Design Attributes for a More Eco-friendly Takeout Cup Using Conjoint Analysis

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Abstract

Background Disposable packaging is emerging as a worldwide sustainability issue and a chief cause of environmental pollution. Moreover, the South Korean government recently placed a ban on disposable coffee cups for in-store customers. This study examined which design attributes of takeout cups provide a more eco-friendly design for iced and hot drinks. We also explored which design attributes raised environmental awareness.

Methods After selecting predominant design attributes of sustainable takeout cups, we used conjoint analysis to figure out the weights of relative importance given to six design attributes. The study compared consumers' preferred takeout cup design and an eco-friendly takeout cup design.

Results In response to consumers' preferences, the best design for an eco-friendly takeout cup for iced and hot drinks is a paper cup without a lid, straw, or printed message and recycling logo. Based on this, we proposed a newly designed eco-friendly paper cup with an embossed logo instead of using an ink-printed logo for two leading coffee brands in South Korea.

Conclusions The study examined emerging design attributes that provide a more eco-friendly takeout cup design for iced and hot drinks. The results show that consumers accept inconvenience for greater environmental benefit. To reflect consumers' preference and their choice of the most eco-friendly design attributes, we proposed a paper takeout cup with no lid, no straw, and no printed message or recycling logo as the best combination for an eco-friendly takeout cup design for both iced and hot drinks while also allowing each brand to address its own visual identity.

Keywords Eco-friendly Design, Packaging Design Attribute, Conjoint Analysis, Takeout Cup

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1. Introduction

Environmental pollution has become a global problem, and the level of contamination is increasing every year (WHO, 2018). Packaging is a main cause of environmental pollution because of packaging-related waste (Pongrácz, 2007). Due to a direct link between packaging and environmental pollution, companies are attempting to reduce design elements of packaging and use biodegradable or eco-friendly materials for packaging (Magnier & Schoormans, 2015). Environmentally conscious packaging reflects the seriousness of the pollution and also raises the environmental awareness of consumers, who can still easily receive information and gain an impression about a product through the design of the packaging (Dick, Jain, & Richardson, 1996). A consumer's eco-awareness influences his or her impression of a brand or product (Orth & Malkewitz, 2008). The better the impression of a certain brand's eco-friendly packaging, the more interest in its product a consumer will have (Luchs, Naylor, Irwin, & Raghunathan, 2010). In addition, consumers are willing to pay more for green products (Zou & Chan, 2019).

In this circumstance, there is an increasing body of research that examines the role of package design to realize eco-friendly designs and raise environmental awareness. Lee (2015) proposed a more preferable eco-friendly reusable cup design by using soy ink on recycled paper with interactive elements that reduce consumption of disposable cups. On Lee's eco-friendly reusable cup, the interactive elements give enjoyment and a sense of pride to the consumer by providing monetary benefit (Lee, 2015). Baik and her colleagues (2011) presented design attributes of organic food packaging that can maximize the organic impression of organic foods and their brands (Baik, Suk, Suh, & Kim, 2011). The study defined principle design elements of organic food packaging, examined its effectiveness by using conjoint analysis, and provided managerial guidelines for effectively designing organic food packages.

The global coffee franchises have been attempting to protect the environment and to raise environmental awareness by providing eco-friendly takeout cups. According to the International Coffee Organization, about 600 billion disposable cups are used globally every year (Houck, 2018). Since Starbucks represents 1% of the total (i.e., 6 billion cups annually), it has started to present a "Global Responsibility Report" that shows its eco-progress (Jang, Kim, & Lee, 2015). Moreover, in 2018, Starbucks introduced a newly designed lid that eliminates the need for a straw. Starbucks began to replace all plastic straws with paper straws and to use cups made of 10% recycled paper (Recycling & Reducing Waste, 2019). These changes show the green movement of the coffee franchises not only solves environmental issues but also increases consumers' environmental awareness. Along with these changes, in 2018, the South Korean government placed far greater emphasis on banning the use of takeout cup for in-store customers and began to penalize coffee shops that committed an infraction of the policy.

Among the eco-friendly takeout cup designs on the market, in this study, we examined the most valued design attributes for eco-friendly takeout cups for iced and hot drinks. We investigated the difference between the consumers' preferred takeout cup and an eco-friendly takeout cup that raises environmental awareness. After reflecting the consumers' evaluation, we proposed the best design attributes of a more eco-friendly takeout cup.

