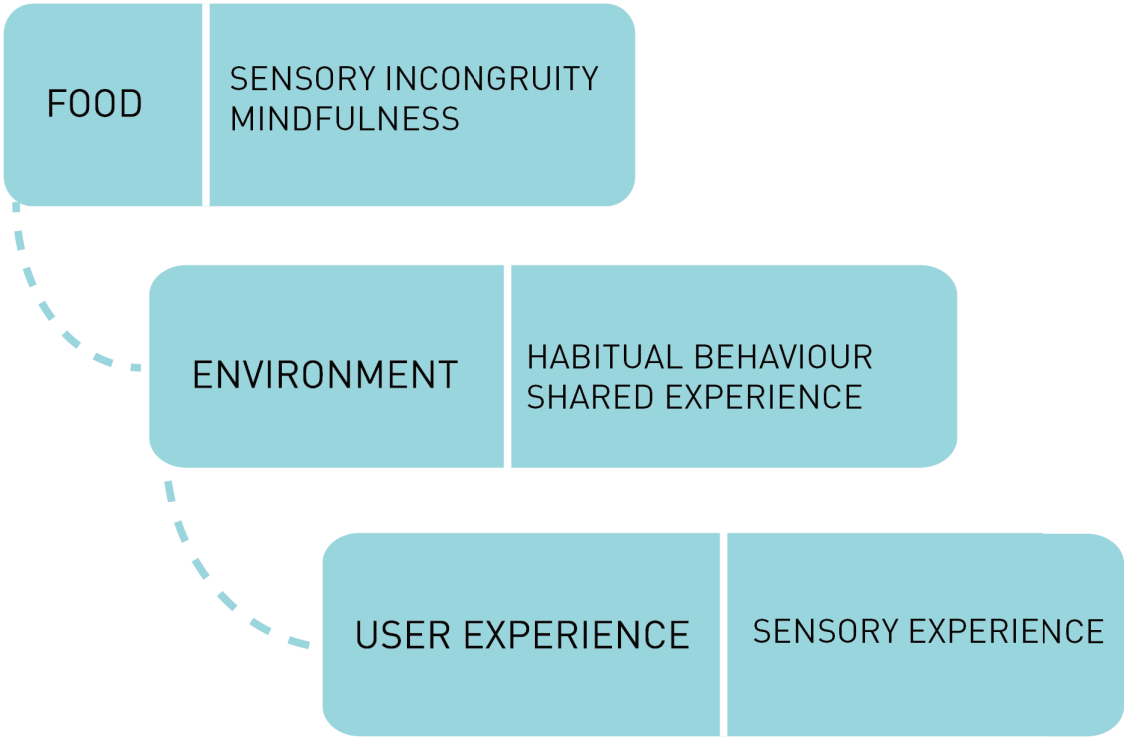

Figure 12. Framework from expert coding

Food

Figure 13. Framework Section: Food

The term 'Food' refers to the foodstuff and/or utensils that make up a meal. These items are also suitable for creating mindfulness, because designers can manipulate these products to evoke various types of emotional response. The term 'sensory incongruity' was introduced and defined to the experts to ensure consistency. It implies some level of manipulation of the vessels, utensils, or the food itself, by the designer to evoke an emotional response from the user by creating incongruous sensory reactions.

The term 'Mindfulness' is used in the food category to mean awareness of being present or responsive attention. Mindfulness and general awareness can be created if sensory incongruity is established in a meal setting.

SOURCE	EXCERPT	CODE		CATEGORY		CONCEPT
David Szanto	[I was] trying to confuse the palette, like "I don't know what this is", so a lot of people played "guess the flavour". The agar texture was also very confusing because it was quite hard.	taste	→	sensory response	→	food

Table 2. Example of Expert Coding

SOURCE	EXCERPT	CODE	CATEGORY	CONCEPT
Dr. Rhona Richman-Kenneally	"Mindfulness comes from the texture of the materials so sensory responses are hugely important."	mindfulness →	sensory response →	food

Table 3. Example of Expert Coding

Environment

Figure 14. Framework Section: Environment

The term 'Environment' refers to the social milieu that surrounds the user. A shared experience between people and users can be created via shifts in habitual behaviour, which can elicit an emotional response amongst those involved. The term 'Habitual Behaviour' includes the regular set of behavioural rituals one performs during the consumption of a meal. Lastly the term 'Shared Experience' refers to bringing people together via the structure of a meal by having them sit together and allowing them to interact with the same foodstuffs.

User Experience

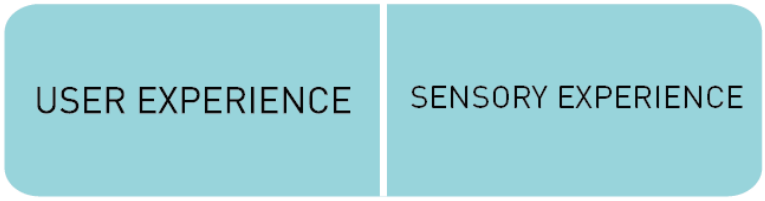

Figure 15. Framework Section: User Experience

Once the Food and Environment has been established, the overall 'Sensory Experience' is recognized, evaluated, and identified by the participants. This affords designers an excellent opportunity for the observation of the particulars of the participants' interactions and reactions, also known as the 'User Experience'. The term 'Sensory Experience' in this case refers to the participant's positive or negative reaction, depending on the type of sensory stimuli engaged. Here, designers can observe variations in the participants' involvement in the experience.

SOURCE	EXCERPT	CODE		CATEGORY		CONCEPT
Dr. Rhona Richman-Kenneally	"...the experience of food becomes manipulated in a completely different way. Because you are changing the utensils, you are changing the way they feel, tactility, the relationship between the food and those utensils. Sensory incongruity comes from making the assumption that a sense is going to respond to something a certain way..."	sensory incongruity	→	sensory manipulation	→	food

Table 4. Example of Expert Coding

4 .2 Experiment preparation and development

This section describes the development, iterations, and final recipe for the edible cups. It explores the number of iterations that led to the correct technique, mixture, and overall shape of the vessels.

Shape of the Edible Container

The initial mould for testing was a silicone cupcake mould from IKEA. It was chosen for its rounded shape and small size, and was later used in the final silicone mould. A tapered conical plug from a shot glass ice cube tray was used

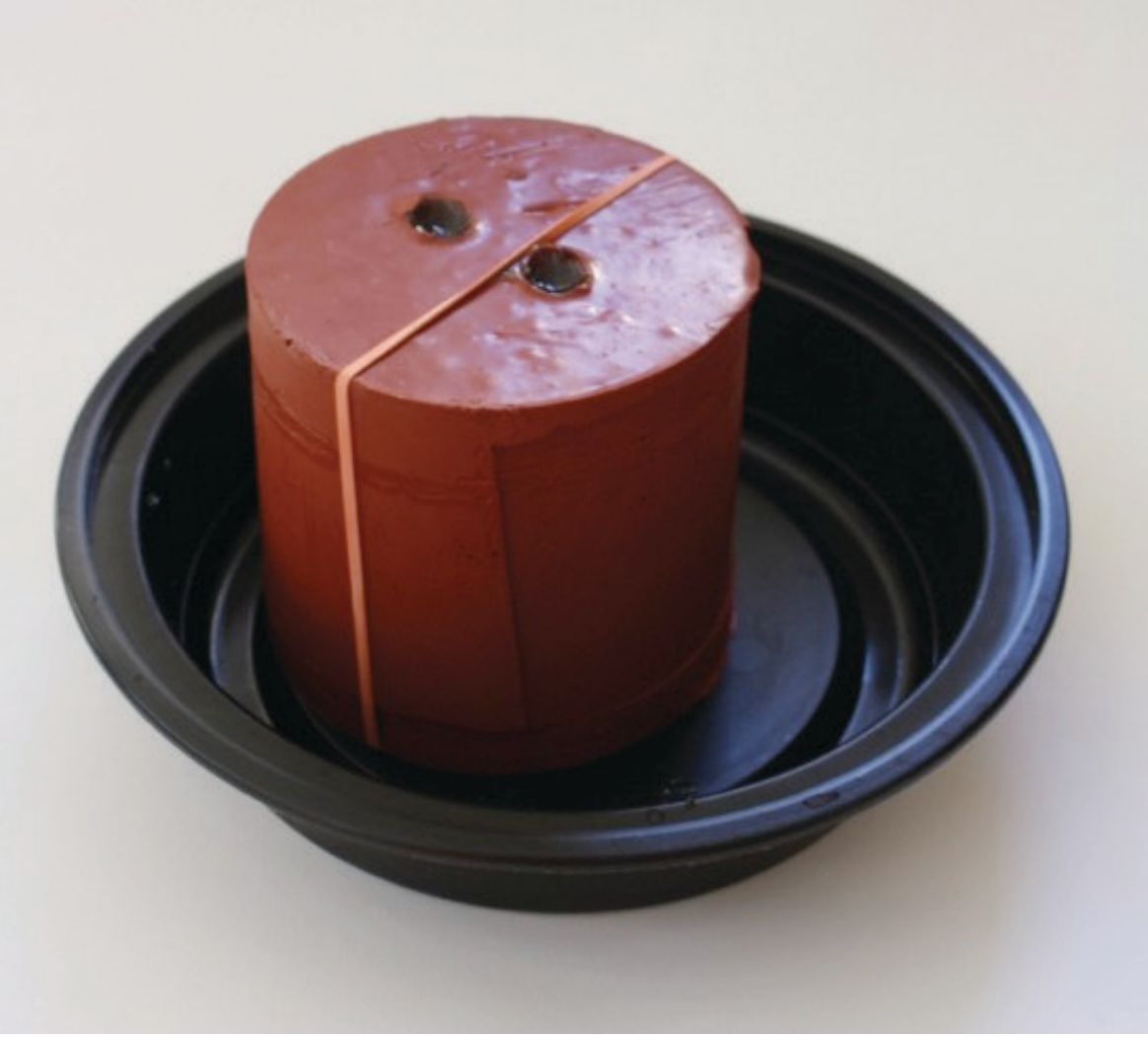

Figure 16. Final version of silicone mould with plug inserted

to create the plug for the mould and walls for the cup. Initially, the wall of the moulded container was ¼ of an inch thick. This was too thick: because of the thickness of the walls, the inner cavity of the cup had very little volume to hold food.

Figure 17. Custom silicone mould and the edible cup inside

A custom silicone mould was then created with the same shape as the cupcake mould. The tapered conical plug shape was used and the wall thickness was thinned down to 1/8 of an inch. This allowed the cavity of the cup to hold more volume.

