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Master's Thesis

Academic Year 2015

OriPOP

The Emotional Impact of Interactive Popcorn
Packaging Design

Graduate School of Media Design,
Keio University

Pei-ying Pamela Chiang

A Master's Thesis

submitted to Graduate School of Media Design, Keio University

in partial fulfillment of the requirements for the degree of

MASTER of Media Design

Pei-ying Pamela Chiang

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Abstract of Master's Thesis of Academic Year 2015

OriPOP
The Emotional Impact of Interactive
Popcorn Packaging Design

Category: Design

Summary

In the food packaging industry, there has been a recent movement towards innovative, smart package design which aims at enhancing communication with the consumer through technological advancement. However, there has been a lack of attention paid to the discourse concerning the way food package design could create desired responses from people.

This research explores how food package design could actively involve users in a way that could generate and evoke positive emotions and build personal attachment. Based on the theoretical framework of the concept of emotional design through the empirical case studies of the processes of co-production and paper-based animated media, the research posits that if users could be involved in the process of creating the popcorn packaging, and could then see their personalized, static packaging become animated and alive, their emotional enjoyment in the experience of having popcorn would increase.

OriPOP, an emotionally enhanced popcorn package design is proposed. It aims at treating users as active designers. They can be engaged to enjoy folding an origami rabbit through a co-production process and see their personalized creature of flat, static packaging become animated in a microwave oven through a co-animation process. Based on a mixed methodological approach, quantitative self-assessment manikin (SAM) measures and qualitative laddering interviews are implemented to examine comparative changes in user's visual, aural, gustatory, olfactory and haptic sensations between the existing popcorn product and OriPOP's

co-production and co-animation process.

Results indicate that when users are involved in the creation of OriPOP during co-production, they are more likely to visually and haptically enjoy the experience of having popcorn. During co-animation, more distinct results are achieved. When OriPOP is animated, users are more likely to visually, aurally, gustatorily, olfactorily and haptically enjoy the experience of having popcorn. The research proves that users' emotional enjoyment would increase through the OriPOP experience.

Formulating conclusions and discussion, it would be intriguing to explore whether the OriPOP design method is specific for this experimental context or could extend or apply to other foods. Further examinations of purchasing and eating behaviors associated with OriPOP are also required. In the discourse of holistic emotional design, OriPOP demands more advanced research in areas such as repeated experience, recalled experience and the possibility of eliciting paradoxical emotions.

Keywords:

Graduate School of Media Design, Keio University

Pei-ying Pamela Chiang

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1. Introduction

1.1 Background: Present Status and Trends in Food Package Design

Food packaging exists to make our lives easier. There are several considerations involved in food package design ranging from containing the food, protecting food products from outside influences and damage, and providing consumers with ingredient and nutritional information [1, 2]. For years, these traditional functional attributes have fulfilled the important needs of the consumer. However, as society is becoming increasingly complex and food package designs have become quite similar in terms of technical performance, quality, and price, there is a move towards innovative package design that is more advanced and creative than what is currently offered [3].

To enhance communication with the consumer, "smart packaging" has become a key part of recent innovations in the global packaging world. It has been defined as an extension of the communication function of traditional packaging. As conventional text-based and graphic packaging communication is reaching the limit of its ability to differentiate products from one to another, smart packaging emphasizes the role of the package as a more effective visual and sensory form of messenger or information link that communicates information based on its ability to sense, detect, or record external or internal changes in the product's environment [4]. This kind of packaging has been classified in many different ways; the terms "active", "controlled", "intelligent", "diagnostic", "functional", "communicative" and "enhanced" have all been used. The all-embracing term "smart packaging" is preferred here, encompassing aspects of packaging design, the use of smart materials, and an integrating method that deals with mechanical, chemical, electrical and electronic forces, or a

combination of these, within or on the package, that enhance the usability or effectiveness of the food products in a proven way [5].

Technologies, such as color-change chemistry, lenticular graphics, radio frequency identification (RFID) labels and tags, two-dimensional (2D) bar codes and augmented reality (AR) are examples of technologies used for smart food packaging design to improve its communication function [4]. They offer a conduit to improve story-telling about a food content's attributes, provenance, how the food can be eaten, and also provide useful food information in a communication format that is easily understandable for the consumer.

For instance, a relatively low-cost image recognition coding system, such as a quick response (QR) code printed on the packaging could enable a smart phone to interact with the packaging and connect it to the Internet [4]. To further this concept and bring it to reality, some attempts have been made to integrate smart food packaging and smart appliances such as microwave ovens at home [4]. In 2008 Mark & Spencer launched a range of microwaveable products printed with a "smart code" that, when scanned by a smart microwave made by Samsung, could be automatically heated and browned through their optimal cooking sequence without intervention from the consumer [4]. The system required a microwave oven with a built-in microprocessor, a bar-code scanner and an optional voice recognition device that connected to a touch screen and the Internet [6]. When the microprocessor was programmed to contain information about oven characteristics and algorithms, then the bar code on the food package could be scanned and the microprocessor would then be able to control the magnetron, heating elements and the turntable in the oven to ensure perfect cooking with practically zero interaction from the consumer [6].

To date, these radically smart, innovative and communicative packaging techniques mainly focus on the "appearance" side of the package. The packages here are treated as active agents to assist the consumer in the

decision-making process, to extend shelf life, enhance safety, improve quality, provide information, and warn of possible problems. However, the current smart packaging system relies on a technological advancement in which the communication conduit seems to be unidirectional rather than interactive. The concept of treating the potential consumer as an active interpreter seems to be absent.

1.2   The Problem: The Absence of Emotional Elements in Food Package Design

As already discussed, the current communication function in food package design is limited to an automation process using advanced technology in which consumer intervention is lacking. Although extant research has demonstrated that package design can have a powerful impact on consumer response, it has provided only scant guidance on how package design could create desired responses. People are emotional beings and food products can tap our emotions in multiple ways. However, package researchers, practitioners or academics place a great emphasis on semantic design, and doubt that consideration of the consumers' emotional response should be a significant factor in the package design and construction process. Little work has been published to understand multisensory afferent and efferent consumer emotive response associated with food package design [7].

Along with the improvement of living standards in recent times there has been an increase in aesthetic expectations, and consumers are increasingly becoming "change agents" [8]. They are both demanding greater levels of personalization in their consumption experience and placing businesses under increasing pressure to co-create value with them. Two major issues and knowledge gaps are identified. First, there is little existing research examining emotion-targeted design and its underlying elements. Identifying these archetypes, prototypes, or standards will substantially improve the understanding of package design. Second, there is

a lack of insight into the relationships between key types of package design and the responses they typically evoke. This has led to inefficiencies in achieving brand management objectives and has left managers and designers in the dark in terms of what design to use to stimulate desired responses.

1.3 The Premise: the Need for Emotion-Evoking Food Package Design

In order to provide a fuller understanding of these knowledge gaps, a theoretical background of the study of emotions is a critical starting point. Humans experience emotion. Emotions play a crucial role throughout the span of people's lives since they color virtually all waking moments with either a pleasant or an unpleasant quality. Although the concept of "emotion" appears to be generally understood and used very frequently, it is surprisingly difficult to come up with a solid definition and a gold-standard method for its measurement.

For several decades, researchers in various disciplines have offered a variety of definitions and measurements, each focusing on different manifestations or components of emotion. Despite the debates, empirical solutions or overarching agreements on how to define and measure emotions have eluded scientists, psychologists, academics and laymen alike [9]. The questions "What is an emotion?" and "How can emotional response be measured?" remain to be answered.

At present, the most favored solution is to say that emotions are best treated as a multifaceted phenomenon consisting of the following components: behavioral reactions (e.g. approaching), expressive reactions (e.g. smiling), physiological reactions (e.g. heart pounding), and subjective feelings (e.g. feeling amused) [10]. Furthermore, they arise if something that a person is experiencing and the emotional response is an evaluation or

interpretation of that event [11]. In other words, emotions are human states that have measurable behavioral, cognitive and physiological consequences. Emotional response to a stimulus has two stages, a sensory–motor primary response which is beneath conscious awareness and a secondary process of awareness of one's emotional experience [12].

Building on these insights, we are able to examine package-evoked emotions. According to Pilditch, packaging was seen as the 'silent salesman' as far back as in the 1950s [13]. Lewis, in reaction to Pilditch, considered packaging to be more than just a salesperson, describing it as a flag of recognition and symbol of the brand [13]. Vazquez, Bruce and Studd furthermore credit Pilditch with the argument that a package must come alive at the point of purchase in order for the salesperson to function successfully [8]. Similarly, McLoone et al. propose that a successful package design meets or exceeds the emotional needs of users, beyond utility and quality [13].

Based on these views, package design can therefore be described as the 'glue' that connects logic and reason with imagination and feelings. It can influence the emotional reaction that consumers attach to a package and the way this may assist in stimulating and eliciting consumer interest. It has often been argued that the emotion-evoking quality of food packaging and emotional responses may even be a decisive factor for purchase decisions [10]. Integrating "feeling" into packages to create emotional communication with the user has become a design trend in the 21st century. As a result, "design for feeling" has become the key factor for innovative food package design.

1.4 The Notion of Emotional Design

To facilitate research into emotional responses to food packaging, one approach is to take a design-based perspective. Design cognitive scientist and design consultant Donald Norman asked a question that is vital to the design of emotion-evoking food packaging: "How can mass-produced objects have personal meaning?" [14] Customization is often the new capitalist/digital answer to this query. Cell phone cases in millions of styles and shoes that are designed-to-order on a company's website are two of many examples. However, such pat customization does not often have the same compelling memories attached to it that craft connoisseurship does. As Norman posited, "Special objects turned out to be those with special memories or associations, those that helped evoke a special feeling in their owners. Special items all evoked stories" [14]. Thus, the ability of packaging to elicit personal feelings and personal stories is central to the design of food packaging. According to Norman's assertions regarding emotional design, there are three different aspects to the processing or understanding of packaging features: the visceral level, the behavioral level and the reflective level [14].

At the visceral level, physical packaging features, including look, feel and sound dominate. These sensory and aesthetic characteristics of the package can affect the experience of its content [14].

At the behavioral level, it is all about use. Successful behavioral design is human-centered, focusing upon understanding and satisfying the needs of the people who actually use the product [14]. It encompasses four components: function, understandability, usability, and physical feel [14].

- *Function* denotes two kinds of packaging development: enhancement and innovation. Enhancement comes primarily by watching people use what exists today, discovering difficulties, overcoming them and making it better [14]. On the other hand, innovation provides a completely new way of doing something, or a completely new thing to do, something that

was not possible before [14].

- *Understandability* involves the establishment of a conceptual model. It consists of the designer's model (the image in the head of the designer), the user's model (the image that the person using the device has of it and the way it works), and the system image (the image conveyed by the packaging and written material). For a package to be used successfully, the user must have an identical mental model (the user's model) to that of the designer (the designer's model) [14]. However, the designer can only talk to the eventual user via the packaging itself. The entire communication process must take place through the "system image". A successful conceptual model ensures that the system image of the final design conveys the proper user model [14]. An important component in developing the conceptual model is feedback. Continuous input from potential consumers allows the designers to enhance the conceptual model by understanding users' needs, desires and expectations.

- *Usability* is a complex topic. A food packaging which does what is required and is understandable may still not be usable [14]. Having a universal design is challenging, yet it is critical to test how well the package performs, how the user feels and how comfortable it is to use [14].

- *Physical feel* can make a huge difference in appreciation of the package. Physical objects like packaging have weight, texture, and surface [14]. These physical attributes matter since human beings are biological creatures. A huge amount of the human brain is taken up by the sensory systems, which are continually probing and interacting with the environment. The successful packaging design makes full use of this interaction [14].

At the reflective level, it is about the overall impression that the package presents to the user. This image may be influenced by the user's culture, beliefs, and the personal meaning and remembrances it evokes. Successful reflective design provides a personal touch, warm interaction and a long-term customer relationship [14].

1.5 Research Proposition: OriPOP Popcorn Packaging

Current food package design mainly focuses on involving users at the visceral level. Users feel that they want the package, but there is a lack of personal and emotional attachment to it. By taking Norman's framework of three levels of emotional design forward, this research intends to understand and explore how food package design could involve users in a way that could generate and evoke positive emotions and build personal attachment. Thus, this research would emphasize all three levels of emotional design: visceral, behavioral and reflective levels.
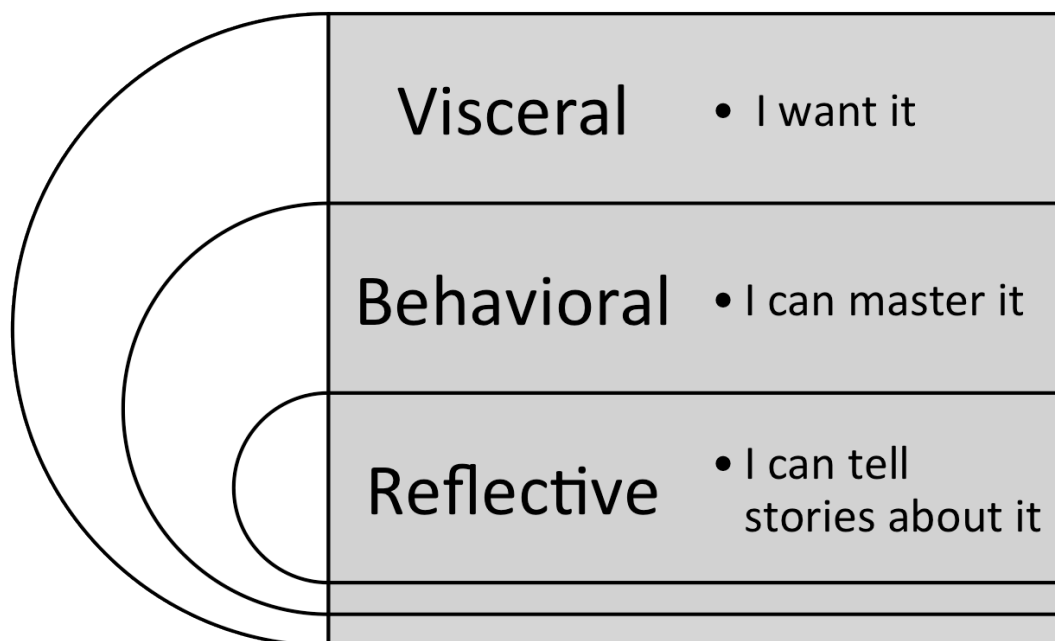
Figure 1.1 OriPOP's three levels of emotional design

While not denying the utility of traditional functions and views of food package design, the research intends to treat users as "active interpreters" and design a self- folding process and paper craft in the form of an animated popcorn package, called "OriPOP", which can increase the user's enjoyment when having popcorn. It contends that when users are

involved in the process of creating the popcorn packaging, and see their personalized packaging become animated and alive in a microwave oven, their emotional enjoyment in the experience of having popcorn will increase. As Figure 1.1 indicates, this emotion-enhancing popcorn package design does not just stress the visceral level, in which users feel that they want the package. It also put a great emphasis on behavioral and reflective levels, in which users feel that they can master it and tell a personal story about it.