2. Method

This study is comprised of three parts: a preliminary workshop, the main study, and in-depth interviews based on the empirical results <Figure 1>. In the preliminary workshop, we planned stimuli and the procedure of the study. We recruited four subjects (two males and two females) who were design students and designers of product and package design. Their ages ranged from 22–35 years old. After we distributed to them 16 printed images of eco-friendly takeout cups for iced and hot drinks, we asked them to choose eco-friendly stimuli of the takeout cups for both iced and hot drinks. Based on their selections, we grouped the attributes along their affinities. Five attributes were established including (1) material, (2) cup holder, (3) lid, (4) recycling symbol, (5) message type, and (6) message content. Next, we conducted brainstorming and grouping to ascertain the levels of each of the six attributes as shown in Table 1.

Then we conveyed a main study for which we applied conjoint analysis to optimally establish which combination of a minimum number of attributes was most influential based on the participants' choices. We recruited 21 subjects (10 males and 11 females) ranging in age from 22–35 years old who were students and designers of product packaging. The survey of each participant lasted for 10-15 minutes in an open space. We showed black-and-white printed images (11 × 11 cm) of 16 design alternatives <Figure 2> and explained the instructions. From 1 to 16, the subjects were asked to rank each cup for iced and hot drinks. To distinguish eco-friendly appeal from style preference, we prepared two kinds of instructions. The first instruction was "please rank your preferred takeout cup design," while the second instruction was "please rank the most eco-friendly takeout cup design that raises environmental awareness." Based on these two instructions, we expected to observe changes in ranking.
As a result, we obtained relative importance and utility scores, and then derived best or worst combinations of the eco-friendly concept for the takeout cups. Finally, we held in-depth interviews with the 21 participants individually to have them explain their rankings in detail, and we selected the 10 most common answers.

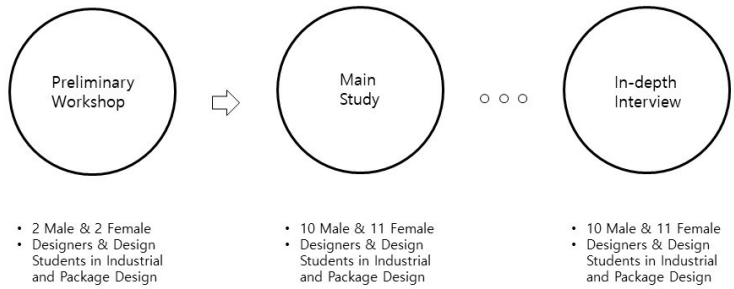


Figure 1 Study procedure

3. Preliminary workshop

A preliminary study was conducted to design the process of collecting data. Before starting the data collection, the purpose of the preliminary study was to identify unclear wording of instructions, the format of the survey such as its length, and printed profiles of the takeout cups.

The preliminary study was done to select the design attributes and levels of the eco-friendly takeout cups and to find the proper formatting of the survey. To define proper levels, we followed the criteria for sustainable packaging from the Sustainable Packaging Alliance (SPA) in Australia (Lewis, Fitzpatrick, Verghese et al., 2007). The SPA has defined sustainable packaging as 'sustainable packaging design attributes that optimize the use of renewable or recycled source materials to achieve benefit, safety, and health for everyone.' Additionally, we visited major coffee shops and studied the design attributes of commonly used takeout cups and newly designed eco-friendly takeout cups. For example, Starbucks Coffee Company began to use 10% recycled paper cups, strawless lids and paper straws, and straws made out of alternative materials.

Table 1 Levels of each design attribute

Attributes	Material	Cup Holder	Lid	Recycling Symbol	Message Type	Message Content
Levels	Paper cup	No cup holder	No lid	No symbol	Positive	Money
			Flat lid & Paper straw			
		Cup holder	Flat lid & Plastic straw	Small symbol		
	Plastic cup		Flat lid & Hot straw		Negative	Green
		Additional cup	Flat lid & No hot straw	Large symbol		
			Strawless lid			

Technically, a total of 432 combinations were possible as the stimuli. However, we tried to minimize the number of combinations of attributes to the essential quantity and utilized an Orthogonal Design method, thereby producing only 16 profiles as a result. The 16 profiles are presented in <Figure 2> and <Figure 3>.

