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IMAGE COGNITION STUDY PERTINENT TO PHYSICAL INTERACTIVE DESIGN OF PUBLIC ART

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ABSTRACT

Under private and government efforts and promotion, public art in Taiwan has made noticeable progress. Influence from diversified thinking and performance in modern art, as well as availability of compound mediums and digital technology have made people discovered the versatile appearances of interactive design for the five senses. Based on visual interactions, public art has been extended to involve interactions through physical contact, voice, the venue, behavior and advanced sensor devices. Subsequently, the expression of public art has become richer and interactions between people, the artwork and the venue are increased.

This study refers to data from Public Art in Taiwan, published by the Council for Cultural Affairs of the Executive Yuan, and uses the corresponding representative public artworks in Taipei City as survey samples. The questionnaire approach and interviews are adopted to present matching questions to the surveyed. The semantic differential approach (SD) is conducted on 36 people to investigate their image cognition. In the end, the data collected are examined and tested with the quantifying software SPSS to analyze viewers' image cognition and aesthetic factors for public art. Hopefully, the results of this study can serve as references for researchers of public art creation and design and academic studies in the future.

Keywords: *physical interactions, public art, artistic street furniture, image cognition*

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1. INTRODUCTION

Thanks to the joint effort of the government and the private sector, Taiwan's public art has experienced significant development in the past few years. The public artworks of Taipei, the capital city of Taiwan, are noteworthy in terms of the number of establishments and richness of rendering. According to this study's observations, in recent years, the rendering methods employed in interactive design of public artworks have expanded from visual interaction to interactive design that involves bodily contact and physical space, as well as one that incorporates behavioral and digital sensing devices. The expansion enriches the expressions of interaction between public arts and human beings. In which public artworks that involve bodily contact and physical space and artistic street furniture performed remarkably well and grew in number. The researcher believes that the characteristics of public artworks designed to involve bodily contact is an issue that deserves further exploration.

This study does not question any contributions that enrich the rendering of public art. Rather, offers a space for the researcher and public art designers to rethink.

The purpose of this study is to:

(1) Explore the main elements that compose body-interactive public art.

(2) Analyze clusters of body-interactive public art.

(3) Explore the distribution of each category on the major ingredient image analysis coordinate.

(4) Explore primary factors underlying body-interactive public artworks that viewers consider to be aesthetic via regression analysis.

2. LITERATURE REVIEW

2.1. Sense of Body and Aesthetics of Interaction

Human beings give life to art via their five physical senses (visual, auditory, olfactory, taste and tactile) and emotional feelings. The body is the carrier of all senses; "sense of body" is the perceptual experience of inner senses being connected with the outer world. Our perception of physical senses is an important sensory function that allows us to perceive all that surrounds us, which is the world's "first truth" [1]. Husserl believes that the tactile sense is what our "sense of body" is mainly based on. Our sense of touch makes us conscious of our body's state, whether its fixed in one position or moving with a rhythm; it reacts to objects by making us feel cool, warm, cold, hot or pain, enabling us to orientate the object. The kinesthetic sense is what makes us conscious of our body movement and helps orientate parts of our bodies [2]. There is a close connection between personal experience with sense of body and personal experiences as well as state of mind. Artists create and design art through their own styles, physical actions and perceptions, constructing the spiritual atmosphere and field space of artworks. Viewing and interaction with artworks sets off humanistic thinking and perception in the minds of viewers from different experiences and backgrounds. Such an interaction can enrich human-human and human-work communications, deepen viewers' concern over public art and trigger educational exploration.

"Interaction" is a behavior through which human beings communicate with, explore and learn the outside world. It is in human nature; it is also a way of life. Human activities in the

public space can be largely divided into three categories [3]: "necessary activity," "optional activity" and "social activity." The construction and progress of these activities give the environment its field meaning. Linkages between activities become various components affecting the interaction [4]. There are many factors that influence interaction with public art: "human factors" such as the creator and the viewers; "environmental factors" such as natural landscape, artificial environment, local custom and history; "artistic factor of the work" such as shape, color, theme and openness and function of the spatial structure. Increasing interaction components and contact opportunities makes interactive behavior easier and deepens the context and motive of interaction. There are two types of interaction [5]. One is "visual/mental interaction" that takes place quietly between the objects; the other is "bodily/physical interaction" that involves physical behavior.

Through participation in and contact with interactive public art, viewers have aesthetic experience and mental perception – "interactive aesthetics." "Interactive aesthetics" involves perceptual-motor skills that employ the physical senses to perceive things done between the body and the artwork, as well as emotional skills by which users undergo the life experience and sensation brought about by interactive products [6]. Physical sensation of interactive design and behavior generates rich aesthetic experiences in association with mental perception. This is the start point from which public art promotes human-human and human-work communication via the concept of interactive design.