Figure 18. First iteration in the mould, one hour in the fridge

When the mixture of the edible cup recipe is correct, the walls are very sturdy at that thickness. If the mixture is too watery, the walls are more pliable, and slippery. The base of the cup is very solid and thick, regardless of the mixture consistency.

Recipe Iterations

The first recipe was a failure. Too much water and too little agar powder were used, resulting in a very watery cup that was not firm enough to stand on its own. The mixture was created with lukewarm water, not boiling water. A touch

of taro powder was added for colouring, giving it the lavender colour. The mould was placed in the refrigerator for an hour, and it did not set completely.

The second round of creation involved the creation of three cups, using more agar powder and boiling water. The first one had margarita mix flavouring, with no colour added. The result was a light yellow, translucent colour. The second one consisted of pure pomegranate juice, water and agar powder. The colour turned out a bright ruby colour, with the sweet tangy taste of pomegranate. Both textures were very firm, making the walls of the cup very thick and unpliable. The third cup included soymilk and taro root powder. It was less firm than the first two cups, and had a slimy sheen to it, unlike the others. The colour was light purple-grey, which made it look like rotting or mouldy food. The

Figure 19. First iteration of the edible cup

visual characteristics of the cup were so unappealing that there was hesitation to taste it. The taste was, however, light and sweet, with a hint of taro flavouring, and the texture was very creamy. The third cup's recipe could have been used as the final recipe for its visually unappealing qualities, but the structure was not firm enough to stand on its own.

Texture

The texture of the edible cup prototypes varied depending on the amount of water used for the mixture. The tactile characteristics ranged from firm, thick,

Figure 20. First two cups on left were made with recipe 2 and the cup on the farthest right was made using recipe 3

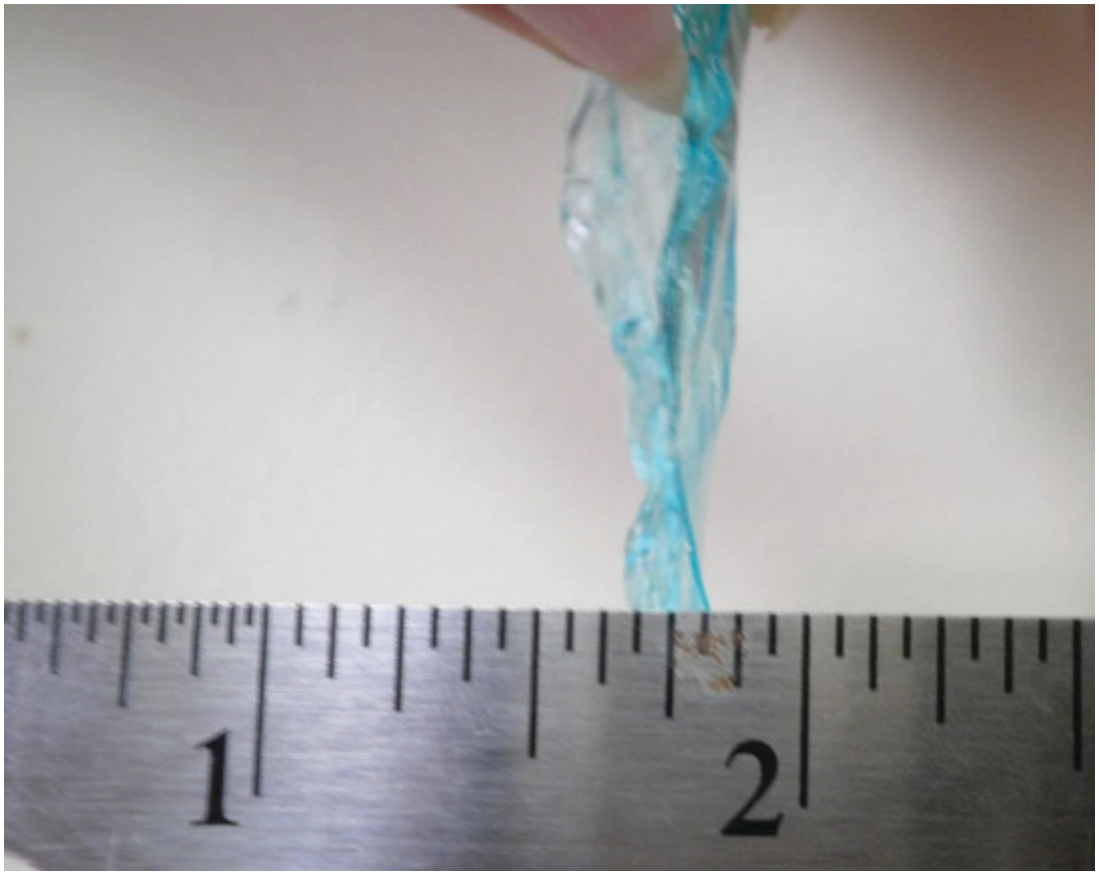

Figure 21. The mixture can be made as thick as ¼ inch and thin as one millimetre

and slightly sticky, to thin and slippery. In all cases, the texture was very smooth and had tactile characteristics that differed from gelatine-based foods.

Taste

The edible cups were each flavoured with 1 teaspoon of margarita mix, which was integrated while the mixture was boiling in the pot. Since the cup is a semi-translucent light yellow colour if left without food colouring, it is an ideal base for potential colouring. However, if the taste additive is already coloured, the mixture will take on the additive's colour. Using essential oils is recommended for future creations for optimal visual/gustatory sensory incongruity. As most

Figure22. Showing the smooth and wet texture of the blue edible cup

essential oils are colourless with a flavour intensity that is stronger than juice, future creations of the edible cups can expand into a wide variety of colour/taste sensory attributes.

Figure 23. Result of mixture simmering too long, and process too slow

Process

The entire process is very quick, and must be done in a speedy, timely manner. If the procedure is performed too slowly, it could burn. If the mixture simmers for too long, it will start to set in the pot. Ingredients and utensils must be prepared and laid out in advance or else the mixture could end up with a different consistency than planned.

The mixture must be hot while being poured into the mould, as it sets relatively quickly once the heat has been lowered. If the mixture is left in the pot to simmer on low heat for too long, it will begin to set, making it very difficult to pour into the mould. The result is an incompletely formed mould. A way to determine whether the mixture is hot enough and at the right consistency is to dip a chopstick or spoon into the mixture, and hold it up. If the liquid on the utensil begins to harden into a gelatinous mass, it is ready. Overall six to ten prototypes were made, with slight adjustments to the ingredients from the final recipe. Blue food colouring tended to make the cup moist and less firm, whereas green and pink colouring made cups that were firm, less moist, and very lightly sticky. The latter characteristics were ideal for containing yogurt and fruit.

4.3 The Experiment Study

After analyzing the videos recorded during the experiment, the researcher created the following narratives and sorted them by theme and code in order to highlight the behaviour, interactions, and comments of the participants during the experiment. Each participant was coded with a pseudonym to protect his or her identity.

4 .3 .1 Group A: Distance Senses and Surprises

Amy, Rob, and Colin arrived at the MDes studio for the study in the early afternoon.

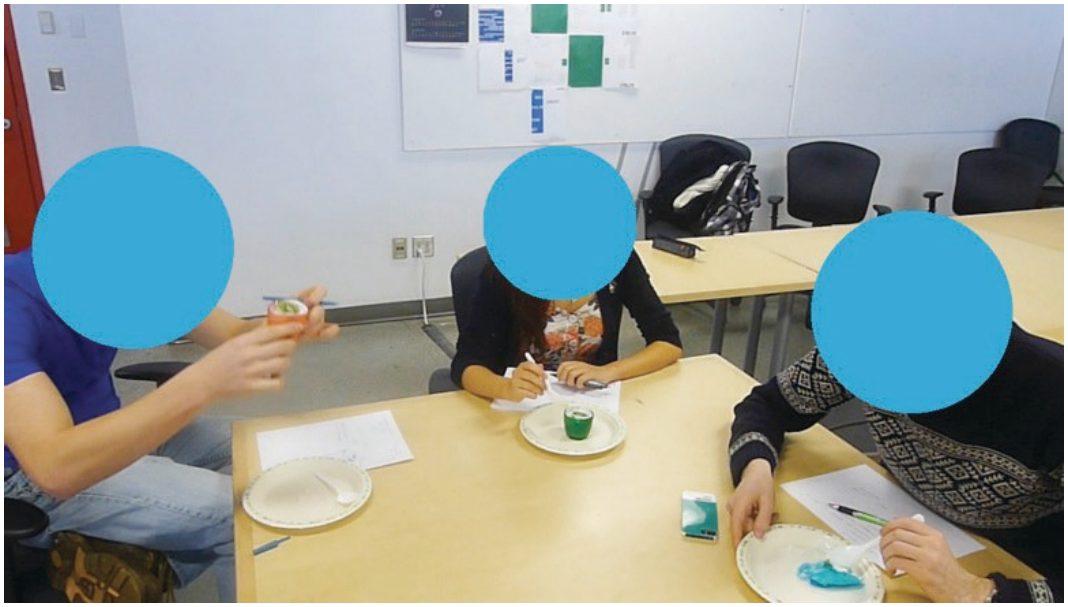

Figure 24. Participants investigating the edible cups

Surprise

Throughout the experiment, Amy laughed when there were new discoveries. She even laughed when she ate her portion of cucumber, and as she ate pieces of her cup. When the cup was placed before her, she exclaimed, “This is so cute!” Rob noticed the cucumber inside his cup, which also brought a smile and laugh from Amy. She continued to laugh when Rob and Colin discussed whether the cucumber caught their attention.

Colin’s facial reactions displayed barely any surprise during the experiment. When his blue cup started to collapse and fall apart on his paper plate, he simply remarked, “it’s on its last straw, it’s gonna go.”

Figure 25. The blue cup beginning to split and break

Assumption and Expectations

Amy and Colin cut into the cup, each using a spoon like a knife before scooping up the yogurt to eat. Colin had guessed the cup was edible, and was the first one to cut and take a bite out of his cup with his plastic spoon. When he took a bite and chewed, he noted, “I knew the cup was edible.” When his blue cup split, its contents spilled onto his plate. On the other hand, Rob spooned the yogurt and kiwi first, and did not eat the edible vessel until he had eaten everything He was busy squeezing the sides of his edible cup, noting, “That’s more solid than I expected…a lot more fragile on the plate than in my mouth.” Amy had a different take on expectations: “The container was harder than I thought it would be.” She said that the yogurt wasn’t as sweet as she thought it would be, and then realized, “you set it up that way!”

