Journal of Ecohumanism
2024
Volume: 3, No: 7, pp. 1355 – 1369
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i7.4303

Designing for Engagement: The Role of Interactive Elements in Public Art Sculptures in Shanghai

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Abstract

Public art in urban landscapes are significant as they play a cultural role for both beautifying and reflecting cultural identity. Traditional public sculptures, catch our eye but quickly fade from cognitive due to passive experience. However, currently, pubic art are integrated with interactive elements such as touch, visuals, sound etc. to enhance perception. Thus, this study aims to i) To explore how public art sculptures can be designed to foster interaction and engagement with the public. ii) To investigates the role of interactive elements in sculptures, such as movement, touch, and multimedia components, and their effectiveness in creating meaningful public experiences. This study adopted a mixed method involving survey of 100 partcipants through online platform and four case studies. Following analysis, it was found that the physical, visual, auditory, and digital interactions contribute uniquely to the engagement of public. Though the study was limited due to its participant selection, it laid a foundation for understanding the designing elements of public art.

Keywords: *Interactive Element, Public Art, Multimedia, Visual and VR.*

Introduction

Background

Currently, public art is considered as an important segment of urban landscape. Public art in urban landscapes are significant as they play a cultural role for both beautifying and reflecting cultural identity(Sharp et al., 2020). For instances, public art in Shanghai is no longer just an observation but also a medium for cultural dissemination and socialization. Currently, Shanghai has been rebuilding for over two decades emerging as a tool to connect with its culturally rich past while forging ahead in this rapid urbanization (earthobservatory.nasa.gov, 2017). It contributes to cultural conservation by showcasing heritage and contemporary Chinese culture, creating a sense of achievement and identity for the locals(Wang, 2018). Thereby, it acts as a platform of cultural expression. Moreover, if considered from the perspective of the urban development, inculcating such art in public spaces enhances the liveability through vibrant and inviting characteristics(Migchels, 2022). It is apparent that the public art goes beyond visual appeal inculcating a sense of belonging and local traditions.

The public art has also seen a shift from traditional to contemporary art. The traditional art were mostly large scale and commemorative, static symbols of historical events or cultural ideals(Silberman, 2015). That is, the traditional art were developed from passive observations which had no interaction with the public. On the other hand, contemporary art inculcates interactive elements transforming the way people experience art(Penny, 2016). Interactive element in art include movement, sound, touch and multimedia. This shift is important since it brings art to the people in a more accessible and approachable way. This shift from being a passive observer to becoming an active participant is pivotal in cultivating a meaningful relationship between the artwork and the audience, providing genuinely deeper engagement with public space. Implementing this approach with an interactive touch suits the contemporary city model(Li & Liew, 2015). Thus, it not only requires aesthetic spaces that reflect urban qualities but also seeks to blend social and cultural rhythms that complement and echo the human dimensions of modern life.

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Inculcating non-interactive art causes lack of public engagement. Traditional public sculptures, catch our eye but quickly fade from cognitive. This is often attributed to the passive experience as passive experience potentially prevent the art from truly connecting with an audience that literally walks through it. In the context of Shanghai, social and cultural dynamics are constantly shifting thus, there is growing recognition of the limited impact of non-interactive sculptures. This is especially true for younger generation who are accustomed to interactive and participatory experiences(Taipale, 2021). Thus, this study aimed to explore how public art sculptures can be designed to foster interaction and engagement with the public.

Thereby, this study aimed to achieve the following research objective:

RO1: To explore how public art sculptures can be designed to foster interaction and engagement with the public.

RO2: To investigates the role of interactive elements in sculptures, such as movement, touch, and multimedia components, and their effectiveness in creating meaningful public experiences.

The study would be instrumental in providing the effectiveness of interactive public art, which could greatly advance the field by offering evidence-based data. The findings could help artists create beautiful pieces that attract a broad audience. By focusing on the specific interactive elements common to successful public art installations, this research can offer valuable insights to artists, urban planners, and policymakers. Furthermore, urban planners can use the research to design public spaces that enhance social interaction and foster a sense of community. At the same time, policymakers could also leverage these insights to support cultural initiatives that promote inclusivity, subgroup exchange, and open participation. Thus, the findings of the study could serves as a bridge between people and their environment, strengthening the bonds that connect people with their cities.