2. Literature Review

Structured on Norman's claim that there are three levels of emotional design, -visceral, behavioral and reflective, the concepts of co-creation and animated media are introduced. They depict how people are actively involved in the process of product design.

2.1 The Concept of Co-creation

Recently, the traditional producer-consumer model has begun to shift. The neologism "prosumer" has sprung up to advocate consumer-oriented transformation from merely a passive recipient of messages and commodities to an active interpreter of both [15]. The increasingly popular proclamations of the demise of marketing, characterized by control over demand, is now superseded by activist-style declarations that new marketing requires the fundamental realization that customers are in charge [15]. The idea is for marketing to position itself as a mere facilitator and partner of consumer ingenuity and agency.

Proponents of this updated view such as scholars Stephen Vargo and Robert Lusch also claim that since use value is now determined by the customer, and commodities represent mere resources for further appropriation by these entrepreneurial consumers, all marketing can do is offer 'value propositions' or suggestions to consumers [15, 16]. They further posit that today's economy is 'service-dominant' (S-D) as opposed to being 'goods-dominant' (G-D) [15]. They note that the emphasis on the efficient production and distribution of goods in G-D logic supports tendencies toward standardized goods produced 'away from the market' that are then inventoried until demanded [15]. In S-D logic, customer participation is denoted as "the degree of consumers' effort and involvement, both mental

and physical, necessary to participate in the production and delivery of services." [17]. In this context, customers are seen as actively involved in creating value, instead of being only passive recipients of service and their associated value.

Parallel to Vargo and Lusch's S-D logic is the notion of "co-creation" posited by scholars Prahalad and Ramaswamy [15]. They assert that there is a need of a deeper, more integrated approach that goes beyond "staging experiences", outsourcing activities or marginal customization since people have been increasingly engaging themselves in an active and explicit dialogue with manufacturers of products and services [18]. The discourse of co-creation argued by Prahalad and Ramaswamy is about experimenting with new possibilities for value creation that are based on the expropriation of the free cultural, technological, social, and affective labor of the consumers, such as lifestyle, expectations, needs and desires [8, 15]. It aspires to build ambiences that foster contingency, experimentation, and playfulness among consumers [15]. Central to Prahalad and Ramaswamy's claim of co-creation is the idea that the market is no longer a mundane site of exchange, but transformed to a buzzing, vibrant "communication hive" where consumers and producers jointly create innovative products and experiences [15].

Similarly, in the field of design, brand consultant David Vinjamuri wrote in Forbes Magazine how design and branding errors often occur when "you try to build your brand by looking at it through the lens of data rather than from the perspective of the consumer" [19]. Norman also described how even when designers are members of the community they are designing for, they "become so proficient with the product that they can no longer perceive or understand the areas that are apt to cause difficulties" [19]. Such gaffs might be avoided through usability testing, a range of research processes in which actual users try and respond to products and texts. Proclaimers argue that users are the best designers because they know what they want and what they can and cannot or will not do [19]. Thus, the emergence of co-

creation as a form of collaborative creativity is seen as a new approach to innovation and user involvement, not just in economics and political science but also in the discipline of design.

2.1.1 Co-production in Product Design

There are several associated concepts and approaches within the co-creation family, such as open innovation (e.g. Linux operating system), mass customization (e.g. Nike ID), user-generated content (e.g. youtube.com), mass-collaboration (e.g. Wikipedia), collaborative innovation (e.g. Airbus) and co-production (e.g. Ikea). This research emphasizes the concept of co-production. In the context of co-production, the user is conceived as an active interpreter and co-producer. There is no longer a question of creating value for the user. The user is in fact interacting in both the design and the production. It is about creating value with the user and incorporating the user's value-creation into the system since only when people successfully complete a labor-intensive task do they come to value the fruits of that labor – the products they have created [20]. In a similar vein, Franke, Schreier, and Kaiser suggest that users value their self- designed products more than those designed by others over and above the value derived from matching their preferences [20].

Co-production in product design appears to be driven by the user's willingness to co-produce [17]. Levels of user co-production are influenced by his or her ability, role clarity and willingness to participate, such as knowledge, skills, experience, energy, effort, money, or time. Users value the benefits that they may expect to receive. According to Rodie and Kleine (2000), benefits of co-production for users may include the efficiency in the process, efficacy of the outcome, and the emotional benefits [17].

To be more specific, Etgar distinguishes between intrinsic and extrinsic benefits. Intrinsic benefits imply that an experience is appreciated for its own sake [17]. Potential intrinsic benefits can be a desire for play and

fun, a search for aesthetics, and a drive for ethics or spirituality [17]. Extrinsic benefits serve as means to an end, such as a search for excellence, autonomy, self-expression and uniqueness, for exercising and using personal inherent capabilities, and realizing hidden fantasies [17].

To address the user's role in the co-production process and associated intrinsic and extrinsic benefits, empirical cases of product design including IKEA and Build-A-Bear Workshop are presented.

IKEA: self-assembly products

A multinational company, IKEA, which depends heavily on ready-to-assemble mass production, arranges for its customers to design their own furniture, appliances, small motor vehicles and home accessories [21]. It provides a box of unassembled pieces and accompanying assembly instructions which give purchasers a clear understanding of their role [20]. People can follow the precise instructions and build exactly what is pictured on the box. But they are also free to use the pieces to build something completely original. The IKEA model aims at stimulating their customers' creativity by involving them in self-assembling activities for furniture. Research suggests that time spent touching objects can increase the sense of ownership and value [20]. The positive feelings of effectance are generated as people are given opportunities to "control" by building their own products yet assembling them according to preset instructions (i.e., "not in control") [20]. Furthermore, positive emotions such as enjoyment and pride are likely to be elicited as a result of the successful assembly of products. It leads people to value their product over and above the value that arises from merely acquiring a product, or merely handling that product [20].

Build-A-Bear Workshop: self-made products

In a similar example, the American retailer, Build-A-Bear Workshop, Inc. sells teddy bears and other stuffed animals. Their customers are given the autonomy to "play" and "create". Purchasers go through an interactive process in which the stuffed animal of their choice is assembled and personalized during their visit to the store [15, 20]. With the company's

motto "Where Best Friends Are Made", the customer is invited to choose a basic bear type and subsequently asked to "give it life" by creating its voice, giving it "a heart filled with their special wishes", and stuffing, stitching, fluffing, naming (with a personalized birth certificate) and accessorizing the bear as they desire so that "each guest goes home with a smile and a new best friend" [15]. The act of personalizing the product with their own design and labor causes purchasers to feel greater attachment and place greater value on the product [20].

2.2 The Concept of Animated Media

Through the co-creation process, users initiate and design their own products. At the behavioral level, they feel they can master those products. However, the products are usually static. Animated media is the process in which the products become animated and alive. Through animated media, the users are able to tell personal stories about the products, which echoes the reflective level of emotional design.

2.2.1 Animated Media in Paper-based Design

Paper is seen as one of the most innovative materials for co-animation. Several advantages are introduced. Paper is an inherent part of human history and our everyday lives. Paper and paperboard materials can be printed, drawn on, written on, glued, cut, creased, shaped and can even create functional prototypes with minimal technical background at a low cost [22, 23]. The use of paper and paperboards for food packaging dates back to the 17th century with accelerated usage in the later part of the 19th century [2]. Today, about 50% of all paper produced is used for packaging [22].

Traditionally, the food packaging sectors have been divided into papers and boards, metals, plastics and glasses [24]. Among these, paper

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and paperboard represents the largest proportion by weight of packaging materials used, and the food and beverage industry is the largest user of paper and paperboard packaging [2]. In terms of its properties, paper remains one of the most pervasive creative materials and platforms worldwide due to its low cost, light weight, ease of physical spatial manipulation and low waste-to-discard [23, 31].

Due to its prototyping benefits and the advantage of transformability allowing flexibility and spatial manipulation, there have been many innovations and developments to enhance and build on this intuitive interface. For instance, Japanese origami, the art of paper folding over 300 years old, has continued to be practiced by people throughout the world, especially as an integral part of engineering design for innovative devices, structures, and fabrication methods [23, 25]. Research has started exploring the use of the origami concept of the folding and unfolding motion for self-assembly.

Animated Paper- paper-based motion media
Origami-based design "animated paper" is a project from the Graduate School of Media Design, Keio University [23]. The project proposes that paper is a medium that can change its shape from two-dimensional to three-dimensional when it is in motion. It proposes an intuitive, physical prototyping medium in which an energy projection system is created to provide the thermal energy to move remotely when the user wants to control the paper. This system involves a small light material that changes paper's shape with temperature as an actuator, including a shape memory alloy (SMA), a retro-reflective material and copper foil [23].

Another feature of animated paper is that it is controlled wirelessly, which solves the working time and the power supply problem. Since the energy projector provides the energy required for changing the shape of the paper remotely, this kind of paper does not need to have actuators, batteries, lines or processors which add hardness and weight that interrupt the paper's motion [23]. With such a special interface, animated paper would

empower and encourage people to experiment tactilely, allowing them to imagine, easily build, bring to life, and thus modify their own creations with their own hands [23].

POPAPY- an animated paper craft

In order to enable people to experience the enjoyment that animated paper crafts bring, another project from the Graduate School of Media Design, Keio University, is an animated post card called "POPAPY" [26]. POPAPY is an animated post card that will transform into a different shape of paper craft model after being heated in a microwave oven. It uses heat shrink tubes and aluminum sheets as actuators to facilitate animated movements in a microwave oven. Users only have to stick the heat shrink tube and the aluminum sheet onto a piece of paper, and put the materials into a microwave oven to get the transformed paper craft [26].

The purpose of this project is to allow people to be able to play with moving paper crafts in their daily lives, and it also increases the enjoyment of sending and receiving cards. Senders who want to send unique cards individualized for each recipient will be able to have fun making their own POPAPY cards since they are very easy to design and heat. Receivers who receive a POPAPY card will be surprised at its unpredictability and transformation [26].

2.3 Significance of the Research

Chapter 1 introduces the recent trend in the development of food package design. The innovations of smart packaging expand the traditional functions of merely containing, protecting and providing information based on visual texts and graphics, and introduce technological advancement in which the packaging becomes a more effective visual and sensory communication conduit. However, people rarely feel that they are emotionally attached to the packaging.

In accordance with Norman's theory of three levels of emotional design, OriPOP, an emotion-enhancing popcorn package design, is introduced. It furthers the idea of using technological advancements in creating food packaging. Rather than treating users as passive recipients, they are active interpreters. It recognizes that people are emotional beings and there is a crucial need to include emotional elements at the visceral, behavioral and reflective levels in food package design which will meet or exceed people's expectations, needs and desires.

Chapter 2 depicts the theoretical assertion of the socio-economic shift towards S-D logic where the discourse of co-creation is emphasized. Within the co-creation family, the co-production process involves collaborative creativity in which producers and consumers jointly create innovative products and experiences. Two empirical product design cases, IKEA (self-assembly products) and Build-A-Bear Workshop (self-made products), are presented. In a similar vein, OriPOP involves the process of co-production by initiating an interactive platform in which users can create their personalized popcorn packaging with instructions provided.

Having the co-production process itself is not enough. In order to make users feel that their involvement is personally meaningful, animated media is introduced. With specific focus on paper and paperboard packaging, origami-based motion media - animated paper and POPAPY - are used as examples. Paper is no longer a material producing static art forms, but can come alive through its self-folding and unfolding motion.

OriPOP is also an example of an origami-based motion medium, which is intended to turn static origami forms into seemingly living creatures. The actuating materials involved in animated paper (SMA, retro-reflective materials and copper foil) and POPAPY (heat shrink tube and aluminum sheets) are not commonly used in everyday life. Unlike animated paper, the advantage of OriPOP is that is uses only the corn kernels as the actuating material. Other than the paper and the corn kernels, no additional materials are required, and so everyone, even people are not

technically inclined, can experience the enjoyment and ease of creating animated and personalized popcorn packaging.

The research emphasizes the concepts of "three levels' of emotional design" through the process of "co-production" and origami-based "animated media", and the interplay of all these concepts. It recognizes the importance of designing food packaging which is not just passive, but involves users in creating their own personalized packaging which tells their story. Users thus are treated as the best designers and active interpreters.

Based on the theoretical framework and empirical examples discussed in Chapter 1 and Chapter 2, this research can be encapsulated in the following research question:

If users could be involved in the process of creating the popcorn packaging, and could see their personalized, static packaging become animated and alive, would their emotional enjoyment in the experience of having popcorn increase?