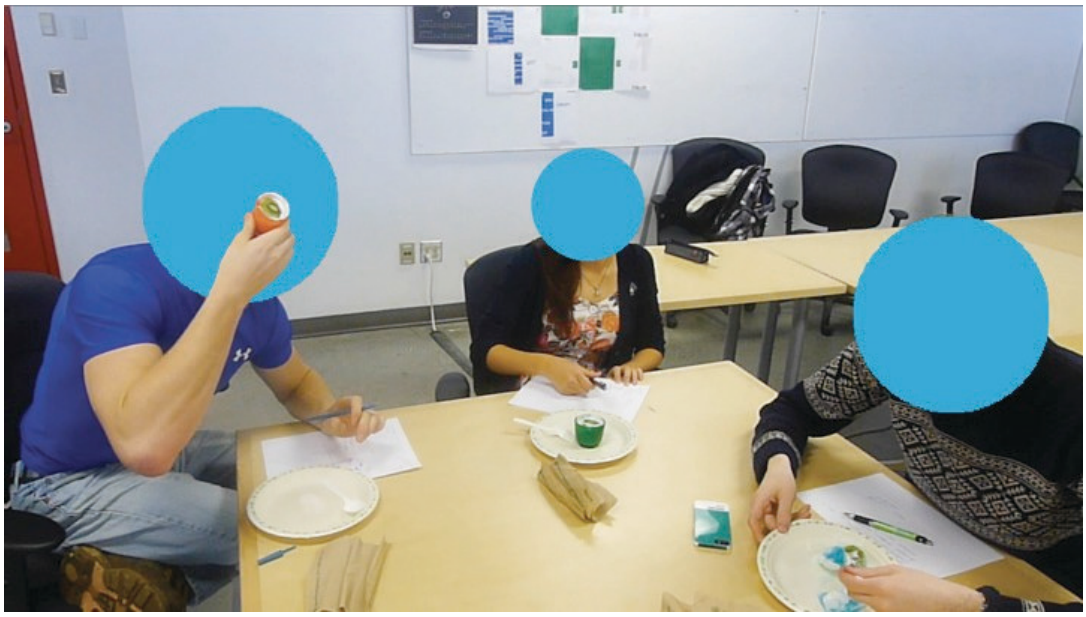

Figure 26. Participants eating during the experiment study

Colour

Amy's cup was green, Colin's was blue, and Rob's was pink. The colour never changed; it didn't warp, sweat or bleed. Rob felt his pink cup was the most compelling, "because the pink and the green looked way nicer than the green and the green." Amy appreciated the translucent aspect of the cup: "Because of the container it was translucent, you think you know the components of it, but there was a tangerine slice, and a cucumber slice in it." She could even tell that the cup had been stored in the fridge from the condensation on the cup wall.

Play

Rob was the most physically playful during the experiment. He used his ballpoint pen to poke and nudge his cup, and he then stood up on his chair, leaning forward to get a bird's eye view of it. As he was nearing the end of Phase 1,

Figure 27. Rob's unfinished cup and drawing

he began to drum his fingers on the table before picking up his pen, announcing "I'm just going to draw the cup now" and proceeding to draw on the paper. Colin and Amy chatted together about drawing their cups and followed suit. They mostly drew in silence, making small comments about their doodles along the way.

When Phase 2 started, Rob reached out and squeezed the sides of his edible cup, picking it up and examining it. He peered at it closely, examined it, and then licked the bottom of the cup to catch the dripping yogurt that had

spilled when he squeezed the cup. After finishing his yogurt and fruit, Rob started to draw shapes on the plate with his pen to amuse himself. He changed the edible vessel into a 3D object as part of a different picture. He interacted with his edible vessel and created something completely different.

Taste & Texture

Colin was the first of the three to begin consuming his edible cup. Rob and Colin discussed with each other whether the cucumber had stuck out to them during consumption. Colin stated that it "was the one thing that didn't match in there, the one thing that stuck out!" Colin enjoyed the kiwi and the clementine, while Rob admitted that he ate the cucumber before really tasting it. Colin commented that the edible cup "tastes nice with the yogurt." Amy was the last to eat hers, as she was watching Rob and Colin take their first bites. Amy noted, "What really struck me was the texture. From what I thought, it would be thicker." Rob later described the plain yogurt, "[it] has a very unique flavour, where it almost feels like it should be sweeter than it really is, and there is a bitter-sour taste." Colin described his cup surface as rubbery, "…the rubber was sort of unusual texture to have in your mouth, it wasn't quite as soft as JELL-O, you know how you eat JELL-O and it dissolves in your mouth, it didn't quite do that." Rob didn't consume much of his edible vessel, "I didn't eat all that much of the cup, but there was definitely a sugary flavour to it. I thought at one point, I tasted a lime aspect, but it wasn't super strong, and I didn't really investigate to see more."

4 .3 .2 Group B: Proximity Senses and Surprise

Group B arrived roughly 30 minutes after Group A had left. All classmates from the Industrial Design program, the three were jovial and laughing with each other.

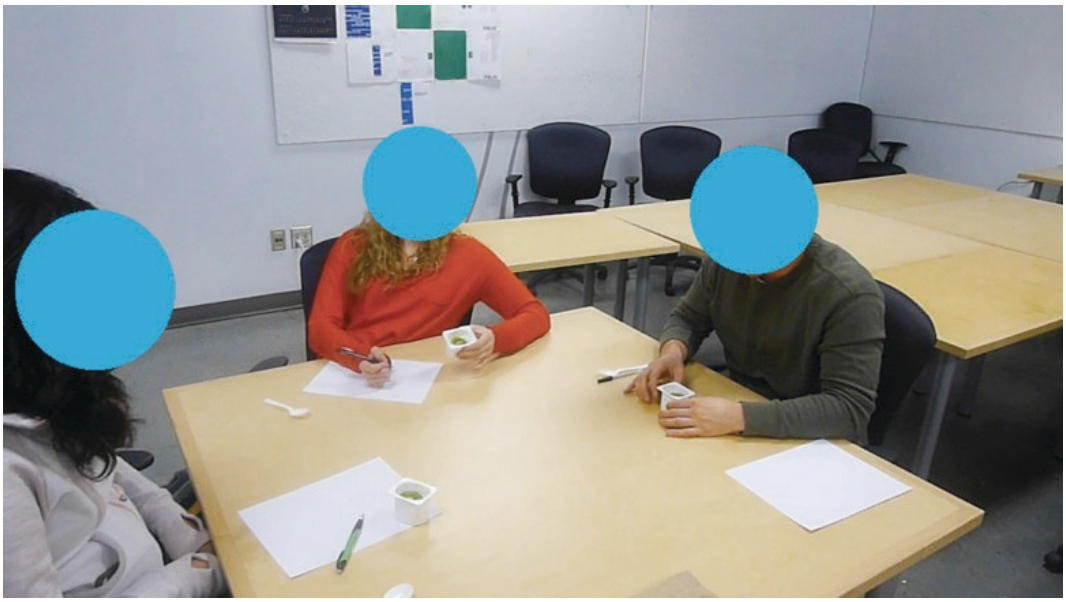

Figure 28. Participants touching the cups after being instructed not to

Surprise

When Phase 1 started, Rose, Leila, and Nathan all reached over to touch their containers, in spite of being asked not to. Rose reached out to pinch the sides of the cup, while Leila and Nathan both reached out to pull the yogurt cup closer to then. Each of them stroked the cup with a finger and squeezed the sides to watch the yogurt move. When they were reminded that touching was not allowed in this phase, they all recoiled. They then asked if they could smell the cup, and all three leaned forward to smell the cups.

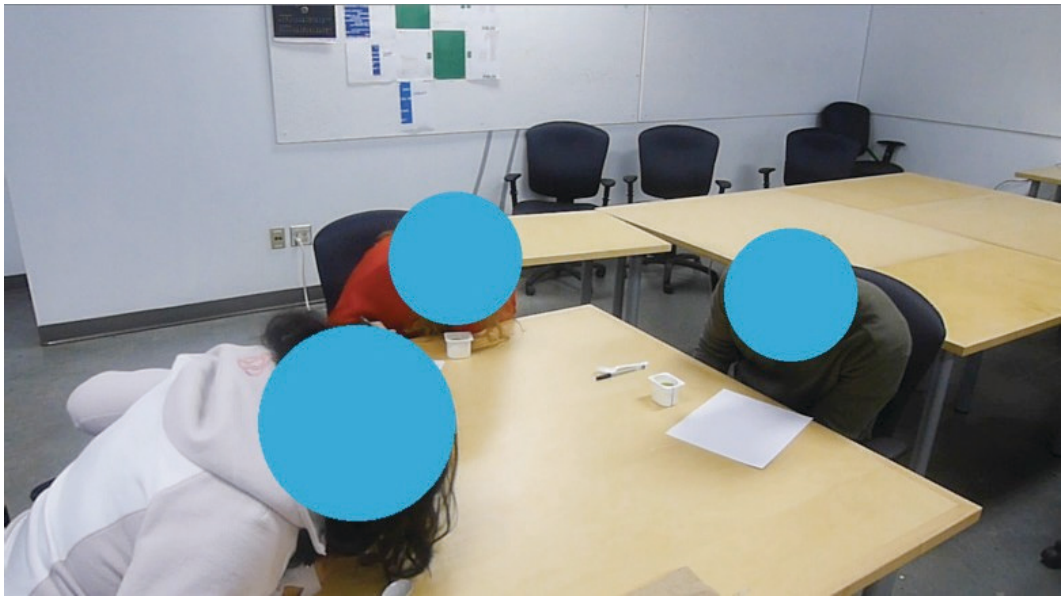

Figure 29. Participants sniffing the cups

Surprise: Humour & Laughter

The participants were making jokes and laughing at each other during the experiment. The overall atmosphere was very relaxed and easy-going. After being reminded that they weren't supposed to touch their cups, Rose giggled and apologized. Nathan blushed and slumped back into his seat. When Phase 2 started, Nathan smirked when he reached for his cup, and Rose smiled when she began to eat. Nathan was startled when he began to eat and realized he was eating yogurt, "[I] thought it was vanilla because kind of had the vanilla smell, and I didn't know there was tangerine or cucumber inside." While Leila laughed most often, Rose smiled more.

