

## DESIGN FOR PRODUCT USAGE: A STUDY ON THE AMBIENT MEDIA IMAGE OF PRODUCT PACKAGING

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### Abstract

The purpose of this study is to explore the application of the interaction image of ambient media in product packaging design, including (1) analyzing and summarizing the conceptual structure of the interaction through an investigation of related examples of existing ambient media, extracting the corresponding design techniques based on the concept of interaction structure, and carrying out packaging design and image testing; (2) using principal component analysis as the main method for testing results to explore the constitutive factors of the ambient media image in packaging use and its corresponding relationship with various interaction forms; and (3) finally, analyzing the interaction image of ambient media that affects "interaction" and "liking to use" with multiple regression analysis.

The interaction concept of ambient media is composed of five sub-concepts: (1) "combining with other things - metaphorical expression concept"; (2) "combining with other things - structural function combination"; (3) "combining with other things - appearance modeling combination"; (4) "user cooperation - intuitive operation to produce situational effect"; and (5) "user cooperation - user operation behavior cooperation". We find that the

ambient media images that influence "interaction" and "like to use" are respectively "lively", "pleasant", "interesting", and "humorous".

Key words: ambient media, interaction, packaging design, image design

### Research Background and Motives

To develop a product, a business requirement to make use of an integrated marketing strategy to clearly convey the product message to consumers in addition to building a complete visual identity system (VIS). In order to make the product more impressive to consumers, advertisements are often placed on special appearance packages, allowing consumers to participate unconsciously and bringing surprises to consumers and viewers. Therefore, ambient media is born as a new type of advertising mode in response to the requirement.

Packaging has always played important and multiple roles in product design and marketing. Its design considerations include how to attract attention, increase purchase rate, and be user-friendly. Aside from protecting the content of product and correctly expressing the message about the content, packaging design also plays a role in conveying good quality and brand image. The purpose of this study is thus to combine ambient media with the environment and use it on packing commodities in an interesting and innovative way to create different interaction ways for consumers, so as to provide a reference for designers in the process of thinking.

### *Ambient Media*

The term "ambient media" was first coined in the United Kingdom's advertising design industry in 1999 to define a new type of advertising media, initially meaning "promoting products or serving non-traditional media outside the home." The main strategy of ambient media advertising emphasizes surprise, humor, creativity, participation, and strengthening advertising messages through the participation of advertising audience (Schiffman, 1997). Tseng (2011) constructs a hypothetical model of ambient media advertising observations to understand the first level of emotional response of subjects forced to interact with ambient media and the relationship between the second-level emotional response caused by cognition and advertisement. The main fields of ambient media are advertising scenes, and their interaction must be from the perspective of "close integration with people's lives", paying special attention to people who are placed unconsciously and who are interacting with the environment. This interaction mode triggered by placing people in advertising situations can make the users involved become resonate, truly bringing an emotional impact to them and affecting their thoughts and evaluations.

### *Levels of Interaction*

Interaction denotes mutual influence, mutual cooperation, mutual promotion, and mutual facilitation. Interac-

tion literally means that every individual involved moves and is thus affected by each other. As far as consumers are concerned, advertising is the product representative. When designing ambient media advertising, designers are concerned about whether the design, operation mode, and visual style of the product itself can effectively support the interaction between people and objects. Once the interaction behavior of the product is defined, the requirements for the design of ambient media advertising will become clearer.

The level of interaction can be divided into three parts: (1) the channel of interaction with the content itself; (2) the degree of interaction with the content itself; and (3) the object of interaction. In other words, the level of interaction depends on the object of interaction and the design of the content. The object of interaction is different for television, radio, personal computer, network, etc., and the function and method of application in design of content are also different and limited.

The interaction between products and users is closely related to emotional

feelings. Norman distinguishes between three aspects, or levels, of the emotional system (i.e. the sum of the parts responsible for emotion in the human mind), which are as follows: the visceral, behavioral and reflective levels (Norman, 2004). Each of these levels or dimensions, while heavily connected and interwoven in the emotional system, influences design in its own specific way (Fig.1 & Fig.2). The design of the visceral level is related to the initial impact of the product, including the appearance, touch, and feel of the product. The visceral level precedes consciousness and thinking, which is the level at which the appearance exerts its influence and where the first impression forms. The behavioral level is related to the use of the product and the experience. It contains many features, including functions, effects, and usability. Consciousness, feelings, emotions, and cognition at the highest level exist only on the reflective level. Only at this level can realize all the influence of feeling and emotions. At the visceral and behavioral levels, there are only emotions without interpretation or consciousness, as interpretation, understanding, and reasoning are all from the reflective level ( Table 1).

Table 1. Emotional Level.