2.2. Public Art and Artistic Street Furniture

Following the evolvement and development of urban life, urban residents now have more diverse and higher requirements on the quality of their living environment. Landscape vitalization and utilization in public spaces is an indicator for which living quality is evaluated, and public art and artistic street furniture are considered essential elements to the composition of a modern urban landscape, as well as the construction of urban image.

The overall image of a city, in terms of its spatial elements, is a network of paths, edges, districts, nodes and landmarks[7]. The first four elements are relatively conceptual, while landmarks are real objects that capture your attention in public spaces. Obvious, unique landmarks give city spaces identification, allow people to develop associative memory that makes the city feel friendlier and more familiar, and construct a city's public image[8]; this is the key role of public art and artistic street furniture.

Public art follows three principles: artistic nature, landscape value and amicability[9]. A public artwork should have an "artistic nature" that is vested with aesthetic context and humanistic depth, a "landscape value" that mingles environmental elements and gives meaning to the place, and "amicability" that allows people to draw near for interaction. Through its rendering style, public art constructs a field situation to convey the author's thought and experience. Introduction of various artistic renderings, such as landscape art, environmental art, installation art and technology art, with different types of forms and concepts, diversifies the representations of public art and affects the way people interact with artworks. Introduced to Taiwan in the 80's and becoming the mainstream in the 90's, installation art [10] influences public art in theme, spatial structure and field layout. Stemming up in the 90's, digital art [11] for its use of high-tech media and digital equipment gives multiple redound to the interaction and sensing of public art.

The typical definition of "street furniture" is "private or public objects or facilities installed in public spaces to provide the public a service or specific function." Street furniture include seats, lights, phone booths, signs, bus stops and water fountains."Public art street furniture" is artistic furniture that combines concepts of "public art" and "street furniture."

According to "Outdoor Space Planning" [12], street furniture have seven functions: to embellish, to provide information, to protect and separate, for recreation and hygiene maintenance, parking, children's games and technicality, to which Michel Carmona added two more functions: public transportation and public communication[13].

The Decaux Group, a renowned street furniture design company in Europe, also proposed five criterion for determining the quality of street furniture: functionality, durability, easy to maintain and clean, specifications and modules, and aesthetic[8]. The creation and installation of artistic street furniture enrich the rendering of public art.

3. RESEARCH AND SURVEY ANALYSIS

3.1. Collection of interaction public artworks

This study uses the Public Art in Taiwan Annual of the Council for Cultural Affairs as its foundation, and after interviews with experts and discussions with college students from art and design backgrounds, selects 15 public artworks in Taipei City that involve body interactions as samples for the experiment (Table.1).

Table 1

				
Sample1	Sample 2	Sample 3	Sample 4	Sample 5
				
Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
				
Sample 11	Sample 12	Sample 13	Sample 14	Sample 15

3.1.1. Table 1:15 public artworks

3.2. Collection and classification of public art descriptive word

To collect bodily-interactive public art descriptive words, the researcher interviews 6 individuals associated with art design, who to certain extent understand the nature of public arts, including art exhibition planners, art designers, and art and sculpture education workers, and integrates the opinions of 5 art school students. Through the interview 72 terms describing visual sensations, 55 terms describing image expression and 38 terms related to perception of interaction with the works are gathered. The 165 expressions are put through the first integration and screening session. With other literatures referenced and subjective/objective conditions evaluated, 27 pairs of comparative descriptive words are

selected for pretest and group discussion. The result undergoes the second integration and screening session, which results in 10 pairs of comparative descriptive words. With the addition of the comprehensive evaluation comment "aesthetic – unaesthetic" and seven stages of semantic evaluation, ensuing surveys have 11 word pairs and employ the semantic difference technique.(Table.2)

Table 2: Adjective terms

1. uneven surface – flat surface	2. spacious – cramped	3. profoundly artistic – superficially artistic
4. Multiple – unitary	5 opaque – transparent	6. amicable – aloof
7. pleasant – stressful	8. for practical purpose – for viewing	9. open – closed
10. warm – cold	11. aesthetic – unaesthetic	

3.3. Public artworks image test

3.3.1. Respond analysis

There are 36 respondents in this study, of whom 22come from art background and 14 from design background; 17 are males and 19 are females.