3. Design

3.1 The concept of OriPOP
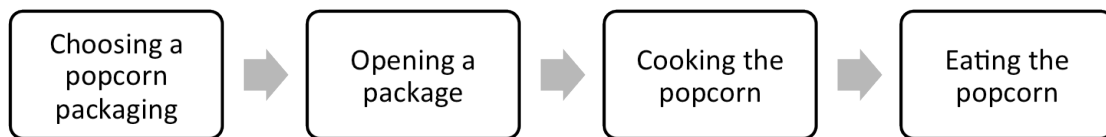
Figure 3.1 Typical stages of user experience with the microwavable popcorn packaging

Typically, people's experience with popcorn packaging involves four stages: choosing a popcorn packaging, opening a package, cooking the popcorn and eating the popcorn (Figure3.1). Within these four stages, "opening a package" and "cooking the popcorn" are the main focus for OriPOP. By involving behavioral and reflective levels of emotions, OriPOP, as Figure 3.2 indicates, redesigns these two stages to "co-production" and "co-animation in which users are actively involved.
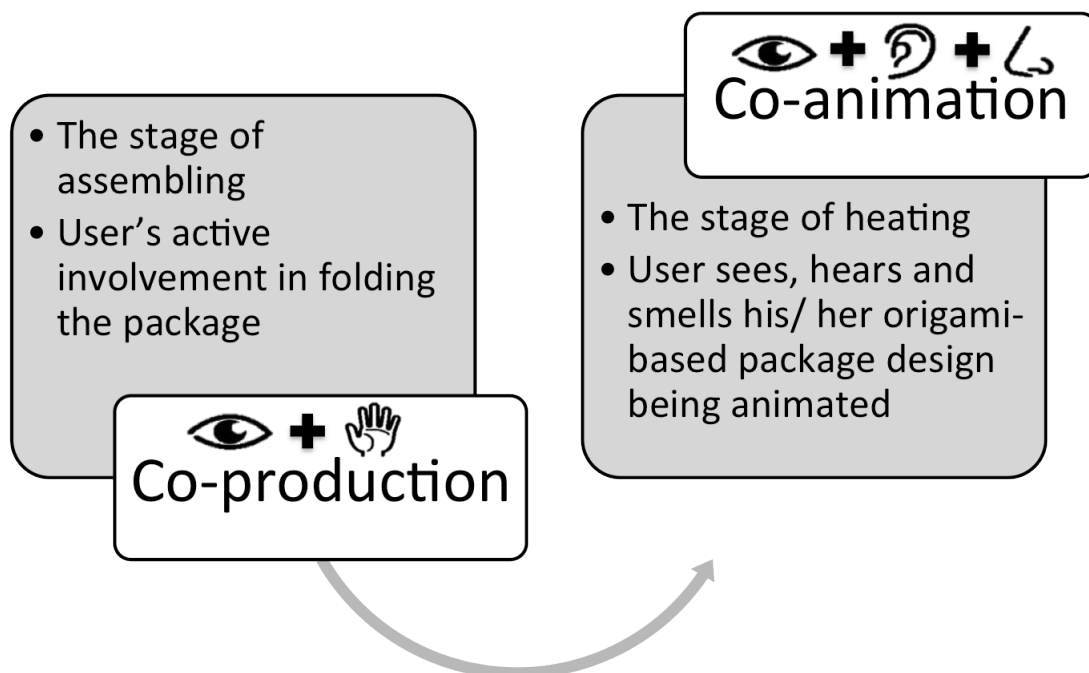
Figure 3.2 OriPOP's co-production and co-animation process
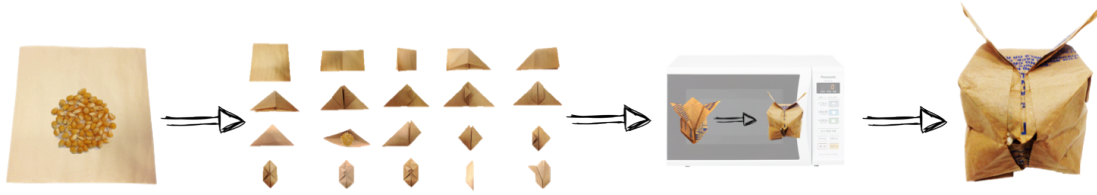
Figure 3.3 Conceptual model of user's involvement in creating OriPOP

The research aims to stir the users' positive emotional responses to popcorn packages by designing a co-production and co-animation process in which the user can be engaged to enjoy folding an origami rabbit and see his/her own creature in flat, static packaging become animated, alive and jumping like a real rabbit during the idle time waiting for popcorn to be heated (Figure 3.3). More specifically, it investigates the ability of popcorn packaging to evoke in its users a positive emotional response to preparing the popcorn and assembling the package, and if it does, then to determine if the animation of popcorn packaging further drives this emotional response.

3.1.1 OriPOP's Co-production Process

The process of co-production in OriPOP occurs during the stage of preparing the popcorn and assembling the package. At this stage, users are involved in folding their own rabbit origami packaging with step-by-step instructions provided. Current microwavable popcorn packaging is ready-to-heat. Users simply place the package in a microwave oven and wait for it to be heated and ready to eat. OriPOP is different in the way that it offers a self-assembly process in which users are no longer passive recipients.

OriPOP is for everyone who is interested in creating their own personalized popcorn packaging. There is no need to have a technical background or special skills. Humans has five senses. The stage of co-production is intended to enhance visual and haptic sensations. The folding process provides a personal touch and thus an enhanced emotional attachment to the product.

3.1.2 OriPOP's Co-animation Process

The process of co-animation in OriPOP also occurs during the stage of heating the popcorn packaging. Kernels placed inside the folded origami are the triggers that make the flat and static origami change its shape into an animated and lively rabbit in a microwave oven. This process is innovative in the way that a new experience of popping popcorn is created. The personalized rabbit origami folded by the user has a jumping movement in a microwave oven once the kernels start popping. It looks like a real rabbit jumping in the oven.

Here, visual, aural and olfactory sensations are stressed. When the users hear the popping sound and see their handmade rabbit jumping in the oven, they feel as if they have given birth using their own hands. Personal meaning is created and users' enjoyment of heating popcorn is increased.

3.2 Initial Prototype Design of OriPOP

To ensure that the user's level of interest is sufficient to make them willing to co-produce and co-animate, designing an initial prototype of OriPOP is crucial. Different aesthetic appeals, types of materials, quantities of kernels, and volumes of the package are experimented with in order to maximize users' enjoyment of having OriPOP.

3.2.1 Aesthetic Appeal of the Package

As Chapter II indicates, OriPOP is an origami-based motion medium and is easy for people to fold and create. There are many different types of design for origami food packaging. In this case, an inflated origami design is adopted since it allows air or different materials to fill the void inside and make the flat folded origami become inflated.

During the OriPOP design process, two different inflated origami

designs, a rabbit and a balloon with wings are compared and experimented with (Figure 3.4).
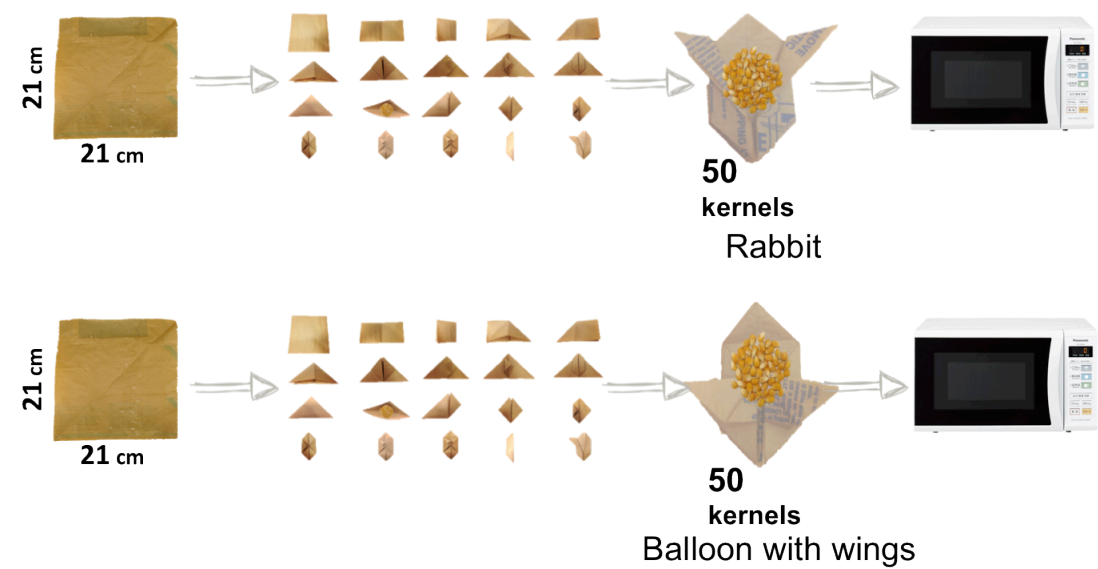
Figure 3.4 Experimenting with different aesthetic appeals of packaging in OriPOP design
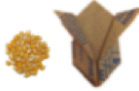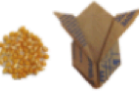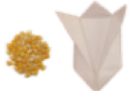
ORIGAMI					
FIRST POP	1m15s	1m14s	59s	55s	1m15s
LAST POP	3m13s	3m13s	3m31s	4m58s	4m10s
3D SHAPE					

Table 3.1 The results of different aesthetic appeals comparing popping time and final shape in OriPOP design

As Table 3.1 shows, when the size of the kraft paper (21cm x 21cm), materials (kraft paper), time (5 minutes), heating power (500w) and number of kernels (50 kernels) are controlled, the kraft rabbit yields a more natural movement during the heating process. During the heating process, the movement of jumping is created from the kernels' movement while popping. A balloon with wings is not a realistic image, but a jumping rabbit is. The rabbit design is therefore used in this case. Its shape is unique and unlike any popcorn packaging sold in the market and it is believed that the user would appreciate this uniqueness and find a connection with this aesthetic design.

3.2.2 The Choice of Materials

OriPOP popcorn packaging is made up of two types of materials: kernels and kraft paper. Kernels are placed inside a flat origami packaging made out of kraft paper. After heating in a microwave oven, kernels pop up and make the flat, static kraft paper packaging move, change its shape and become animated. Since OriPOP is made of kraft paper and kernels, it is very light and affordable. The heating equipment used for heating OriPOP, a microwave oven, is an appliance in most homes. There are no extra or unnatural materials involved as popping actuators for OriPOP.

Properties of kernels

Microwave ovens are attracted to water, fat and carbohydrates. If the food is microwave-attractive, it will move, change shape and become animated after being heated by a microwave oven. During the ideation process, different combinations of microwave-attractive food in kraft paper were considered, such as marshmallows with edible glue, rice cakes and popcorn. In the end, popcorn was chosen since kernels placed inside kraft paper have the strongest reactions against a microwave oven.

Popcorn is one of the most popular snack foods for consumers in much of the world. Out of all the types of corn (sweet, dent, flint and popcorn), only popcorn pops [27]. It is distinct in two ways. The first is that it contains almost entirely hard starch. The second is that it has a very hard pericarp and outer layers of endosperm, which permit the internal pressure and temperature to rise high enough to pop [27]. Each kernel contains a tiny droplet of water inside. When heated in a microwave oven, the water turns into steam, which builds pressure inside the kernels. When the kernels can no longer contain the pressure, they pop. Due to their special properties, the kernels enable the transformation of the kraft paper from a flat and static form to a designated animated shape after being heated.

Kraft paper

Chapter 2 explains the advantages of paper and paperboard used for food packaging. There are many different types of paper used in food packaging. Printing paper and kraft paper are compared and experimented with (Figure 3.5) to see which material is more suitable for OriPOP design.
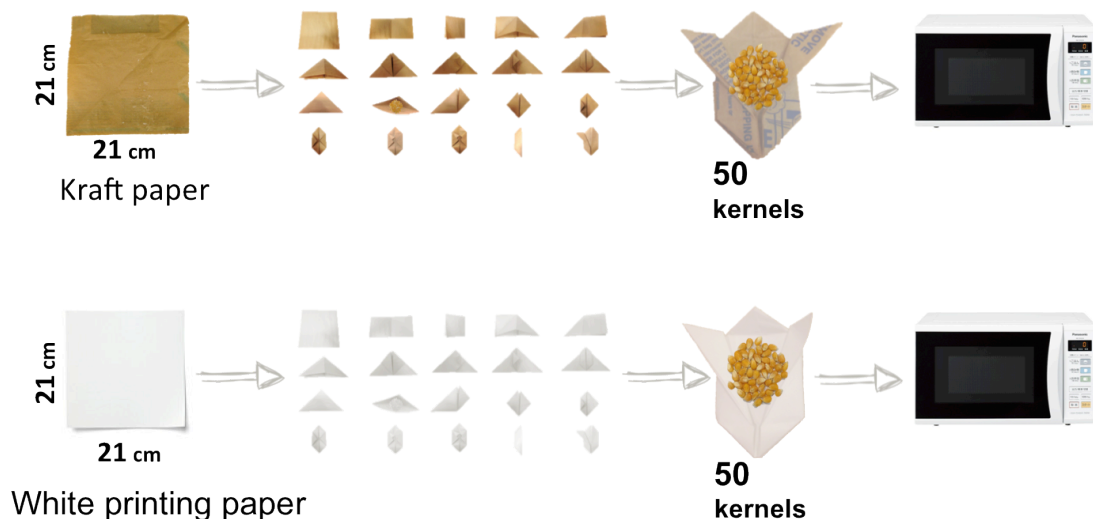
Figure 3.5 Experimenting with different materials in OriPOP design

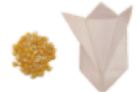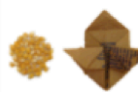| ORIGAMI					
FIRST POP	1m15s	1m14s	59s	55s	1m15s
LAST POP	3m13s	3m13s	3m31s	4m58s	4m10s
3D SHAPE					

Table 3.2 The results using different materials comparing popping time and final shape in OriPOP design

As Table 3.2 shows, when size of paper (21cm x 21cm), aesthetic design (rabbit), time (5 minutes), heating power (500w) and quantity of kernels (50 kernels) are controlled, materials do affect the popping time. Thinner materials, like white printing paper, take a longer time (4 minutes 58 seconds) to finish popping and transform into a 3-dimensional shape of a rabbit. The reason is that white printing paper has poor barrier properties and is not heat sealable. If white printing paper is used, it has to be treated, coated, laminated, or impregnated with materials such as waxes, resins, or lacquers to improve functional and protective properties [2].

Kraft paper, on the other hand, takes 3 minutes 13 seconds to finish popping. Kraft paper is available in several forms: natural brown, unbleached, heavy duty, and bleached white. The natural kraft is the strongest of all these papers and is commonly used for bags, wrapping and packaging food [2]. Natural brown kraft paper is used in this case and is seen to be an appropriate material for the OriPOP design.
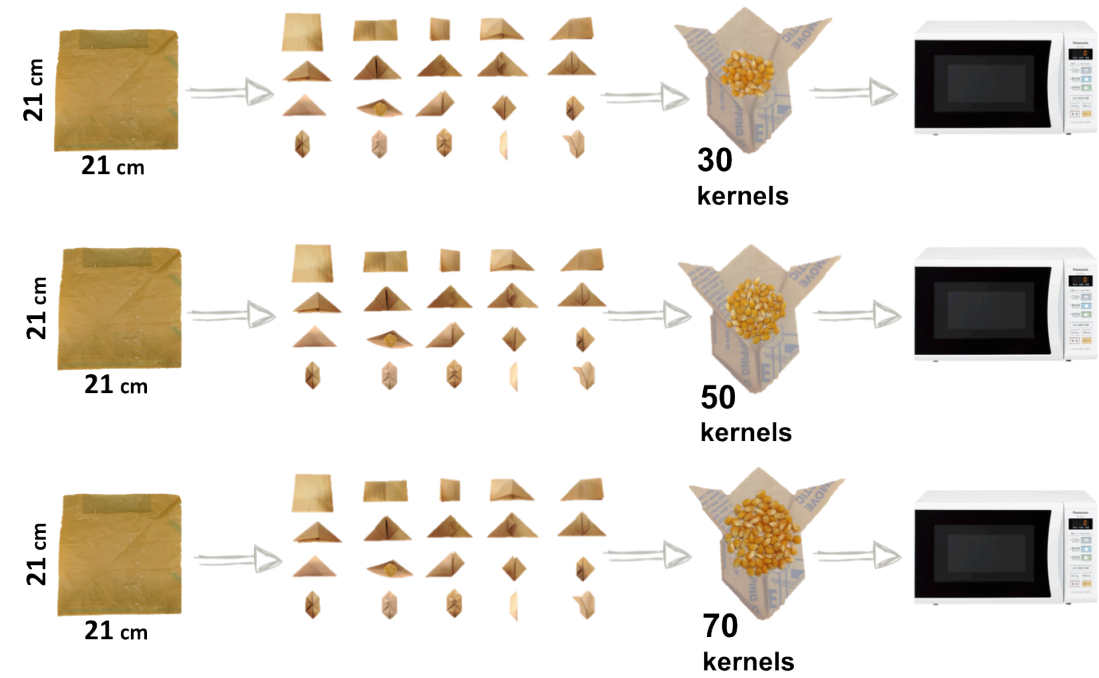
3.2.3 Number of Kernels

Figure 3.6 Experimenting with different quantities of kernels in OriPOP design
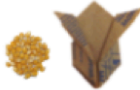
ORIGAMI					
FIRST POP	1m15s	1m14s	59s	55s	1m15s
LAST POP	3m13s	3m13s	3m31s	4m58s	4m10s
3D SHAPE					

Table 3.3 The results with different quantities of kernels comparing popping time and final shape in OriPOP design

To understand the relationship between the quantities of kernels, popping time and the aesthetic appearance of OriPOP when finished heating, different quantities of kernels (30, 50 and 70 kernels) are experimented with respectively (Figure 3.6).