Surprise: Food

Leila and Nathan talked about finding surprises in the cup. Leila discovered the kiwi and laughed when she realized what kind of it was, "it was really cool that I tasted the yogurt first, it kind of cleansed my palette before trying the different types of fruit in the yogurt, and having that taste like, amplified, different, like, excitement happened on my tastebuds." Nathan also commented that there was a surprise inside the cup when he discovered the clementine wedge. Rose didn't even notice the cucumber or the clementine in the cup until the other participants mentioned it. "I didn't notice there was a cucumber or an orange!" She was unsure of how the flavours would taste with such different combinations. She said, "When I had the kiwi I was okay with kiwi and yogurt [together as], that kind of makes sense. Same with the orange, since it is more of a dessert type thing. I was kind of surprised at the cucumber; I was a little intrigued and worried about those two tasting together and that's why I was interested to see that the yogurt actually overpowered the cucumber."

Colour

Each participant received a white yogurt cup with no label. The exterior of the cup was smooth white plastic with a white fuzzy texture from the peeled paper label. During and after the experiment, none of the Group B participants mentioned colour in their notes or interview. All three participants mentioned the glossy white plastic and fuzzy paper-like coating of the yogurt cup. Rose noted that the whiteness of the yogurt cup and the yogurt made the kiwi appear to have a more vibrant colour.

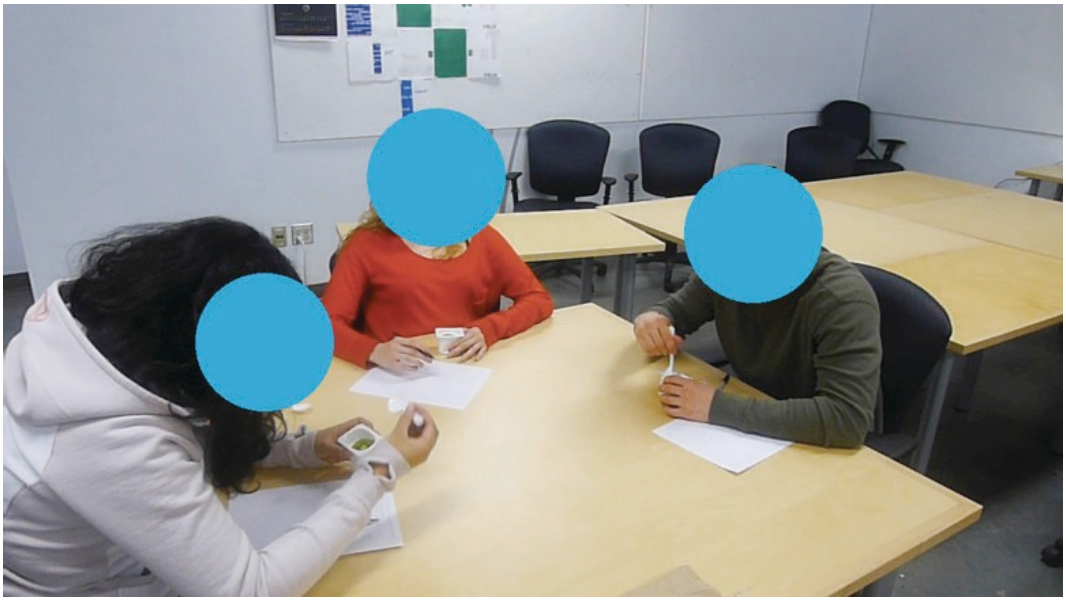

Figure 30. *Group B consuming the yogurt.*

Play

Between eating and writing notes, Rose squeezed the yogurt cup with her fingers a few times. Nathan used his spoon to scrape the inside of the cup frequently, even when it seemed there was nothing left to eat. Both Rose and Nathan twirled their spoons before dipping them into the cup. All three participants licked and sucked the contents of the spoon at several occasions during the experiment. Rose picked up the kiwi with her spoon, and licked the yogurt off of the fruit. When most of the contents were eaten, they used their mouths to touch the lip of the yogurt container.

Nathan noted, "it was better than I expected…[I] thought it was just kiwi and yogurt and that we had to squish it and play with it in our mouths." He said he ended up mixing and matching the fruits with the yogurts to determine which flavour combination he liked best. He said, "I was figuring out what I wanted

to mix: kiwi with the orange, orange and the cucumber, and the yogurt just by itself."

Taste & Texture

Throughout the experiment, Rose was the most vocal about the overall taste of the food, though she was not particularly descriptive. She commented twice about the taste of the yogurt, stating that it "is pretty good." She said later, "the yogurt was sweet for a short amount of time, and then it went toward a more of a tangy flavour. I guess it's interesting since I'm used to eating Greek yogurt and this is a lot runnier than the usual yogurt I eat, so that was kind of interesting just in general, not being used to the runnier kind of consistency." Leila commented frequently on the texture of the kiwi in the cup, exclaiming: "It's crunchy!"

4.3.2 Summary of Experiment Findings

Group A experienced surprise as a result of the gap between assumption and expectation when they were eating the vessels. The emotions and reactions of the participants were clearly recordable and provided opportunities for coded comparison. The most surprise and overall positive, joyful emotional reactions came from the distance senses. The participants themselves confirmed the literature research on sensory incongruity evoking surprise, using the term "surprise" to describe their reactions. Group B also experienced surprise, but from a different aspect of the study. The surprise reaction among Group B

participants was a response to the proximity senses when taste came into play as they ate the contents of their cups.

Group A members were more playful with their cups while Group B members were more reserved. Both groups touched the exterior of cups to receive tactile sensory information. When tasting the snack, Group A commented more on the texture of the edible cup, noting its thickness and rubber-like tactile feel. Group B focused more on the intensity of flavour and the different mouth-feel textures from the fruit.

4.3.3 Codes From Interview and Experiment

The data from the experiments and the participant interviews overlapped with the codes from the expert interviews. The researcher applied the codes collected from the expert interviews to the experiments, and this confirmed the initial hypothesis that users respond to sensory incongruity. The codes support the literature review on emotional responses to sensory attributes, as well as the data collected from experts surrounding the topic. The results are presented in the diagram in Figure 31.

4.3.4 Overlap of Codes

As noted in the expert interviews, a collection of codes created the experts' framework to approach and create the experiment. The data collected and analyzed from the expert interviews resulted in an affinity diagram identifying codes. These codes would ultimately provide the framework for the experiment, the second method in methodological triangulation.

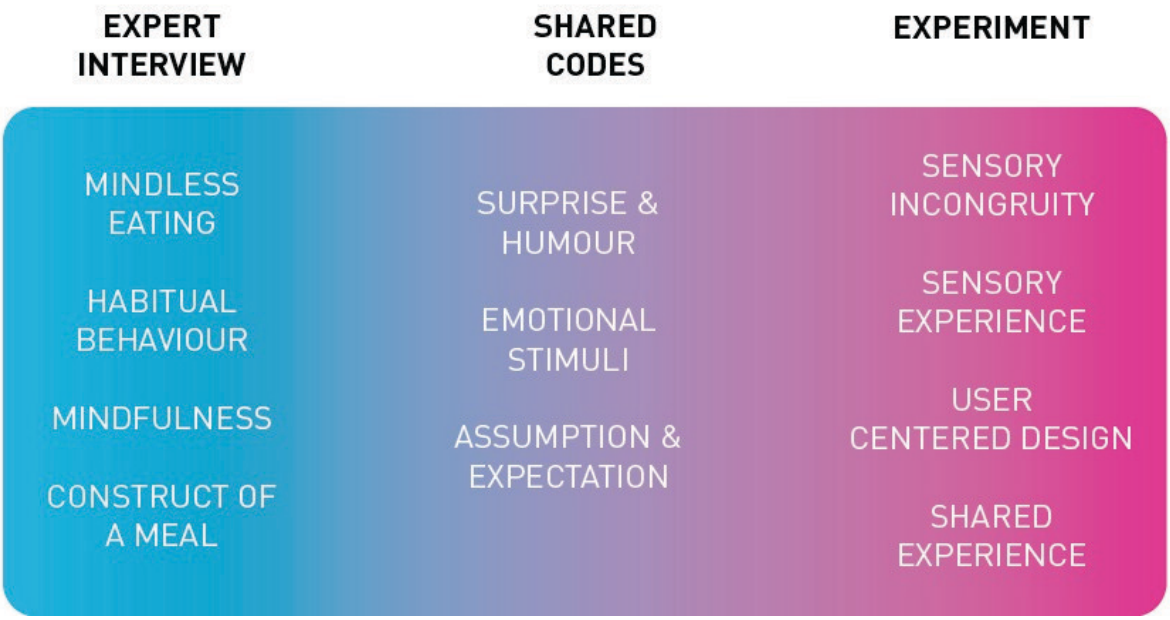

Figure 31. Diagram of overlapping codes

The figure above shows codes derived from the expert interviews and from the experiment with the participants. The "shared codes" in purple represent the codes that derive from both methods. The codes in that section become the themes that appear in the narrative descriptions.

4.3.5 Overview of the Participants' Interview Findings

The participant interviews allowed for a greater understanding of each participant's experiences and observations during the study. The main ideas and codes they discussed are plotted out on the following affinity diagram:

The categories and sections indicated in the diagram served as a means for organizing the opinions of the participants during the interview. They are Assumption, Surprise, Expectation, Colour, Mindfulness, Taste, Play, and Sensory Stimuli. Data from Group A is on the bottom row, and Group B, the

DISTANCE SENSES

	ASSUMPTION	SURPRISE	EXPECTATION	COLOUR
GROUP B	not used to the runnier consistency of yogurt thought it was vanilla because it had a vanilla smell thought kiwi was frozen thought it was colder because it was darker colder than usual	surprised at the cucumber little surprise of the orange-tasty surprise	didn't notice there was a cucumber or an orange better than expected knew it was yogurt and kiwi/happy to find other things expected the same citrusy taste [kiwi/orange] "what am i expecting?"	white
GROUP A	smelled vanilla did not expect the other fruit/veg should have been sweeter	knew it was going to be yogurt with kiwi happy to know there were two other fruits inside "better than i expected, thought it was just kiwi and yogurt" surprised, more rubbery than thought originally	did not expect fruits translucent= did not know components expected container to dissolve a lot more fragile on the plate than in my mouth for a gelatin food, expected it to be a lot less rigid	thirst quenching very calming smelled vanilla lime tasted lime sugar

Table 5. Affinity Diagram featuring distance senses

PROXIMITY SENSES

	MINDFULNESS	TASTE	PLAY	SENSORY STIMULI
GROUP B	different things led to better experiences seeds of kiwi pips very present took half the study to realize the cucumber i realized there was a more tasteful experience, going through entire container	orange overpowered the yogurt tangy and sweet kiwi was crunchy thought cucumber was kiwi because of colour thought yogurt was vanilla tasting bland, watery	play with the sides and squish intrigued and interested of two flavours tasting together "had to squish it and play with it in my mouth" excitement ended up figuring out what i wanted to mix kiwi/orange cucumber/orange yogurt alone	kiwi and cucumber had auditory stimuli appearance looked cool, looked fancy, tastewise kiwi has such a texture in your mouth yogurt is so smooth
GROUP A	kept an open mind to flavours (yogurt)	easier to eat because container was sweeter gelatin yogurt was a very unique flavour should be sweeter bitter-sour	it was very cute squidgey, light and fresh thought of the summer when you set it down it jiggled	nice change of texture because of thickness mix of textures felt funny biting rubber unusual texture orange/tangerine interesting texture sensory of the mouth

Table 6. Affinity Diagram featuring proximity senses

top row. Participants' comments are also categorized by proximity and distance senses. These categories differ by how the user would approach the codes. For example, taste is a proximity sensory attribute, as the user has to physically interact with the product. Each blurb is a quote from a participant. The quotes in pink illustrate opinions that stood out significantly during participant interviews and will be examined in the following sections. For example, one participant gave the response "very thirst-quenching" in the Colour category, rather than simply stating the colour of the cup. The affinity diagram groups codes according to whether they involve the distance senses or the proximity senses.