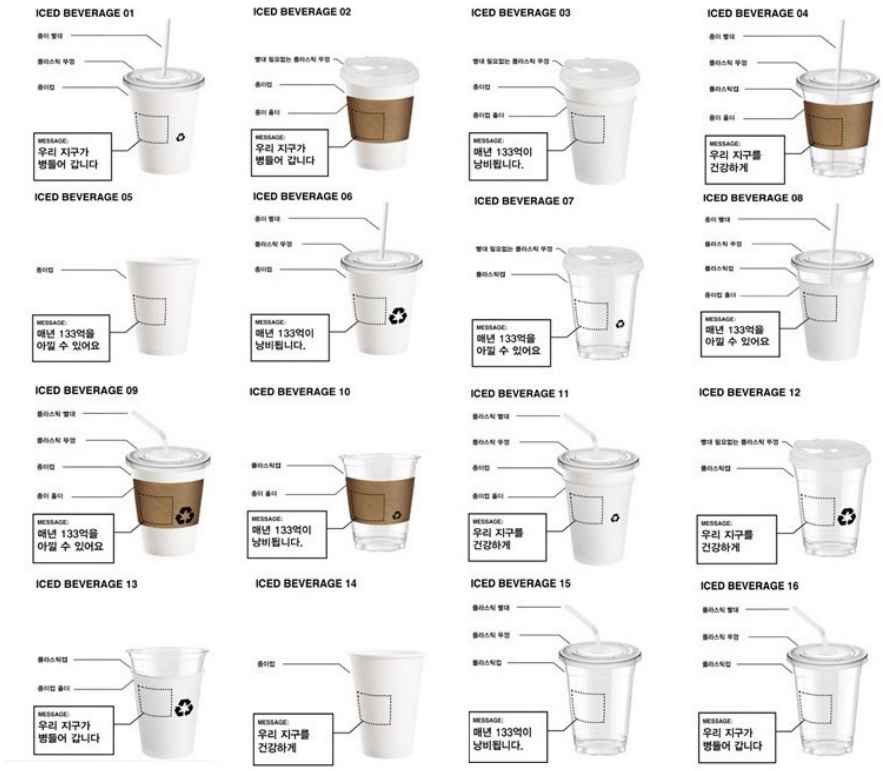


Figure 2 Sixteen profiles of takeout cups for iced drinks

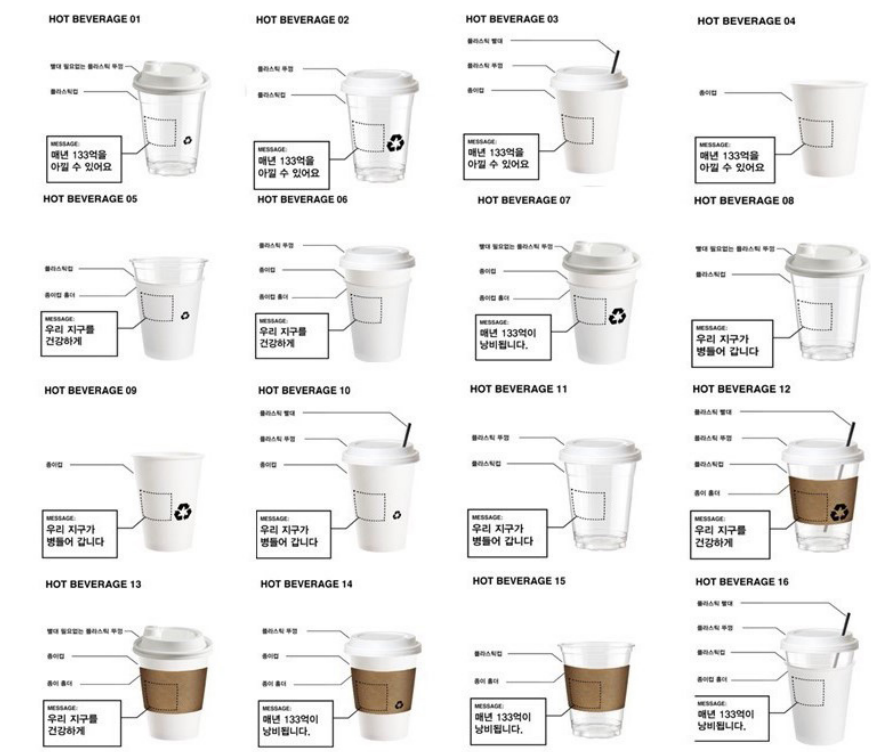


Figure 3 Sixteen profiles of takeout cup for hot drinks

4. Main study

The main study intended to determine which design attributes of takeout cups make a more eco-friendly takeout cup design for iced and hot drinks. We also explored how design attributes can raise environmental awareness. We found a gap between consumers' choices for a preferred takeout cup design and the most eco-friendly takeout cup. Finally, we suggested optimized eco-friendly takeout cup design attributes that can effectively raise environmental awareness.

4. 1. Results and analyses

Based on the subjects' ranking data, we obtained four types of takeout cup rankings for iced and hot drinks, as well as instructions. To analyze the impact of design attributes and levels, we performed conjoint analysis using SPSS 24 with regard to the individual ranking data, thereby obtaining 24 (i.e. 2 drinks × 2 criteria × 6 design attributes) distributions from 21 subjects. From the Kolmogorov-Smirnov test, 17 (70.83%) distributions were not statistically different from the normal distributions ($p > .05$), indicating that the averaged values may represent the central tendency of most of the assessments. Then we conducted the conjoint analysis based on the subjects' ranking data and obtained the