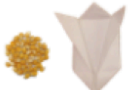As Table 3.3 shows, when the size of kraft paper (21cm x 21cm), aesthetic design (rabbit), materials (kraft paper), time (5 minutes) and heating power (500w) are controlled, there is no distinct relationship between the quantity of kernels and the time it takes to finish popping. However, different quantities of kernels do affect the shape of the final aesthetic appearance of OriPOP. With 5 minutes of heating time and 500w heating power, the origami popcorn packaging with 50 kernels produces the most aesthetically appealing rabbit in comparison with 30 and 70 kernels. Also during the heating process, the package with 50 kernels creates a more uniform jumping movement, like a real rabbit jumping.

3.2.4 Volume of the Package

Since 50 kernels and 21cm x 21cm popcorn packaging provides the best result, it is interesting to discover that this ratio applies to other volumes. Based on the same ratio of 21cm x 21cm kraft paper with 50 kernels, 18cm x 18cm kraft paper with 25 kernels, 24cm x 24cm kraft paper with 75 kernels, and 27cm x 27cm kraft paper with 100 kernels are compared and experimented with (Figure 3.7).
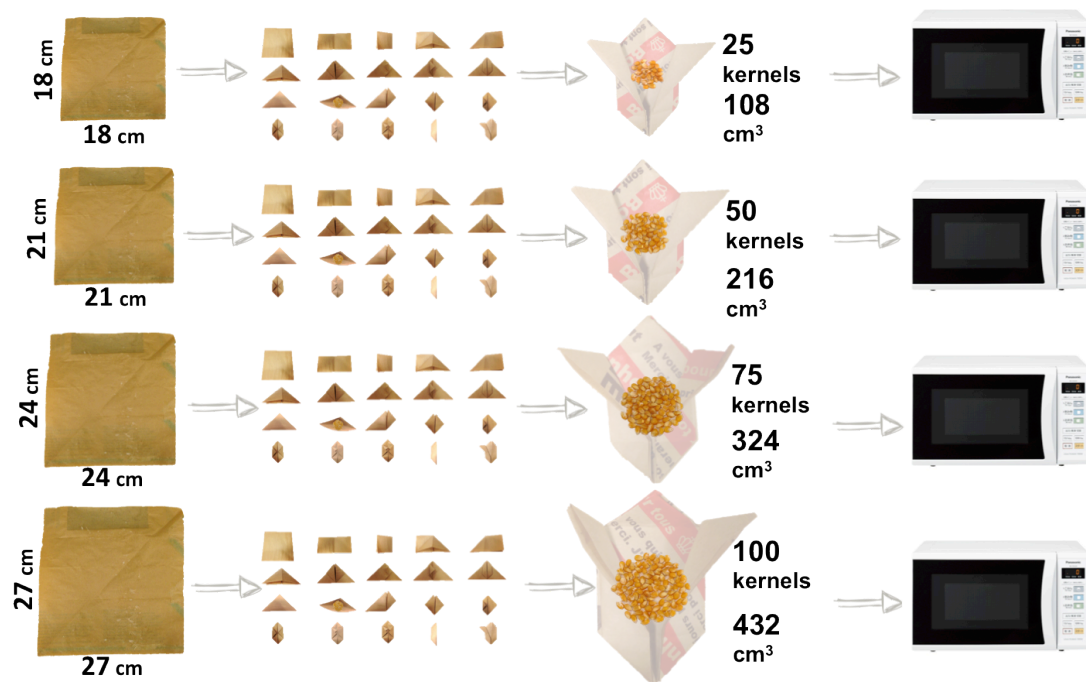
Figure 3.7 Experimenting with different sizes of kraft paper and quantities of kernels in OriPOP design

ORIGAMI				
FIRST POP	2m07s	2m19s	1m10s	1m24s
LAST POP	4m54s	4m58s	3m35s	3m59s
3D SHAPE				

Table 3.4 The results of different quantities of kernels and size of kraft paper based on the same ratio compared with popping time and final shape of OriPOP design

As Table 3.4 shows, when the aesthetic design (rabbit), materials (kraft paper), time (5 minutes) and heating power (500w) and the ratio of 21cm x 21cm kraft paper with 50 kernels are controlled, the same ratio is applicable to different quantities of kernels and sizes of kraft paper. There is no major difference in terms of popping time and the final shape of rabbit. As a result, OriPOP adopts the ratio of 21cm x 21cm kraft paper with 50 kernels. Popcorn packaging sold in the market is usually a family size. OriPOP is designed to be in the size of 21cm x 21cm so that one person would be able to hold the pack and finish it.

3.3 Initial User Feedback

From the initial prototype design process, the physical design of OriPOP is based on the idea of 21cm x 21cm kraft paper with 50 kernels. After heating in a microwave oven with controlled time (5 minutes) and heating power (500w), an animated rabbit will be formed and created (Figure 3.8).
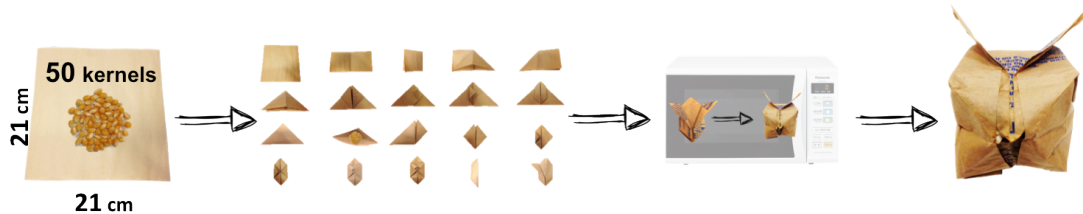
Figure 3.8 Initial prototype design of OriPOP

According to Norman's three levels of emotional design at the behavioral level, it is crucial to measure if this prototype idea matches with what users' expect and desire. In order to test the validity, a user feedback session is conducted. With the aim that "when users are involved in the creation of popcorn packaging and see their personalized package become animated, they are more likely to enjoy the experience of heating popcorn", six Keio Student Tsunashima Dormitory residents are evaluated individual by individual.

First, users follow the verbal instructions provided by the author to fold and create an origami shape with 50 kernels placed inside 21cm x 21cm kraft paper. Second, they place a completed origami package in a microwave oven and set the oven for 5 minutes/500W. Third, they heat the package and wait for it to become animated. After that, they repeat steps one to three. But this time, users are asked to design and create their own origami packaging.

After the second round, interviews are conducted in order to obtain user feedback. In summary, users enjoy the experience of heating OriPOP. They feel surprised, entertained and excited when they see the rabbit jumping in a microwave oven. They also feel that there is a sense of achievement. Therefore, they prefer OriPOP to the current popcorn packaging. They say OriPOP looks more decorative, interesting, entertaining, fun, cute, and unique.

During the experiment, users are asked to fold a rabbit following the author's instructions, as well as create their own design. In the end, all the users feel that they cannot make their own origami packaging design from scratch. They intend to try, but give up in the end. They prefer to have paper instructions provided instead of verbal instructions, like IKEA products. They suggest that it would be good to show the completed picture of OriPOP on the package and provide paper instructions inside the package.

Another suggestion is that they think it would be better to have another layer of paper outside or inside the package in order to control the way the kernels pop and the shape of the package. Finally, users also believe that OriPOP could be a potentially profitable business opportunity since it is simple, affordable and practical.

3.4 Final Prototype

Drawing on users' feedback, several adjustments are implemented with respect to the final prototype of OriPOP. For the co-production process, step-by-step instructions with a completed picture of OriPOP are provided in a paper format, so that users will not lose interest. The level of involvement is also adjusted. Users will not be asked to design their own packing from scratch. Similar to IKEA products, users follow the designated instructions for folding a rabbit.

Figure 3.9 Adjusted OriPOP prototype design with white cardboard paper attached at the bottom

In terms of the co-animation process, as users suggested, another layer of paper is attached to the origami rabbit during the folding process. White cardboard paper is used in this case since it is thicker than kraft paper with a higher weight per unit area and often made in multiple layers for heat sealability. White cardboard paper is glued to the bottom of the flat kraft rabbit. When heating in a microwave oven, it delays the time required for the kernels at the bottom to pop. As a result, the rabbit moves and jumps in the straight direction and looks more like a real rabbit.

4. Evaluation

4.1 Experimental Design

As Chapter 1 identified, in the recent development of packaging design there is a lack of insight into the emotive relationship between types of packaging design and the responses they evoke. The objective of the research is to create a user-interactive co-production and co-animation process in making an innovative popcorn package, OriPOP. It believes that if users could be involved in the process of creating the popcorn packaging, and could see their personalized, static packaging become animated and alive, their emotional enjoyment in the experience of having popcorn would increase. With this contention, two experimental conditions are identified.

Condition I: When users are involved in the creation of OriPOP, they are more likely to visually and haptically enjoy the experience of having popcorn.

Condition II: When OriPOP is animated, they are more likely to visually, aurally and olfactorily enjoy the experience of having popcorn.

This experiment is designed to evaluate the emotional changes of Keio University Tsunashima Student Dormitory residents before and after creating OriPOP, especially emotional changes in visual, aural, olfactory and haptic sensations. Residents are involved in folding and creating OriPOP packaging with paper instructions provided, and see it become animated in a microwave oven. The Self-Assessment Manikin (SAM) measure is implemented with pre- and post-questionnaires to evaluate whether the residents' emotional reactions towards the existing popcorn packaging as relates to the five human senses (sight, hearing, taste, smell and touch) differ from their emotional reactions towards OriPOP. This evaluation process is followed by laddering interviews and assisted by user observations and video recording.

4.2 Experiment Setup

4.2.1 Sample Description

Participants are recruited from the students currently residing at Keio University Tsunashima Student Dormitory. To be eligible, they are selected on the basis of being readily available to participate and having had previous experience heating microwavable popcorn.

A non-probability sampling approach is used to draw a convenience sample consisting of 10 respondents, 50% men and 50% women, and 50% in master's degrees and 50% in undergraduate degrees with a wide range of ages from 21 to 40 years old, and cultural origins including Canada, China, Japan, Korea, Russia, Taiwan and USA. The variation and variety of the participants' cultural origins, age and educational levels are intentional since the major aim is to capture and identify common patterns within that variation. This sample size is deemed sufficient for the mixed method research design, considering quantitative and qualitative analysis requirements.

Participants are evaluated one at a time and face-to-face. The author employs SAM picture-oriented questionnaires, laddering interviews and user behavioral observations. These processes are video recorded. All the participants must read and sign an agreement in which the purpose of the research is fully explained and they are guaranteed that the data they provide is only used for the purpose of this research. Confidentiality and anonymity are granted in order to aid open and honest discussion. They are also assured that there are no right or wrong answers and they should answer questions as honestly as possible. These procedures are intended to reduce participants' apprehension, which might cause them to give responses that they deem more socially desirable, acquiescent, and

consistent with how they think the interviewer wants them to respond.

4.2.2 Environment

The evaluations are conducted in a cafeteria at the Keio University Tsunashima Student Dormitory with the approval of the dormitory manager. The room is set up exclusively for the study and it is air-conditioned, bright, clean and quiet with big tables and chairs provided.
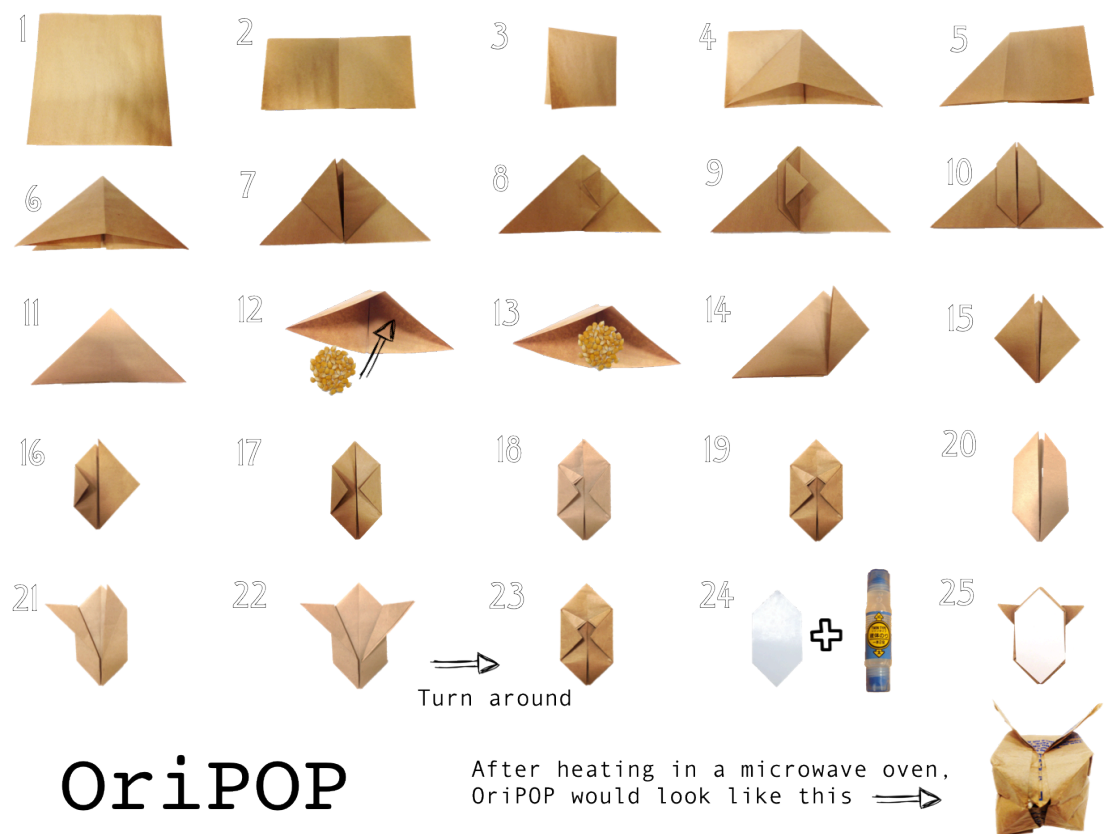
4.3 Procedure

