Cumulus Beijing CAFA 2023

Volume III Track 3 Design Flow

Cumulus Association

中央美術學院 Central Academy of Fine Arts

CAFA

Narratives of Love

爱的阐释

Narratives of Love
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Preface

Track 3 Design Flow

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CAFA 2023 Conference
Narratives of Love

Li Yufeng
Larry393@126.com
Professor of Central Academy of Fine Arts

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"Crisis and Opportunity"
Throughout the past three years of the COVID-19 pandemic, humanity has shown its remarkable resilience in the face of adversity. However, the relief felt at the end of the pandemic was short-lived as it was quickly overshadowed by the nervousness surrounding the ongoing world crisis. It is now more urgent than ever to re-examine our ecological foundation, lifestyle, production relations, and the meaning of life. The diverse advancements in artificial intelligence have created a dilemma for human self-understanding and the ethics of human-machine interaction, evoking a mixture of hope and fear.With the increasingly intensifying climate warming, cultural conflicts, economic fragmentation, and scientific iteration, how do humans react to standards of morality, ideas of design, thought of art, and methods of education? These common issues in the field of art and design will provide us with important references for strategic adaptation, structural reshaping, and redefinition of values.

"Ideology and Ideality"
Over the ages, "Love", as the matrix of human sensibility and rationality, the enlightenment of ideology and idealism, is the harmony of Tao, nature, and human wisdom. Love permeates every aspect of human civilization. Chinese civilization, Greek civilization, Islamic civilization, Indian civilization, Egyptian civilization, and the Maya civilization, among almost all major cultural systems, unanimously cherish and emphasize the importance of 'Love'.From the symbiosis of humans and nature, the healing of collective traumas, the compatibility of heteroge-

neous perspectives, the stability of social structures, to the innovation of art and culture, "Love" has always been created, interpreted, applied, and disseminated through a harmonious beauty, providing solace to life and nurturing existence. We firmly believe that facing an uncertain future, "Love" will continue to be the immortal energy driving the evolution and progress of human civilization, enduring through the ages and persisting eternally.The current Cumulus Association International Art and Design Conference has chosen "Narrative of Love" as its annual theme. Through the means of art and design, the conference aims to explore and interpret the ideas and forms of "Love" in multiple dimensions, including the individual, family, ethnic group, nation, world, nature, even the supernatural. It will delve into the realms of thoughts and thinking, discussing interdisciplinary topics such as culture and ecology, society and education, policy and economy, science and ethics, philosophy and faith. The conference seeks to gather cross-cultural wisdom to explore the future directions and methodologies of art and design.

"East and West"
Beijing, as the capital of China, stands as a profound embodiment of rich historical heritage, serene ecological surroundings, avant-garde fashion districts, vibrant community life, efficient service systems, and endearing folk traditions. These multifaceted elements have forged a distinctive design culture with worldwide influence, making Beijing an indispensable gateway and an enchanting source of inspiration for global designers, artists, and scholars to experience the essence of Chinese culture and the grandeur of Eastern civilization. We eagerly anticipate the gathering of Cumulus members from around the world in Beijing in November 2023, where we can unite in our efforts to forge a sustainable future imbued with the essence of "Love," igniting passion, motivation, and hope.

Narratives of Love: Towards Healing, Transformation, and Transcendence.

Lorenzo Imbesi
Full Professor, Sapienza University of Rome
President, Cumulus Association

The Cumulus Beijing 2023 Conference, held at the prestigious Central Academy of Fine Arts, represented a significant milestone for the organization. Set against the backdrop of Beijing's rich historical and cultural landscape, the event was notably enriched through satellite conferences hosted at various prestigious institutions, including the Sichuan Fine Arts Institute, Guangzhou Academy of Fine Arts, Xi'an Academy of Fine Arts, Nanjing University of the Arts, Jingdezhen Ceramic Institute, and Xiamen University. This expansion of the conference's reach has significantly transformed it into a vibrant hub for cultural exchange and academic discourse, gathering a diverse array of participants from around the globe, all united by a shared commitment to exploring the intricate interplay of love, design, and social responsibility.

The overarching theme of the conference, "Narratives of Love: Towards Healing, Transformation, and Transcendence," provided a rich tapestry of insights and perspectives, prompting both the international and Chinese design communities to collaborate in efforts to forge a sustainable future imbued with the essence of love. In this context, the notion of love transcends mere emotion; it embodies a profound commitment to social justice, environmental stewardship, and cultural inclusivity.

The multifaceted challenges facing our planet, ranging from cultural conflicts and technological acceleration to social development, demand a heightened level of responsibility from designers and artists. They are called to reconsider how design can serve as a vehicle for positive change, challenging the status quo and addressing pressing global issues. Through thought-provoking discussions and reflections on critical dilemmas, including "Crisis and Opportunity," "Ideology and Ideality," and "East and West," the conference offered a unique platform that resonated globally.

The conference featured numerous paper presentations, panel discussions, keynote speeches, and networking opportunities, all of which collectively generated cross-cultural insights and social reflections on urgent topics, including environmental and ecological issues, societal and local cultural dynamics, policy, and economic considerations, as well as scientific, ethical, philosophical, and faith-based inquiries.

Humanity is currently undergoing unprecedented transformations. In the face of an uncertain future, design actions must increasingly prioritize human self-understanding and the ethics of human-machine interaction, while also providing positive references for strategic adaptation, structural reshaping, and the redefinition of values. Design, as a creative process aimed at solving problems, fulfilling needs, and creating value, must incorporate a multidimensional vision that informs today's actions. New paradigms in design innovation and technologies must reflect a responsibility toward future generations, fostering the blending and coexistence of Eastern and Western artistic and cultural traditions and promoting a flow of consciousness and mutual respect that ultimately nurtures love as a force for unity and understanding.

The proceedings compiled in this volume resonate the interconnectedness of these discussions, conveying a clear message to the global design community: design encompasses multifaceted responsibilities; every decision, ranging from product development to urban planning, carries ethical implications. The substantial attendance from around the globe demonstrated remarkable resilience in the face of adversity, underscoring the necessity to re-examine our ecological foundations, ethics, and values. This highlights the importance of fostering cross-cultural exchange, cross-border community development, and cultural inheritance, ultimately contributing to a new distinctive design culture in which love and design are perceived as catalysts for social change, inspiring individuals and communities to strive toward a more equitable and just society wherein a sense of belonging, diversity, and pluralism are celebrated and where the environment is preserved. Thus, the creation of a more inclusive, dynamic, and cherished global design landscape.

The insights collected in this volume encapsulate only a fraction of the meaningful contributions that the Cumulus Conference Beijing 2023 and its parallel events have offered to address the multifaceted crises of our time. The memories will undoubtedly resonate within the global design community, inspiring ongoing dialogue and collaboration in the pursuit of a better world.

Lorenzo Imbesi is Full Professor of Design at Sapienza University of Rome, where he is the Director of Sapienza Design Research and the Chair of the PhD program in Service Design for the Public Sector. Currently, he serves as the President of the Global Cumulus Association (cumulusassociation.org), the President of the Italian Scientific Design Society SID (societaitalianadesign.it), and a member of the Executive Committee of the European Academy of Design (eadresearch.org).

The Two Main Forms of Design Flow

Hu Hanhua

Central Academy of Fine Arts

In the encompassing material world, everything can take the form of "flow" - be it the flow of people, goods, behavior, emotions, data, and more. Therefore, when discussing this at a conceptual level, the essence of design closely linked to materiality is "flow" - the manifestation of a fluid form of overall consciousness. In the realm of design theory, design flow does not refer to the traditional process of design, from needs analysis, research, detailed design to product launch and sales. Instead, it denotes the study and expression of design values and orientations. It serves as both a design methodology and a crucial task in constructing the underlying values of designers.

The understanding of design flow can easily be seen as a reexamination of the design process. The traditional concept of "flow" is considered a "process," emphasizing a linear thought process and a step-by-step implementation, leading to a "mechanical rationality" outcome. Essentially, we have been persisting in the rationalistic framework since the Enlightenment era, especially prevalent in the field of design. However, the powerful inertia of this thinking, evident today, cannot be simply encompassed or obscured by the simplicity of postmodernist design. More unnoticed drawbacks have made creators prone to fatigue and lethargy in their work.