averaged relative importance of each attribute <Table 2>. The most important design attribute that aroused environmental awareness was the lid of the iced drink cup (42.46%) and the material of the hot drink cup (50.79%). There was a noticeable increase in the relative importance of the lids of both the iced and hot drink eco-friendly cups compared with preferred cups. Specifically, in terms of iced drinks, material (34.31%), cup holder (29.44%), and lid (21.32%) design were more important for preferred takeout cups; while lid (42.46%), cup holder (31.12%), and material (12.91%) were more important for eco-friendly takeout cups. In terms of hot drinks, material was the most important design attribute for both preferred (70.23%) and eco-friendly (50.79%) takeout cups. Lid design was more important than cup holder design for eco-friendly takeout cups, while it was the opposite for preferred takeout cups. In addition, recycling symbol, message type, and message content were not of great importance.

Table 2 The averaged importance value of each design attribute of takeout cups for iced and hot drinks

Attribute	Importance values (%)			
	Iced		Hot	
	Preferred	Eco-friendly	Preferred	Eco-friendly
Material	**34.31**	12.91	**70.23**	**50.79**
Cup Holder	29.44	31.12	11.77	14.42
Lid	21.32	**42.46**	8.66	20.24
Recycling Symbol	8.63	7.24	0.68	7.84
Message Type	2.03	5.43	4.47	3.98
Message Content	4.26	0.84	4.19	2.72