Figure 4.1 A step-by-step instruction of how to fold OriPOP

The process of evaluation consists of 10 stages:

1. After arriving at the cafeteria, each participant is given a brief explanation of the procedure and purpose of this research. At the same time, video recording is started.
2. The participant is asked to read and sign the agreement of participation.
3. The participant is then given a survey and asked to rate his/her emotional reactions in terms of valence and arousal of the five human senses towards the existing popcorn packaging using a 9-point rating scale of SAM that uses pictorial facial expressions. To understand the participant's experience with the existing popcorn packaging, he or she is asked to rate such things as "the look of the existing popcorn product", "the sound of the existing popcorn product" and "the taste of the existing popcorn product" (Appendix A- Pre-questionnaire). For each of the statements, the participant circles one pictogram from each of the SAM dimensions that best describes his or her emotion.
4. After the questionnaire, the participant is given printed instructions on how to fold and create an origami rabbit with 50 kernels placed inside 21cm x 21cm kraft paper, and glue a 5cm x 5cm flat white cardboard paper at the bottom of the flat origami rabbit (Figure 4.1).
5. The participant places a completed and flat package in a microwave oven and sets the oven for 5 minutes/500W.
6. The package is heated and the participant waits for it to be ready.
7. After the participant finishes heating OriPOP, he or she is asked to complete another two SAM questionnaires with the same sets of questions given at the beginning of the experiment. But this time, they are asked to evaluate their emotional reactions towards the process of creating OriPOP (Appendix B- Post-questionnaire I) and the process of heating OriPOP (Appendix C- Post-questionnaire II). For each of the statements, the participant also circles one pictogram from each of the SAM dimensions that best portrays his or her emotion.

8. Once the SAM questionnaires are completed, the interviewer follows up on the participant's circled responses by asking the questions "Why?" or "Why it is important to you?"

9. Questioning usually proceeds in this way until the participant is unable to articulate an answer to the ultimate "Why" prompt, or until his or her response represents a simple rewording of the previous construct.

10. At the end of the interviews, the participant is asked to provide his or her demographic background information, including age, gender, nationality and current student status. This is followed by a thank you message.

4.4 Measure

This research takes a mixed method approach for measuring emotional reactions associated with popcorn within the context of packaging design and development. A joint application of quantitative and qualitative data collection methods is employed. Data collection by means of the visual self-report SAM instrument may be described as quantitative, indicating emotional reactions from the users. For qualitative data collection, in-depth laddering interviews are conducted, providing an understanding of the influencing personal values behind the emotional reactions evoked in the users. The entire evaluation process is video recorded to allow for a smoothly flowing interview and the capturing of the respondents' verbatim comments. To facilitate further analysis, the interviews are subsequently transcribed. The evaluation process is also assisted by observing any unconscious reactions made by the participant.

4.4.1 Quantitative Measures: the Self-Assessment Manikin (SAM)

Emotions evoked by packaging are idiosyncratic. In other words, different people can have different feelings towards the same packaging. Although emotional reactions are not easy to measure, various instruments have been developed throughout the years [28]. From a quantitative methodological point of view, measures of emotional responses can, according to Poels and Dewitte, be classified as either self-report or autonomic psychophysiological methods [11, 28].

There are several underlying reasons for the choice of a non-verbal, picture-oriented self-report instrument, SAM. In the case of an automatic psychophysiological instrument, it has the advantage of not requiring language skills. However, psychophysiological responses are generally not sensitive enough to distinguish between different types of positive emotions nor to capture the breadth of emotions listed in self-reported measures [29]. Furthermore, this instrument is expensive and has a problem of validity since it usually has to be completed in unnatural lab settings. In terms of verbal self-report, the main disadvantage is that it is difficult to apply between cultures. In emotion research, translating emotion words is known to be difficult because a one-to-one, "straight" translation is often not available. Intercultural comparisons are thus notoriously problematic.

To overcome these problems, a picture-oriented visual self-report instrument, SAM, is used in this research [30]. From a methodological view, SAM enables the measure of emotional responses to support the research in terms of exploring the relationship between OriPOP design and the emotional responses it evokes. From a practical point of view, SAM has an advantage over other self-report measures of emotion in that it is easy and cheap to administer, and can produce quick measurements of emotional reactions [30, 31]. Since it is unobtrusive, it does not disturb participants during the measurement. Although it can only measure subjective feelings,

the cognitive bias is lower than for verbal self-report. Moreover, instead of relying on verbalizations or a list of emotion words, responses of SAM are based on cartoon-like figures that represent different emotions or emotional states. Thus, SAM is language-independent and cross-cultural. It is suitable for a variety of subject populations, including non-English speakers, children, people with language disorders, and all clinical syndromes [30].
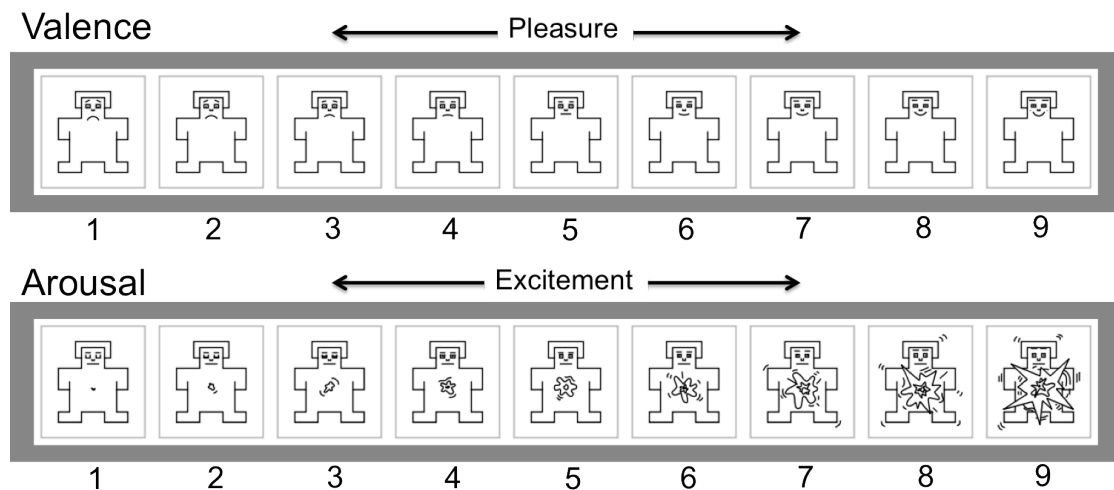

Figure 4.2 A 9-point rating scale of SAM measures for OriPOP

The SAM instrument is derived from Mehrabian and Russell's PAD-dimensions [31]. Instead of rating a set of emotion-adjectives for all three PAD-dimension, SAM uses pictorial facial expressions to measure emotional reactions in terms of valence, arousal and dominance (Figure 4.2). Accordingly, for every single dimension respondents have to indicate which figure best represents their emotional state [30]. This research employs a 9-point rating scale of SAM. The valence dimension represents ranges from a smiling, happy figure to a frowning, unhappy figure. For the arousal dimension, it ranges from an excited, wide-eyed figure to a relaxed, sleepy figure. The dominance dimension represents changes in control with changes in the size of SAM: a large figure indicates maximum control in the situation [30]. Since there is a lack of effects found on the dominance dimension, this dimension is dispensed with in this research.

4.4.2 Qualitative Measures: Laddering Interviews

The SAM technique alone may not be fully appropriate as this method may be biased by factors such as post-justification or insensitivity to subtle momentary changes of affect. For emotion-driven design to become a mature design strategy, it is crucial to understand why, when, and how the popcorn packaging, OriPOP, evokes particular emotions.

As Corbin and Strauss stressed, the primary purpose of qualitative research is discovery. Qualitative approaches can be used to obtain the intricate details of phenomena that are difficult to convey with quantitative methods [17]. Using the data obtained during the SAM technique, laddering interviews are conducted. A joint application of both types of measures is deemed to be an appropriate approach to explore underlying factors influencing participants' emotional reactions when creating and heating OriPOP, such as their own reality, values and experience.

Based on the logic of recursive questioning, the laddering up approach is adopted by asking the participant "Why?" or "Why is it important to you?" from the pictograms of SAM measurement that he or she chooses. This theoretically ladders up to the next higher-order construct, to which a further associated reason is elicited by repeating the cycle of questioning at each new rung. Questioning usually proceeds in this way until the respondent is unable to articulate an answer to the ultimate "Why" prompt, or until his or her response represents a simple rewording of the previous construct. The result represents a multi-layered hierarchy of personal meanings.

The interviews are intended to be conversational and situational. The interviewer decides the sequence and wording of the open-ended questions and is free to explore, probe, and ask questions to elucidate and illuminate a particular subject. Discussions flow like a conversation. In fact, interviews are kept as loosely structured as possible, allowing the participants the freedom to broach topics in their own ways and at their

own paces.

This semi-constructed, open-ended and discovery-oriented methodology can provide a deeper understanding of subjective emotions based on the participant's personal experience. By interviewing, in-depth motivations, feelings, attitudes and prejudices, all of which determine the participants' reactions, can be uncovered and deeply explored. This information provides the author with the opportunity to examine, to reason out, and to analyze the participant's motives for actions which previously he or she had always done more or less automatically.

4.5 Result

According to the SAM questionnaire results, laddering interviews and user observation, the valence and arousal dimensions yielded linear results. The majority of the participants became incrementally happier and more excited from the co-production to co-animation process.
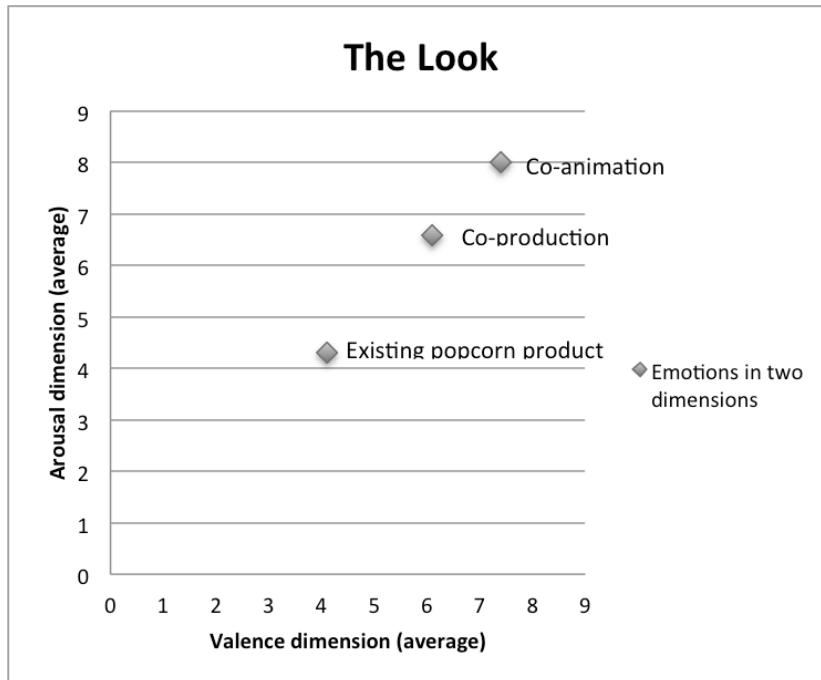
4.5.1 The Look of OriPOP

Figure 4.3 The look of OriPOP in valence and arousal dimensions

According to Figure 4.3 there is a positive linear trend of participants' emotional changes. The relationship between valence and arousal dimensions is also linear. It illustrates that participants progressively feel happier and more excited from the existing popcorn product to the co-production process, and from the production process to the co-animation process. From the laddering interviews, some participants felt happy about the look of OriPOP because it reminded them a good memory and introduced a new experience. "I like origami. As a kid, I played it at home and school. It brings back good memories. It's a happy memory of my childhood" (a 40-year-old Canadian male master's student). Some of the participants smiled while folding origami. A 29-year-old Taiwanese male undergraduate student stressed: "I never experienced this way of creating a popcorn package. It was unique and fun to see popcorn packaging folded into an interesting animal shape. It's like magic. Something created by me."

Figure 4.4 A 24-year-old Taiwanese male undergraduate student looked very intent while folding OriPOP

All of the participants were very focused while folding OriPOP, similar to the participant in Figure 4.4. Yet, some participants claimed that they felt the folding steps looked too complicated, long and hard to understand. Some worried that they could not fold it successfully. When they found difficulties during the folding process, some of them unconsciously scratched their heads or pushed their glasses. A 24-year-old Taiwanese male undergraduate student said: "I was worried that the final product would not look as pretty as the existing popcorn product. I am a perfectionist and wanted the final product to be in a size and shape that I would feel satisfied with." A 28-year-old Chinese female master's student said: "I'm not good at folding paper. It is troublesome and difficult for me." However, she also claimed that: "Even though it took time and personal ability, I was still excited to see how it would turn out." A 21-year-old American male undergraduate student also said: "It felt interactive and challenging, but at the same time I felt I could accomplish it." Some also

said that they felt curious and mysterious, thus they were very excited and motivated to see the outcome.

Figure 4.5 A 23-year-old Hong Kongese female undergraduate student unconsciously made hand gestures to show her excitement

As Figure 4.3 indicates, the participants' happiness and excitement greatly increased during the co-animation process in comparison to the existing popcorn product. Most of the participants said that they found the product unique, cool, cute, playful, entertaining, and felt happy and excited to see the origami changing shape in a microwave oven. From user observation, when participants saw the rabbit start jumping, some of them unconsciously made some hand gestures to show their excitement (Figure 4.5). A 29-year-old Taiwanese female master's student claimed that: "During the co-production and folding process, I felt I was just folding paper. But during the co-animation process, seeing the rabbit growing bigger in a microwave oven, I felt I couldn't wait to share this happiness with my friends." Another participant said: "When I saw the rabbit's long ears

gradually standing up and becoming more and more inflated, I thought it was a real rabbit" (a 29-year-old Taiwanese female master's student).