<b>Emotional level</b>	<b>Scope of application</b>
<b>Design at visceral level</b>	Appearance (shape), touch, feeling (product appearance)
<b>Design at behavioral level</b>	Experience, function, utility
<b>Design at reflective level</b>	Self-image, personal satisfaction, feeling (inner)

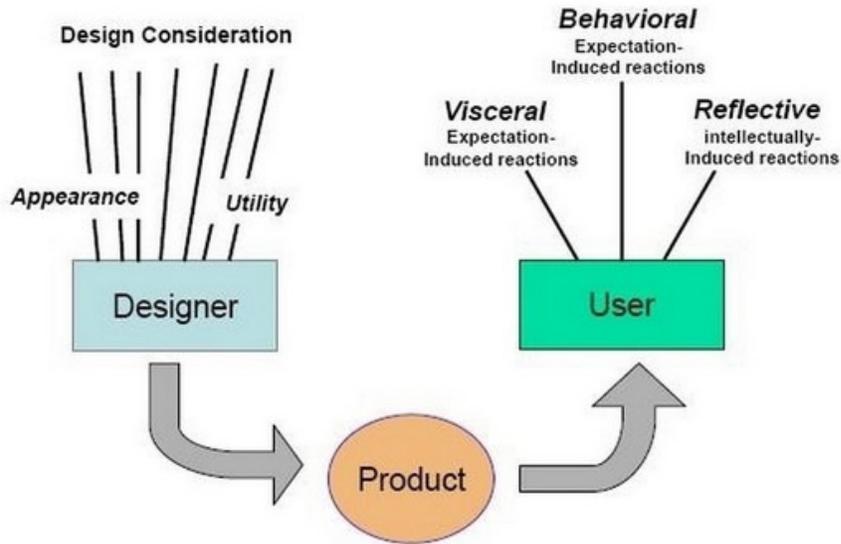


Figure 1. Each of these levels or dimensions, while heavily connected and interwoven in the emotional system, influences design in its own specific way (Norma, 2005).

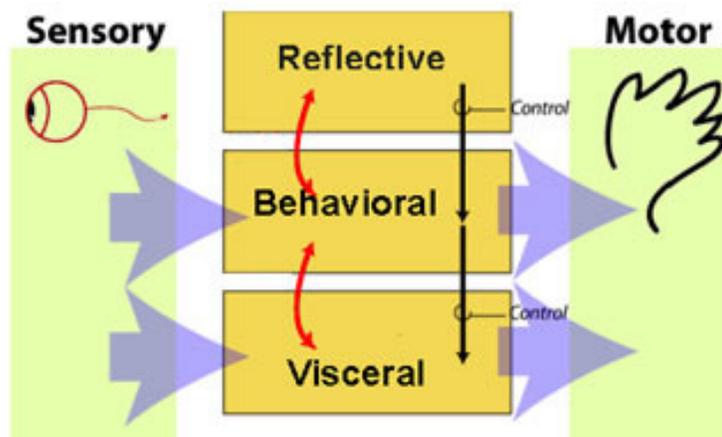


Figure 2. Correlation of Three Levels of Interaction. (Norman, 2005)

According to these levels, the reflective level is most likely to change with culture, experience, education, and individual differences, and this level can override other levels. It is common for these three levels of design to conflict with different levels of emotion: people will interpret the same experience at

multiple levels, and the experience will appeal to one level, but not necessarily to another. A successful design must be excellent at all levels.

### *Packaging Design*

Packaging is a very practical and function-oriented behavior. Excellent packaging design can enable consumer to understand the nature of the products, thus arousing their desire to buy. Packaging for "gifts" differs from packaging for "products" in motivation, function, and presentation. Products include food, beverages, cosmetics, household cleaning products etc. The common characteristic of these products is that they have no specific type. Consumers often cannot touch the product themselves when buying and can only decide whether to buy or not depending on the information and atmosphere transmitted on the packaging of the product (Chu and Ho, 2010).

Packaging design is thus an act of linking product information with shape, structure, color, image, typographic, and design elements so that

products can be sold in the market. Product package provide accommodation, protection, transportation, distribution, identification, and product features to convey the characteristics or functions of the products in a unique way, thus achieving the purpose of marketing the products (Klimchuk and Krasovec, 2011). The functions of packaging design include: (1) to ensure that the products in the package can reach consumers in good condition; (2) to ensure minimum waste and damage during distribution and storage; (3) to ensure hygiene and safety during transportation; (4) to make the products easy to handle, accumulate, store, and transport; (5) to help consumers easily identify the products in the store; and (6) to provide information (Table 2).

Table 2. Human Disposition Map to Different Dimensions of Product Design

Human disposition		Profession	Example
<b>reflective</b>	intellectually driven	brand/ image	Perrier drinking water
<b>behavioral</b>	Expectation driven	usability	Water in a plastic bottle
<b>visceral</b>	Perceptually driven	Graphic design	A beautiful blue bottle that is used as a vase

#### Methods

##### *Ambient media design cases and interaction methods*

This study collected advertising and commodity cases related to ambient media on the market and analyzed the

concept development and the application of interaction methods. First, 23 cases were sorted out from relevant websites, books, and magazines as test samples for analyzing the concept of ambient media interaction. The concept of inter-sample communication, similarity assessment of interaction effects, and group analysis of

the results was carried out. The characteristics and design methods of the five

groups obtained are described as follows ( Table 3 to Table 7).