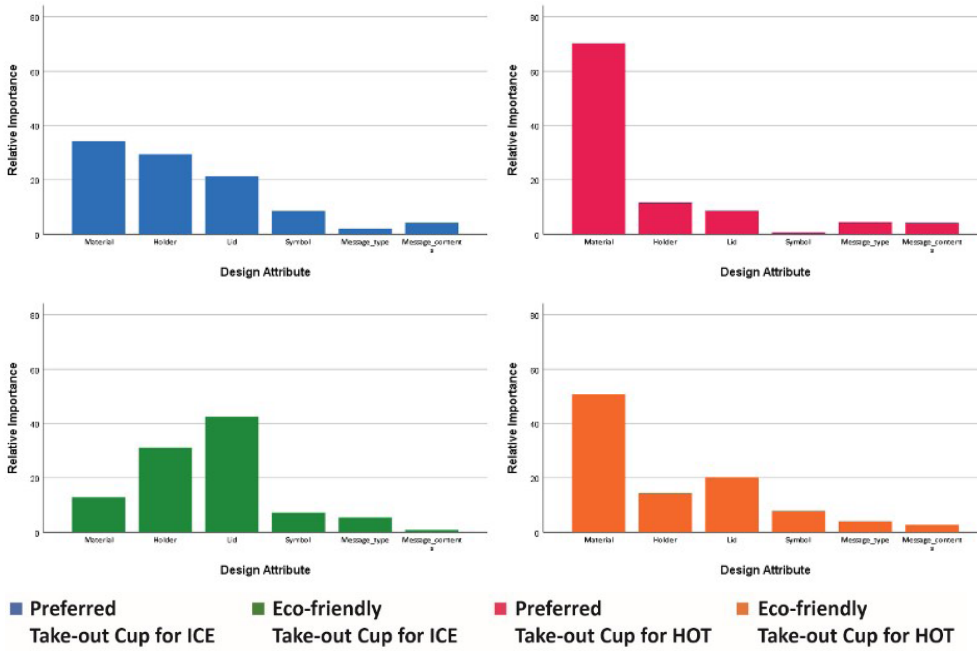


Figure 4 The averaged importance values of design attributes

To figure out what levels of attributes are more suitable for different drink types, utility scores were taken into consideration as presented in <Table 3>. As mentioned above, since recycling symbol, message type, and message content were less important, we focused on the material, cup holder, and lid attributes for utility scores. For eco-friendly cups for both iced and hot drinks, a paper cup without a lid and cup holder was the most valued design. For preferred cups, a flat lid with paper straw was valued for both iced and hot drinks. Differently, a plastic cup without a cup holder was preferred for iced drinks but a paper cup with a cup holder was preferred for hot drinks. Consequently, the top combinations of preferred and eco-friendly takeout cups for iced and hot drinks are shown in <Figure 5>.

Table 3 The utility scores of each design attribute of takeout cups for iced and hot drinks. Standard errors are in parentheses (N = 21)

Attribute	Level	Utility score (Standard Error)			
		Iced		Hot	
		Preferred	Eco-friendly	Preferred	Eco-friendly
Material	**Paper**	−1.01 (0.18)	**0.64 (0.07)**	**3.09 (0.13)**	**2.39 (0.15)**
	Plastic	**1.01 (0.18)**	−0.64 (0.07)	−3.09 (0.13)	−2.39 (0.15)
Cup Holder	No cup holder	**0.65 (0.24)**	**1.61 (0.11)**	−0.58 (0.17)	**0.61 (0.20)**
	Cup holder	0.43 (0.28)	−0.15 (0.11)	**0.46 (0.21)**	0.14 (0.23)
	Additional cup	−1.08 (0.28)	−1.46 (0.09)	0.12 (0.21)	−0.75 (0.23)
Lid	No lid	−0.71 (0.31)	**2.29 (0.12)**	0.17 (0.23)	**1.11 (0.25)**
	Flat lid with plastic straw	0.35 (0.31)	−1.90 (0.12)	−0.54 (0.23)	−0.80 (0.25)
	Flat lid with paper straw	**0.54 (0.31)**	−0.64 (0.12)	**0.22 (0.23)**	−0.16 (0.25)
	Lid without straw	−0.17 (0.31)	0.24 (0.12)	0.15 (0.23)	−0.15 (0.25)
Recycling Symbol	No	−0.25 (0.24)	−0.42 (0.09)	−0.04 (0.17)	−0.49 (0.20)
	Small	0.26 (0.28)	0.29 (0.11)	0.02 (0.21)	0.24 (0.23)
	Large	−0.01 (0.28)	−0.13 (0.11)	0.02 (0.21)	0.25 (0.23)
Message Type	Positive	−0.06 (0.18)	−0.27 (0.07)	0.20 (0.13)	−0.19 (0.15)
	Negative	0.06 (0.18)	0.27 (0.07)	−0.20 (0.13)	0.19 (0.15)
Message Content	Money	−0.13 (0.18)	−0.04 (0.07)	−0.19 (0.13)	0.13 (0.15)
	Green	0.13 (0.18)	0.04 (0.07)	0.19 (0.13)	−0.13 (0.15)

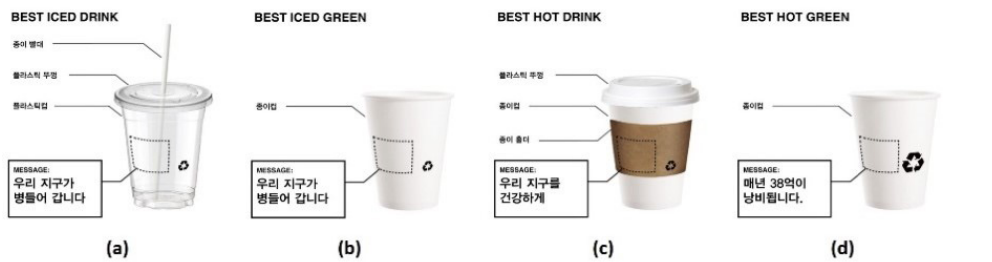


Figure 5 The top combinations: preferred iced (a), eco-friendly iced (b), preferred hot (c), and eco-friendly hot (d)