The participants also felt that the process was full of unexpectedness. One participant said: "Even though the folding process sheet showed how the final product would look, I didn't know the incremental development and changing process in the oven. So when I saw the shape of the origami start changing, I was very excited. I couldn't wait to see how this self-made product was going to turn out. It's an unexpected enjoyment and excitement" (a 24-year-old Taiwanese male undergraduate student). Another participant also said "It was unexpected. I was wondering how the origami would expand and inflate. I've never seen popcorn packaging expand in this way. It was really entertaining and interesting" (a 28-year-old Chinese female master's student).

In addition, the participants felt a personal involvement and a sense of achievement with the moving rabbit they saw inside the oven. A 22-year-old Japanese female undergraduate student said: "I have never had popcorn packaging which I could design and personalize." One participant even said: "When I saw the rabbit grow bigger and bigger it felt like raising a baby and seeing him grow up. I felt very happy about this (a 24-year-old Taiwanese female master's student)." Moreover, it could even make a participant feel relaxed. A 24-year-old Taiwanese female master's student said, "Seeing the rabbit jumping in the oven, I felt I got healed."
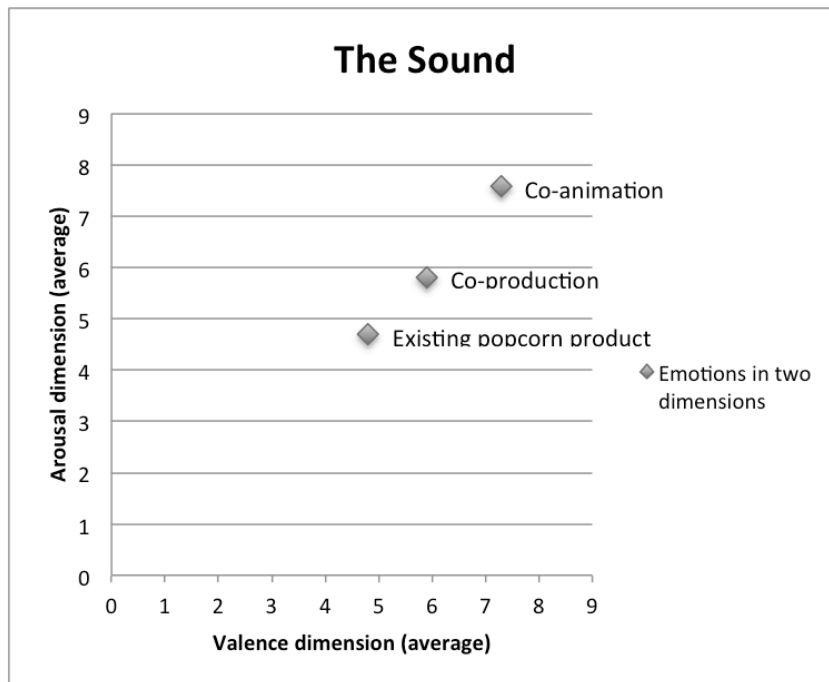
4.5.2 The Sound of OriPOP

Figure 4.6 The sound of OriPOP in valence and arousal dimensions

In terms of the sound of OriPOP (Figure 4.6), the results show a similar trend to the look of OriPOP (Figure 4.3). Participants also progressively felt happier and more excited from the existing popcorn product to the co-production process, and from the production process to the co-animation process. There is a very marked increase in happiness and excitement from the existing popcorn product to the co-animation process. During the co-animation process, the majority of the participants said that they enjoyed the sound of OriPOP. At the beginning, participants all looked a little bit nervous in front of a microwave oven. Perhaps they were afraid of what was going to happen. None were at all distracted by mobile phones while waiting for OriPOP to be ready. They paid attention to what would happen inside a microwave oven. As soon as the participants heard the first popping sound, some of them opened their mouths and smiled. One participant said that: "The popping sound makes me feel so happy because it made me feel I am going to do something happy" (a 29-year-old Taiwanese female master's student). Another said the unexpected and irregular popping sound made

45

him feel surprised.

Participants also felt that the more popping sounds they heard from OriPOP, the more they felt it was getting closer to success. As a 23-year-old Hong Kongese female undergraduate student claimed, "Although the regular microwavable popcorn products also have popping sound, I did not pay attention to it. Since I was creating something myself this time, I specially paid attention to the popping sound and felt excited." Moreover, the popping sound brought back a good childhood memory. "As a kid I used to make popcorn over a fire. It was fun" (a 40-year-old Canadian male master's student).
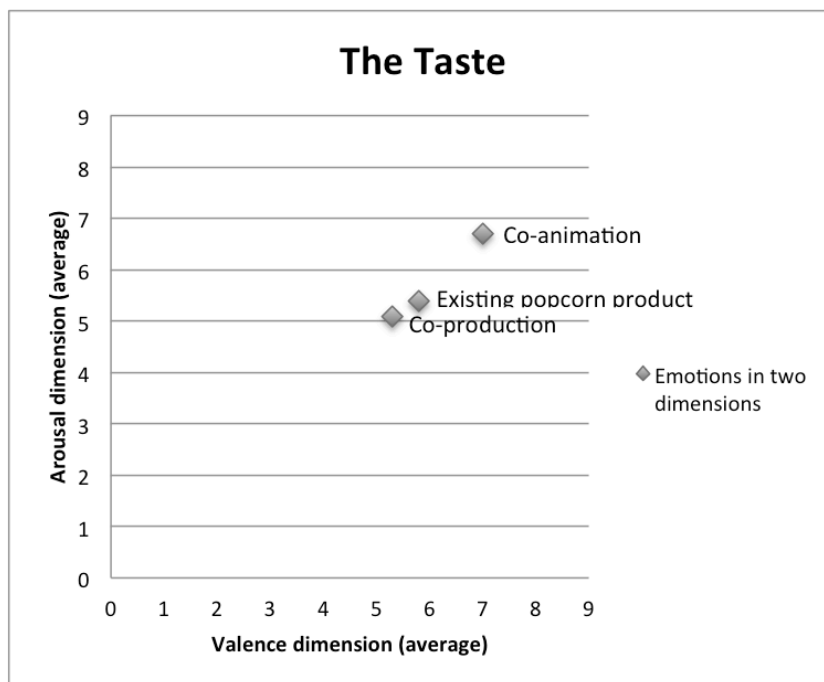
4.5.3 The Taste of OriPOP

Figure 4.7 The taste of OriPOP in valence and arousal dimensions

As Figure 4.7 depicts, there is a slight decrease of happiness and excitement from the existing popcorn product to the co-production process. The majority of the participants were worried about the taste of OriPOP during the co-

production process. From the interviews, most of the participants said they were worried that their folding skills might affect the taste and so it might not taste the same as the existing popcorn product. "Since I was worried that I didn't fold well, I was worried that OriPOP might not be very tasty. So I had to be very careful while folding" (a 24-year-old Taiwanese male undergraduate student)

However, this feeling drastically changed during the co-animation process. Participants were a lot happier and more excited about the taste of OriPOP when they saw the rabbit jumping inside a microwave oven. The majority of them said they started feeling curious and intrigued, and thought that OriPOP might be more delicious than they had imagined when they were folding it during co-production. One participant said: "When the shape of the packaging started changing, I was wondering if the taste would also get changed and become better" (a 24-year-old Taiwanese female master's student). Another said: "Once the rabbit became chubbier and chubbier, it looked so yummy. I felt I couldn't wait to eat it" (a 29-year-old Taiwanese female master's student). A sense of achievement was also built up during the co-animation process: "I was quite happy because I felt that self-made is always better. It's like I felt self-grown vegetables are better" (a 28-year-old Chinese female master's student).

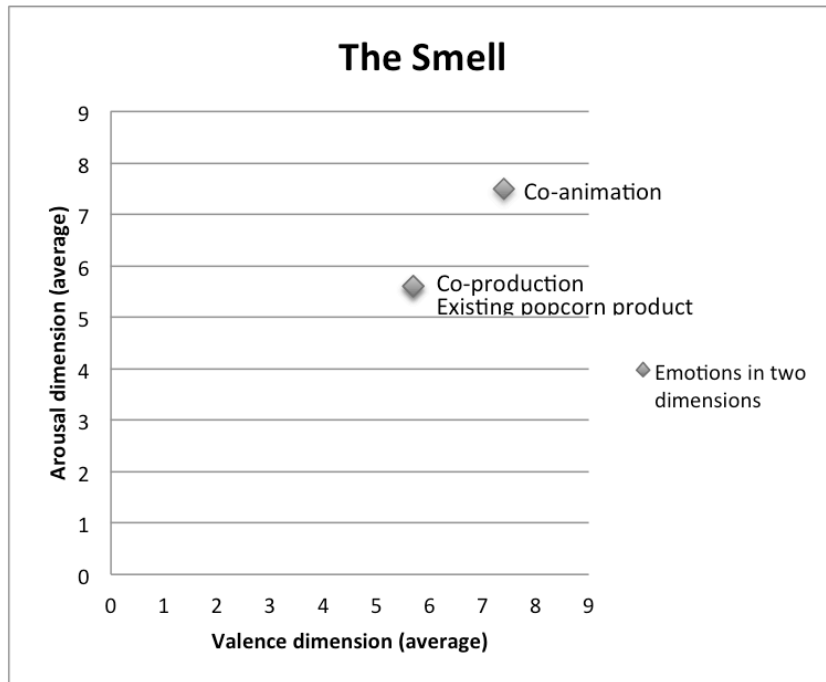## 4.5.4 The Smell of OriPOP

The Smell

Figure 4.8 The smell of OriPOP in valence and arousal dimensions

During the co-production process, the majority of the participants felt that their feeling about the smell of OriPOP did not change in comparison to the existing popcorn product (Figure 4.8).

However Figure 4.8 depicts a very marked and positive emotional change from the co-production to the co-animation process. During the co-animation process, most participants felt they could not wait to eat OriPOP when they smelled the popcorn from the microwave oven. This happiness and excitement were higher than for the existing popcorn product. One participant said: "The more I waited, the more it smelled good. I became so hungry and tempted to eat it" (a 24-year-old Taiwanese male undergraduate student). One participant said that the more the rabbit jumped and the more the smell came out, the more the happy memories came out. She said that: "It was like the popcorn I smelled in Disneyland. I felt blessed and sweet" (a 29-year-old Taiwanese female master's student). Furthermore, the more the participants smelled, the more they felt a sense of achievement. A

23-year-old Hong Kongese female undergraduate student said: "I felt a smell of success." Another said: "Because I made it, I felt the smell was especially good" (a 24-year-old Taiwanese female master's student).
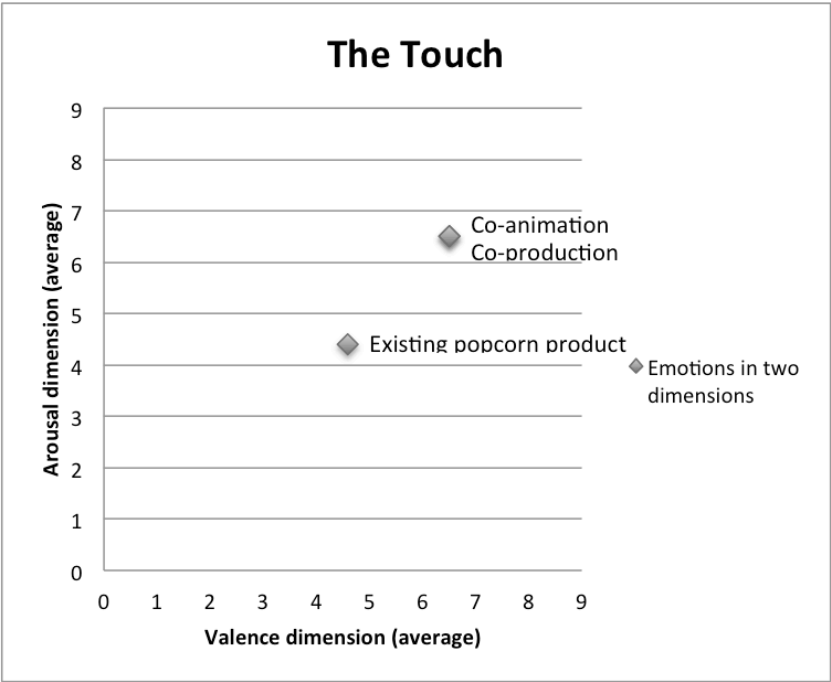
4.5.5 The Touch of OriPOP

Figure 4.9 The touch of OriPOP in valence and arousal dimensions

Figure 4.10 A 29-year-old Taiwanese female master's student felt happy while folding OriPOP

Figure 4.9 clearly shows that in comparison to the existing popcorn product, most participants' feeling of happiness and excitement increased during the co-production process. However, such feelings stayed the same from the co-production process to the co-animation process. During the co-production process, participants felt that folding origami brought back happy childhood memories. One participant said: "I haven't had a chance to fold origami for a long time. Suddenly, my childhood memories came back. It's like I was doing something back in time" (a 29-year-old Taiwanese female master's student). Also during the folding process, participants felt happy to be involved and were curious since it was a whole new experience with this popcorn product (Figure 4.10). One participant said: "The action of folding made me feel that I could design and control something myself. I was thinking and imagining what kind of shape it would change into as a paper. What kind of rabbit it would be" (a 40-year-old Canadian male master's student). Another suggested: "There are too many instant food products in

our everyday lives. It is rare to have something like OriPOP which involves a step-by-step folding process and made me use my brain" (a 23-year-old Hong Kongese female undergraduate student).

During the co-animation process, the feeling of touching OriPOP tended to be at the same level as during the co-production process. Most of the participants could not wait to take OriPOP out of the oven and touch it once they saw the shape was changing. This feeling is connected to the feeling of success. One participant said: "When I opened the oven and touched the completed OriPOP, I was so happy that I had made something successful. It's like I achieved something (a 22-year-old Japanese female undergraduate student). Another said that: "When I took it out from the oven, the package was so hot. Because it was so hot, I felt I made it successfully" (a 23-year-old Hong Kongese female undergraduate student).