Engagement

Group A spent a total of twenty minutes and thirty seconds on the study, while Group B spent only ten minutes and twenty seconds. The time was calculated from the start time of Phase 1 to the end of Phase 2. For Phase 1, time was measured from when the first spoonful entered the mouth until there were clear

indications that participants had finished consumption. Group B took less time for this phase, ranging from roughly two minutes to five minutes and forty-one seconds. Rose's time is recorded in approximate terms because she would occasionally scrape her spoon inside the container to lick whatever remained, long after her initial indication of having finished eating. Rob spent the longest time eating, for a total of eleven minutes and forty-seven seconds, while Amy spent the shortest amount of time, at three minutes and fifteen seconds. These

measurements confirmed expectations that Group A members would participate and interact with their cups and contents for a longer time than Group B members due to the peculiar nature of their vessels and the awareness that their interactions with the vessels were being observed.

Figure 32. Amount of time spent consuming

Assumption and Expectation

The post-experiment interviews revealed that participants themselves had assumptions and expectations. For example, using visual information during Phase 1, they made predictions for how the contents would taste and smell. Group A's responses were primarily based on the sensory experience of the edible

cup, while Group B's responses centred largely on the discovery of fruit buried inside the cup and the tactile sensations of the fruit in their mouths. Both groups responded strongly to the odour of the yogurt.

Surprise

Based on information from the literature review and the expert interviews on the subject of surprise and humour, it could be expected that the participants would display some sort of emotional response. However, surprise occurred at different points for each group. Proximity and Distance senses play a role here, as vision was the primary sense involved in receiving and identifying information during Phase 1, and the proximity senses of taste played a larger role in Phase 2.

Group A participants were more vocal about their feelings of surprise, primarily during Phase 1. The highest element of surprise came from the features of the cup (thickness, flavour, ingredients). Their surprise was primarily a reaction to the preconceived ideas and assumptions they had developed during Phase 1.

The Group B participants experienced surprise in response to the taste of the yogurt. Their comments addressed the strength of the taste and odour of the yogurt and the fruit as well as the tactile stimuli of the kiwi pips and overall texture of the different fruits.

Mindfulness

In the participant interviews, the term 'mindfulness' was either minimally used, or not used at all, by participants. In spite of this, the participants generally indicated they were more mindful and aware of what was going on in the environment, and the unnatural eating environment could have been the chief reason for this increased mindfulness. While the participants did not express conscious mindfulness about eating, they were mindful of the information they were sensing. However, the researcher found evidence of mindfulness throughout the experiment in two particular categories:

•*Memory Recall*

During the one-on-one interviewing, every participant was able to recall the cups and the foodstuff with great detail. They thoroughly elaborated on the sensory modalities of their experience, from the gustatory senses to the olfactory senses, explaining the sensation of the yogurt and the fruit.

•*Social Interaction*

During the experiment, the participants engaged with one another by talking, making jokes, and asking each other questions. This social interaction among the participants demonstrated mindfulness of each other, especially since the members of both groups were not in the habit of eating together, nor were they in the same social circles.

Taste & Texture

Group B had the most to say about taste. The participants made detailed comments about the texture, tactile mouth feel, and overall sensation of consuming the fruit, specifically in their comments about the kiwi pips, the crunchiness and cool temperature of the cucumber, and the intense flavour of the clementine wedge.

On the other hand, Group A focused primarily on the taste of the edible vessel, noting its sweetness. Only one participant commented on the sour taste of the yogurt, and he also noted that he smelled vanilla prior to consumption. The general comment about the texture of the cup was its smoothness, firmness, and difference from Jell-O.

Play

The data collected from the Group B participants showed more attitudes and reactions that aligned with the "play" code. Participants mentioned squeezing the sides of the plastic cup and noting the exterior fuzzy paper texture. They also expressed their enjoyment in mixing and matching the different food textures and flavours.

Group A subjects were more focused on the physical properties of the edible cup. They commented on the sturdiness of the agar when they jiggled it on the plate and noted that the colours were fun. Given the overtly research-oriented setting and relatively abnormal characteristics of their meals, it is possible that the participants in Group A were too focused on following instructions to engage in the playful behaviour observed in Group B.

Sensory Stimuli

This code was assigned whenever a participant talked about a sensory modality as a means of defining and describing their experience. Rose, a member of Group B, mentioned the auditory stimuli of crunching and so on when eating the kiwi and cucumber, as well as the conflicting tactile textures when the fruit was eaten with the yogurt. Other participants noted the appearance of the fruit in terms of its tactile mouth feels, using words such as 'freshness', 'cool looking', 'cold', and 'frozen'. Group A commented on the nice change of texture from the cup to the yogurt to the fruit, and one participant commented on the thickness and texture of the cup itself.

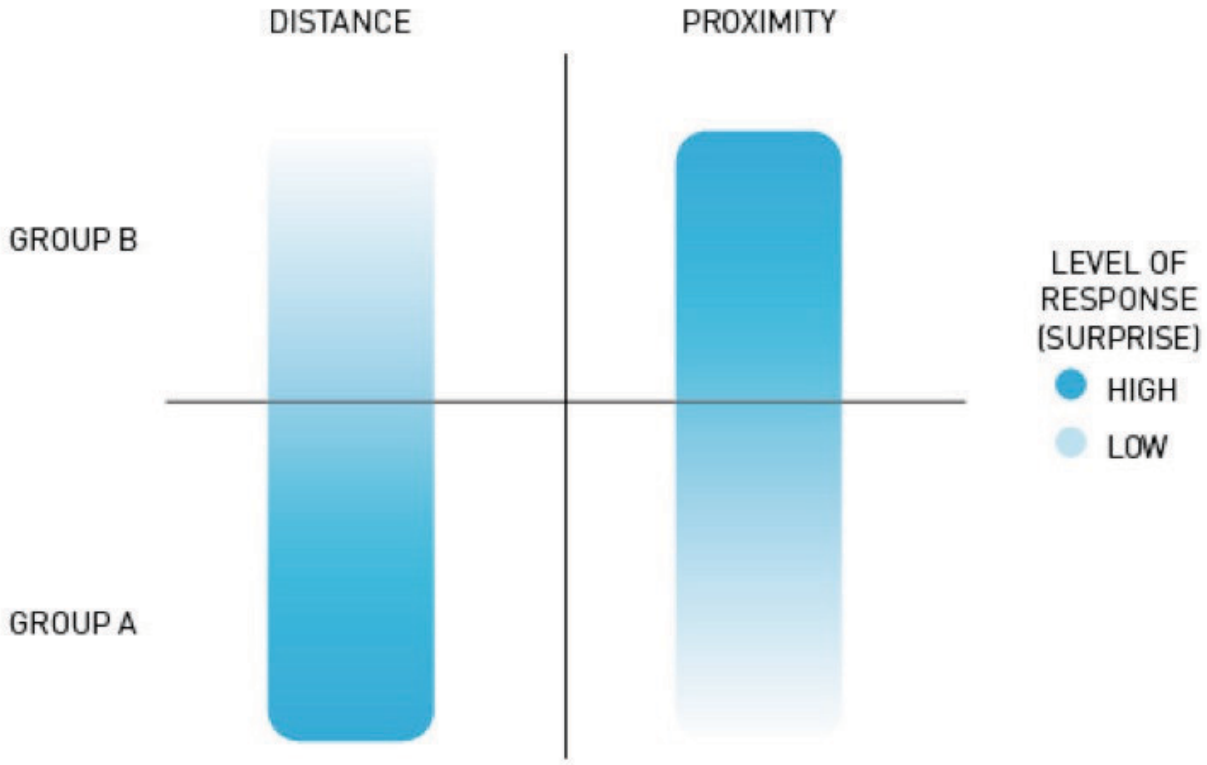

Figure 33. Diagram representation of the level of emotional response (surprise)

4.3.6 Overall Level of Emotional Response

Surprise was the most frequently recurring emotional response found in the experiment and data collection. The affinity diagram Figure 33 shows the kinds of surprise reactions observed in the data analysis of the different sensory experiences. Darker blue shows where there were a higher number of references to surprise. This indicates that the experimental group experienced higher emotional response to the stimulation of their distance senses, while the control group experienced higher emotional responses to the stimulation of their proximity senses. While both groups were given instructions not to touch the cups, all participants in Group B touched them, pulling away only after the researcher reminded them of the rules. They then proceeded in the next few minutes to lean forward and smell the cups, whereas the experiment group did not. When their ability to touch was taken away, the control group focused solely on their distance senses to gather the majority of the information within the cup. This distinction is noteworthy because it can contribute to our understanding of how emotional responses and sensory stimuli are prioritized and evaluated during new product development.

4.3.7 Summary of Findings

One of the most significant findings to come from the research is the relationship between emotional response and the type of sensory modalities the participants were engaging with. For Group A, surprise resulted from their assumptions and expectations in response to what they perceived through their

distance senses, whereas Group B's surprise resulted from the actual taste of the contents in their cup, and was therefore based on the proximity senses.