Literature Review

Overview of Public Art and Its Evolution

Public art refers to any artistic work created for a public place. According to Asociation for Public Art, these arts are designed to be accessible to everyone and integrated into the environment in which it is located (associationforpublicart.org, n.d.). Public art can take many forms and mediums, including sculptures, murals, installations, performances, and digital media. Contrary to art in galleries, public art exists in the public domain, making it a part of everyday life. Sculpture, perhaps the most recognizable genre of public art, has long been used to commemorate historical figures and events, while murals transform blank urban canvases into vibrant storytelling spaces(Silberman, 2015). On the other hand, installations, whether temporary or permanent, often invite interaction and can transform public spaces into immersive environments. This inclusivity is central to its definition, as public art seeks to engage a broad audience, ideally free from cultural, social, or economic constraints.

Public art has its root in root in ancient civilizations. These early forms of public art served as cultural and political symbols, reflecting societal values and ideas about hierarchy(Sharp et al., 2020). For instances, Terracotta Army from the Qin Dynasty is one of the oldest and most noteworthy examples of public art, serving as a symbol of imperial power and as a guardian for the emperor in the afterlife(Murray, n.d.). However, the public art has undergone evolution, especially, during 20th century(Zhou, 2020). The Communist Party used public art as a tool for political propaganda, thereby, these works were designed to encourage collective and patriotic sentiment, serving the state's ideological purposes. These arts generally included sculptures and murals depicting heroic figures, workers in action, and revolutionary scenes spread across public spaces.

On the other hand, late 20th century saw economic reforms and more exposure to global markets and cultures. Subsequently, public art began to diversify, incorporating more contemporary and abstract forms(Zhou, 2020). Currently, China has gradually shifted towards interactive and participatory forms inculcating new social dynamics and global trends influencing Chinese art. Therefore, transition from

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traditional, state-directed public art to more varied and interactive forms mirrors the broader cultural and economic transformations occurring in Chinese society.

Public art has had a major impact on their development of Chinese cities. The use of public art as a means to beautify cities and foster a sense of community has often been integrated into urban planning(Zhang, 2015). For instances, the 2008 Beijing Olympics served as a catalyst for change, inspiring a surge in public art installations and transforming Beijing into a showcase of contemporary Chinese art and culture(Olympics, 2019). This implies that Chinese government has recognized that public art enhances the livability and cultural vitality of urban areas increasingly dominated by development. In this context, Kochan presented a study exploring the calls for socializing urban development in China(Kochan, 2021). Additionally, initiatives such as the "Shenzhen Biennale of Urbanism and Architecture" weave public art into the cityscape, providing residents with spaces where they can encounter artistic expressions every day, fostering a sense of shared cultural identity. The study further stated that as Chinese cities continue to diversify and develop, public art is expected to play a crucial role in shaping their cultural identity. These examples highlight the close relationship between public art and urban development in China to create distinctive identities and enhance the liveability of urban spaces.

Role of Interactive Elements in Engaging the Public

Interactive elements in public art refer to components that engage people by active participation in the artistic experience. These interactive features fall into three categories: physical interaction, sensory engagement, and digital interfaces. Tzortzi et al. (Tzortzi & Fatah gen. Schieck, 2017) stated that spatial understanding increases the symbolic nature of the art. The authors developed the conclusion based on various case studies. These interactive features fall into three categories: physical interaction, sensory engagement, and digital interfaces. Though the study was based on case studies on museums, it necessarily highlighted the efficiency of the interactive elements in the art. In this context, one excellent example holds the “Jing'an Sculpture Park” in Shanghai which allows viewers to influence installations that respond to their presence and movements(Chun, 2014). Physical interaction involves direct manipulation of the artwork. In this case, when children play around a sculpture or touch it to trigger movements enabling them to change the artwork's form or meaning.