Table 3. A1 group features

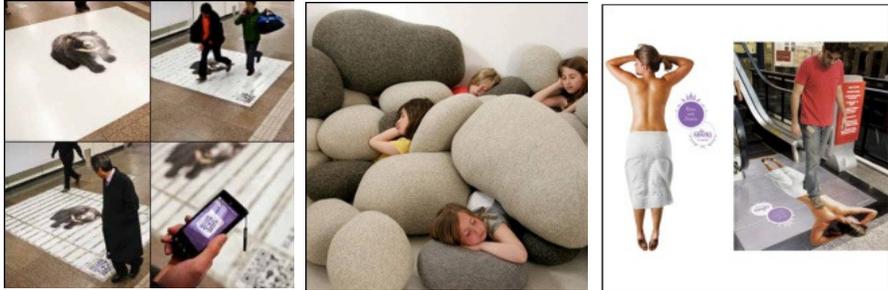
A1 group	
Type	Combing with other things – Metaphorical expression concept
Level of interaction	Visceral level → Behavioral level → Reflective Level
Concept	The user unknowingly participates in it, and the continuous action of participating in the process has some meaning. When a third party watches, it can also receive its metaphorical message.
Cases	

Table 4. A2 group features

A2 group	
Type	Combing with other things – Combination of structure and function
Level of interaction	Visceral level → Behavioral level
Concept	Combine the similar appearance of the two items, so that users can have interesting associations after watching it.
Cases	

Table 5. A3 group features

A3 group	
Type	Combing with other things – Combination of appearance and modeling
Level of interaction	Visceral level
Concept	Combine the similar appearance of the two items, so that users can have interesting associations after watching it
Cases	

Table 6. A4 group features

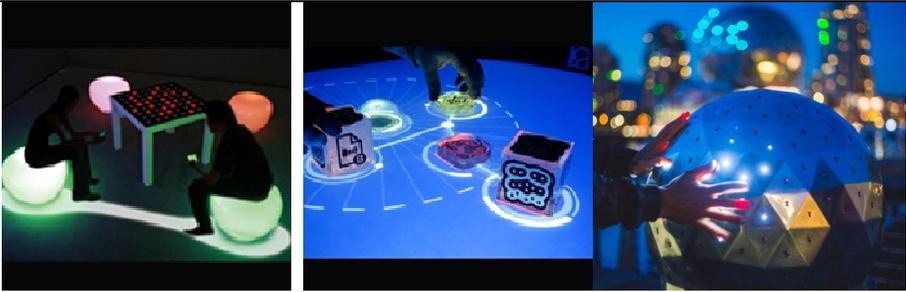
A4 group	
Type	User cooperation – Intuitive operations to produce situational effects
Level of interaction	Visceral level → Behavioral level
Concept	The user operates by instinctive action, extending a certain situation or using visual and audio effect.
Cases	

Table 7. A5 group features

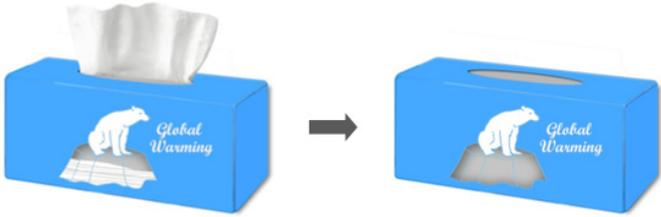
A5 group	
Type	User cooperation — User operation behavior cooperation
Level of interaction	Visceral level → Behavioral level
Concept	Users use instinctive actions to operate and continue to cooperate with each other through the use of operation behaviors to produce interesting interaction effects.
Cases	

*Ambient media design samples*

According to the ambient media concept, industrial design students de

veloped 14 concept products through a brainstorming method, and then simulated the ambient media elements, make 14 dynamic images as experimental samples ( Table 8 to Table 12).