The synergy between industrial machine civilization and artificial intelligence, as well as information technology, is undoubtedly apparent today and in the foreseeable future. Emerging artificial intelligence and big data models are flattening modernist design, causing certain specialized design sectors to rapidly shift towards artificial intelligence. Through Al and big data, the will of individuals can be effortlessly manifested, allowing everyone to become a "designer." Is this not the democratization of design pursued by the masters of the modernist movement over a century ago? Interestingly, the first and second industrial revolutions were also separated by approximately a hundred years! The advent of new technologies has abruptly placed the century-long operation of modernist design into an entirely new industry context. Traditional design knowledge systems urgently need fresh interpretations and applications to break through mental barriers and foster reflection.

In the creative process of design, design flow can manifest in various forms, deeply influencing, and even determining, the level and boundaries of our creations. It primarily consists of two creative "flow consciousness"components: explicit line flow and implicit line flow, as well as the contradiction flow. These two components have a hierarchical relationship with progression.

I. Design Flow Composed of Explicit and Implicit Lines

German philosopher Arthur Schopenhauer (1788-1860) posited that "the world is my representation." Here, the "I" is not a subject but an entity-will. Similarly, this "representation" is the phenomenon-the world is the

representation of will. Schopenhauer discovered that if one starts the journey toward objective knowledge from the phenomenon, one can never surpass it, remaining confined within appearances. If artistic or design creation is based on phenomenal logic, the conclusion will perpetually be a subjectification of phenomenal logic. We would still be outside things, unable to fathom their inherent nature. Schopenhauer believed that human cognition (including artistic creation) is not only about recognizing the subject but also about the self being among the entities it needs to comprehend. The self is the thing itself, (the "noumena" in Kant's term). Liu Xie, a literary theorist from the Southern Dynasties of China, in his work "Wenxin Diaolong · Yinxiu," approached this from a philosophical perspective, suggesting that "yin" and "xiu" represent a contradictory unity. Liu Xie stated,"Literature knows excellence and concealment. Concealment refers to the profound essence outside the text; excellence is the unique and outstanding within the composition." Concealment implies expressing meanings beyond words, with layered connotations and multiple meanings, while "excellence" is the opposite, requiring a conspicuous and prominent presence.

In design, the creative will and representation can be understood in design epistemology as the implicit and explicit lines of design. They form a "flow" of will, summarized as follows:

1. In the actual process of creative thinking, any will and representation cannot be distinctly separate or independent. Explicit and implicit lines often intertwine, winding upward, continually oscillating (verification or argumentation), integrating into a "whole." This forms a sense of space and time in design, an inherent perception in our subconscious. This "whole" is the framework of thought, a dynamic fluid process, and can also be considered the presentation of the material "whole." Explicit and implicit lines, unlike the relationship between the concrete and the abstract, differ in that they are a dynamic cognitive process, a "flow." It is akin to the constant self-balancing process of flowing water towards the sea, leaning towards the category of design methodology. In contrast, the concrete and the abstract belong to the philosophical category of dialectical unity. They represent two different ways of understanding reality and thought, without emphasizing methods and processes, expressing a philosophical speculative relationship.

2. The Primacy and Subordination of Explicit and Implicit Lines:
In the realm of art creation, there is no absolute balance or uniformity in all things. In artistic creation, we may emphasize implicit lines as primary and explicit lines as "phenomena" or auxiliary, or vice versa, emphasizing explicit lines and neglecting implicit lines. Considering the essence of the first point, we understand that there is no fixed hierarchy or distinction in strength between explicit and implicit lines. This hierarchy is not constant, requiring creators to skillfully manage the proportion between the two or consciously adjust their ratio, being capable of doing so at any moment.

3. Explicit and Implicit Lines Ensure Design Differentiation:
Explicit lines, being relatively stable, have fluctuations but are generally steady. In contrast to explicit lines, understanding and expressing implicit factors in implicit lines are the fundamental guarantee of the differentiation of works. Through clever design, implicit lines can, in specific situations, transform into the so-called explicit lines. However, this transformation needs to be planned at the beginning of the design with suitable design concepts. For instance, this could involve forms with strong suggestive but functional aesthetics. These aspects ensure the differentiation and individualization of design. One of the greatest novelists of 20th-century France, Marcel Proust (1871-1922), believed that writers have two selves: the inner self (implicit lines)

existing in artistic life and the outer self (explicit lines) in real social life. In artistic creation, it's not the external self but the internal self that is at work. According to Proust, these selves "rise powerfully and completely to the surface through non-subjective memory." This understanding aligns with the concepts of concealment and excellence, explicit and implicit.

II. Contradictory Flow in Creation:

In dialectical materialism, contradiction originates from Hegelianism and generally refers to an inherent opposition within a domain, a unified force, or an object. These contradictory elements must exist in objective reality. They do not mutually offset or devour each other but rather practically define and ruthlessly reveal each other's existence. This aligns well with the fundamental viewpoint of existentialist philosophy.

Design fundamentally possesses strong applicability and utility, a key distinction widely acknowledged between art and design. Simultaneously, design carries a pronounced need for autonomous aesthetics. This innate contradiction, viewed by Edward Bullough (1880-1934), involves a relationship between utility (practicality) and distance (beyond practicality) termed "the inherent contradiction of distance." If the creator is too distant from the object, it leans towards idealism; conversely, leaning towards natural realism occurs if the distance is too close. Setting the distance too subjectively is idealism, and setting it too objectively is realism. The management of this distance is precisely the temporal and spatial distance between things and the subject.

1. Contradictory Flow in Opposition and Unity:

Ancient Greek philosopher, mathematician, and father of mathematics Pythagoras believed that mathematics is the foundation of everything. Without mathematics, understanding the physical world is impossible. He asserted that the physical world depends on the interaction forces between opposites, such as up/down, sunny/rainy, etc. According to the Pythagorean view, "existence" implies opposites, containing or depending on opposites.

Opposition and unity exist in reality, determining our creations. Complete balance between them implies stagnation and imbalance in creation (unless deliberately intended). In the creative process, either opposition or unity eventually takes the lead; it just needs time to manifest. Unity is the basic principle that allows any specific opposite to exist as a force against any other opposite, e.g., "closed" can only exist if there is "open,"and "round" cannot exist without"square." They are opposing yet mutually affirming, with one's existence being necessary because the opposite requires it.

Knowing these philosophical principles of creation, we can intentionally exaggerate the opposition in a work, "deliberately disrupt" the unity, or let the imbalance between the two become even more imbalanced, forming a powerful contradictory flow in the creation. This creative philosophy can interpret the majority of artistic or design works. As Parmenides of Elea from the ancient Greek "Eleatic" school said: "Harmony always arises from opposition!"

2.The Dramatic Propelling Force of Contradictory Flow on Artworks:

French literary giant Voltaire believed that every scene in drama must depict a struggle. French drama theorist Brunetière (1849-1906) in his work "The Laws of Drama" also clearly identifies conflict as the essential characteristic of dramatic art. In design, conflict, akin to symbiotic contradictions, is equivalent to the conflicts inherent in drama. Essentially, both serve as the origin of creation! From a certain perspective, dramatic works

are replete with conflict. Conflict arises from various artificially set contradictory flows. It can be said that a drama without conflict is not a good work. In various types of works, the plot depends on the setup of conflicts and is subject to the level of conflict design. Design, much like drama, has designers as the directors of their own works. They need to establish the conflicting parties of "spear" and "shield" at the beginning of the work -without a "spear," there is no "shield," and if there is a "shield," a "spear" is needed. There are mainly two types of contradictory flows:

1) Contradictory Expressions in Artworks Caused by Stream of Consciousness Conflict: This involves the portrayal of conflicts arising from differences in cognition and consciousness within the work. It includes internal contradictions within the work itself (the inner world of the dramatic protagonist), contradictions between the work and the surrounding environment, and contradictions between the work and the non-contact environment, such as in the dramatic works "Thunderstorm" and "Teahouse."

2) Contradictory Expressions in Artworks Caused by Social Contradictions: This includes contradictions between an individual's consciousness and the consciousness of others, as well as the relationship and expressions of contradictions between them and their social attributes. It also involves contradictions between individuals and the social environment, forming a comprehensive contradictory flow. In dramatic works, this is often achieved by "humanizing," "objectifying," or "concretizing" the social environment, the irreconcilable contradictions gradually emerging between them and the protagonist, thus driving the dramatic development of the story. Unlike dramatic works, design works usually appear in a fixed form, requiring the condensation of the contradictory flow into a specific contradictory entity, focusing on key aspects.