3.3.2. Survey method

In this study the respondents are given ample time experience body interaction with the 15 samples. Objective explanations are given to help the respondents understand the theme and materials of the samples before they answer the descriptive word survey questionnaires. In accordance with their perception and feeling generated during their interaction with the artwork, the respondents go through seven stages of semantic evaluation, assessing the extent to which the artwork matches the descriptive words.

3.4. Image survey outcome analysis

3.4.1. Image structure analysis

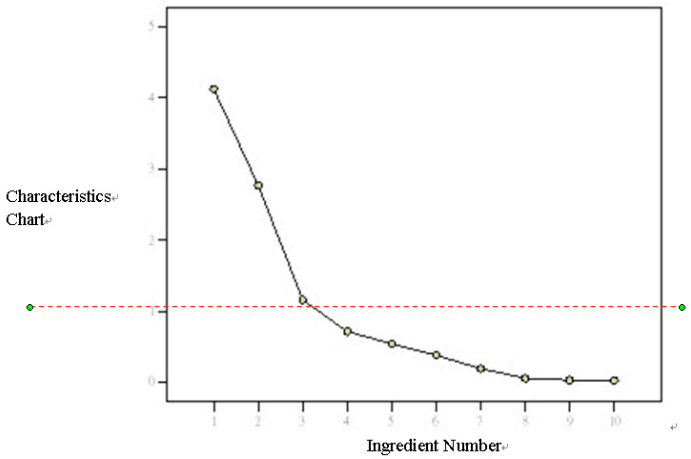

Figure 1: Steep slope chart

To explore the primary factors that make up the interactive design image structure of public arts, outcomes of the image test are put through the major ingredient analysis. From the major ingredient analysis table and steep slope chart(Fig.1) we can see that the accumulated explanation ratio of the three major ingredients reaches 80.571%(Table.3), and that the characteristic values are all above 1, major ingredients 1 thru 3 are chosen for analysis. Outcomes of the analysis are shown in the following table.

Table 3: Major ingredient analysis

		Ingredient		
		1	2	3
Diversified rendering of artwork design and spatial variations: Design space axis (Diversified – simple)	Uneven surface – flat surface	.861	-.031	.337
	Spacious – cramped	.837	.109	.107
	Profoundly artistic – superficially artistic	.832	.099	.352
	Multiple – unitary	.722	.269	-.408
	Opaque – transparent	.679	-.041	-.151
Atmosphere of interaction between viewers and artworks: Interaction atmosphere axis (Amicable – aloof)	Amicable – aloof	.091	.963	.087
	Pleasant – anxious	.135	.958	-.068
	For practical purpose – for viewing	-.316	.855	.096
	Open – closed	.447	.816	.122
Experience from touching artworks: Tactile sensation axis (Warm – cold)	Warm – cold	.125	.133	.876
Characteristic Value		3.459	3.356	1.242
Explanation Ratio (%)		34.592	33.561	12.418
Accumulated Explanation Ratio (%)		34.592	68.153	80.571

3.4.2. Major ingredient analysis

From Table 3 we can see that the first primary ingredient consists of typical images, including "uneven surface – flat surface", "spacious – cramped", "profoundly artistic – superficially artistic", "Multiple – unitary" and "opaque – transparent" because the scores of the first three items are high and they are all used to describe atmosphere shaping by work. They can therefore be interpreted as the "design space" factor of "diversified – simple."The second primary ingredient comprises typical images including "amicable – aloof", "pleasant – anxious", "for practical purpose – for viewing" and "open – closed." The scores of the first three items are high and they are all used to describe the atmosphere when respondents interact with artworks. They can therefore be interpreted as the "interaction atmosphere" of "amicable – aloof."The third primary ingredient is made up of typical images of "warm – cold", expressing sensations when respondents touched samples, and can be interpreted as the "tactile sensation" of "warm – cold."

3.5. Cluster analysis and corresponding relation of image main ingredient factor axis

3.5.1. Cluster analysis

To pinpoint corresponding relations between artwork samples and main ingredient factor axis, the points identified from major ingredient analysis are spread along each major ingredient axis to form an image space. The outcomes for clusters G1 and G2 are analyzed via Ward's Minimum Variance Method to find the relation between samples and the image of bodily-interaction public art.In terms of human-artwork body interaction, public art can be divided into two clusters: G1 Landscape field experience public art and G2 Public art for practical purposes.(Fig.2)