Table 8. According the A1 group ambient media concept (sample 1, sample 2 and sample 3)

According the A1 group ambient media concept	
Type	Combing with other things — Metaphorical expression concept
Level of interaction	Visceral level → Behavioral level → Reflective Level
Sample 1. box tissue	

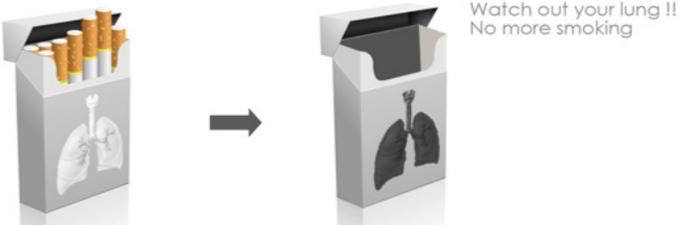
<p>Sample 2. cigarette</p>	
<p>Sample 3. memo paper</p>	

Table 9. According the A2 group ambient media concept (sample 4, sample 5 and sample 6)

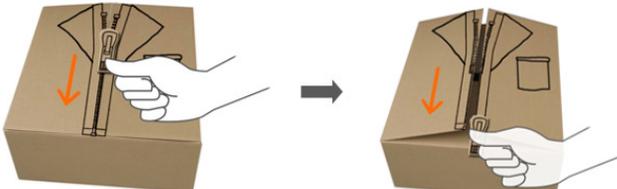
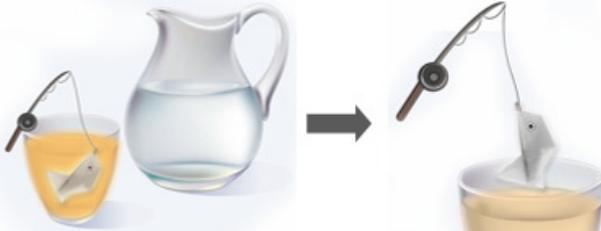
According the A2 group ambient media concept	
Type	Combing with other things — Combination of structure and function
Level of interaction	Visceral level → Behavioral level
Sample 4. clothing storage box	
Sample 5. tea bag	



Table 10. According the A3 group ambient media concept (sample 7, sample 8 and sample 9)

According the A3 group ambient media concept	
Type	Combing with other things — Combination of appearance and modeling
Level of interaction	Visceral level
<p>Sample 7. napkin</p>	
<p>Sample 8. energy drink</p>	
<p>Sample 9. paper cup</p>	

Table 11. According the A4 group ambient media concept (sample 11 and sample 12)

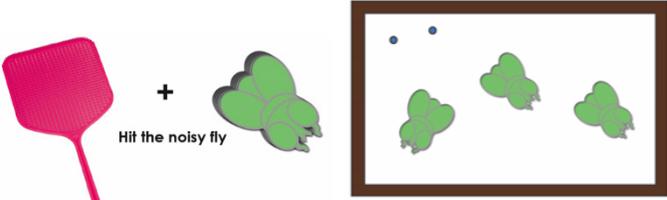
According the A4 group ambient media concept	
Type	User cooperation — Intuitive operations to produce situational effects
Level of interaction	Visceral level → Behavioral level
Sample 11. garbage bag	
Sample 12. Memo paper	

Table 12. According the A5 group ambient media concept (sample 13 and sample 14)

According the A5 group ambient media concept	
Type	User cooperation — User operation behavior cooperation
Level of interaction	Visceral level → Behavioral level
Sample 13. chopsticks	



*Modifiers of the interaction of ambient media*

Compiled by this study, 30 modifiers related to the interaction of ambient media were obtained, and then vocabulary pairs that are more suitable for describing the interaction of ambient media were selected and classified by questionnaire survey. The top 10 vocabulary

pairs selected were used for the interaction image test. In order to understand the "interaction" of packaging design and the relationship between these adjectives and the evaluation of "strong interaction - weak interaction" and "like to use - hate to use", 12 sets of ambient media interactive image vocabularies were finally obtained as shown (Table 13).

Table 13. Ambient Media Interactive Vocabularies

No.	Adjective pairs	No.	Adjective pairs
01	Surprising - ordinary	02	Exaggerated - restrained
03	Innovative - rigid	04	Lively - dull
05	Strong - soft	06	Interesting - boring
07	Humorous - serious	08	Pleasant - gloomy
09	Easy to understand - difficult to understand	10	Active - passive
11	Strong Interaction - Weak Interaction	12	Like to use - hate to use

*Interaction image test*

The subjects were 30 participants (male: 18, female: 12), aged between 20 and 32 years old. First step, the Participants were asked to watch the animation of 14 pieces of packaging design samples, understand the characteristics of the packaging design, and then conduct a 7-

stage scale evaluation of the vocabulary of 12 groups of ambient media images according to the thinking and interaction of the packaging. Principal component analysis on the evaluation results was performed to extract the main factors that constitute the interaction of ambient media. The principal component analysis results as show (Table 14).

Table 14. Principal Component Analysis Results

No	Adjective pair	Principal components		
		Principal components 1	Principal components 2	Principal components 3
8	Pleasant - gloomy	0.973*	-0.016	-0.099
4	Lively - dull	0.907*	0.343	0.031
7	Humorous - serious	0.890*	0.222	- 0.018
6	Interesting - boring	0.815*	0.292	0.458
10	Active - passive	0.707*	0.242	0.005
3	Innovative - rigid	0.692	0.659	0.014
5	Strong - soft	-0.025	0.946*	- 0.113
1	Surprising - ordinary	0.451	0.843*	0.190
2	Exaggerated - restrained	0.424	0.841*	- 0.279
9	Easy to understand - difficult to understand	-0.004	-0.137	0.985*
Eigenvalue		6.040	1.799	1.143
Explanation rate (%)		60.401	17.066	11.433
Cumulative explanation rate (%)		60.401	17.990	89.824*

Since the cumulative explanation rate of the three principal components hit 89.824% and the eigenvalues are above 1, the third principal components are extracted for analysis.