In summary, in artistic creation, the juxtaposition and symbiosis of explicit and implicit lines, spear, and shield are crucial means and indicators for giving depth to an artwork. These elements are not isolated within the ideological consciousness of creation but are always and must be pre-existentially present in our creative consciousness in the form of a "flow." This "flow" gradually becomes the subconscious of our design, flowing into the minutiae of the creator's innermost thoughts, providing the audience with a more diverse and multi-perspective artistic enjoyment and experience. This is called the "design flow"!

In design, it is essential to be adept at layout and skillfully establish contradictions, light, and shadow as a three-dimensional dynamic framework and process. It becomes a dynamic adjustment process of artistic thinking and design methods. This is a state in which the things we create and objective things (naturalism)exist, or a fluid state of the coexistence and symbiosis of multiple things.

Trying to Crack the Secret of China's Shared Economy

Li Wei[1], Gong Mei[2]

[1]School of Design, Central Academy of Fine Arts
liwei@cafa.edu.cn
[2]School of Art, California Institute of the Arts
meigong@students.calarts.edu

Abstract

After experiencing a period of rapid development in China, the shared economy has now entered a period of decline. In order to uncover a series of questions surrounding the shared economy, such as "why do so many sharing economy platforms fail", "Why is there a division between the shared economy and the sharing economy" and "Is the traditional sharing of resources a shared economy?". The authors tried to describe three kinds of shared economy models through two sets of words: "owning and using" and "exclusive, shared and sharing". The authors tried to draw the following conclusions through the concrete analysis of the two kinds of lifestyles: The first kind of traditional shared resources mode is the ancient shared economy; The second typeof sharing of personal idle goods is the dynamic shared economy. The third type of conversion of individual ownership into platform ownership is a failed attempt at a shared economy, the core problem of which is excessive reliance on capital. This study is the basis of the authors' series of studies on the shared economy, trying to find out the problems first and then explore new pathways and new methods on this basis.

Keywords

"Own and use"; "exclusive; sharing and shared"; sharing economy; shared economy

Introduction

The concept of the shared economy was first described in a paper <Community Structure and Collaborative Consumption: A Routine Activity Approach gt> by Marcus Felson and Joe L, Spoeth in 1978. That model didn't attract much attention until Brian Chesky and Joe Gebbia founded Airbnb in 2008. And in 2010, Rachel Botsman and Roo Rogers gave a more detailed description of the sharing economy model in their, which promoted the global spread and development of the sharing economy (Ni,2015). Influenced by this,China has also experienced a period of rapid development. In 2017, the transaction volume of China's shared economy reached 490.25 billion yuan (RMB), the financing scale reached 216 billion yuan (RMB), the number of platform employees was 7.16 million, the number of service providers was 70 million, and the number of users was 700 million (Zhang et al., 2019). At the same time, monographs on the theory and practice of shared economy and shared economy emerge in an endless stream: Economic theory (Jiang, 2017); Business Theory (Alvin et al.,2015; Don,2014). Field experience: (Robin 2015; Ma et al., 2016); Summary of experience: (Cao, 2015; Guo, 2016; Zhang, 2016; Craig, 2016). But at the present time, fewer and fewer people pay attention to the shared economy, and only few shared economy platforms barely survive. Why do so many shared economy platforms fail? (Zhang et al.,2019). Why

is there a division between the shared economy and shared economy? Is traditional resource sharing a shared economy?

Methodology

In order to study the related issues surrounding the shared economy, the authors first tried to simplify the economic model with two sets of easy to understand words. The two groups of words are "to own and to use";"exclusive, shared and sharing". Group 1 "to own" means to possess, have, get, or keep something; To use means to put people, money, etc. to work for an end. The former focuses on the holding state; The latter focuses on getting results. Related terms include "ownership" and "right to use" (Ma et al., 2016; Ling, 2017). Another group of "exclusives" are individuals who own and use them alone; "Sharing" is personal ownership, allowing others to use; "Shared" is shared ownership, shared use. The authors tried to use these two sets of words to crack the complex economic model, so that the problem becomes clear.

Business models in the real world are very rich and not static (Mitani, 2015). In order to summarize the typical economic model for analysis, the authors condensed the social development system into four stages: First, the pre-civilized society was located as the first stage, where the ancestors were full of reverence for nature, they defended and owned a living area in order to obtain the right to use, for which the people must unite and share resources. For the sake of simplifying the work, the authors have positioned the entire agrarian and nomadic civilization of the past as the second stage, because during this relatively long period, human beings actually lived in a barbaric and predatory society in order to own and control resources. (Stanley et al.,2014; Raul et al.,2023); In this stage, the upper class monopolized resources and maintained the survival of the lower class by sharing the right to use them. The third stage is from the Industrial revolution in Britain to the present, the society is relatively civilized and individuals are encouraged to obtain the ability to own resources through competition. At the same time, they share the fruits exclusively and maintain the government's ability to return the shared social public resources to the society through taxation (Rachel et al. 2015). The fourth stage focuses on exploring the current new economic model, which mainly benefits from a series of scientific and technological advances such as the Internet, big data and intelligence, which greatly promote social exchanges and make information more smooth and convenient. This creates conditions for individuals to share what they have with others. As the audience can completely "use rather than own" (Jiang, 2017). For example, shared living Airbnb, shared travel Uber and so on.

It is significant to note that not all sharing of personal items is successful, that even the best economic and social systems can be "gamed" (W, 2023). The real world can be described as a near-death experience. For the sake of facilitating the study of the shared economy, the authors finally summarized three types of typical economic models related to sharing: 1, traditional sharing resources model; 2, Sharing personal idle goods model; And 3, transforming personal ownership into platform ownership model. In the following, the author will analyze the two types of lifestyles in daily life, short-term rental living and short-distance travel, and concretely show how the two groups of words show the differences between the three typical sharing economy models, so as to find out the deep reasons for the decline of the sharing economy.

Discussion

Firstly, we use two sets of words to generate interpretable descriptions of short-term rental with reference to the three classical economic models. The first type of traditional shared resources model is to rent in hotels and restaurants. This type of rent-for-rent lifestyle has existed since ancient times, requiring the owner to invest

upfront to create a dedicated space for public use. This kind of traditional economic model with shared value has the advantage of scale, but the disadvantage is that the investment has a certain risk. The second type of sharing of personal idle items is to share the living space owned by individuals with others for the purose of generating income or expanding communication. The advantages of this new way of sharing economy are convenience and human touch and the downside is the privacy of renters and the sense of constraint that renters feel, such as Airbnb's early development model (Tom, 2017). The third type of conversion of personal ownership into the platform ownership model is to transform the idle space owned by individuals into a relatively independent service space for the purpose of generating revenue. The advantage of this new model is that the assets are revitalized, and the operators are divided into two kinds: one is the actual owner of the space while they could often gradually generate income with a good attitude after investing appropriate space transformation funds. The other is "the second landlord", which chooses the area suitable for operation to rent and transform the living conditions to achieve commercial purposes, but this is a test of comprehensive ability. The disadvantage is that the benefits are not controllable. After all, "the second landlord" invests a certain amount of capital, at least a few called homestays, more than a few floors or a hotel, such as Home Inn Hotel Group, 7 Days Inn, etc., which has basically the nature of a hotel but the space is rented rather than owned.Airbnb now has a large number of such listings. From the above three types of short-term rental methods, the first and third types belong to the shared economy due to the direct owners of the space or the indirect"the second landlord" with the sole purpose of providing rental space. The second category belongs to the sharing economy while the space is the owners' priority to their own living with due consideration for the tenant experience. The second group is now the beneficiary of changing times and it's exactly the reason forAirbnb's success. The first group belongs to the victims of partition, while the third category is asset-light but its effectiveness depends on operational capacity. With the development of the operation, the third group has a tendency to over-rely on capital and gradually become "primitive, naked capitalism". (Steven, 2017)