4. 2. In-depth Interviews and further investigation

In addition, we organized an interview session for the 21 participants during the survey and asked them to explain their highest and lowest rankings among the design attributes of preferred and eco-friendly takeout cups. When respondents were asked to choose eco-friendly iced and hot takeout cup design attributes that raise environmental awareness, they chose the combination that had fewer design attributes and accepted their inconveniences for greater environmental benefit. According to the interviews with the respondents, P2, P8, P15, and P21 stated that "adding more design attributes to the takeout cup will use more resources, create more waste, and eventually cause more environmental pollution." When it comes to the preferred takeout cup, their prime considerations were familiarity and convenience, and eco-friendliness was secondary. P2, P8, P15, and P21 stated that "I chose no lid for an eco-friendly cup for iced drinks, whereas I selected a lid for the preferred takeout cup for iced drinks." Participants P3, P7, P18, and P20 said that "the newly designed strawless lid seems eco-friendly, nonetheless it was ranked the lowest for the eco-friendly design attribute due to the unfamiliarity." P8 insisted, "The takeout cup with a paper straw

was ranked the lowest among the other takeout cup combinations, because I am not familiar with using a paper straw. I can imagine that the paper straw will break off and will taste like wet paper while I am using it." P5, P9, P13, and P19 asserted that "the paper gives us an impression of eco-friendliness so that the design attributes made of paper were ranked the highest." P19 additionally explained that "compared to the paper, I am not sure if the plastic cup, lid, and straw are able to be recycled." In terms of message content and types on the takeout cup, P1, P11, and P17 maintained that the message is not the main consideration for an eco-friendly takeout cup design attribute. Additionally, for the preferred takeout cup, most of the respondents said that they do not want to pay for a coffee cup that has a negative message about environmental pollution. P1 said that "I prefer to have positive messages for both preferred and eco-friendly takeout cups, because I do not want to feel negative pressure while I enjoy my drink." P11 added that "I prefer positive messages, because I want to feel less guilty while I use takeout cups." Meanwhile, P3, P14, P18, and P21 chose a negative message for the eco-friendly takeout cup for iced and hot drinks. They said that "the negative message raised more environmental awareness." Moreover, P15 pointed out that "the ink of the printed message can make it harder to recycle the takeout cup so that it will be better to not have an ink-printed message or to use biodegradable ink such as soy ink."

5. General Discussion

We conducted this study to determine which design attributes of takeout cups made more eco-friendly takeout cup designs for iced and hot drinks. To find out which design attributes people value the most, a conjoint analysis was performed. The result for the relative importance shows that lid (42.46%) and cup material (50.79%) were the most influential eco-friendly design attributes that aroused environmental awareness for iced and hot drink takeout cups, respectively. When we looked into the utility scores, the types of the lid showed a difference in iced and hot drinks. While a flat lid with a paper straw (0.54) was the most frequently chosen design attribute for a preferred iced drink takeout cup, no lid (2.29) was the most frequently chosen design attribute for an eco-friendly iced drink takeout cup. With regard to cup material, the iced drink cup showed a big difference. Whereas a plastic cup (1.01) was the most frequently chosen design attribute for the preferred iced drink takeout cup, a paper cup (0.64) was the most frequently chosen design attribute for an eco-friendly takeout cup. For hot drinks, a paper cup was the most frequently chosen design attribute for both preferred (3.09) and eco-friendly (2.40) cups.

We also compared the best combination of preferred and eco-friendly takeout cups for iced and hot drinks. The best combination for an eco-friendly cup for iced drinks was made up of a paper cup with no holder, no lid, no straw, a small recycling symbol, and a negative eco-message. The best combination for an eco-friendly cup for hot drinks consists of a paper cup, no holder, no lid, no straw, a large recycling symbol, and a negative money-related message. For comparison, the best combination for the preferred iced drink takeout cup was made up of a plastic cup with a flat plastic lid, paper straw, small recycling symbol, and a negative environmental message. Moreover, the best combination for the preferred hot drink takeout

cup consisted of a paper cup, paper cup holder, flat plastic lid, small recycling symbol, and a positive environmental message. The comparison shows that respondents emphasized the functionality of the takeout cup when they were asked to rank preferred takeout cups for both iced and hot drinks. When it comes to an eco-friendly takeout cup, respondents were less focused on the functionality of the takeout cup than on waste reduction.