While coding the data, the researcher found evidence of mindfulness and mindful eating during the experiment. The unnatural setting for eating, a result of the environment and the context in which the experiment took place, potentially contributed to this. The insights that arose from these findings are discussed in more detail in the following chapter. The framework, its effectiveness, and its future improvements will be discussed, as well as the role of the designer-researcher when observing participants in the study.

5 Chapter: Discussion

This chapter synthesizes the information presented in the literature review with the data and events identified in the exploratory case study. It identifies the similarities and differences between the data collected and that of the literature review in order to address and discuss the central research questions of this study. It also examines relationships between different sensory incongruity attributes uncovered through the findings, as well as possible academic and professional contributions emerging from this research.

5.1 Overview of Expert Framework

The expert framework was constructed from the data that emerged from the preliminary expert interviews, with the participant experiment study in mind. The elements of Food, Environment, and User Experience provided insight into the research hypothesis, as outlined in the first chapter. The criteria in both expert interviews in each of the three categories of the framework provided an analysis grid for identifying the participants' user and sensory experience.

The most revealing category in the framework was Environment. The participants in both groups altered their usual manners of consumption to adhere to the instructions of the study and to understand the composition of the food. Their habitual behaviours changed to accommodate the foreign foodstuff, leading to increased mindfulness among the participants. This evoked a sense of common experience in which the participants conversed with each other about the food.

The Food category also provided insight into sensory incongruity. While

certain sensory modalities were manipulated to try to evoke an emotional response, such as visual/tactile and visual/gustation incongruities, others were unexpected, such as the incongruity of odour/gustation. In the experiment, participants reacted to the surprisingly different texture of the kiwi in contrast to the yogurt, consistent with the observations of Lawless & Heymann (2010), who find that compared to colour and flavour, texture is not only an indicator of food safety but is also a visual marker of food quality (p.260). Visual texture can also be reinforced when experienced in the mouth, specifically when feeling the texture of the food item. Given that consumers tend to rely on visual perception when determining what is consumable, colour is one of the dominant elements in food selection (Lee, Lee, Lee & Song, 2013). The study help confirm this perception since participants formed these expectations and assumptions within the first ten minutes of Phase 1.

In the Experience category, the overall sensory experience was demonstrated by participants' interaction with and responses to the incongruities. The emotional stimuli were all positive, ranging from curiosity to humour and surprise. The analysis helped understand how habitual behaviour can change through experience.

The application of the framework as an analysis tool was not sufficient to answer all the research questions comprehensively. While some of the elements in the three categories were easy to investigate, not all of them were feasible with the available resources. In particular, it was difficult to create a 'perfect' environment for optimal mindfulness, as this part of the study took place within

an academic setting at a location that was both unfamiliar to the participants. Overall, the participants' knowledge that the activity was for research led to an increased general self-awareness in terms of their body movements and interpersonal interactions.

5.2 Relationships

The participant interviews and observation of participants with the edible and non-edible cups revealed several relationships governed by assumption and expectation that were not discussed in the expert interviews. These relationships are gustatory/odour, vision/taste, and tactile/vision.

5.2.1 Taste/Odour of Yogurt

It is common for people to struggle to put olfactory experiences effectively into words (Maric & Jacquot, 2013) and taste is commonly assumed to be olfactory. The white yogurt used in the study was plain probiotic yogurt and was not as creamy as standard Greek yogurt. Rose from Group B stated it had a "fresh, bitter, tangy" taste and a "slightly sour" aroma. As discussed in the literature review, Bouteille et al. (2013) note that consumers emphasize freshness in their ratings of yogurt and yogurt-like products.

The most compelling element in the data arising from the analysis was the code "smelling vanilla." Almost all participants in both groups mentioned vanilla, whether from an assumption standpoint or an expectation standpoint. Further, two participants perceived a vanilla scent, in spite of the fact that there was no

vanilla flavouring any of the food products. This was the first actively noted instance of incongruity in the study. Since there was no purposeful or conscious manipulation to create olfactory incongruity in the study, it seems to indicate that visual information can create assumptions and expectations.

The results confirm the olfactory and gustatory sensory incongruities. As mentioned in the literature, people in Western countries perceive the odours of vanilla, caramel, strawberry, and mint as scents to be associated with sweetness, and they are most commonly associated with sucrose (Auvray & Spence, 2008, p. 1018). Connecting white yogurt with vanilla is most likely because of the Western assumption that non-coloured yogurt will be sweetened with vanilla and marketed accordingly. Furthermore, based on the responses in the interview, the majority of the participants expected the consistency of the yogurt to be thicker and creamier, similar to vanilla-flavoured Greek yogurt.

5.2.2 Vision/Taste of Edible Cup

All the edible cups were flavoured with the same amount of margarita mix. Throughout the experiment and the subsequent participant interviews, various answers were given about the flavour and perception of the edible cup. One participant noted its sweetness while another commented on its thirst-quenching colour. Only one participant correctly identified the flavour of the edible vessel. Not only did this participant correctly identify the flavour, her tone indicated certainty. When asked why she said lime, the participant said it was because her edible cup was green.

The literature review discussed other research indicating that colour has an impact on the perception of taste. Mariot and Jacquot (2013) found that lime was usually associated with yellow, green, and orange colours, while synthetic strawberry odour was associated with a bright pink colour (194). While all the cups were flavoured with the same amount of the same ingredient, only the participant with the green cup could correctly identify the lemon-lime flavour, suggesting a possible link between colour and perception of taste.

Recent research in colour-odour associations indicates that hue influences the perceived edibility of odours; the more an odour was considered edible, the more likely it was yellow, while less edible colours were more likely blue (Maric & Jacquot, 2013). Further, reds and oranges are usually found to be more thirst-quenching than other colours (Fenko et al., 2009).The participant with the jewel-toned blue cup remarked on its thirst-quenching visual stimuli, as well as an "artificial blue" taste. The participant with the pink cup stated that he could taste sugar and maybe lime, but was unsure and eventually decided he could only taste sweetness. Therefore there seems to be a strong connection between colour and perceived taste.

5.2.3 Visual/Tactile Assumptions of the Edible Cup

During the experimental study, Group A used different methods to assess the durability of the cup, either by prodding it with a pen or jiggling the plate. When asked about these acts of evaluation during the interviews, participants noted that they sought to confirm their assumptions and expectation that the

vessels were made of gelatine or JELL-O, which turned out to be false. Upon realizing this, participants used their hands and mouth to assess the vessel's texture, finding that it was much firmer and thicker than they had expected. This realization of visual/tactile sensory incongruity is not any different from the observations made from Ludden et. al. (2007), about a seemingly wooden bench with a soft, rubbery surface.

5.2.4 Sensory Incongruity, Surprise, and the Relationship Between Them

With only one participant recognizing the correct flavour of the edible cups, and another noting its sweetness, there could be a connection to research associating olfactory and taste relationships with colour. The only participant who correctly guessed the lemon-lime flavour had been given a green cup, suggesting that assumption had an impact on the experience. In terms of sensory incongruity, the incongruities experienced ranged in degrees of pleasantness; one participant did not finish eating the cup, as he found the texture to be unsatisfactory relative to his expectation. Participants formed these expectations and assumptions within the first ten minutes of Phase 1. It is possible that the length of time during which the distance senses make their assessments can greatly increase or decrease the certainty of expectations and the level of surprise.

The findings of this study are consistent with sensory research discussed in the literature review. In particular, the findings are supported by research on taste/smell relationships and the research on colour and taste/flavour

assumptions. The significant sensory relationships identified in this study were taste/odour, vision/taste, and vision/tactile. These relationships seem to be influenced by assumptions, time, and pre-conceived expectations based on users' interaction with food in the past.

5.3 The Role of the Designer

In the context of this research, the role of the designer was also the role of the researcher; after the presentation of the meal and meal setting, the designer became an observer. The analysis of the interviews with the experts and the results of the study suggest that designers may find it valuable to foster and investigate user interaction and sensory experiences through user-testing.

5.3.1 The Role of Designers in Creating Sensory Experiences

Creative understanding is defined as "the combination of a rich, cognitive and affective understanding, and the ability to translate this understanding into user-centered products and services" (Postma, 2012, p. 59). Manipulation of the targeted sensory modalities of edible food vessels and the sensory components of the meal may enhance the user experience of product interaction through sensory incongruity. Designers may be able to successfully observe user interaction by implementing incongruous sensory elements into their product design and development. For example, adding a visual/tactile incongruent sensory relationship to a product is a common method of enhancing user experience. It may be wholly beneficial to apply this relationship to an edible product that

a user commonly interacts with and eats with, and have the designer observe the interaction, perspective, and opinions of the user. As such, a thorough understanding of user experience and emotional response is a key benefit to using this method to enhance user-product interaction.

5.3.2 Increasing Surprise in User Interaction

As noted in the previous chapter, the findings showed more than one emotional response among participants. Participants expressed surprise, humour, and curiosity, and the first of these, surprise, was the most frequent reaction. Group A was more surprised based on their assumptions about the cup, as visual signals and prior food experiences dramatically influenced their expectations. However, it is possible that this was merely the result of novelty, and that using surprise more frequently would negate the impact of surprise in individual products by making surprise itself a more habitual and predictable experience.

5.4 Edible Vessels

This study attempted to determine whether or not serving food in edible vessels would change the habitual behaviour of consumers. The introduction of incongruous elements appeared to increase the communal dynamic, as the participants collectively discovered and discussed the taste and texture of the meals' various components.

Participants with edible vessels reacted to its sensory stimuli and framed

their expectations using their distance senses, creating assumptions of how it would taste and feel. As discussed in the literature review, people in Western countries perceive the odours of vanilla, caramel, strawberry and mint as sweet scents. It seems likely that people associate white yogurt with vanilla because non-coloured yogurt is usually sweetened with vanilla in the Western world. Furthermore, based on the responses in the interview, the majority of the participants expected the consistency of the yogurt to be thicker and creamier, similar to Greek yogurt. Edible vessels also impact the construction of a meal, necessitating a re-evaluation of Douglas's (1972) analysis of what makes a meal. Edible vessels introduce possibilities for constructing and defining meals differently. Understanding how design features of edible vessels can create sensory incongruity may create opportunities for designers to investigate further the dynamics of incongruous relationships between product features and food.

5.5 Contributions

Three elements from this research may contribute to the field. The first is the framework for studying sensory responses to edible containers. The second is the recommendations about specific sensory relationships that may enhance people's positive responses to edible vessels. The third is the recipe for the edible vessel developed by the researcher.