Now let's take another kind of short trip and use the three classical economic models to generate two sets of words that can be interpreted. The first type of traditional shared resources model is the public transportation system that replaces walking for traditional short trips. In this model, the government or commercial platform invests in and owns the infrastructure, and the public uses it for free or for a fee. The advantage is convenient support due to the shortage in the rush hour queue but which cannot always meet the demands of the single. The second type of sharing of personal idle items is that with the impact of the shared economy and the help of information technology, private cars owned by individuals can be shared with the public through the sharing platform. Like Zipcar, Uber and DiDi. (Robin, 2015). The advantage of this model is that it solves the limitations of taxis in the past and revitalizes social resources. The actual operating platform does not own the car, and the owner chooses whether to provide the service for passengers according to his own situation. This model has been a disaster for taxi companies but a boon for consumers. Because of its obvious advantages, it has been sought after by capital once it was published. The search for market share has become the platform's focus, in the words of Steven Hill, author of RAW DEAL, "to use its greedy claws to wipe out all competitors and take the top spot in the sharing industry." (Steven, 2017). The third type of personal ownership into a platform ownership model is to solve the one-kilometer shared travel "shared bike". The difference between this model and sharing a personally owned car or home is that the platform must own the resources and users only need to pay a deposit to use them. In the early stage of its development, there are two types of products, Ofo and Mobike, of which Ofo is a traditional bicycle with intelligent lock while Mobike has reinvented parts like tires for sharing.The former is more like sharing private bicycles with others. If it is OK on campus once it enters the broad society, the latter

maintenance cost will be amazing. It is precisely because of the differences in the team's cognition of the shared economy that the fate of Ofo is more bumpy than that of Mobike. In fact, Mobike and the United States Group that acquired it in the later period are not winners. According to a ZAKER News article entitled "Shared bicycle price is criticized, it is better to buy a bicycle," revealed: from 23:00 on August 10, 2022, the 90-day free discount price of Meituan Bicycle riding card will be adjusted from 60 yuan to 90 yuan (RMB)..... The three shared bike head platforms are still in a bleeding development. Hellobike suffered a total loss of 4.841 billion yuan (RMB) in the three years from 2018 to 2020, Mobike under Meituan also lost nearly 5 billion yuan(RMB) in the three years, and Qingke under DiDi suffered a loss of up to 30 billion yuan (RMB) in 2021. Why is the same sharing economy model to solve the travel problem? Is DiDi's cars much better than Meituan's bicycles?

The authors further refined and sorted out the differences between the three models:the first type of traditional shared resources model can be implemented by relying on the considerable strength of the operator. That is to say, it can save enough money by itself or borrow and own assets. Although this type of model is a heavy asset with certain risks, it will gradually recover costs and create profits as long as it is well operated. The second type of sharing of personal idle goods promotes the creation of new value for personal idle goods. The platform doesn't own the assets, it just charges fees in between. For the time being, although the development of such enterprises has many problems and needs to be improved, the overall situation is still developing steadily.The third type of personal ownership into the platform ownership model is more prominent. The new sharing economy needs to rely on the platform operation so that it first needs to inject funds in order to have the ability to serve users, which used to be personal accumulation and how much ability to do bigger things. Now through the input of venture capital it can quickly have the ability to capture more users, but the cost is to enter the cycle of being kidnapped by capital. At present, due to the gradual decline of the sharing economy, the research enthusiasm has declined significantly so that few research monographs have come out to reflect on the problem. However, we can still obtain a large number of critical and reflective essays through the Internet platform. After collecting and analyzing a number of viewpoints, the authors selected an article entitled "We have studied hundreds of sharing projects and summarized the five reasons for failure" to share with you.

The authors summarized the problems as follows: 1, Most of them are entrepreneurial projects, which rely heavily on capital and lack absolute right to speak; 2, Lack of innovation and differentiation; 3, False demand cannot withstand the market's test; 4, The development is striding too fast and too fierce, resulting in excess supply, waste of resources, contrary to the original intention of sharing; 5, There are also some projects that are completely designed to attract attention, hype, and hot-points, and they have no intention of success from the beginning. The authors believe that there are indeed many problems in various transformation modes. But in terms of various internal and external factors, the authors believe that the core problem is: All the third type of sharing economy that transforms personal ownership into a platform ownership model, whether it is expensive to jewelry, clothing, bicycles or strollers, or cheap folding stools, basketball, umbrella or power bank. Because the platform wants to quickly seize the market with capital for owning resources, so at present none of them is satisfactory to investors. Because capital is for the purpose of profit, reflects the capital's "selfish" world view,"insatiable" values. Venture capital is a double-edged sword, do not rely on it, and cannot quickly occupy the market, but once kidnapped, it is a short-sighted tool to make money. Often in the name of the public, startups are actually more concerned about beautiful data. All to-go-public as the ultimate goal, once successful, either lose morale, or become a track for a larger capital game. For the moment, the commercial scale of the third type of sharing economy model is simply not in the eye of capitalists, so the current downturn in the sharing economy

is more normal. If you want to comprehend the sharing economy now, it is difficult to find such books in physical bookstores. And if you buy new books online, many of them are discounted by two percent.

Conclusion

1. Through the two sets of words "own and use" and "exclusive, shared and sharing", the complex economic model is simply described into three models related to the sharing economy: the first type of traditional shared resources model; The second type of sharing personal idle goods mode; The third category transforms individual ownership into platform ownership.

2. The first type of traditional shared resources model also belongs to the category of shared economy,and has existed in ancient times. Although it needs to allocate heavy assets and will be affected by the new economic model, it can be predicted that it will still have vitality in the future for a long time.

3. The second type of sharing personal idle goods model is a new kind of economic model generated by the age of information and the Internet, but it can only be called "shared". With the intensification of competition, its greedy nature will be revealed. Whether it can control the monster is unknown, but it is certain that this model is not the shared economy.

4. The third category,transforming individual ownership into platform ownership, is a valuable experiment in the shared economy, but it has failed. The root of the problem is to try to build a platform for sharing economy under the logicof shared economy. Because it does not have the strength of the traditional shared resource model, the operation model of quick success has prematurely destroyed the lives of countless startup companies.

5. With the development of society, people have realized that the traditional way of life and economic model can no longer make the society develop in a more sustainable direction. Human beings need to explore new ways of life and economic models. It is not that everyone must own first in order to use, but a new sharing economy model with common ownership and shared use can be explored. Given space constraints, who, at what stage in life,should try to use only rather than own? What types of things will they use? What is a new sharing economy model that can fulill the above needs? We will gradually share our thinking and practice with you in the future.

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Shanshui Architecture: An Evolution of Tradition?

Guo Xi[1], Han Tao[2]

[1]Central Academy of Fine Arts
arcxi@foxmail.com
[2]Central Academy of Fine Arts
thanlab@163.com

Abstract
Since the beginning of the 21st century, a large number of Chinese architects have started to engage in architectural creation and discourse construction centered around the theme of traditional Chinese 'shanshui' culture. This raises three related questions: first, can 'shanshui architecture' be used to summarize the phenomena that have already occurred as a 'trend'? Second, how did 'shanshui culture' become the intrinsic gene of 'shanshui architecture'? Third, what is the significance of 'shanshui architecture' for the future construction of China's discourse system? This article examines the overall historical evolution from 'shanshui culture' to 'shanshui city' to 'shanshui architecture' from the perspectives of shanshui concepts, shanshui images, and shanshui gardens. The research finds that the contemporary Chinese 'shanshui architecture' trend has preliminary theoretical conditions and has accumulated the potential to trigger a movement of Chinese shanshui architecture, thereby contributing to the construction of a contemporary Chinese architectural discourse system with genuine Chinese cultural genes.

Keywords
Shanshui Architecture; Shanshui Culture; Shanshui City; Shanshui Garden; Architectural Trend

Introduction:"Shanshui" has become a key term in contemporary Chinese architecture.
Since the beginning of the 21st century, a large number of contemporary Chinese architects have begun to explore and practice contemporary Chinese architecture with the relationship between architecture and nature as a clue, one of the keywords being "shanshui". Architectural creations themed around "shanshui" are presenting an increasingly recognizable appearance. Represented by a group of important contemporary architects and scholars such as Wang Shu, Zhang Yonghe, Liu Jiakun, Ma Yansong, Zhu Pei, Amateur Architecture Studio, Li Xinggang, Dong Yugan, etc., although their individual cases vary in function, type, form, and style, and have not yet been clearly summarized as a school or trend, the citation and transformation of traditional shanshui thought resources have become a cultural attitude and underlying logic that they commonly pursue. At the same time, a new generation of architectural historians and theorists, such as Feng Shida, Li Xiangning, Lu Andong, Jin Qiuye, Wang Xin, and architects who are also engaged in theoretical writing, such as Wang Shu, Zhang Yonghe, Dong Yugan, Ge Ming, Gu Kai, etc., have all conducted necessary in-depth thinking on certain specific themes and topics of "shanshui" architecture.