We hypothesized that there would be a difference between the consumers' preferred takeout cup and an eco-friendly takeout cup that raises environmental awareness. In addition, we presumed that the most eco-friendly takeout cup is composed of a paper cup, paper straw, strawless lid, a large recycling symbol, and a positive green message. Similar to the assumption, there was a difference between the consumers' preferred takeout cup and an eco-friendly takeout cup. However, different from our supposition, a paper cup, no lid, no cup holder, no straw, a recycling symbol, and a negative eco-message were the most valued design attributes for eco-friendly takeout cups for iced and hot drinks.

Starbucks, tops in sales among franchise coffee brands in South Korea, presented a paper cup that consisted of 10% recycled paper (Recycling & Reducing Waste, 2019). Also, Starbucks introduced a paper straw and a strawless lid with a plastic cup for cold drinks (Logan, 2018). A Twosome Place, which recorded the second highest sales among franchise coffee brands in South Korea (Park, 2017), showed a newly designed eco-friendly paper cup for hot drinks. It removed the red and grey color of the cup and reduced the ink usage for their printed logo. This was because the uncolored paper cup is more easily recycled than the colored paper cup (Park, 2018). For cold drinks, A Twosome Place used a plastic straw, a plastic lid, and a plastic cup (Yoo, 2018).

According to the survey results, the best combination for an eco-friendly cup for iced drinks is made up of a paper cup, no holder, no lid, no straw, a small recycling symbol, and a negative eco-message. The best combination for an eco-friendly cup for hot drinks also consists of a paper cup, no holder, no lid, no straw, a large recycling symbol, and a negative money-related message. When respondents were asked to choose eco-friendly iced and hot drink takeout cup design attributes that raise environmental awareness, they chose the combination that has fewer design attributes and accepted the inconveniences for greater environmental benefit. In terms of the recycling logo, message content, and message type on the takeout cups, respondents asserted that they were not the main consideration for eco-friendly takeout cup design attributes. In response to the results, we proposed recycled paper cups for hot and cold drinks that have an embossed logo for Starbucks and A Twosome Place <Figure 6>. The embossing not only reduces the ink used on the cups, but also minimizes the consumption of cup sleeves. Moreover, the embossing on the cup elevates the contact surface of the cup and prevents burning one's hand. However, we need further study to solve the displeasure of touching extremely hot and cold takeout cups instead of using general cup sleeves.



(a) (b)

Figure 6 Proposals of existing takeout paper cups for two leading coffee brands: (a) embossed Starbucks logo on a paper cup; (b) embossed A Twosome Place logo on a cup. Further study is needed to solve the displeasure of touching extremely hot and cold takeout cups instead of using general cup sleeves

In a future study, we will include the design attribute of no message type and no message content, since the message type and content were shown to have the lowest relative importance in the results (Table 1). Future studies should also include multiple perspectives by including consumer groups from various fields and of different ages. Furthermore, we will explore the gap between the best combination of a preferred takeout cup and an eco-friendly takeout cup and suggest a newly designed eco-friendly takeout cup that can narrow the gap. Nonetheless, the study attempted to shed light on the gap between consumers' preferred takeout cup and an eco-friendly takeout cup. Moreover, the study revealed consumers' opinions around emerging design attributes of an eco-friendly takeout cup and indicated the best design attributes to make a more eco-friendly takeout cup.

6. Conclusion

The study examined emerging design attributes that make a more eco-friendly takeout cup design for iced and hot drinks. The study showed a discrepancy between consumers' preferred takeout cup design and the most eco-friendly takeout cup design. The collected data also revealed that the optimal eco-friendly takeout cup has fewer design attributes. The result shows that consumers accept the inconvenience for greater environmental benefit. To reflect consumers' preferences and their choice of the most eco-friendly design attributes, we would like to propose a paper takeout cup with no lid, no straw, no message, and no recycling logo as the best combination of eco-friendly takeout cup design attributes for both iced and hot drinks.

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