Figure 1. Jing'an Sculpture Park” in Shanghai (Source: Chun, 2014)

On the other hand, sensory engagement includes elements beyond sight, such as sound, light, or tactile stimuli. A study by (Chen et al., 2024) provided a detailed implication of these sensory elements through their investigation using panaromic pictures. The study was unique as it utilized advanced methods to quantify colours in addition to regression analysis for predicting visiting scores. The findings state that integration of natural elements, especially trees, and land use openness/space structures with landscape colour harmony should be seen as a key strategy for designers or planners. The substantial implication of this can be further understood through “The Singing Ringing Tree” in U.K(Jonathan Brind, 2009). It

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produces musical sounds depending on wind conditions, creating a unique auditory experience each time. Another such example includes TeamLab(teamLab, n.d.) in Tokyo which includes technology that allows people to interact with devices or other users through hardware and software components like keypads, screens, and LED lights. Thereby, these arts makes the perception more alluring.

Figure 2. "The Singing Ringing Tree" in Lancashire, England (Source: Flickr, n.d.)

Figure 3. Arts from TeamLabs(teamLab, n.d.)

Previous Studies on Public Art in Urban Spaces

Various previous has presented discussions on art in urban spaces. Wang (2022) conducted an analysis of the spatial environment characteristic of public environmental art. According to the findings of the study, good public art is rooted in its cultural and historical context, encourages public interaction, and considers ecological sustainability. Additionally, it stated that public environmental art sculptures is an essential tool for transforming urban spaces into more balanced environments that engage passersby. Elements like scale, material, and placement are crucial to ensuring that sculptures complement their surroundings and engage the public. The findings also stated that trend has emerged in applying technologies such as GIS to optimize public art placement, ensuring it enhances urban landscapes both visually and environmentally. However, neglect and poor integration can quickly undermine their aesthetic value.

In this context, another review study provide further insight focused on Shanghai(Zheng, 2019). In Shanghai, public art has shifted from traditional monuments to symbols of collective urban reflections. The

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article further states that it has greatly influenced contemporary urbanism as overt political didacticism now subtly accomplishes the same through public implications. However, the review states that the public participation has been limited. The emergence of public art in Shanghai is closely linked with state-led cultural policies, urban planning, and globalization, framing sculptures as tools for city branding and economic prosperity. There has been democratization of monuments which has led portrayals of everyday life and multiculturalism. For instances, the telephone lady on Shanghai Huaihai Middle Road(Zheng, 2019). Additionally, the review found strategically importing global artworks further strengthens Shanghai's reputation for cosmopolitanism. This has aligned with international trends that use public art as a marker of desired aesthetic and ideological futures.

1.1. Gaps in Research

The authors added that the urban cities are mainly divided by functional requirements(Wang, 2022). Therefore the placements of the art forms needs to be unique. On the other hand, the review by Zheng found that despite democratisation there has been limited public participation. Thus, there is a need to understand how public art sculptures can be designed to foster interaction and engagement with the public. Thus the study aimed to explore the role of interactive elements in public art sculptures in shanghai.

Theoretical Framework

This study is developed based on four theories, namely, Relational Aesthetics, Participatory Art Theory, Environmental Psychology, and Cultural Theory. Firstly, relational aesthetics given by Nicolas Bourriaud(Bourriaud, 2020) which highlights the social interactions with art aligns with research objective (RO1). Through its lens, an art is perceived as a catalyst rather than object. This theory aided in emphasizing designing public art that creates opportunities for collective engagement through relational experience. Secondly, participatory art theory provided a perspective directly for the second research objective (RO2). This theory given by Claire Bishop(Bishop, 2023) provided that the participation in art created a creative process. Thus, it provided implications of movement and touch. Thirdly, environmental psychology provided a perspective for both the research objectives. It was an instrumental theory for understanding how these arts can shape the emotional responses from public(Gifford, 2007). Finally, cultural theory provided how interactive elements, such as movement and tactile features in sculptures, can encourage public engagement (Hall, 1997). This can aid in making art accessible.

Methodology

Research Design

This study followed a mixed-method to explore how public art sculptures can be designed to foster interaction and engagement. Given the complexities of motivations for participation and understanding, this approach was well-suited to gain a fuller understanding of how public art sculptures foster interaction(Plano Clark, 2017). Firstly, qualitative approach of the mixed-method included case study analysis which entailed analyzing public artworks in Shanghai. Art entails ideas, personal vision and emotions. Thus, the case studies aid in developing insight on the tangible elements(Sankowski, 1976). Secondly, the study used surveys to measure public responses to these interactive elements. This quantitative data helped to confirm and enrich the qualitative findings, adding a new dimension of information around the research questions(Plano Clark, 2017). In this context, including only survey would have failed to capture the tangible nature of the art works. Complementarily, case studies provided detailed insights into public art's interactive design, implementation, and outcome. Thus, the research design aided in obtaining how public art sculptures can be designed to foster interaction and engagement with the public.