In response to the current changes, can we use "shanshui architecture" to summarize them as a "trend" or

"theoretical summary"? If so, how can we trace back from a historical dimension how the "shanshui tradition" became the cultural gene and academic path of the "shanshui architecture" trend? How to judge the national significance of "shanshui architecture" for the future construction of China's discourse system? If not, under what conditions can "shanshui architecture" be called a trend or theory? What do we already have, and what do we still need to build? This article will make broad-brush considerations on these issues through historical sorting: first, it examines the three levels of traditional Chinese shanshui culture: shanshui concept, shanshui image, and shanshui garden; then it examines the three dimensions of modern Chinese shanshui city: modernization dimension, human settlement dimension, and architectural dimension; finally, it examines the internal contradictions and tensions of contemporary shanshui architectural theory discourse, as well as judgments on the revelations for the future.

1.The Three Levels and Evolution of Shanshui Culture

1.1 The Rise and Evolution of Shanshui Concept

The "Shanshui Concept" in China can be traced back to the ancient worship of mountain and water deities. Natural landscapes were important objects of worship before the Qin Dynasty, and the worship of these landscapes also gave rise to the concept of the relationship between humans and nature. For example, Laozi's philosophical view of "Man follows the earth, the earth follows the heaven, the heaven follows the Dao, and the Dao follows nature" suggests that nature here is not only the natural world that is not human, but also carries the meaning of being free and natural. Confucius' saying "The wise find pleasure in water; the virtuous find pleasure in mountains" became an important concept influencing the aesthetics of nature in later generations, embodying the ancient Chinese philosophical view of "unity of man and nature" and summarizing the main spirit of ancient Chinese aesthetic culture. There is also Zhuangzi's aesthetic way of "body and object transformation". During the Wei Jin, the literati of the gentry class often traveled to mountains and rivers, chanting poems, practicing Zen, and discussing metaphysical principles, giving birth to landscape poetry and landscape painting. In this period, the relationship between humans and nature evolved from religious worship to philosophical contemplation and then to cultural aesthetics, and natural landscapes began to become independent aesthetic objects. Poets like Tao Yuanming and Xie Lingyun have already used landscapes as objects of cultural aesthetics and ideal sustenance, and people began to infuse personal ideals into the Dao of landscapes and nature, seeking a space for spiritual habitation.(Ninggao, 199) This shift in aesthetic approach has opened up new dimensions for the development of shanshui imagery and shanshui gardens.

1.2 The Rise and Evolution of Shanshui Imagery

The "Shanshui Imagery" can be traced back to the ancient maps depicting geographical landscapes and cityscapes, from the early "man is greater than the mountain" to the Southern Dynasty Zong Bing's landscape painting theory "Painting Shanshui Preface" proposing "to charm the Dao with form", "reclining travel",and "unleashing the spirit" as markers, giving shanshui painting an independent aesthetic character. During the Sui and Tang Dynasties, shanshui painting matured, and blue-green shanshui and ink shanshui pushed shanshui painting to new heights. During the Northern Song Dynasty, Guo Xi's " The Lofty Message of Forests and Streams" proposed the "three distances method" of "high distance, deep distance, and level distance", pioneering the observation of landscapes and scattered point perspective. Through multiple viewing methods such as looking up, looking straight, and looking down, he defined the spatial composition and formal principles of landscape painting. The shanshui painting not only needs to be walkable and viewable in form, but also needs to have a sense of space, so that literati and scholars can live in it and travel leisurely, in order to entrust the realm

of seclusion in the mountains and wilds. By the Ming Dynasty, literati paintings of ink shanshui emphasized "painting with poetry, painting with books, and painting with Zen", pursuing pleasure rather than resemblance. The brush and ink of landscapes are separated from "object meaning" and seek "heart meaning", becoming the expression of the painter's spirit. (Cahill, 2009) Gu Kai of Southeast University School ofArchitecture believes that Dong Qichang's shanshui painting can be regarded as the recognition of "gardening and painting interconnected" and "painting is gardening" in the literati concept. (Kai, 2010) Shanshui painting, as a thought experiment for gardening activities, will continue to stimulate the practice of shanshui gardens and foreshadows the intertwined relationship between shanshui culture and architectural practice in the 21 stcentury.

1.3 The Rise and Evolution of Shanshui Gardens

The development of "Shanshui Gardens" can be traced back to a thousand years ago, the "Book of Poetry" has descriptions of the Lingtai and Lingzhao at the end of the Shang Dynasty. From the Qi Garden built during the Western Zhou Dynasty, to the gardens of the lords during the Spring and Autumn Period, to the gardens of the Qin and Han Dynasties, all have "mountains, stones, trees, and ponds, terraces and pavilions", and have the basic form of a shanshui garden. During the Liu Song period, with the emergence of shanshui poetry and painting, the literati also pursued natural shanshui gardens, with the reproduction of natural landscapes as the aesthetic pursuit, "as if natural". By the Tang Dynasty, the aesthetic of landscape culture had become the lifestyle of the literati.Wang Wei built the Wangchuan Villa shanshui garden, wrote the "Wangchuan Villa" shanshui poem, and painted the "Wangchuan shanshui painting". From Wang Wei, we can see the mutual penetration and combination of the literati's poetry, painting, and garden building under the influence of shanshui thought. During the Song and Yuan Dynasties, from Su Shi's management of the "West Lake" and repair of the "Su Causeway", to Chao Wujiu's "Returning Garden", literati and painters built gardens, "reaching the peak". By the Ming and Qing Dynasties, shanshui gardening had transformed into being mainly presided over by professional garden builders, such as the earliest recorded professional garden builders Lu DieShan, Ji Cheng, Zhang Nan Yuan, and others. Although literati painters still participated in garden building, they gradually transformed into depicting and expressing gardens, such as Wen Zhengming's "HumbleAdministrator's Garden Painting Song", Shen Zhou's "Dongzhuang Painting", etc., and the shanshui garden itself became the aesthetic object of literati painters. After the death of Ge Yuliang, the garden builder of the greatest stacked mountain in the shanshui garden, the Opium War broke out, marking the end of ancient Chinese history, and the art of shanshui gardening also declined and was interrupted. (Xun, 2019)The subsequent revival of shanshui gardens will intervene in the contemporary architectural system in multiple dimensions such as cities, habitats, and architecture.

2.The Rise and Development of Shanshui Cities: Discontinuity and Continuity

The frequent wars in the early 20th century and the construction of the national state during the Republic of China period led to a structural decline in traditional shanshui culture, but its ideological genes still exist. Liang Sicheng represents the discontinuous continuity of the official system, while Tong Jun and Liu Dunzhen's garden research in the 1930s represents the discontinuous continuity of the literati system. In the late 20 thcentury, shanshui culture achieved new developments in the dimension of shanshui cities, manifested as three distinct and continuous paths represented by Qian Xuesen, Wu Liangyong,and Ma Yansong.

2.1 Qian Xuesen's Shanshui City: Urbanization of Shanshui

In the 1950s, Qian Xuesen started with garden studies, and by the 1990s, he proposed the concept of shanshui city, linking the future urban development model with the concept of shanshui gardens. (Mengchao, 2000) In his

letter to Wu Liangyong on July 31 of that year, Qian Xuesen mentioned, "I have been thinking about a question in recent years: Can we integrate Chinese shanshui poetry, Chinese classical garden architecture, andChinese shanshui painting to create the concept of 'shanshui city'? In this way, people can leave nature and return to nature." (Shixing, 2000)Qian Xuesen proposed that China's urban construction should turn the city into a super-large garden, a man-made shanshui, that is, a "shanshui city", which promoted the "Shanshui City Discussion Meeting", prompted Chinese architecture to reflect on various problems of modern architecture and urban development models, and continued the ideological resources of China's traditional shanshui culture for thousands of years, becoming a beneficial exploration in response to the theme of the times. The proposal of Qian Xuesen's shanshui city concept also provides a theoretical reference for the future practice of architects such as Wu Liangyong and Ma Yansong.