The framework and the data is a stepping-stone to future research. An expanded framework with input from other experts may enhance the initial framework presented below. Currently, roughly one to six percent of designers

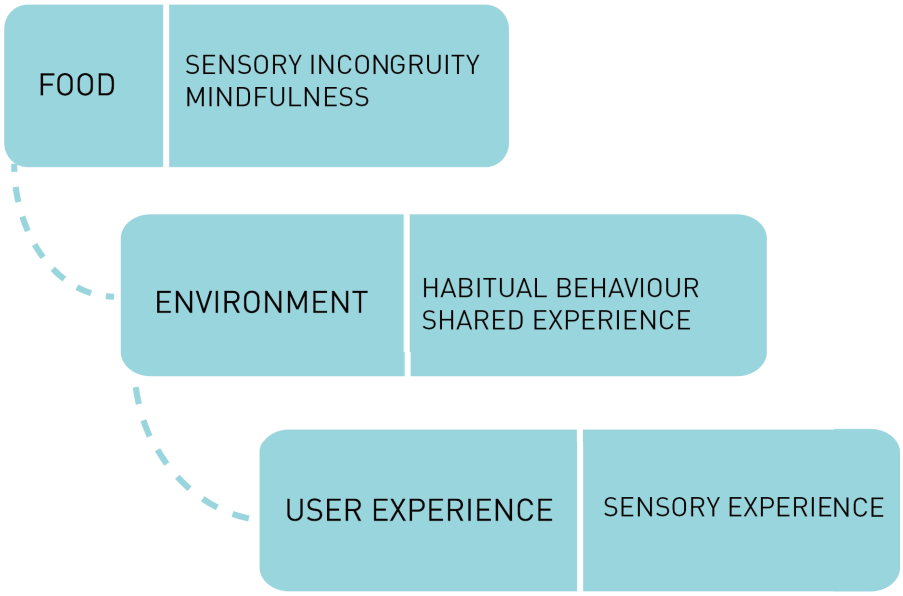

Figure 34. Initial Framework for Studying Sensory Responses

use visual-tactual incongruity as a strategy to design surprise (Ludden et al., 2008). Increasing the use of sensory incongruity to enhance the sensory and user experience of food products may open up possibilities for different ways for people to interact with food and their environment. Furthermore, by including olfactory/gustatory and olfactory/visual sensory relationships into edible food vessel design it may be possible to explore how sensory elements can evoke mindfulness in more familiar meal environments. Changing the context of experience by applying sensory design elements to create mindful eating may be a new opportunity in the field of food container design. Food design no longer engages exclusively with the foodstuff, but has expanded to the various elements that shape the overall product experience. The increased interest in and awareness of human-centered design makes it easy for designers to engage in the area of designing for food. This involves observing and then accommodating the nuanced needs of users.

The recipe that the researcher created enables these and new sensory relationships to be to studied and experimented with. Future creations open opportunities for more research and data collection on incongruous sensory relationships, as well as mindful eating from an academic perspective. Chefs in the restaurant and food industry may benefit from the recipe to create new mindful dining experiences for their consumers, allowing new creations with molecular gastronomy.

5.5.1 Recommendations

A starting point to answering this question is to gather opinions from a multitude of experts about sensory design and food. As the sub-question is too broad to be answered comprehensively in a study of this scope, another recommendation for future work is to conduct further experiments integrating new sensory relationships into edible vessels. Future experiments would benefit from a broader representation of users in terms of race, gender, occupation, age, and interests. Collecting results from a larger data sample will help determine what constitutes a suitable edible sensory product, as different users have different needs.

5.6 Limitations

This study attempted to make a significant step in collecting meaningful data through exploratory methods, in order to refine the process for gathering data in the context of design for sensory incongruity. Nonetheless, there were a

number of pertinent limitations to the findings themselves.

The experiment was conducted in a bare-walled studio space filled with desks. The atmosphere was sterile and unwelcoming, and not a typical setting for consuming meals. While differences were observed between the groups, both groups displayed greater attention and mindfulness of their meal experience than might be usual in other settings. The responses and reactions from the participants may have been different elsewhere, such as in a more relaxed home environment or a larger communal environment in which food consumption is a typical activity.

The majority of participants were enrolled in the same sensory design course at Carleton University. During class time, they were exposed to several terms related to sensory design (e.g., topology) including sensory incongruity, though it is uncertain whether they truly absorbed the meaning of the term and the course materials.

The small sample of participants was another limitation for data analysis. Because the method was exploratory, it was appropriate for the time and resources that such a small sample be used. A larger sample group would be beneficial to verify and expand upon the research findings.

Another limitation was the age group. Participants were recruited from an undergrad program of mostly young adults. Recruiting people of all ages could influence and impact the type of sensory stimuli and emotional responses.

The expert interviews served as a source of data and a reflection of the experts' respective research and studies. The data analyzed from those interviews

provided a framework for the study. Due to the small number of experts interviewed, the responses were also limited. There were only two interviews; therefore more diverse expert interviews could have provided a broader and more comprehensive framework for further study. In addition, the insight of experts in other academic fields such as nutritional science and psychology could contribute to a more thorough framework, increasing the usefulness of future experimental studies. Another limitation was that the framework was created with a one-time scenario in mind. It may be beneficial to have an added category for determining the long-term effects of sensory incongruity and habitual behaviour.

Also, participants were not asked to avoid consuming food or smoking for a period of time prior to the study. Restrictions on eating, drinking, and smoking could change the perception of taste and odour. This could also have changed the level and time of engagement with the food, depending on their hunger levels. Participants were not asked if they were smokers or how recently they had consumed food or flavoured beverages.

In addition, further research would benefit from more questions and probing during the interviews with the participants. Deeper consideration of what is meant by "suitable" is also advisable. Given more time and more detailed questions, participants may have been more revealing in their responses.

5.7 Future Research

Future research on the sensory incongruity relationships within food can lead to new insights about how a meal is constructed, and how habitual behaviour

can change. Researchers could focus on manipulating the different senses to understand the different types of emotional responses they can evoke. Designers can contribute to food container design, given their ability to manipulate the senses through design features. Future exploratory research in edible food vessels can further the understanding of how users share experiences and can also explore new ways of interacting with food. It would be interesting to study participants of a wider age range and wider cultural range, in order to determine whether the senses perceive different things based on cultural and social differences.

6 Chapter: Conclusion

This research project sought to explore the relationship among sensory design, and food consumption. In relation to the research question, this study contributes to the emerging field of food container design in several ways. The chief contributions are the framework of criteria for observation, the analysis of food related interactions, the recipe for edible vessels, and the recommendations as noted at the end of the last chapter.

The initial hypothesis was that users would respond emotionally while interacting with an edible object with visual or tactile sensory incongruities. This led to the literature review, which surveyed research about sensory design and incongruity, sensory research, and social dimensions of meal consumption. Real-world applications were investigated through case studies of designers who apply sensory design to their work with edible vessels. The research thus helped determine how to study the phenomenon of sensory incongruity attributes in edible vessels.

The research study involved three qualitative methods. The first method was expert interviews that led to a framework of criteria for observation and analysis. That informed the development of the context and materials for the experiment, and thus the development and design of the edible vessel. Through the A/B study model and the follow-up participant interviews, insights were gained into people's behaviours. Through methodological and analytical triangulation, the collection, interpretation, and synthesis of data yielded important contributions and insight.

6.1 Research Questions

The research aimed to understand how edible vessels could create mindfulness by manipulating their sensory modalities through sensory incongruity by using exploratory methods. Other aspects of sensory incongruity were also explored, including the issue of whether various sensory incongruities encouraged changes in habitual behaviour. When the data was collected and analyzed, the researcher also began to look into the role of the designer when creating edible vessels for mindfulness.

6.2 Findings

The research framework provided an opportunity to document and understand users' experiences with edible vessels. The results from the research were derived from observing users interacting and engaging with the food products and their environment. The study provided a shared experience in which the participants interacted with each other about the contents and physical attributes of the food.

During the data analysis the researcher identified an additional relationship, other than the literature review had addressed: the olfactory/ gustation relationship. Also, the data showed that participants with the edible vessel had a stronger emotional response to the cup based on expectations and assumptions derived from their distance senses, whereas for the control group the proximity senses had a stronger effect on their responses. All Group B participants expressed the most intense emotional responses when in direct contact with their cups, and the focus of their comments was chiefly on the taste

and texture of the contents of their cup.

The possible cues for eliciting mindfulness emerged in this study through the participants with each other and with the environment. Participants were aware of each other, of their behaviour, and their interaction with the cups and the food within them.

6.3 Contributions to the Field

A breakdown summary of the main contributions gleaned from the study are explained below.

•*Framework*

The framework was derived from a compilation of experience and academic knowledge across the expert interviewees' three categories of expertise: Food, Environment, and Experience. It provided an analysis grid for identifying the participants' user and sensory experience.

•*Suitable Sensory Incongruities*

The study found that visual information can create assumptions and expectations, as an overwhelming number of participants perceived olfactory/ gustatory and olfactory/visual incongruous sensory relationships. It may be possible to explore how these sensory elements can evoke mindfulness in more familiar meal environments.

•*Recipe for edible vessel*

The creation of the recipe allowed the researcher to experiment and explore various incongruous sensory relationships, which were consistent with and supported the findings of sensory research from the literature review. Going forward, the recipe can be used to create edible vessels for further sensory design experimentation for researchers, or to reaffirm the findings of this study. Future real world applications of the edible vessels can play a role in the restaurant industry, including molecular gastronomy.

•*Recommendation*

A good start is to interview and gather more opinions of experts about sensory design and food. Gathering a larger pool of participants in terms of race, gender, age and interests would greatly benefit future experiments.

6.4 Suggestions for Future Research

Maric and Jacquot (2013) suggested that future research was needed to examine whether odour attributes can be linked in more diverse colour-odour relationships. The work in this study contributes to this area of research. In the future, a focus on studying more diverse colours and taste may contribute to a more comprehensive understanding of these relationships.

Designers can apply sensory incongruity design features in new food products and observe user interaction. Ideally this would help create sensory products that change the context of experience in order to promote mindfulness.

Future exploratory research into edible food vessels can develop a better understanding of how users share experiences, and this research can also explore new ways of interacting with food. Since individual behavioural changes influence food selection and intake, a further understanding of the environment and its cues would also be beneficial (Sobal & Wansink, 2006).