Case Study Selection

This study aligned with specific criteria for selecting case studies. This approach ensured they are representative examples of contemporary interactive public sculpture. Firstly, Shanghai was chosen as the city for these case studies due to its blend of traditional and modern public spaces. Identifying the elements

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of public art, namely, motion, touch, or digital interfacing, public access to the sculptures, and cultural relevance, in the study by Wang (2018)provided the foundation. These elements were crucial because they align with the research objective of exploring how public art fosters connectedness and interaction. These case studies were also culturally significant, reflecting the social and cultural dynamics in Shanghai. Based on these criteria, existing databases such as Google Scholar and EBSCO were utilised. Finally, four articles were selected.

Survey Method

The survey method utilised questionnaires disseminated through online platforms. Questionnaires were developed based on the factors such as public engagement, emotional impact, and the perceived effectiveness of the interactive features. These questionnaires were disseminated through popular channels like WeChat which is popular in Shanghai. This ensured that a diverse population, including both the art enthusiasts and local residents could provide a broad understanding of public sentiment. Thus, the study followed a convenience sampling. Contrary to other sampling methods, convenience sampling ensured that the target population provided the response in the current study(Bryman, 2016). This study included 100 participants through convenience sampling.

Data Analysis

The data from the survey was analysed utilising various statistical methods. This study included dependent variable as impact of interactive element. On the other hand, dependent variables included experiences, interaction and perception. Firstly, descriptive statistics was utilized to understand the basic features of the data, allowing key trends in public engagement, preferences, and emotional responses to be visualized(Bryman, 2016). Secondly, correlation analysis was then used to examine relationships between different variables, such as the type of interactive elements. The quantitative data was then coupled with the qualitative findings from case studies to develop a complementary account of how interactive public art contributes to engagement.

Ethical Considerations

The study followed ethical considerations throughout the research. The names and other personal information were not disclosed in the survey. Moreover, details of the research were comprehensively mentioned at the beginning of the survey for transparency. Additionally, the cases studies developed from existing literatures were properly cited and referenced to avoid any form of plagiarism.

Case Studies

Case Study 1

Augmented Reality (AR) is gradually commonly integrated within the various arts. Song and Zhong (2021) stated that integrating AR into the urban sculptures is a significant transformation whereby, it inculcated dynamic and interactive experiences. The AR entails adding layer to the physical sculptures, creating a dual experience that appeals to multiple senses. The authors stated AR improves user interaction with sculptures, allowing for more immersive experiences through combination of real and virtual realms. A sculpture can change colours, reveal hidden stories, or react to viewers' movements, all through a smartphone or AR glasses. It also encourages the public to return as each encounter with the sculpture can differ based on how the AR content is presented. For instance, people could use AR to view different historical figures or events when looking at a statue. The authors provided example of Dalian city "Rong", whereby, real sculptures were imported with Maya, C4D etc. and produced relative art (Figure 4).

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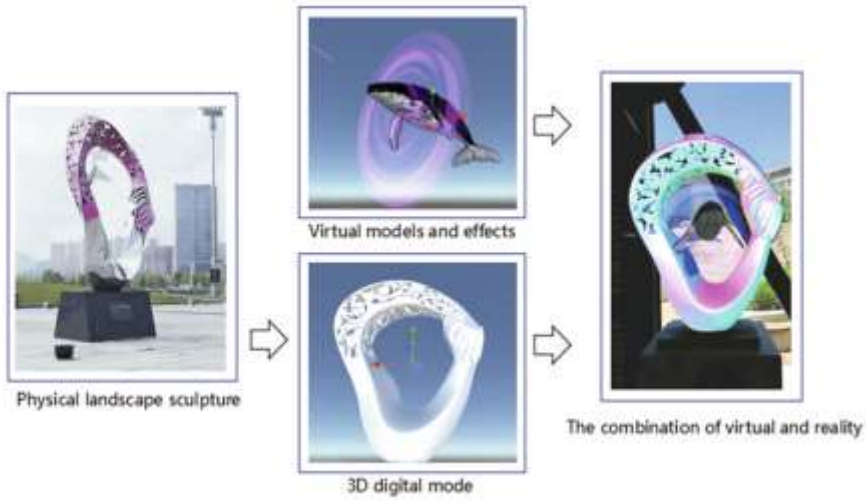