2.2 Wu Liangyong's Shanshui City: Humanization of Shanshui

Wu Liangyong believes that shanshui city and human settlement environment research have a common pursuit, discussing not only aesthetics, but also a series of issues such as ecology, cultural context, and urban development. (Liangyong, 2003) In addition to the above understanding of "shanshui", there is also the"Art of Shanshui", which is a comprehensive feng shui theory that combines geography, meteorology, landscape studies, ecology, urban architecture and other aspects, emphasizing the philosophical view of "unity of man and nature", studying the natural shanshui orientation, defining the geography of rivers and mountains, urban site layout, village and town residential planning, which is a knowledge that combines philosophy and aesthetics. Large-scale cities or architectural groups in ancient China were all completed under the guidance of this "Art of Shanshui" feng shui theory. Wu Liangyong's research on the living environment is comprehensive, and shanshui culture is incorporated into the research system of contemporary architecture.

2.3 Ma Yansong's Shanshui City: Architecturalization of Shanshui

From Qian Xuesen's shanshui city, to Wu Liangyong's human settlement studies, to Ma Yansong's architectural manifesto "Shanshui City" published in 2014. The transformation from the discontinuity of architectural studies to the practice of contemporary architectural studies has been completed. Ma Yansong further thought and explored the concept of shanshui city along Qian Xuesen's line of thought. He believes that the idea of shanshui city is a call for natural life, which comes from a spiritual guidance. He believes that classical cities are about gods, modern cities are about capital and rights, and future cities should be about people and nature. This is the concept of "shanshui city" proposed by Ma Yansong. (Yansong, 2014) Ma Yansong's shanshui city directly points to contemporary practice, opening up new practical dimensions for the intertwining of shanshui culture and contemporary architecture.

3.Shanshui Architecture's Diverse Practices and Internal Tensions

3.1 Diverse Practices of "Shanshui Architecture": Analysis of Four Paths

If the development of shanshui culture since the Qin and Han dynasties has a vague correlation with the medium or carrier, the earliest appearance is the non-material shanshui of thought, such as the philosophical views of Confucius and Laozi, followed by shanshui poetry and shanshui painting in the form of painting, and then the material shanshui garden. Qian Xuesen's concept of shanshui city further magnifies the material scale of shanshui to a larger artificial environment, and shanshui architecture as a medium-scale material shanshui being discussed and defined is an inevitable result, making shanshui city, shanshui garden, shanshui image, and shanshui concept all converge into the contemporary "shanshui architecture" trend within the architectural profession.

Dong Yugan: The Path Mainly Based on Shanshui Gardens

Shanshui gardens have the most direct impact on contemporary architects, such as Dong Yugan's "Modernity of Gardens", all draw inspiration directly from shanshui gardens. Dong Yugan believes that Western architectural studies are centered on the architectural entity, while in China's shanshui gardens, the relationship between architecture, nature, and people becomes the focus, so it can break away from the integrity of architecture, architectural proportions and other issues, and reopen the imagination of space. (Yugan, 2006)Dong Yugan's Qingshui Clubhouse, Red Brik Art Museum and other practical works draw inspiration from shanshui culture, focusing on the shanshui experience of people in them, but it is difficult to directly judge the relationship between its architecture and shanshui from the appearance. In the research field, Ge Ming takes "garden as a method", uses the tree-stone structure of the garden as a way to study space, and summarizes the "Six Rules ofGardens".(Ming, 2015) Tong Ming believes that we need to "look back at the garden", because the significance of shanshui culture to contemporary architecture is not only to create a realm, but also to rethink the cognition of the living environment. Shanshui gardens, as a method, also influence the practice and research of contemporary architecture, and the same is true for shanshui imagery.

Wang Shu: The Path Mainly Based on Shanshui lmagery

In 2012, Wang Shu published "We are in Need of Reentering a Natural Philosophy", proposing to "rebuild a contemporary Chinese local architectural studies", advocating the human geography of the natural way and "mountain" "water" as the poetic background, (Shu, 2012) his representative work Ningbo Museum's "Big Mountain Method", China Academy of Art Xiangshan Campus "architecture occupies half, nature occupies the other half" layout, all reflect that Wang Shu's thinking about shanshui culture has deeply penetrated into his practice. Wang Shu's "Return to the Way of Nature" was inspired by shanshui gardens, and was also greatly influenced by shanshui paintings. In addition to Wang Shu, shanshui imagery also influenced a large number of architects' works including Da She's "Sensitive Urbanity", Li Xinggang's "Scenery and Geometry",and Wang Xin's "An Architecture Towards Shanshui" teaching research. Wang Xin's " Arcadia" teaching is a shanshui thought experiment. Traditional shanshui paintings have always stimulated garden practice, and in contemporary times, Wang Xin uses the method of "paper garden" to try to keep shanshui culture always parallel and complementary to architectural practice. (Xin, 2016)Shanshui imagery and shanshui gardens"communicate with each other in gardens and paintings", jointly promoting the experimental and experiential nature of contemporary architecture, while the impact of shanshui concepts on contemporary architecture is different.

Zhu Pei: The Path Mainly Based on Shanshui Concept

Shanshui concept has influencd many architects, represented by Zhu Pei's "Natural Architecture",who pay more attention to the environment and the rules and attitudes behind construction. The architecture influenced by shanshui culture shows a diverse focus on ecology, form, space, environment, and construction logic. Different from the pursuit of shanshui experience or shanshui form, Zhu Pei's "Natural Architecture" pursues an architectural attitude influenced by climate, natural environment, and tradiional factors. It is difficult to experience a direct relationship with Chinese shanshui from its architectural space, and it does not focus on the shaping of shanshui form. Xin Saibo believes that Zhu Pei's "Natural Architecture", in addition to the dimension of natural ecology, points more to the Taoist "natural" shanshui construction philosophy. (Saibo, 2021) If shanshui gardens and shanshui imagery pay more attention to the spatial experience of architecture, and the architecture influenced by shanshui concepts pays more attention to the construction logic and attitude of architecture, then the architecture of Ma Yansong under the influence of shanshui city pays more attention to the shanshui form

of architecture. The analysis of shanshui experience, shanshui form, and shanshui construction only focuses on some aspects of the architect's works, and the practice works in reality involve more complex and diverse dimensions of shanshui culture.

Ma Yansong: The Path Mainly Based on Shanshui City

Different from the experiential shanshui architecture, Ma Yansong's architecture obviously has more shanshui form. He believes that the architecture of shanshui form is anorganism that generates emotional connections between nature and people, and is a call to nature and life. Gu Mengchao believes that Ma Yansong's formulation accurately grasps the tradition of Chinese shanshui architecture, and shanshui is man-made second nature. However, when Zhang Yonghe once evaluated Ma Yansong's shanshui-shaped architecture, he believed that its form was superficial. Li Xiangning believes that Ma Yansong's large-scale, high-density man-made shanshui city is a rebellion, resisting the rapid urbanization status quo with the pursuit of shanshui nature,(Xiangning, 2014) while Wang Mingxian believes that Ma Yansong's shanshui city concept is a imaginative prophecy for the future city. (Mingxian, 2014) The four contemporary architectural practice paths of shanshui culture, including Ma Yansong's shanshui city, have created a new situation for Chinese architectural studies that is completely different from the 20th century Chinese architectural studies.

3.2 The internal tension of "Shanshui Architecture": Wang Mingxian's question

Wang Mingxian's question: Ancient and modern, East and West.

In 2014, Wang Mingxian pointed out in the article "a Conversation with the Nature: Righteousness ought to be included in discussion of future urban culture" that since the first modern architectural work "Building Construction" was published in China in 1910, China's modern architecture has a history of more than 100 years. However, in the 20th century, Chinese architectural studies did not propose architectural thoughts with global influence, and the Chinese architectural community did not appear similar to Japan's "Metabolism" movement that had a significant impact on world architectural studies in the 1960s. (Mingxian, 2014) In response to the critical question raised by Wang Mingxian from the macro perspective of Eastern and Western cultures onChinese architectural studies, we should start from the current situation of architectural practice and research of contemporary shanshui culture and try to make a preliminary response. Although Chinese architectural studies did not appear to have a significant impact on the architectural movement in the 20th century, since the21st century, a large number of contemporary Chinese architects and scholars have shown a common cultural consciousness and the underlying logic of creation, and have already had a considerable range of influence and intellectual depth. So how should we define the practice and creation of such a group of architects and scholars? The author is willing to summarize it as a "shanshui architecture" trend.