The first principal component is composed of representative images such as "pleasant - gloomy", "lively - dull", and "humorous - serious", which are positive feelings brought to users by the appearance of packaging design and can be interpreted as the factor of "joyful - dull". The second principal component is composed of representative images such as "strong - soft", "surprising - ordinary", and "exaggerated - restrained", which can be interpreted as the factor of "stimulating - plain", representing the degree of shock and impact brought to

the user's operation by using interaction methods in packaging design. The third principal component is the representative image of "easy to understand - difficult to understand", which shows whether the presentation concept and operation mode of packaging design can be easily conveyed to users and can be interpreted as the factor of "clear - ambiguous".

*Correspondence between ambient media design and interaction mode*

To find out the corresponding relationship between ambient media images and forms of interaction in packaging, Ward's Minimum Variance Method was then used to obtain the scores for all concept design product (Fig.3), the points of principal components of each

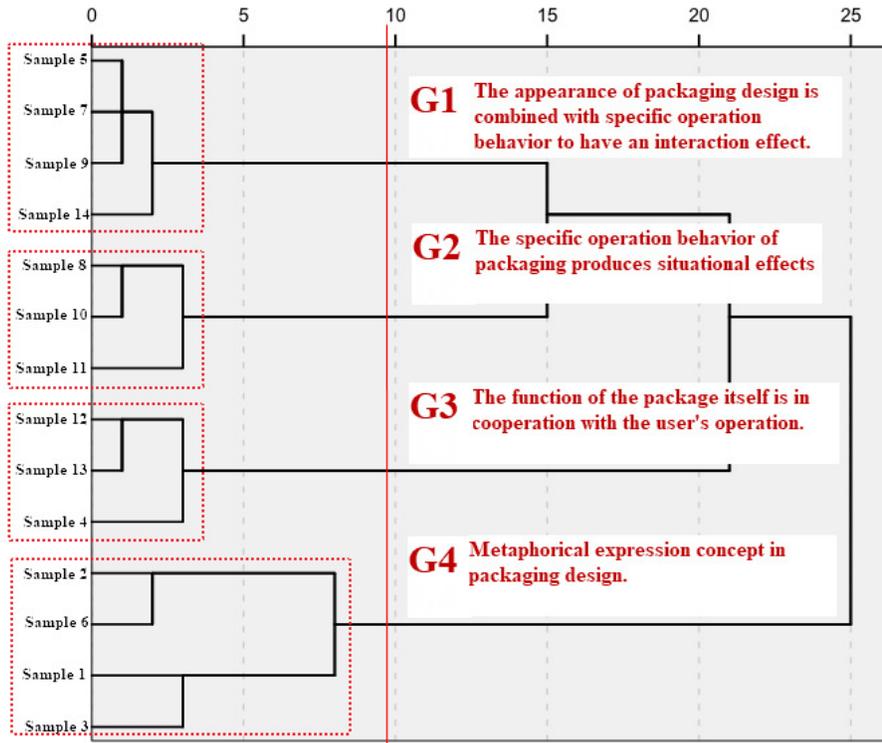


Figure 3. Results of cluster analysis of 14 concept design samples and 5 interactive behavior.

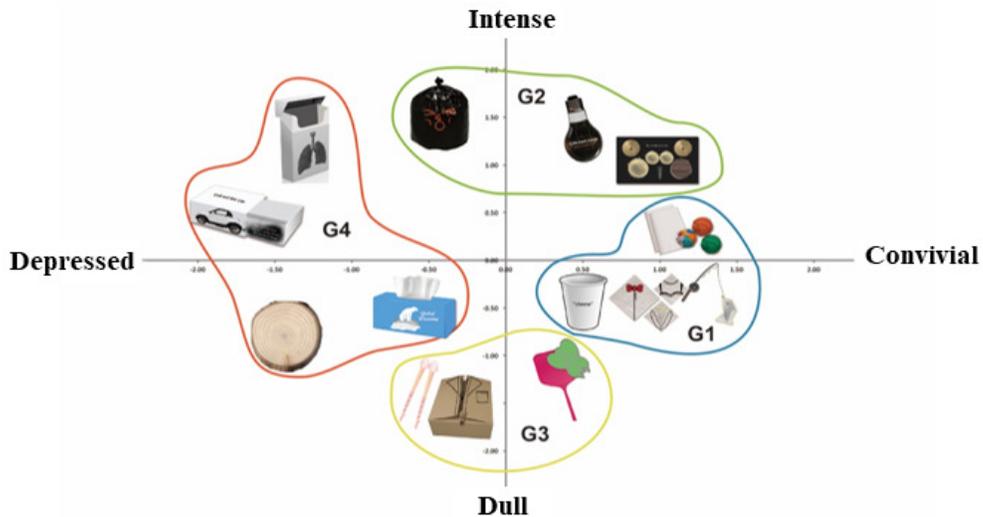


Figure 4. Scatter Diagram of Interaction Samples of Ambient Media in the Image Space in Packaging (Principal Components No. 1 and No. 2)