Figure 4. Dalian City "Rong" Sculpture of The Augmented Reality Production Effect (Source: Song & Zhong, 2021)

However, the authors discusses that there can be significant challenges. Most prominent aong it includes lack of technical device, skill or compatible devices. Another challenge identified included that it could reduce its standalone aesthetic value if the digital overlay overwhelm the physical sculpture. Despite the identified challenges, the potential to increase interactivity and renew public interest in urban sculptures makes AR promising.

Case Study 2

The conference paper on 'Research on the Trend of Interaction Design in Public Art' provided an elaborative understanding on the interaction elements. The authors presented an example of Crown Fountain at Chicago's Millennium Park(Zhu, 2021). The fountain features LED screens displaying live video feeds of Chicago residents, with water spurting out of their mouths and cycling into a shallow pool below where people can splash around. This sculptures is designed to encourage public interaction. This interaction goes beyond just water play, creating a deeper bond between the artwork and the public, turning the fountain into a living element of the urban landscape.

Figure 5. Crown Fountain in Chicago (Source: Zhu, 2021)

The authors discusses another such art installed in Lindau, Germany. This utilises facial recognition technology is used to reproduce pedestrians' facial expressions on a large-scale smiley face sculpture. By reflecting the collective emotions of the public, the sculpture offers a shared experience that static sculptures cannot achieve. This art again demonstrates how public art can involve its viewers, making them part of

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the artwork itself. However, interactive public art is yet to mature as the interaction is one-way. This is attributed to the fact pre-determined designs are being executed rather than engaging in a dynamic, two-way exchange. Additionally, technological barriers, such as the need for high-tech sensors and responsive systems, pose challenges. Subsequently, create a disconnection with parts of the public who lack access to or understanding of new technology. However, public sculpture design holds immense potential for fluid evolution with constant input from all sides. Thus, the possibilities offered by interactive public art are vast and may lead to more intimate, meaningful, and participative spaces.

Case Study 3

Various interactive arts has been placed in different parts of Shanghai. In a city like Shanghai, public art has evolved beyond the traditional static installations that once dominated urban landscapes(Yin & Wang, 2020). The authors argues that designing public art with interaction in mind not only enhances aesthetics but also deepens the connection between the artwork and its audience. This is due to the shift that has largely come about through the incorporation of interactive elements, revolutionizing how art is experienced by audiences. The presence of people turns them into active participants, allowing them to co-create their experience with the sculpture.

A notable example cited by the author is a dynamic light installation on the Bund, a historically significant waterfront walkway in Shanghai(Yin & Wang, 2020). The installation adjusts its light patterns according to detected movements transforming the public space into an interactive environment. This interaction is not just a peripheral feature but is central to the artwork itself, encouraging visitors to return repeatedly for continued engagement. Public art that reacts to its surroundings and its audience has the potential to become a permanent fixture in urban culture. It is based on ability to engage with something more than just decoration. This approach not only makes art more accessible to a wider audience but also more relevant. Thus, the art make the experience more personal and impactful.

Case Study 4

Sensors are significantly utilised in the current public art. Sensors could detect when and how viewers are present, triggering changes in the sculpture's form, color, or sound. Song(Song, 2021) suggested adding sensors and VR to make public art more autonomous, shifting it from passive observation to active experience. Thereby, VR technology extends the limits of traditional art by creating fully explorable digital spaces. This dynamic relationship between the artwork and the public means each experience is unique and personal, capturing the audience's interest. Consequently, it encourages repeated visits as the artwork offers something new each time.

VR serves as a medium for art that transcends physical limitations. The VR technology generally entails helmet, glasses, one machine(Song, 2021). Through these equipment physical and virtual art offers a more immersive and engaging experience. For instances, a virtual twin of a park sculpture could allow viewers to fly around it or alter its scale using VR glasses. Such an interaction is impossible in the physical world. However, the study provides that the VR technology involves complex calculations thus highlighting the challenges in integrating these technologies. Subsequently, there is a risk that technology might overwhelm the art, reducing it to a tech demo rather than a meaningful cultural expression. Additionally, expense of VR equipment and the technical know-how required to interact with such art could limit access of portions of society. However, it plays a big role in new forms of cultural participation while enhancing the role of art in public spaces.