Shanshui Architecture has risen as a Recognizable Trend

The exploration of "Shanshui Architecture" began to emerge in the 1990s, and in the past decade of many architectural theories and creative practices, it has gradually developed into a focused research topic. Shanshui architecture has risen as a recognizable trend in future Chinese architectural studies and has accumulated the energy that may give birth to the Chinese shanshui architectural movement. Shanshui architecture not only has a wide cultural impact due to its large number of creations on the theme of shanshui, making it comparable to the architectural trends of other countries in the world; also because shanshui culture has a profound accumulation spanning thousands of years in China, and it has had an extremely wide-ranging impact in the fields of Chinese thought, culture, art, and construction., contemporary shanshui architecture as a continuation of the

development of shanshui culture for thousands of years, so its internal cultural driving force is inexhaustible, Chinese shanshui architectural trend will have a more lasting cultural vitality.

Conclusion: From shanshui culture, to shanshui city, to shanshui architecture

The trend of shanshui architecture has gone through the evolution from shanshui culture to shanshui city and then to shanshui architecture. If the creations of a large number of contemporary architects and scholars about "shanshui" are interpreted as a design flow, there is no doubt that its source comes from the shanshui culture that has been around for thousands of years. The intellectual resources and cultural drive of contemporary "shanshui" architectural creation all come from this. The rise and development of shanshui architecture will trigger a transformation in Chinese architectural studies, refining the standards and special creative principles of Chinese architectural language, and will transform the academic and disciplinary system mainly inherited from Western architectural studies into a truly constructed contemporary Chinese architectural discourse system with Chinese cultural genes and measured by Chinese culture. Once such a system is established, it will provide important support for shaping and disseminating China's unique cultural discourse from the perspective of architectural studies, and provide China's thoughts and insights for the world in the intertwined global changes.

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Research on China's Industrial Design Trends in the Context of "China-Chic"

Wang Qiannan [1], Wang Xuanzheng[2]

[1]Central Academy of Fine Arts
wangqiannan@cafa.edu.cn
[2]Central Academy of Fine Arts
wangxuanzheng@cafa.edu.cn

Abstract

Currently, China finds itself in the midst of a significant transformation, transitioning from a state of mid-industrialization to a post-industrialized landscape. This shift has made increased investment in industrial design an imperative necessity. A noteworthy concept, known as "China-Chic," has emerged, denoting Chinese products that bear distinct Chinese characteristics. These products are aligned with contemporary aesthetics and technological trends, showcasing China's self-expression on an international stage.

This paper undertakes a comparative examination of the evolutionary trajectories of industrial design styles imbued with national identity in various countries. The study concludes that the essence of industrial design with Chinese attributes should stem from the fusion of traditional culture and modernity. To uncover this nexus, the paper employs co-occurrence analysis, offering insights that can contribute to the development of Chinese industrial design styles endowed with national uniqueness within the overarching framework of "China-Chic."

Introduction

In the present era, generating and implementing innovative ideas is of paramount importance. China has emerged as the world's largest industrialized nation. In the seven decades since the founding of the People's Republic of China, it has established the most comprehensive industrial system globally. The production of major goods ranks among the world's highest, fostering increased international competitiveness and securing its position as the world's leading exporterfor many years. Often referred to as the "world's factory," China has exported a substantial volume of manufactured goods, significantly elevating living standards worldwide, including within China itself. However, over the past few decades, due to the relatively modest starting point of Chinese industrial design, China has often exported inexpensive industrial products that closely mimic foreign counterparts. This has led to a perception that "Made in China" is synonymous with low-cost, imitative products.

In the current era marked by rapidly shifting international dynamics, China's consistent economic growth across the entire industrial spectrum, coupled with remarkable technological advancements, has led to an enhanced sense of well-being, personal fulfillment, and national identity, particularly among the younger generation. Within the realm of culture, there is a growing demand for works that propagate Chinese values and products that embody Chinese aesthetics. Concurrently, the advent of technologies like big data, artificial intelligence, and drones promises revolutionary changes in China's industrial design landscape. In response, the concept of the "China-Chic" has emerged. Initially, before 2018, the term " China-Chic "narrowly referred to niche brands crafted

by local trend designer. However, post-2018, the concept expanded to encompass Chinese products characterized by Chinese attributes, adhering to contemporary aesthetics and technological trends, while projecting a self-assured international perspective (Institute for Culture Creativity, Tsinghua University, 2019). In this new historical phase, "China-Chic" design is expected to exhibit high aesthetic and cultural qualities, serving as a national emblem reflecting Chinese characteristics as Chinese industrial products make a global impact.

Industrial Design through a Cultural Perspective

The anthropologist Malinowski described culture with a vast apparatus of material, human, and spiritual layers (1944). He asserted that material culture is the most immediately observable aspect of culture, shaping a culture's level of development and work efficiency. However, he also posited that material possessions alone, devoid of the spritual component, are devoid of life and utility. The utilization of artifacts entails the acknowledgment of values, representing the spiritual dimension. Artifact consumption necessitates collective cooperation, subsequently influencing the organizational facet of culture. F. Graebner, a German scholar affiliated with the transmissionist school of cultural anthropology, proposed an intriguing concept known as the "cultural wave" (Lin, 1991). The enigmatic "cultural wave" can be viewed as a phenomenon wherein geographically distant cultures come into contact with each other due to human needs for material goods and affluence. With each exchange of goods, the costs may decrease and potential profits rise, yet this interaction simultaneously raises awareness of the existence of other cultures.

Industrial products, as products of industrial civilization, often serve as conduits for cultural dissemination due to their worldwide circulation and significant impact on lifestyles. During China's semi-colonial and semi-feudal era in 19th century early 20th century, industrial products like textiles, thermos flasks, matches, bicycles, and then automobiles, trains, and ships entered the country one after another. These products constituted early means through which the Chinese populace gained exposure to the world beyond its borders. Post-World War II, the United States utilized industrial products as vehicles for exporting American values and lifestyles globally, including Europe. "Fridge, washing machine, television set and automobile , each were symbols of yet another step having been taken towards the middle class (Tumminello,2011)". America's industrial design, exemplified by streamlined design, broadcast its leadership in industry to the world. In these cross-cultural interactions, people often initially embrace the material achievements of industrial civilization. They subsequently adopt the lifestyle shifts it engenders and eventually internalize the aesthetics and values it represents. Over the last century, the widespread dissemination of culture has been substantially driven by the spread of modernization, closely accompanied by the proliferation of modern transportation and industrial products. Thus, industrial design constitutes an exceptionally potent vehicle for cultural diffusion.

Following the introduction of the "Belt and Road" policy, Chinese high-tech products like high-speed rail, new energy vehicles, cell phones, and smart homes have expanded globally, serving as symbols of "Chinese modernization" and potent mediums for conveying China's narrative and voice. These products are transforming the perception of Chinese-made goods, moving away from the stereotype of being cheap and of low quality. Consequently, industrial design, within the context of the "China Chic, " is expected to be visionary and pioneering while simultaneously remaining recognizable and accessible, encapsulating the Chinese aesthetics and values.

A notable phenomenon in cultural communication is the prevalence of ethnocentrism, where each culture tends

to employ its own cultural values as a lens to observe and judge others, often seeking dominance over other cultures. However, when industrial design is utilized as a platform for cultural dissemination, due to the varied perspectives of businesses on consumers, it becomes more accessible to foster what we may call "reciprocal understanding." This form of understanding is rooted in dialogue and cooperation, enabling us to transcend cultural biases and the inclination to view other cultures merely as sources of knowledge, comprehension, and interest fulfillment.

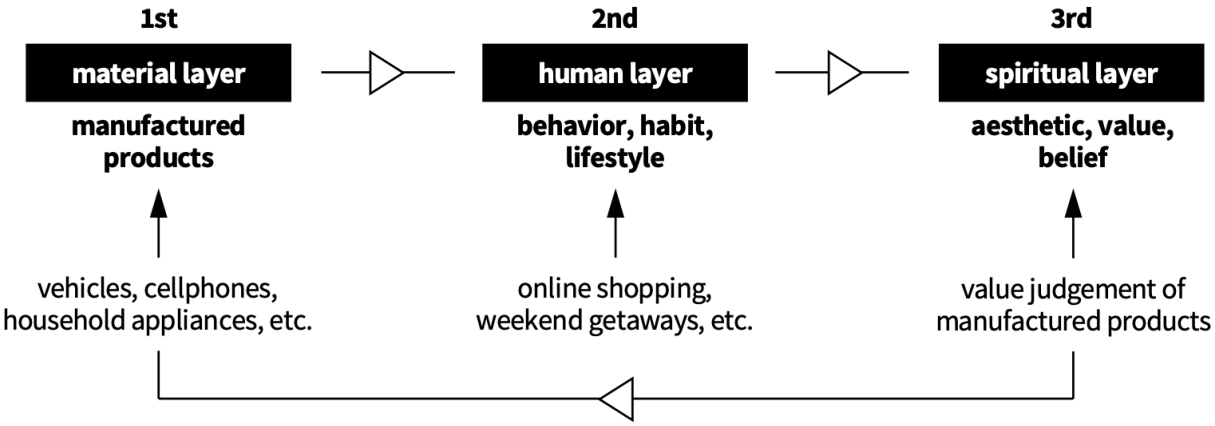

Figure 1. Process of culture dissemination through industrial design.