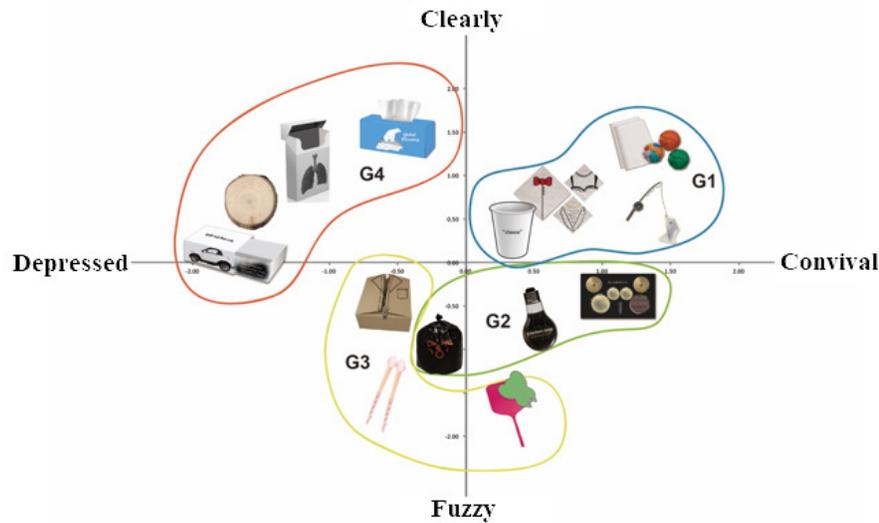


Figure 5. Scatter Diagram of Interaction Samples of Ambient Media in the Image Space in Packaging (Principal Components No. 1 and No. 3)

test sample were scattered in the interaction image space of ambient media (Fig. 4 & Fig. 5). The relationship between the samples and the ambient media images was then observed with the group analysis results.

### Results

After summarizing the experimental data and behavioral observations from the research subjects and conducting statistical analysis, the results and discussion were as follows:

- (1) Interaction images that affect "interaction" and "like to use"
- (2) Correlation between overall comprehensive evaluation and interaction of ambient media.

### *Interaction images that affect "interaction" and "like to use"*

In order to understand the images that affect the "interaction" and "like to use" of each test sample group, linear regression analysis was carried out by taking the image evaluation of the four groups of samples as an independent variable, with "strong interaction- strong interaction" and "like to use - hate to use" as dependent variables.

(a) Group G1: The appearance of the packaging design is combined with the specific operation behavior to have an interaction effect.

The image that affects "strong interaction - weak interaction" is "lively - dull". In the process of packaging design and use, users can only have lively and pleasant use experience if the proper selection is made. The image that affects

Table 15. Regression Analysis Results of Group G1 Sample Comprehensive Evaluation

Comprehensive evaluation	Image word pair	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std.	Beta		
Strong interaction - weak interaction	(Constant)	-0.104	0.282	0.0	-0.371	0.746
	Lively - dull	0.992	0.139	0.981	7.133	0.019
Like to use - hate to use	(Constant)	-0.821	0.156	0.0	0.137	0.892
	Surprising - ordinary	1.545	0.098	0.996	15.692	0.004

"like to use - hate to use" is "surprising - ordinary". Because the appearance or use of packaging is different from the stereotype use process, a novel feeling is provided for users to enjoy using it (Table 15).

(b) Group G2: The specific operational behavior of packaging produces a situational effect.

The image that affects "strong interaction - weak interaction" is "exag-

gerated - restrained"; the image that affects "like to use - hate to use" is "interesting - boring". When users use this type of packaging with specific actions, they participate in the situation together through the special situation atmosphere extended in the process of use, creating a strong sense of interest and interaction between people and thus making people like to use it (Table 16).