3.5.2. Analysis of characteristics of 2 groups

G1 Landscape field experience public art: Artworks have an artistic space for viewers to experience and explore.There are 7 pieces of works in this group (Table.4). Artworks in this group comprise several structures, have wider and more open space, and are more diverse in design; they not only beautify the landscape, but also provide space for people to interact with them. An aesthetic atmosphere and beautiful landscape is the result when artworks of this group are combined with their environment or architectures. People can enter, come in contact with and wander through the artistic space created by these artworks, giving them the opportunity to experience, think, imagine and explore.In the distribution of the major ingredient image space (Fig. 3, Fig. 4), we can see that G1 (except for samples 14 and 9) is closer to the "diversified" image on the "design space axis" than G2, but is closer to the "aloof" and "warm" images on the "interaction atmosphere axis" and "tactile sensation axis."Samples 14 and 9 are closer to "simple" image on the "design space axis" and the "aloof" image on the "interaction atmosphere axis", but sample 9 is closer to the "warm" image on the "tactile sensation axis." The theme of sample 14 is science, represented by rulers and compasses and scientific symbols that people are familiar with. It can be inferred that sample 14 is more inclined to "aloof" and "cold" than other artworks in G1 because its layout makes people feel more distant and it is made of cold stainless steel. Samples 2 and 15 give people a sense of diversity in its design space, but sample 15 is more "amicable", whereas sample 2 is closer to "warm" on the tactile sensation axis.

G2 Public art for practical purposes: Artistic street furniture that are for practical purposes, such as games and for resting.There are 8 pieces of works in this group (Table.5). As a whole the works of this group demonstrate two characteristics: artistic and practical. The artworks of this group have either a structure or design space that allow people to draw near and use; they are street furniture that mingle artistic appreciation and experience with practical purposes like games, education and rest. People can come in contact or amuse themselves with the functions of these artworks via their body actions.In the distribution of the major ingredient image space (Fig. 3, Fig. 4), we can see that although G2 is closer to the "simple" image on the "design space axis" than G1, it is closer to the "amicable" image on the "interaction atmosphere axis." We can reason that artworks apparently intended to be used for games or rest generates an amicable atmosphere.Samples 12 and 8 are the closest to the "amicable" image among all other artworks. Sample 12 was the most "amicable" artwork in G2 with its seed design, bright colors and educational plant illustrations in the surrounding space, which allowed people to learn as well as play when they wandered through its space.

Sample 8 is in the shape of a big bird cage with a small tree and chairs for people to rest in it; it is an artwork with a sense of humor.Sample 5 had the most diversified design, however, was inclined to the "cold" image on the "tactile sensation axis."Sample 1 utilized geometry shapes, obviously for the purpose of letting people sit on, and compound materials to give off a "warm" image on the "tactile sensation axis."

Table 4:

G1 Landscape field experience public art

G1				
				
Sample3	Sample 4	Sample 15	Sample 2	Sample 6
				
Sample 9	Sample 14			

Table 5:

G2 Public art for practical purposes

G2				
				
Sample 11	Sample 12	Sample 5	Sample 7	Sample 10
				
Sample 13	Sample 1	Sample 8		

G1 Landscape field experience public art: Design space of artworks is rich in variation, artistic space that can be explored and experienced. Artworks compose of several structures and have wider space. More diverse design and space; possesses visual beauty and space for people to interact with artworks.

G2 Public art for practical purposes: Public art for practical purposes, such as games, education and rest, or artistic street furniture. Such artworks have an amicable structure or design space that has an apparent practical purpose, such as a game, education or for resting, and allows the body to interact with it.