Data Findings

The sample constituted 100 participants. Following the demographics of the sample, it was identified that the responses were mostly obtained from the females and the most of the participants were aged 18-29 (Table 1). Additionally, the levels of education varied between graduate and undergraduates while employment varied between employed and self-employed.

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Baseline characteristic	Distribution	
	n	%
Gender		
Female	75.8	75.8
Male	24.2	24.2
Age		
18-29	59	59
30-39	20	20.2
40-49	20	20.2
>50	0	0
Level of Education		
High School	0	0
Graduate	50	50.5
Undergraduate	49	49.5
Postgraduate	0	0
Employment		
Unemployed	0	0
Employed	74	74.7
Self-Employed	25	25.3
Retired	0	0

Table 1. Baseline Characteristics of Demographics (Total Sample, n=100)

The descriptive statistical analysis of the variables in the study was conducted. It was found that most of the participants had mostly positive perception (mean=4.75; S.D.=0.437). While most of the participants agreed that interactive elements enhanced engagements among the public. This observation was substantial as most of the participants had previous interaction with public art (mean=1.18, S.D. = 0.38766). In terms of the impacts, it was found that movable parts, multimedia components, and visual interaction were uniformly impacted, on the other hand, augmented reality was identified to be impactful but not uniformly (Table 2). Furthermore, in terms of what kind of interaction provided most outcomes, digital interaction was most impactful among the other interactive elements.

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	Mean	Std. Deviation
Perception	4.75	.437
Enhance_Engagement	5.00	.000
Impact_Movable_Parts	1.00	.000
Impact_Multimedia_components	1.00	.000
Impact_AR	.67	.474
Impact_Touchsensitive_surfaces	.33	.474
Interactive_Feature_Visual_interaction	1.00	.000
Interactive_Feature_Physical_interaction	.51	.503
Interactive_Feature_Digital_interaction	.84	.370
Interactive_Feature_Auditory_interaction	.49	.503
Future_Preference	1.0000	.00000
Previous_Interaction	1.1818	.38766

Table 2. Mean And Standard Deviations of Variables Included in The Study. (Total Sample=100)

Furthermore, the Pearson's Correlation provided significant overview on the engagement. In terms of the perception and interaction features, it was found that physical and auditory interactions such as, sound, video and lights (Table 3). However, the digital interactions such as augmented reality was found to be less perceived among the participants.

	Previous_Interaction	Familiarity	Perception	Impact_AR	Impact_Touchsensitive_surfaces	Interactive_Feature_Digital_interaction	Interactive_Feature_Physical_interaction	Interactive_Feature_Auditory_interaction
Previous_Interaction	1	0.102	0.033	0.111	-0.111	0.065	-0.005	0.005
Familiarity	0.102	1	-0.007	0.000	0.000	0.017	0.013	-0.013
Perception	0.033	-0.007	1	-0.016	0.016	-.255*	.215*	.575**
Impact_AR	0.111	0.000	-0.016	1	-1.000**	.621**	-0.014	0.014
Impact_Touchsensitive_surfaces	-0.111	0.000	0.016	-1.000**	1	-.621**	0.014	-0.014
Interactive_Feature_Dig	0.065	0.017	-.255*	.621**	-.621**	1	.444**	-.444**

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ital_interacti on								
Interactive_ Feature_Phy sical_interac tion	-0.005	0.013	.215*	-0.014	0.014	.444**	1	.333**
Interactive_ Feature_Au ditory_inter action	0.005	-0.013	.575**	0.014	-0.014	-.444**	.333**	1

Table 3. Correlations Between Interactive Elements and Percepion. Here, Sig. "*" 0.05; "**" 0.01. Note: The Data of Impact on Multimedia, Movable Part and Visual Interaction Could Not Be Computed as Atleast One Variable Was Constant.