5. Evaluation

5.1 Experimental Results Discussion

5.1.1 Linking Results to Condition I

		Co-Production Process- Valence Dimension				
		Look	Sound	Taste	Smell	Touch
Existing Popcorn Product -Valence Dimension	Look	○				
	Sound		○			
	Taste			✕		
	Smell				△	
	Touch					○

○　　　Valence level increases from the existing popcorn product

△　　　Valence level stays the same as the existing popcorn product

✕　　　Valence level decreases from the existing popcorn product

Table 5.1 Emotional reactions in valence dimension- existing popcorn product versus co-production process

		Co-Production Process- Arousal Dimension				
		Look	Sound	Taste	Smell	Touch
Existing Popcorn Product -Arousal Dimension	Look	○				
	Sound		○			
	Taste			✕		
	Smell				△	
	Touch					○

○　　　Arousal level increases from the existing popcorn product

△　　　Arousal level stays the same as the existing popcorn product

✕　　　Arousal level decreases from the existing popcorn product

Table 5.2 Emotional reactions in arousal dimension- existing popcorn product versus co-production process

The research posits:

Condition I: When users are involved in the creation of OriPOP, they are more likely to visually and haptically enjoy the experience of having popcorn.

Table 5.1 and Table 5.2 summarize and compare emotional changes from the existing popcorn product to the co-production process in valence and arousal dimensions. Table 5.1 and Table 5.2 suggest that users become happier and more excited when they are involved in looking at, hearing and folding OriPOP. Personal experience is an influential factor here. Users feel folding OriPOP reminds them of happy memories. However, they worry that their self-folded origami packaging might cause the popcorn to be less tasty. Even though they still feel happy when they are actually involved in folding, adjusting the user's level of involvement in co-production would be important.

One suggestion could be designing a shorter folding process by cutting the 25 steps to half so that users do not need to be involved in folding the origami rabbit from the beginning. Having the structure already half-folded and letting users complete the folding would make them feel more comfortable, and possibly become happier and more excited when they anaticipate the taste of OriPOP. Overall, Condition I is achieved. Compared to the existing popcorn product, involving users in the creation of popcorn packaging could lead them to feel visually and haptically more excited and haptically happier with the experience of having popcorn. Co-production is deemed to be an effective method to involve users actively in popcorn packaging design. In addition, it is interesting to find that aural sensation surprisingly increases during this stage. The sound of paper might indirectly prompt participants to imagine happiness and excitement, a consideration which demands further research.

5.1.2 Linking Results to Condition II

		Co-Animation Process- Valence Dimension				
		Look	Sound	Taste	Smell	Touch
Existing Popcorn Product -Valence Dimension	Look	○				
	Sound		○			
	Taste			○		
	Smell				○	
	Touch					○

○   Valence level increases from the existing popcorn product

△   Valence level stays the same as the existing popcorn product

✕   Valence level decreases from the existing popcorn product

Table 5.3 Emotional reactions in valence dimension- existing popcorn product versus co-animation process

		Co-Animation Process- Arousal Dimension				
		Look	Sound	Taste	Smell	Touch
Existing Popcorn Product -Arousal Dimension	Look	○				
	Sound		○			
	Taste			○		
	Smell				○	
	Touch					○

○   Arousal level increases from the existing popcorn product

△   Arousal level stays the same as the existing popcorn product

✕   Arousal level decreases from the existing popcorn product

Table 5.4 Emotional reactions in arousal dimension- existing popcorn product versus co-animation process

The research posits:

Condition II: When OriPOP is animated, users are more likely to visually, aurally and olfactorily enjoy the experience of having popcorn.

According to Table 5.3 and Table 5.4, co-animation does not just achieve Condition II, making users feel visually, aurally and olfactorily happier and more excited with OriPOP. It exceeds the expectations. During the co-animation process, all five human senses seem to influence each other and lead users to feel visually, aurally, gustatorily, olfactorily and haptically happier and more excited with OriPOP.

The combination of the kernels and the origami rabbit create incremental jumping movements, smells, sounds and alteration of shape when heating in a microwave oven. These give users a new experience with popcorn packaging. They feel as if a real rabbit that they have raised is growing up in front of them. There is a strong sense of achievement. The combination of the kernels and paper for packaging design are seen as a very effective actuator and motion medium that pleases and excites users. For the next stage, it is intriguing to further examine how five human senses influence each other at this stage.

5.2 Limitations

The research adopts a non-verbal self-report method, SAM, and laddering interviews. However, there are some important methodological limitations concerning the reliability and validity. Despite the fact that psychologists have tended to view emotions as intrinsically conscious, non-conscious affects exist. Human beings process information automatically and behave spontaneously on many occasions. Emotions cannot be measured adequately by these methods. Although user observations and video recording are implemented to reduce non-conscious affects, participants may be unable to

report their emotions because they are not aware of exactly how they feel or are unwilling to report their emotions because of social desirability concerns, or pre-existing attitudes and beliefs.

Another issue involves the fact that SAM and laddering interviews are retrospective. They can measure emotional reactions only after the co-production and co-animation process, not during the process. Given that emotions can be spontaneous, fleeting and subconscious, the use of these methods to assess subtle and fleeting emotions may encourage cognitive bias and may be less appropriate in assessing directly experienced emotion. Even though user observations and video recording are implemented to help, they may not be able to capture all subtle and fleeting emotions. Furthermore, the research focuses on the measurement of single emotions. This means they only measure one type of emotion at one given moment or one single emotion in a continuous manner. Thus, mixed emotions, paradoxical emotions cannot be measured. Combining these constraints, it can be argued that a perception of emotional response may be measured rather than the emotional response itself.

The reliance on a certain socio-cultural group is another limitation. It is questionable whether a product that is enjoyable in one culture would also be enjoyable in another. The research is evaluated by a limited number of 10 students living in Keio University Tsunashima Student Dormitory. Although this research is intended to maximize socio-cultural variations in terms of age, gender, cultural origins and educational levels, there is a possibility that the outcomes are specific to this subcultural and socio-economic group. Responses to emotions vary with people and cultures. The prevailing norms of a society and the process of enculturation shape people's behavior and these vary with time and place. Those in some Eastern societies, for instance, have been described as reserved, but so have some in the West at certain times. It is not appropriate to assume that such differences are permanent or universal within a particular society. Thus, the sample population in this research may be specific to the experimental

context and may not be sufficiently representative to yield significant results at the miso or macro level.

6. Conclusions

6.1 Future Research Recommendations

The research centers on two stages of popcorn user-product interactions: "opening a package" and "cooking the popcorn". Two other important stages, "choosing the popcorn packaging" and "eating the popcorn", are sidelined. Thus, for a holistic emotional experience of food packaging design, OriPOP requires further examinations of purchasing and eating behaviors.

Furthermore, the research proposes "co-production" and "co-animation" processes by involving users in creating their personalized popcorn packaging, OriPOP, and animating it. However, the research is limited to a single food product, popcorn, in the area of paper-based food packaging design. There is an acute need to examine whether this food package design method is specific for this experimental context or could extend or apply to other food.

In the area of emotional design, the research emphasizes and applies all three of Norman's levels of emotional design: visceral, behavioral and reflective. However, it does not take differences in time and space into consideration. It is unknown whether people feel enjoyment more in retrospect or in the moment, alone or socially.

Emotions associated with the food packaging experience could vary in intensity over time. Happiness and excitement are likely to diminish with repeated experience. One way to keep the user interested is to enhance OriPOP's multisensory experience. In future research, it would be interesting to investigate the dynamic relationships of various sensory experiences with cognitive and affective processes more closely, and, for example, to combine materials that would make OriPOP change colors when

it is heated in a microwave oven. In this case, when the OriPOP rabbit was heated in the oven, its ears and body might gradually turn red. This would enhance the users' multisensory experience and make them feel the rabbit was even more real. Another way to sustain user interest would be to increase the variety of OriPOP experiences. This could be, for instance, achieved through shared experience. With changing needs, people desire a wide variety of product experiences. OriPOP could be redesigned to provide options not just for individuals, but also groups. Therefore, an opportunity is provided to fold and create OriPOP with friends and see the OriPOP rabbit jumping inside a microwave oven with them.

Findings from the research suggest that people may take pleasure from nostalgia and use their recollections to inform their present emotional reactions. Participants find that seeing and folding OriPOP reminds them of happy childhood memories with origami. The smell of OriPOP and its popping sound in a microwave oven also evoke positive memories of heating popcorn in childhood and having popcorn with friends. Recalled experience seems to be an important determinant of prediction and expectation, and demands further research.

It cannot be assumed that designers should only create products that elicit pleasant emotions. Indeed, emotions are complex and have multifaceted manifestations. People feel good or feel bad, or both at the same time. An intriguing and rewarding research area to explore as an extension of designing OriPOP would be the possibility of eliciting paradoxical emotions, that is, positive and negative emotions simultaneously. People enjoy watching misery and will pay fair amounts of money to experience fright and suspense. Whether people can simultaneously experience pleasure along with any number of negative emotions, such as pain and fear, in their experience with OriPOP requires further examination. Eventually, these efforts may result in food packaging design that is unique, innovative, rich, challenging and, therefore, desirable.

6.2 Conclusions

The era of ubiquitous smart and innovative food packaging design is rapidly approaching. Integrating "feelings" into packages to create emotional communication with the user is a research domain which demands more emphasis. By introducing the concept of an emotion-evoking popcorn packaging design, OriPOP, users have felt that their emotional enjoyment in having popcorn is significantly increased. The research demonstrates effective linkages between emotional design, popcorn packaging, active user involvement and value creation. It does indeed seem as if food package design could provide the "glue" that connects logic and reason with feelings and emotions. Future research could reveal more about the functional, applicational and dynamic emotional design associated with food packaging and its users. The perception of food packaging design has been transformed and it must now be considered a means through which "human emotions" affect and are affected.

Acknowledgements

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Appendix

A. Pre-questionnaire

The following statements are related to what you feel about the existing popcorn product. Please circle one picture from each of the dimensions that best portrays your emotion in each statement.

1. The look of the existing popcorn product

   Valence dimension (pleasure)
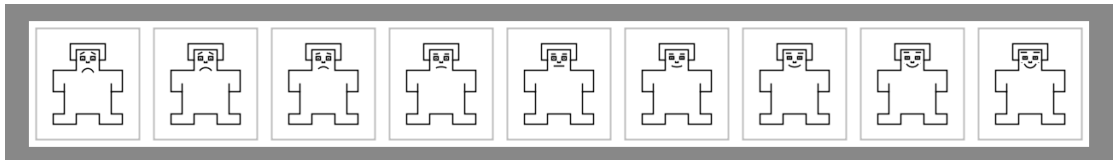
   Arousal dimension (excitement)
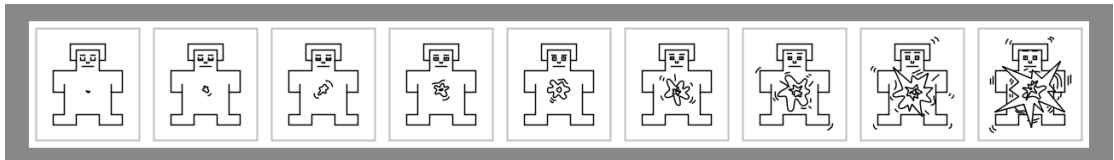
2. The sound of the existing popcorn product

   Valence dimension (pleasure)
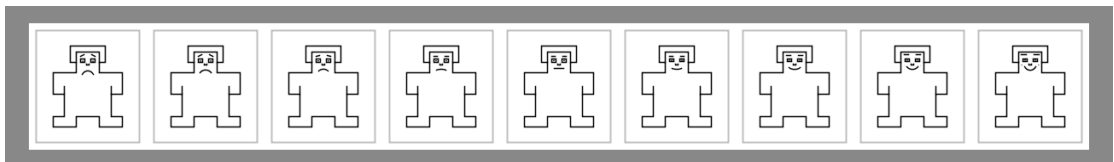
   Arousal dimension (excitement)
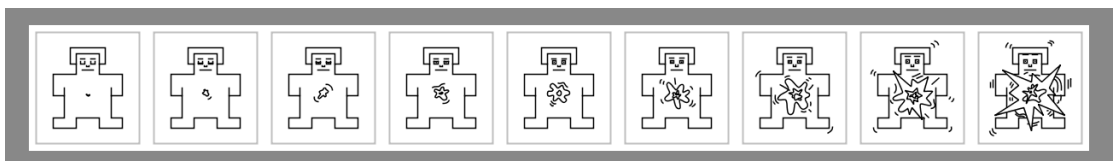
3. The taste of the existing popcorn product

Valence dimension (pleasure)
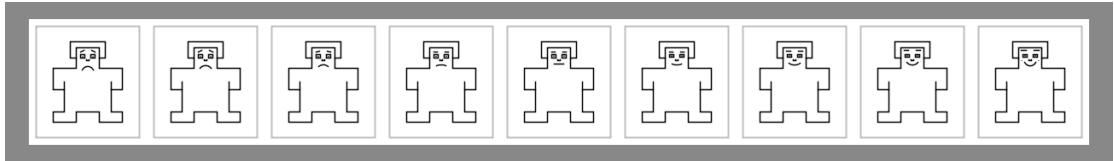
Arousal dimension (excitement)
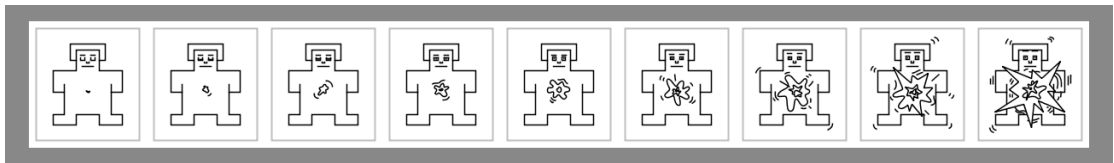
4. The smell of the existing popcorn product