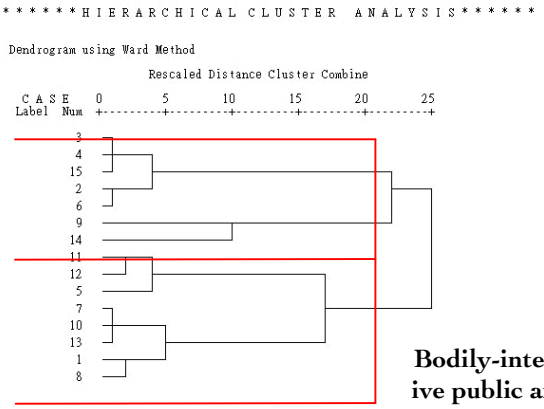

Figure 2: Cluster Analysis Outcomes

Image Space and Main Ingredient Axes

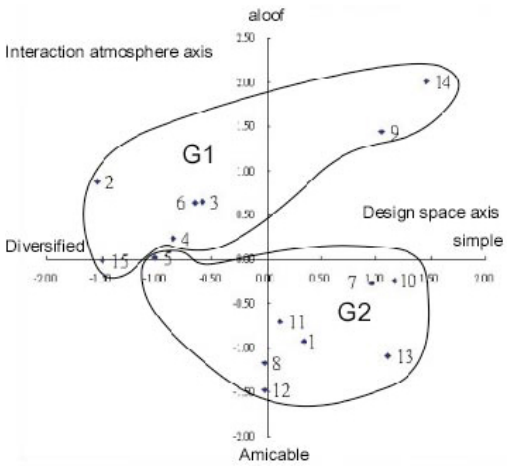

Figure 3: 1st & 2nd major ingredients

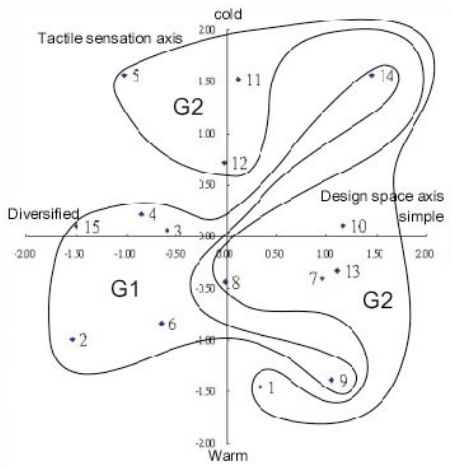

Figure 4: 1st & 3rd major ingredients

3.6. Comprehensive Evaluation

Causation of "aesthetic" rating and image of bodily-interactive public artwork

To understand the cause-effect relationship of "aesthetic" rating and image of bodily-interactive public artwork, this study in this stage employs "aesthetic – unaesthetic" as the dependent variable and other image description words as dependent variables for regression analysis. The outcomes are shown in Table 6. Analysis results indicate the significance of "profoundly artistic – superficially artistic" and "opaque – transparent" is less than 0.05. Therefore we can explain that the two are independent variables that generate the "aesthetic" sensation. So "profoundly artistic" and "opaque" images affect which public artworks respondents felt were "aesthetic." Its regression equation is:

Pre-standardization regression equation is:

Aesthetic＝0.815+0.849×"profoundly artistic"+(-0.171)×"opaque"

Post-standardization regression equation is:

Aesthetic＝1.023×"profoundly artistic"+(-0.247)×"opaque"

Then we observe the Model Summary Table (see Table 7). The adjusted R square coefficient of Model 2 is 0.891, which is greater than 0.5. So its goodness-of-fit is acceptable.

Table 6: Regression Analysis Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B estimate	Std. Error	Beta		
1	(Constant)	.433	.298		1.455	.169
	profoundly artistic – superficially artistic	.768	.088	.925	8.762	.000
2	(Constant)	.815	.290		2.816	.016
	profoundly artistic – superficially artistic	.849	.080	1.023	10.653	.000
	opaque – transparent	-.171	.066	-.247	-2.575	.024

a Dependent variable: aesthetic – unaesthetic

Table 7 : Model Summary

Model	R	R square	Adjusted R square	Standard error of estimate
1	.925(a)	.855	.844	.19918
2	.952(b)	.907	.891	.16638

a Predictor: (constant), "profoundly artistic – superficially artistic"

b Predictor: (constant), "profoundly artistic – superficially artistic", "opaque – transparent"

c Dependent variable: "aesthetic – unaesthetic"

4. CONCLUSION AND REASONING

(1) From the major ingredient analysis, we know that the major ingredients of bodily-interactive public art are "design space", "interaction atmosphere" and "tactile sensation."

(2) From the outcome of the cluster analysis, we understand that bodily-interactive public art can be divided two clusters: "G1 Landscape field experience public art" and "G2 Public art for practical purposes." Both clusters are public artworks that involve bodily interaction.

(3) Based on the major ingredient image space analysis, we understand that G1 Landscape field experience public art is more inclined to the image perception of "diversified" design space and "aloof" interaction atmosphere. G2 Public art for practical purposes is more inclined to "simple" design space and "amicable" interaction atmosphere. We can reason that even though public art for practical purposes, such as games, education and rest, have relatively simple design space, it appears more amicable to people.

(4) The possibility for bodily interaction artworks is affected by the layout and spaciousness.

(5) From outcomes of the regression analysis, we understand that "profoundly artistic" and "opaque" are the main ingredients of "aesthetic." We can interpret this into: "artistic sense and possibility of bodily exploration" are the main factors underlying public artworks respondents felt were aesthetic.

It is true that diversified rendering and utilization of various materials have enriched the appearance of public arts and enhanced possibilities of human-artwork interaction, as well as extended our world of perception. Human beings are capable of creating art and culture to express their perceptions because they have profound emotions and feelings.Every human being should search through their bodily perceptions, use their imagination and spiritual exploration to uncover the creativity and passion that is buried deep within them.

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