The findings support that that physical and audio interaction positively correlate with expectations of the viewers. However, touch-sensitive surfaces and AR have nearly inverse relationships, meaning that focusing too much on one can diminish the impact of the other. Thereby, these elements can significantly enhance user engagement only when presented in a balanced manner. It can be implied that integrating components of touch, sound, and AR can create a holistic public sculpture that is far more engaging than one or two aspects would be in isolation. While movement and multimedia were not directly analyzed, they likely contribute similarly when designed alongside physical and auditory elements in a multi-sensory approach, optimizing the creation of impactful public art experiences.

Findings and Discussions

Designing Public Art Sculptures to Foster Interaction and Engagement with the Public

The case studies in this study provided some significant examples of how public art are currently designed. Subsequently, this study highlighted how interactive elements play a critical role in this. The analysis highlighted that strong preference for digital interactions combined with physical and augmented reality components. This finding was aligned with a case study on TeamLabs which stated that digital art can exist in an evolving and immersive state, capturing public interest.(Ng, 2023). Moreover, the high mean score for the digital interaction highlight that digital interaction is particularly effective in engaging audiences. This is a significant need in the urban environment as city environment harbours various other stimuli as well(Candy & Ferguson, 2014). This is brought about by digital experiences enabling real-time engagement, transforming passive observation into active participation.

According to Relational Aesthetics discussed earlier, enabling the public to physically engage with sculptures, artists can foster a sense of ownership and familiarity. The substantial mean score of familiarity highlights that art more accessible and meaningful to a broader audience. This notion is also supported by the Dalian city "Rong" discussed by Song and Zhong. This insight also aligns with the fact that allowing someone to touch or move parts of the sculpture enhances the sensory experience(Cho, 2021). Consequently, it may create a stronger bond between viewers and the artwork. This highlights how deeply integrating interactive elements into public art can make it more accessible and appealing. Thus, it also allows fulfilling its role as a medium for social interaction and cultural expression.

However, based on the data, it was evident that there can varying effectiveness of different interactive elements. It was found that while movable parts and multimedia were more preferable, other did not resonate as strongly with the public. This implies that there is a need to judge and place site-specific design in interactive public art, recognizing the cultural and social intricacies of each location. For instances, Zhu(Zhu, 2021) stated that interactive public art must be culturally unique to foster genuine engagement

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DOI: https://doi.org/10.62754/joe.v3i7.4303

while being technologically advanced. Moreover, public art can serve as a collective site, bringing diverse groups together through shared experiences(Rendell, 2020). Therefore, while physical touch, multimedia components has been identified as important factors to be considered while designing public art, the environment must also be considered.

Role of Interactive Elements in Sculptures and Their Effectiveness in Creating Meaningful Public Experiences

The most significant interactive elements included physical, visual, auditory, and digital interactions. The case studies implied that each offered distinct modes of interaction that appeal to various senses and preferences. Firstly, this study found that physical contact allowed viewers to become part of the artwork, fostering a more intimate bond between them and the piece. Few significant examples were drawn from the case studies. For instances the touch-sensitive surfaces and moving parts can influence the structure and behavior of the art as observed in Jing'an Sculpture Park in Shanghai. However, the mean for the touch-sensitiveness was low implying that there can be significant variability. While some participants enjoyed this interaction, others found it less engaging. Existing study has found that preference towards colour compositions and other attributes of paintings are influenced by cultures(Nakauchi et al., 2022). Thus, physical interactive elements can enhance the experiences of public but the cultural influences must be considered.

Visual and audio interactive elements were significant factors identified through statistical analysis. Additionally, exposure to colorful light installations, as seen in the Public Face installation observed from the case studies highlight the significant capability of the element. This aligns with theories suggesting that the immediate impact of visual stimuli in art can create emotional reinforcement and enhance the overall experience. Visual elements are universally understandable and can instantly convey emotions and concepts, thereby, making them effective in engaging a broad audience. On the other hand, though sound may rank lower compared to visual and digital interactions, it still significantly enhances the atmosphere, deepening audience engagement. For instances, the singing tree in U.K. discussed earlier in review was an impactful art. This is because, sound is capable of evoking strong emotional responses.

Furthermore, digital interaction was another significant factor identified in this study. The case study on AR in Shanghai's urban sculptures shows how digital interaction can extend the physical boundaries of the artwork. According to study by Liu(Liu, 2021), integrating digital interaction shortens the gap between urban space and people. Additionally, the integration also entails changing the view of public art from the perspective of people. This is also capable of promoting innovating the public art. This interaction allows for a more personalized and interactive experience, enabling users to engage with art in previously impossible ways using digital technology.