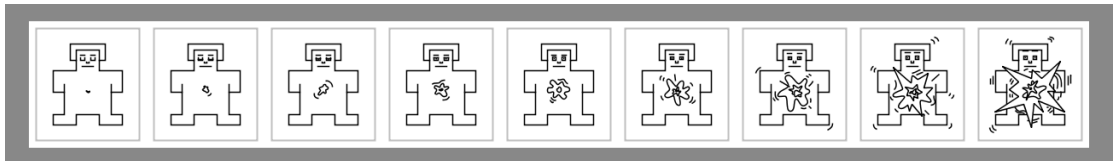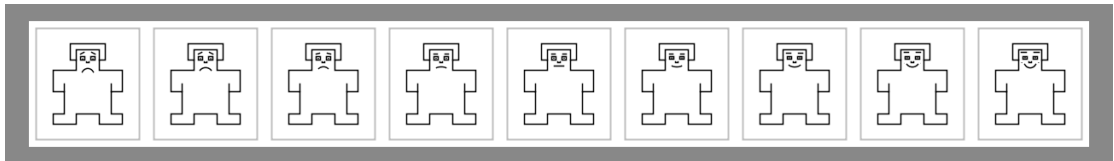Valence dimension (pleasure)
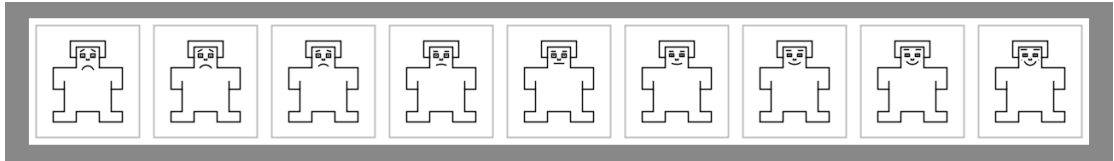
Arousal dimension (excitement)
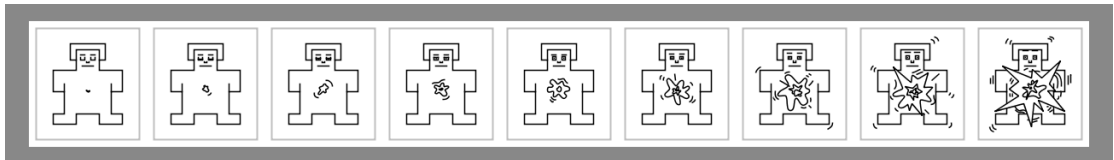
5. The touch of the existing popcorn product

Valence dimension (pleasure)
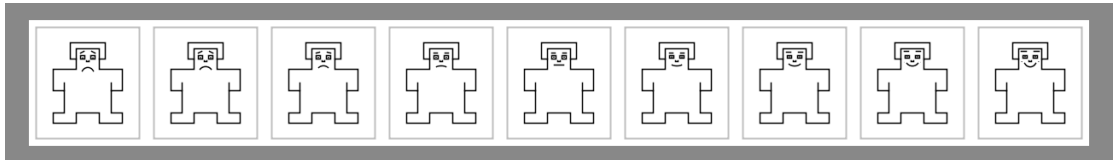
Arousal dimension (excitement)
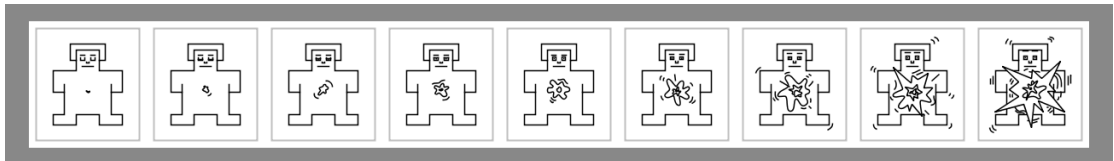
B. Post-questionnaire I

The following statements are related to what you feel about the process of creating OriPOP. Please circle one picture from each of the dimensions that best portrays your emotion in each statement.

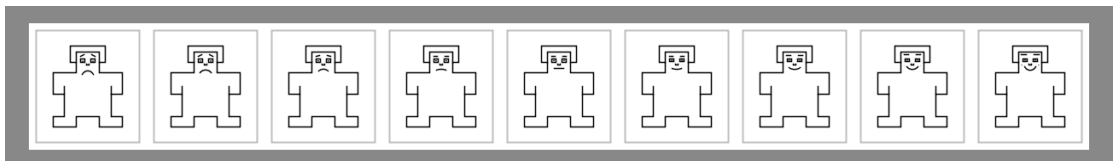1. The look of OriPOP

    Valence dimension (pleasure)
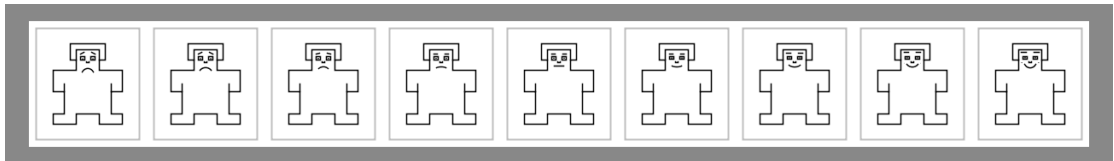
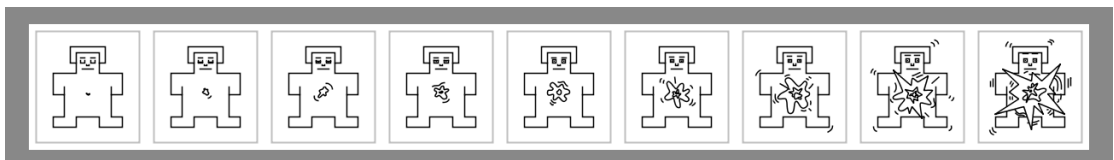   Arousal dimension (excitement)
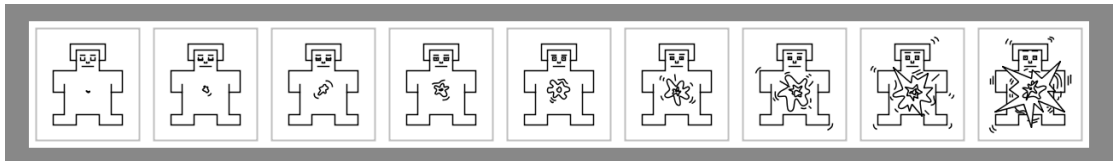
2. The sound of OriPOP paper materials

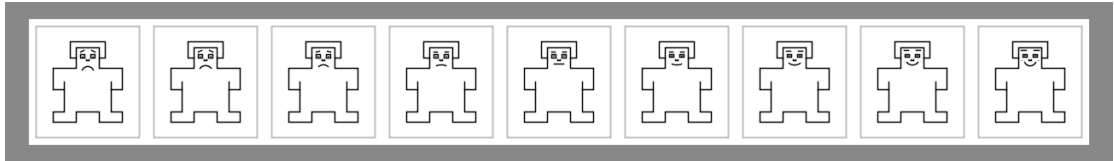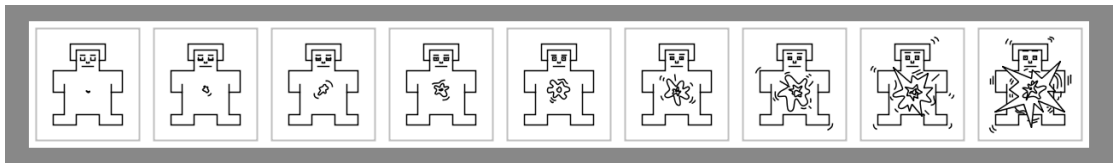   Valence dimension (pleasure)
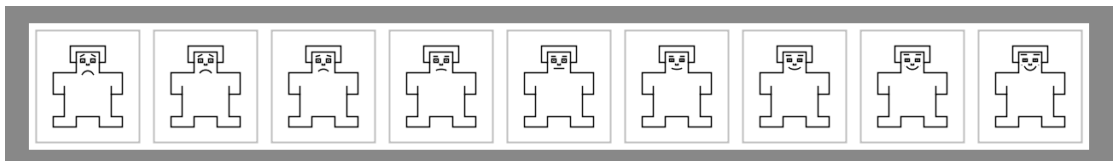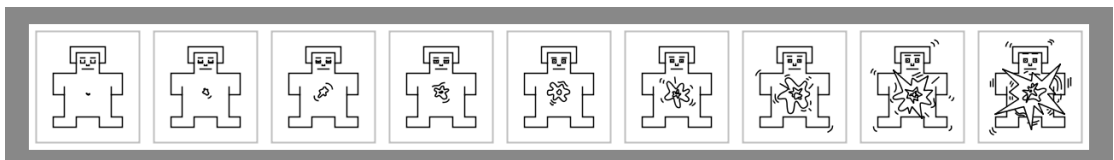
    Arousal dimension (excitement)

3. The taste of OriPOP you would imagine after completion

Valence dimension (pleasure)
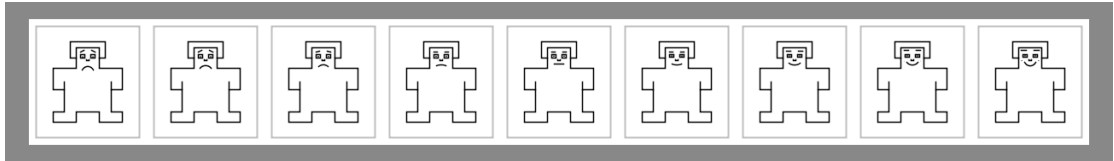
Arousal dimension (excitement)
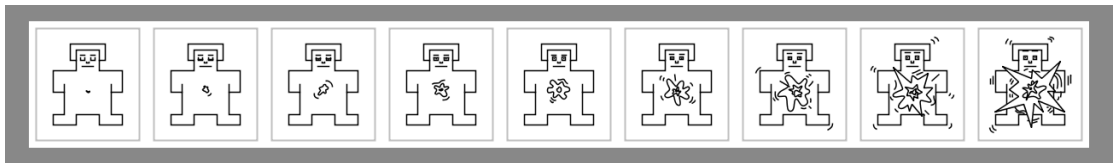
4. The smell of OriPOP you would imagine after completion

Valence dimension (pleasure)
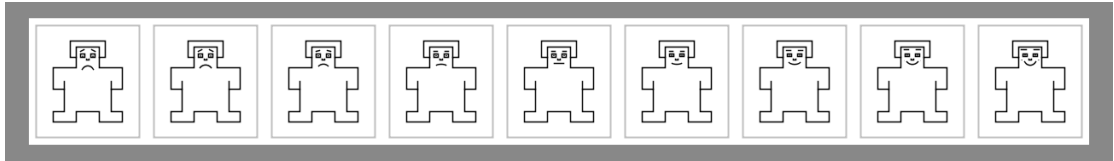
Arousal dimension (excitement)
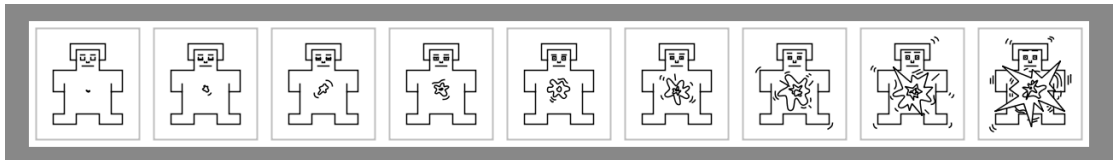
5. The touch of OriPOP while folding the paper

Valence dimension (pleasure)
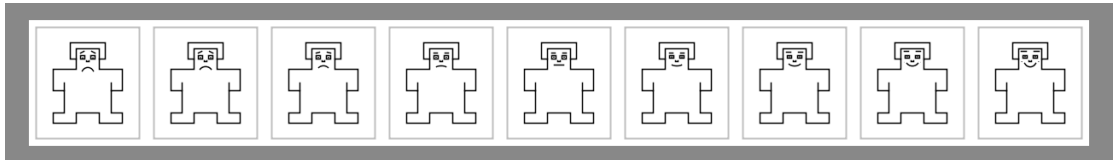
Arousal dimension (excitement)

C. Post-questionnaire II

The following statements are related to what you feel about the process of heating OriPOP. Please circle one picture from each of the dimensions that best portrays your emotion in each statement.

1. The look of OriPOP

   Valence dimension (pleasure)

   Arousal dimension (excitement)
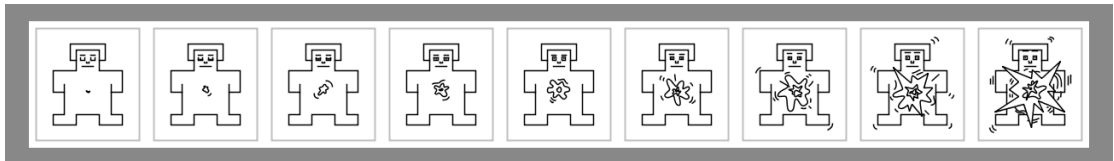
2. The sound of popping OriPOP

   Valence dimension (pleasure)

   Arousal dimension (excitement)

3. The taste of OriPOP you would imagine after completion
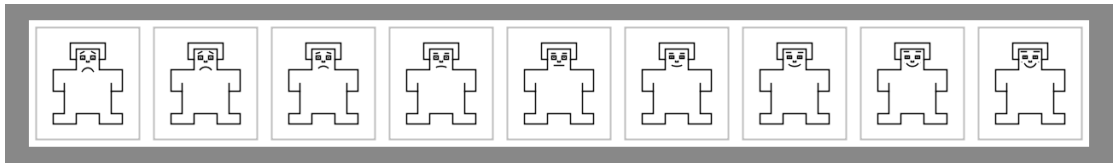
Valence dimension (pleasure)

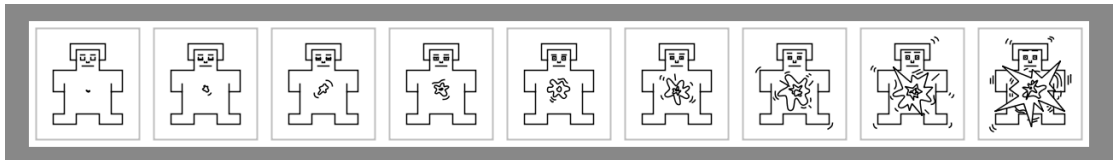Arousal dimension (excitement)

4. The smell of OriPOP in a microwave oven
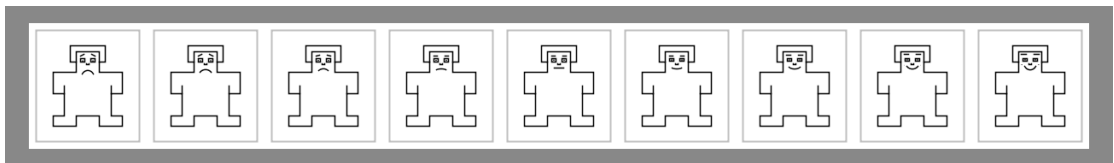
Valence dimension (pleasure)

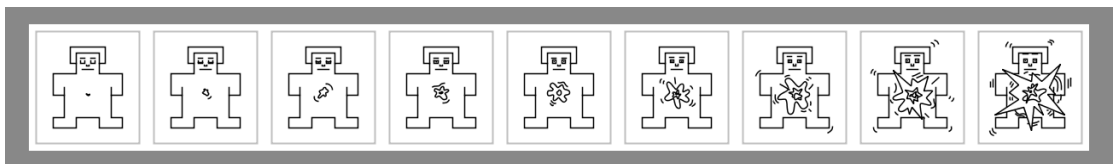Arousal dimension (excitement)

5. The touch of OriPOP when you take it out from a microwave oven

Valence dimension (pleasure)

Arousal dimension (excitement)

D. Personal Information

Age:

Gender:

Nationality:

Student status:

Thank you for participating in this survey. Your feedback is important!