6.5 Closing Comments

This study revealed that user-product interaction could be enhanced through the introduction of sensory incongruity in edible food packaging. It showed that edible vessels could contribute to mindfulness, especially through sensory incongruity. Despite a small sample, the findings indicate that mindfulness occurred with the participants in various ways. The essential insight this study has yielded is that designers can contribute significantly to food container design, given their ability to manipulate the senses through design features. With sensory incongruity, designers can create richer and enhanced user experiences with food.

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APPENDICES

Appendix A

Interview Questions for Experts

1. Can you briefly tell me about your research background?
2. Can you describe your definition of mindless eating, and the concept of mindfulness?
3. What are some ways sensory stimuli can change people's habitual behaviours with food?
4. Sensory incongruity can be created on a previously formed expectation, and upon perception through a second sense, the expectation is disconfirmed. In your opinion, can sensory incongruity help bring in mindfulness?
5. In designing meal environments for mindful eating, what are some things to take into consideration? A) cues from the surrounding
6. Do you think the designer can play a role in creating mindful eating experiences?

Appendix B

Script for Participant Study

BRIEF:

Hi everyone, as you know my name is Jessie and I want to thank you for participating in my study.

This group experiment and interview should take approximately 60 minutes to complete. The first phase of this study is to study the container and observe it without touching. It is very similar exercise to a project done at IDES2205. In that class, the term sensory incongruity was introduced. Just so we are all on the same page, the definition of sensory incongruity is when one sensory attribute does not match another sensory attribute.

There are slips of paper for you to write notes if you want. When you are satisfied with your observation, you can move along the second phase of this study, which is to eat and enjoy. Take notice of your consumption and your interaction with the food by using all your senses.

Appendix C

Interview Questions for Participants

INTERVIEW QUESTIONS:

1. Please describe the container *(shape, form, colour topology, etc)*.
2. Please describe the food *(the texture, taste, colour, etc.)*
3. Did your expectation about consuming the food change before the experiment started and after?
4. Please describe your sensory experiences and/or reactions when consuming the food.

Appendix D

Invitation for Experts

Carleton UNIVERSITY
Canada's Capital University

Letter of Invitation

Title: Mindful Eating through Sensory Design

Date of ethics clearance: December 4th, 2013

Ethics Clearance for the Collection of Data Expires: May 31st, 2014

March 10th, 2014

Dear Sir or Madam,

My name is Jessie Thavonekham and I am a Master's student in the School of Industrial Design at Carleton University. I am working on a research project under the supervision of Industrial Design Professor Lois Frankel and Sociology Professor Michael Mopas.

I invited you to participate in an interview on mindful eating and sensory design in October, 2013. The data I collected from the interview proved to be very insightful and helpful towards my research. I would like to officially use this data towards my thesis.

This interview took place at a convenient time and location at the participant's choosing; either in person or conference call. The interview did not take more than 60 minutes with the researcher and the session was audio-recorded.

All research data, including video/audio-recordings, and any notes are password-protected on an external hard drive. Any hard copies of data (including any handwritten notes or USB keys) are kept in a locked cabinet at Carleton University. Research data will only be accessible by the researcher and the research supervisors. The data will be used strictly for academic purposes.

This project was reviewed by the Carleton University Research Ethics Board, which provided clearance to carry out the research. Should you have questions or concerns related to your involvement in this research, please contact:

REB contact information:
Professor Andy Adler, Chair
Professor Louise Heslop, Vice-Chair
Research Ethics Board

Carleton University
1325 Dunton Tower
1125 Colonel By Drive
Ottawa, ON K1S 5B6
Tel: 613-520-2517
ethics@carleton.ca

If you would like to participate in this research project, or have any questions, please contact me at (insert Carleton University phone number) or (insert Carleton University email address).

Sincerely,

Jessie Thavonekham

Appendix E

Invitation for Participants

Carleton UNIVERSITY
Canada's Capital University

Letter of Invitation

Title: Mindful Eating through Sensory Design

Date of ethics clearance: December 4th, 2013

Ethics Clearance for the Collection of Data Expires: May 31st, 2014

December 6th, 2013

Dear Sir or Madam,

My name is Jessie Thavonekham and I am a Master's student in the School of Industrial Design at Carleton University. I am working on a research project under the supervision of Industrial Design Professor Lois Frankel and Sociology Professor Michael Mopas.

I would like to invite you to participate in a study on mindful eating and sensory design. This study aims to investigate the influence of edible vessels with elements of sensory design on mindful eating.

This study involves one 60-minute group experiment and interview that will take place in a convenient location on the campus of Carleton University. The study will be done with a total of 3 participants per group with the researcher and will be video-recorded.

Since this project involves food consumption; care will be taken to ensure there are no health concerns. This will be done by screening potential participants for fruit, dairy and egg allergies. Those with serious food allergies are asked not to participate.

You will have the right to end your participation in the study at any time, for any reason, up until January 15, 2014. If you choose to withdraw, the information attributed to you will be destroyed.

I will be providing you with refreshments and a small thank you gift during the experiment. No other compensation will be provided.

All research data, including video/audio-recordings, photographs and any notes will be password-protected on an external hard drive. Any hard copies of data (including any handwritten notes or USB keys) will be kept in a locked cabinet at Carleton University. Research data will only be accessible by the researcher and the research supervisors. The data will be used strictly for academic purposes.

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Carleton University
1325 Dunton Tower
1125 Colonel By Drive
Ottawa, ON K1S 5B6
Tel: 613-520-2517
ethics@carleton.ca

If you would like to participate in this research project, or have any questions, please contact me at jessie.thavonekham@carleton.ca

Sincerely,

Jessie Thavonekham

Appendix F

Consent Form for Experts

Carleton UNIVERSITY
Canada's Capital University

CARLETON UNIVERSITY
SCHOOL OF INDUSTRIAL DESIGN

(Consent form for research experiment)

I, _____(participant's name), understand that I am being asked to participate in this interview that forms a part of Jessie Thavonekham's required Masters' thesis work at the School of Industrial Design, Carleton University. The purpose of the interview is to investigate mindful eating and sensory design. This interview aims to create a framework towards the researcher's subsequent study of edible vessels, sensory design and mindfulness.

The researcher has explained the purpose and the process of this interview. I have been given the opportunity to ask questions, which the researcher has addressed to my satisfaction. I understand that the interview will take place with the researcher, and the session will be audiotaped.

It is my understanding that this interview will cover the following subjects or topics:
--- Sensory design and its application in food consumption
---The designer's role in creating mindful eating experiences

I understand that the audio recordings and transcripts will be kept in a password---protected file and can only be accessed by the researcher and her supervisor. Any hard copies of data (including any handwritten notes or USB keys) will be kept in a locked cabinet at Carleton University. The data will be kept for 2 years and then be deleted permanently.

I understand that all information obtained in this study will be kept strictly confidential and anonymous**.** I agree that the researcher may publish documents that contain quotations by me.

By signing this consent form, I am indicating that I fully understand the above information and agree to participate in this interview.

Participant's signature _____

Date: _____

Researcher's signature:

Date: March 10th, 2014

If you have any questions or concerns about this study, please contact Jessie Thavonekham by email at jessie_thavonekham@carleton.ca, and/or Lois Frankel by e---mail at lois_frankel@carleton.ca.

This research has been reviewed and approved by Carleton University Research Ethics Board
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Appendix G

Consent Form for Participants

Carleton UNIVERSITY Canada's Capital University

CARLETON UNIVERSITY SCHOOL OF INDUSTRIAL DESIGN

(Consent form for research experiment)

I, _____(participant's name), understand that I am being asked to participate in this study that forms part of Jessie Thavonekham's required Masters' thesis work at the School of Industrial Design, Carleton University. The purpose of the study is to investigate mindful eating and sensory design. This study aims to investigate the influence of edible vessels with elements of sensory design on mindful eating.

The researcher has explained the purpose and the process of this study. I have been given the opportunity to ask questions, which the researcher has addressed to my satisfaction. I understand that the 60 minute study and interview will take place in a group setting with the researcher, and the session will be audio and video---taped .

I understand that I am free to withdraw my consent and discontinue my participation in this study at any time prior to or at any point during the experiment, until January the 15th, 2014. I understand that I can choose to answer only the questions that I wish to answer. I can ask to have any data that I have contributed removed from the study if I withdraw.

I understand that the video---recordings and transcripts will be kept in a password protected file and can only be accessed by the researcher and her supervisor. Any hard copies of data (including any handwritten notes or USB keys) will be kept in a locked cabinet at Carleton University. The data will be kept for 2 years and then be deleted permanently.

I understand that all information obtained in this study will be kept strictly confidential and anonymous. I understand that this experiment involves food and I have no serious food allergies, and am not allergic to any forms of dairy, eggs and fruit.

The results of this study will be presented collectively and no individual participants will be identified without their permissions.

By signing this consent form, I am indicating that I fully understand the above information and agree to participate in this study.

Participant's signature _____

Date: _____

Researcher's signature: _____

Date: _____

If you have any questions or concerns about this study, please contact Jessie Thavonekham by email at jessie.thavonekham@carleton.ca, and/or Lois Frankel by e---mail at lois.frankel@carleton.ca.

This research has been reviewed and approved by Carleton University Research Ethics Board
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Appendix H

Recipe

The recipe makes exactly one edible vessel.

Ingredients:

- *1/3 cup water*
- *2 tbsp agar agar powder*
- *2 tbsp jelly powder*
- *1 tbsp margarita mix*

Instructions:

Bring the water to a boil in a pot. While the water is bubbling, add the agar agar powder and stir until it completely dissolves. Add in the jelly powder and continue stirring. Slowly pour in the margarita mix. Lower the heat and allow the water to simmer until the mixture begins to bubble. Take the pot off the heat and set up the silicone mould. Carefully pour the mixture into the mould, being careful not to splash the hot liquid on bare skin. Leave the mould untouched for 20 minutes in the refrigerator.

Removing the cup from the mould:

Once it is determined that the agar mixture is cooled and set, carefully remove the top section of the mould. Use a butter knife to carefully separate the walls of

the mould and the cup. The edible cup should be firm enough to stand on its own. The entire process is very quick, and must be done in a speedy, timely manner. If the process is done too slowly, the mixture could burn. If the mixture simmers for too long, it will start to set in the pot. Ingredients and utensils must be set out and prepared in advance in order to be able to move quickly and achieve the desired results.

Figure 35. The emerald green agar-agar cup, flavoured with margarita mix. Wall thickness is approximately 1/8 inches thick

Figure 36. Close up of the different tactile surface textures of the edible cup

Figure 37. The edible cup is *set and ready to take out of the silicone mould*