Table 16. Regression Analysis Results of Group G2 Sample Comprehensive Evaluation

Comprehensive evaluation	Image word pair	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std.	Beta		
Strong interaction - weak interaction	(Constant)	5.235	0.055	0.0	94.425	0.007
	Exaggerated - restrained	-1.687	0.029	-1.000	-59.082	0.011
Like to use -	(Constant)	-2.757	0.249	0.0	-	0.057

hate to use					11.069	
	Interesting - boring	2.150	0.132	0.998	16.241	0.039

(c) Group G3: The functions of the package itself is in coordination with the user's operation. The image that affects "strong interaction - weak interaction" is "exaggerated - restrained". The use of exaggerated actions in interaction makes people feel interaction, because the concept of packaging is expressed in an exaggerative manner. The images that af

fect "like to use - hate to use" are "pleasant - gloomy" and "active - passive". If packaging design has a "pleasant" feeling and the function of packaging is passively matched with the user's operation, then this will make people like to use it (Table 17).

Table 17. Regression Analysis Results of Group G3 Sample Comprehensive Evaluation

Comprehensive evaluation	Image word pair	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std.	Beta		
Strong interaction - weak interaction	(Constant)	0.328	0.024	0.0	13.384	0.047
	Exaggerated - restrained	1.336	0.043	0.999	31.369	0.020
Like to use - hate to use	(Constant)	-2.562	0.0	0.0	0.0	0.0
	Pleasant - gloomy	3.159	0.0	0.966	0.0	0.0
	Active - passive	-0.469	0.0	-0.273	0.0	0.0

(d) Group G4: Metaphorical expression concept of packaging design.

The image that affects "strong interaction - weak interaction" is "lively - dull", and the image of "lively" in packaging can make people feel interaction. The images that affect the "like to use -

hate to use" are "active - passive", "strong - soft" and "lively - dull". When the metaphorical expression concept of this group of packaging has "passive", "soft", and "lively" images at the same time, it will make people like to use it (Table 18).

Table 18. Regression Analysis Results of Group G4 Sample Comprehensive Evaluation

Comprehensive evaluation	Image word pair	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std.	Beta		
Strong interaction - weak interaction	(Constant)	0.540	0.094	0.0	5.733	0.029
	Lively - dull	0.695	0.091	0.983	7.598	0.017
Like to use - hate to use	(Constant)	1.944	0.000	0.0	0.0	0.0
	Lively - dull	0.251	0.000	0.348	0.0	0.0
	Strong - soft	-0.316	0.000	-0.506	0.0	0.0
	Active - passive	-1.077	0.000	-0.550	0.0	0.0

*Correlation between overall comprehensive evaluation and interaction of ambient media*

We now try to understand the regression analysis results of the images that affect the "interaction" and "like to use" of all samples. The images that affect the "strong interaction- weak interaction" are "lively - dull". If one can

change the appearance and use of the original packaging and add different use procedures, then users will feel more interaction. The images that affect the "like to use - hate to use" are "interesting - boring". If packaging is interesting, then users will like to use it more (Table 19).

Table 19. Comprehensive Evaluation Regression Analysis Results of All Samples

Comprehensive evaluation	Image word pair	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std.	Beta		
Strong interaction - weak interaction	(Constant)	-0.037	0.186	0.0	-0.198	0.846
	Lively - dull	1.159	0.166	1.309	6.962	0.000
Like to use - hate to use	(Constant)	-0.656	0.278	0.0	-2.358	0.038
	Interesting - boring	1.613	0.273	1.255	5.896	0.000

### Conclusions

The main conclusions are summarized as follows. The main images that affect "interaction" are Group 1 "lively - dull", which means a more

vivid and brisk feeling in packaging design is more interaction, and Group 2 "exaggerated - restrained", which means the use of exaggerated visual effects of packaging or special actions makes people feel more interaction (Table 20).

Table 20. Relationship between Various Samples and "Interaction" Comprehensive Evaluation and Comparison

Type	Interaction type	Images affecting interaction evaluation	Explanation	Evaluation sequence
G1	The appearance of packaging design is combined with specific operation behavior to have an interaction effect.	Lively - dull	Packaging design makes people feel "lively" and refreshing.	2
G2	The specific operation behavior of packaging produces situational effects.	Exaggerated - restrained	Using design techniques such as special situations to create "exaggerated" visual or acousto-optic effects will give users the highest evaluation on the interaction of packaging.	1
G3	The function of the package itself is in cooperation with the user's operation.	Exaggerated - restrained	The function of packaging matches the usual actions of users, which gives people a more "insipid" and "restrained" feeling due to its liveliness.	4
G4	Metaphorical expression concept in packaging design.	Lively - dull	There is a special meaning in the use of packaging with a metaphor conveying messages to users, which denotes less interaction.	3

Table 21. Relationship between Various Samples and Comprehensive Evaluation of "Like to Use" and Comparison

Type	Interaction type	Images affecting interaction evaluation	Explanation	Evaluation sequence
G1	The appearance of packaging design is combined with specific operation behavior to have an interaction effect.	Surprising - ordinary	The appearance of the package has a surprising and expectant feeling, and the use of the appearance with the user produces an unexpected effect.	1
G2	The specific operation behavior of packaging produces situational effects.	Interesting - boring	Packaging usage creates a special situation in which users can exude a highly "interesting" evaluation and enjoy using it.	2
G3	The function of the package itself is in cooperation with the user's operation.	Pleasant – gloomy Active - passive	The combination of packaging function and daily necessities can produce a pleasant effect.	4
G4	Metaphorical expression concept in packaging design.	Lively – dull Strong – soft Active - passive	The concept conveyed by packaging is more serious and educational, and so users prefer to use it to a lesser extent.	3

Through the transformation, design, investigation, and verification of the interaction image of ambient media, this study specifically obtained the components of packaging design as follows: (1) the constitutive factors of the interaction of ambient media; and (2) the ambi-

ent media images that influence “interaction” and “like to use”.