However, according to the findings the digital integration could be challenging as they could not be used due to technology backwardness. Additionally, the case studies also identified that the application of these technologies could also lower the quality of art. That is why, identifying the role of each interactive elements, it is essential to find the balance while inculcating the elements.

Conclusion

The study aimed to explore the role of interactive elements in designing public art. Through analyzing case studies and survey data, the research highlights how physical, visual, auditory, and digital interactions uniquely impact audience engagement in urban environments. Among the examples found, the "Rong" installation in Dalian city was one demonstrating how combining digital and physical elements can enhance sensory experiences and strengthen the connection between viewers and the artwork. In addressing how public art can be designed to foster interaction, the results emphasize a strong preference for multimedia, especially when combined with physical or augmented reality (AR) components. The high mean scores for digital interaction underscore its significance, particularly in urban settings where public art competes with various stimuli. However, the study reveals variability in the effectiveness of interactive element.

Journal of Ecohumanism
2024
Volume: 3, No: 7, pp. 1355 – 1369
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i7.4303

Furthermore, participants generally favoured movable components and multimedia interactions over touch-sensitive surfaces or other physical elements. This highlighted the need to consider the environment and audience when designing public art, ensuring that the interactive elements align with local customs and social dynamics. Thus, design of interactive public art must be site-specific, considering the cultural and social context of each location as well. In terms of the role of the interactive elements, physical, visual, auditory, and digital interactions each play unique roles. However, touch-sensitive elements were not uniformly effective, with some participants finding them less engaging, suggesting that cultural influences significantly impact preferences for physical interaction.

While auditory interactions ranked lower than visual and digital ones, they still played a crucial role in enhancing the atmosphere and deepening engagement. The use of colorful light installations highlighted the strong impact of visual stimuli in engaging audiences and creating emotional reinforcement. The "Singing Ringing Tree" installation in the UK demonstrated how sound can evoke powerful emotional responses. Thus, all elements invariably added to the overall impact of the artwork.

Despite the robust findings, this study was limited. The limitations were due to the self-responses in the survey and participant selection. The participants were identified through online whereby, there is a lack of evidence on the real interaction with artwork. Additionally, the case studies selected could be biased thereby, inculcating unintentional bias in the current study. Thereby, future studies could be conducted aligning with broader number of sample size which will also increase generalizability.

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Journal of Ecohumanism
2024
Volume: 3, No: 7, pp. 1355 – 1369
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
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DOI: https://doi.org/10.62754/joe.v3i7.4303

Appendix

Section 1: Demographics

- Age:
- Under 18
- 18-29
- 30-39
- 40-49
- 50 and above
- Gender:
- Male
- Female
- Prefer not to say
- Occupation:
- Student
- Employed
- Self-employed
- Unemployed
- Retired
- Education Level:
- High School
- Undergraduate
- Graduate
- Postgraduate

Section 2: Experience with Public Art in Shanghai

How often do you visit public art installations in Shanghai?

Frequently (Once a week or more)

Occasionally (Once a month)

Rarely (A few times a year)

Never

Are you familiar with interactive public art sculptures in Shanghai?

Yes

No

Section 3: Interaction with Public Art

Have you ever interacted with an interactive public art sculpture in Shanghai?

Yes

No

What type of interactive elements have you encountered in public art sculptures? (Select all that apply)

Touch-sensitive surfaces

Movable parts

Multimedia components (sound, video, lights)

Augmented Reality (AR)

Other (please specify)

Section 4: Perception and Impact of Interactive Elements

On a scale of 1-5, how important do you think interactive elements are in enhancing your experience with public art?

1 (Not important) to 10 (Extremely important)

Which interactive feature(s) do you find most engaging? (Select all that apply)

Physical interaction (e.g., touch, movement)

Visual interaction (e.g., lights, colors)

Auditory interaction (e.g., sound, music)

Digital interaction (e.g., AR, multimedia)

Other (please specify)

Do you believe interactive public art can enhance community engagement in Shanghai?

Strongly agree

Agree

Neutral

Disagree

Strongly disagree

Section 5: Suggestions and Future Directions

Would you like to see more interactive public art in your local area? –

- Yes
- No
- Not sure