The purpose of this study is to explore the application of the interaction image of ambient media in product packaging design, including (1) analyzing and summarizing the conceptual

structure of interaction through the investigation of related examples of existing ambient media, extracting the corresponding design techniques based on the concept of interaction structure, and carrying out packaging design and image testing; (2) using principal component analysis as the main method for testing results to explore the constitutive factors of the ambient media image in packaging use and its corresponding relationship with various interaction forms; and (3) finally, analyzing the interaction image of ambient media that affects "interaction" and "liking to use" with multiple regression analysis.

The findings result show that "G1 the appearance of packaging design is combined with specific operation behavior to have interaction effect" is more popular than "G2 the specific operation behavior of packaging produces situational effects." We also show that it is most popular when there are special or exaggerated designs on the package. However, in terms of "interaction", G2 is higher than G1, showing that a package design with strong interaction does not necessarily requirement exaggerated or special appearance (Fig. 6).

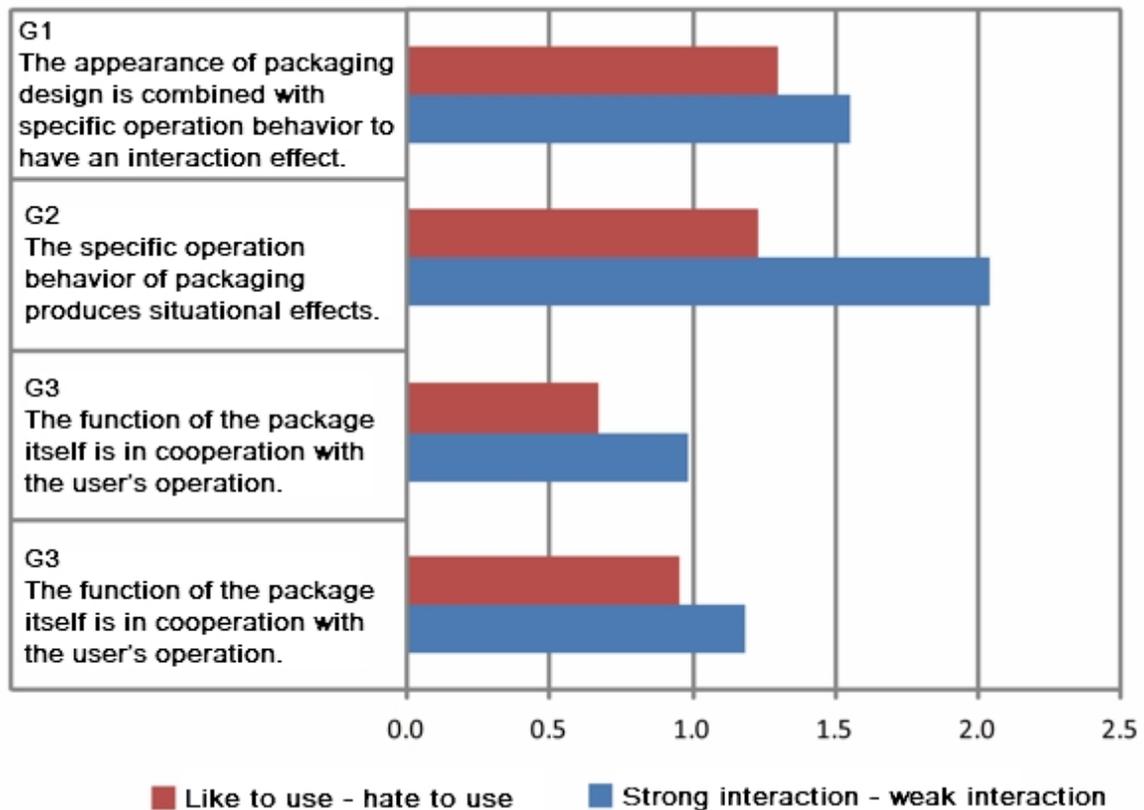


Figure 6. Comparison of a comprehensive evaluation of "Interaction" and "Like to Use"

However, for the packaging design like G2 with an imagination space, because of the situation created in the use process, users themselves and people around in the environment can feel its

atmosphere, thus giving people a strong interaction. The relationship between both groups in terms of "interaction" and "like to use" can be explored in future research.

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