Background to the Emergence of Chinese-style Industrial Design

Huang Qunhui, in his article "China's Industrialization Process: Stages, Characteristics, and Prospects," contends that China's industrialization is currently transitioning towards service-oriented manufacturing (2013). This transition necessitates increased involvement of service elements such as industrialdesign, accounting, law, finance, in the product manufacturing process. Furthermore, Huang Qunhui postulates several characteristics of China's industrialization process: 1.China's industrialization occurs within the context of a vast population, exceeding the combined populations of all industrialized countries and regions; 2.China's industrialization is characterized by sustained rapid growth, a feat few countries worldwide have maintained over an extended period; 3.China's industrialization predominantly follows a low-cost, export-oriented model, with affordable Chinese products permeating nearly every corner of the globe.

The aforementioned characteristics of China's industrialization create exceptionally unique circumstances for the advancement of Chinese industrial design. Within China, designers confront an expansive market of unprecedented scale, unparalleled in many respects. Industrial products are being both manufactured and consumed in staggering quantities. Moreover, in the context of rapid industrialization, efficiency has emerged as the linchpin for enterprise survival. The design process itself now unfolds at a significantly accelerated pace, often completing in merely half or even one-third of the time compared to foreign counterparts operating within the same industry. Furthermore, Chinese designers contend with an exceptionally diverse and intricate consumer landscape. The demands of consumers vary not only across differen tcountries but also within distinct regions of the same nation. These unique features provided istinctive opportunities and challenges for the evolution of industrial design in China.

Analysis of Nation-Specific Industrial Design Styles

Over the course of more than a century of industrial design evolution, numerous countries have cultivated distinct industrial design styles, each uniquely tied to its historical and socio-economic context. Examining the genesis of these styles, it becomes evident that industrial design is intricately interwoven with technological advancements, economic progress, societal dynamics, and prevailing lifestyles. One can argue that these styles themselves are the outcomes of the confluence and fusion of these multifaceted factors.

The German industrial design style, for instance, begantaking shape during the 1910s through the "Working Alliance." It matured during the 1930s, notably in the era of "Bauhaus" design. Subsequently, it was perpetuated by industrial design luminaries such as Dieter Rams after World War II. This evolution of style became inextricably linked to the emergence of modern industrial production paradigms. Figures like Gropius, a pioneering force in modern design in Germany, championed a design ethos that prioritized service to society as a whole rather than serving a privileged few. Concurrently, the adoption of standardization and mass production techniques significantly reduced costs, allowing the broader public to partake in the fruits of the industrial revolution. Hence, the German industrial design style distinctly adheres to a "de-decorative" tradition, consistently emphasizing principles such as "less is more" and "form follows function." Dieter Rams' "Ten Principles of Good Design" in the 1970s aptly encapsulates this tradition. Given its compatibility with modern production methods, this design philosophy transcended national boundaries, gradually coalescing into an "international design style."

In stark contrast, the American industrial design style was profoundly influenced by consumerism. Figures like Raymond Loewy famously asserted that " he most beautiful curve is a rising sales graph." Designers during this formative era believed in the maxim "form follows market" as opposed to "form follows function." Consequently, American design during this period often exhibited a penchant for ostentation. For example, the "streamlined style" became emblematic of American industrial design, thanks to its superb aerodynamic attributes. Originally applied to vehicles lie cars, airships, and trains due to their aerodynamic benefits, streamlining gradually found its way into products with no aerodynamic requirement, such as lamps, telephones, andirons. Here, the emphasis shifted from practicality to formality, highlighting the products' aesthetic allure. Post-World War Il, a plethora of American industrial products were exported globally. Consumers often acquired these products not solely for their functionality and cost-effectiveness but also because they epitomized the American way of life through their distinctive forms. The 1960s marked a period of reevaluation of consumerism-based styling, though market-oriented industrial design processes and standards continued to exert a profound influence worldwide.

The Japanese industrial design style crystallized after World War II, flourishing during Japan's rapid industrialization. To adapt to Japan's high population density, intense urbanization, and fast-paced urban life, Japanese industrial products embraced simplicity, compactness, portability, and multifunctionality. Additionally, Japanese industrial design strongly reflects traditional aesthetics. Influenced by Shintoism's reverence for nature, Buddhism's embrace of emptiness, and Taoism's notion of nothingness, Japan fostered a "wabi-sabi" aesthetic (Wang,2015). This ethos champions simplicity, serenity, naturalness, and unadulterated beauty-coinciding seamlessly with the modern design principles of simplicity, de-decorativeness, and"less is more." Concurrently, the clamor of urbanized life amplified the demand for natural elements and materials in everyday life. The fusion of these elements birthed the distinctive aesthetic essence of Japanese industrial design.

From these case analyses, it becomes evident that the development of nation-specific industrial design styles

stems not exclusively from the nation's traditional culture and unique aesthetics but results from their intricate entanglement with modernity. During the trajectory of industrial design's evolution, elements of national culture and traditional aesthetics collide and amalgamate with modern influences, such as mass production, consumerism, and urban living.Elements compatible with modernization are assimilated and magnified, finding their way into industrial product design and daily life. In contrast, elements incompatible with modernization become part of a nation's cultural heritage, often preserved in documentaries and museums. The establishment of a nation's distinct industrial design style typically necessitates a comprehensive modernization process.

Exploring the Intersection of Traditional Chinese Culture and Trends in ChineseIndustrial Design through "Co-word Analysis"ountries that have Co-word analysis, or keyword co-occurrence analysis, is a method employed to uncover the intricate semantic connections between keywords within a particular domain of knowledge. This approach hinges on evaluating the frequency and centrality of keywords within the existing literature. Consequently, it aids in identifying overarching research themes and discerning areas of consensus or divergence within a given subject or field. Based on a scientometric analysis conducted using CiteSpace, we present the top 10 high-frequency co-occurring keywords within the realm of "traditional culture" and "industrial design" in Chinese academia between 2000 and2023.These keywords are organized by five-year intervals as follows:

Year	Top 10 high-frequency co-words
2001-2005	Design Management, Design Culture, Expression, Nature, Social Environment, Ideal Personality, National Characteristics, Localization Effective Management
2006-2010	Design Education, Innovative Design, Design Philosophy, Diversification, Development Strategy, Cell Phone Design, Industrialization, Harmony, Chinese Elements, Semiotics
2021-2015	Innovation, Modern Design, Chinese Elements, Symbolism, Westernized Chinese Style, Chinese Dream, Internet， Product Styling, Human-Machine System, People-Orientation, Corporate Innovation
2016-2020	Intelligence, Curriculum Ideology, Innovation and Application, Chinese Elements, Design Education, Green Design, Local Culture, Social Development, Economic Development, Business Rights, Practical Ability
2021-2023	Curriculum Ideology, Cultural and Creative Products, Evaluation Methods, Development Strategies, Aesthetic Thinking, Cultural Innovation, Creative Thought, Labor Alienation, Discipline Construction, Design Strategies

Table 1. Co-occurring keywords within the realm of "traditional culture" and "industrial design" in Chinese academia between 2000 and 2023

This analysis underscores that Chinese academic interest in exploring the interplay between traditional culture and industrial design has evolved significantly over the examined time periods. Giles' Speech Accommodation Theory (1987) offers valuable insights into the linguistic dynamics of communication. It posits two forms of speech accommodation: "convergence," wherein the speaker adapts their speech to align with their interlocutor, and "divergence," where the speaker deliberately departs from their interlocutor's language in certain situations. Historically, industrial design in China primarily focused on showcasing the nation's distinctiveness, locality, and the natural environment. The emphasis was on highlighting the "uniqueness" of Chinese culture on the global stage to foster cultural self-awareness and gain international recognition. However, as China's industrialization

transitioned from its early to middle stages, industrial design assumed a more pivotal role in serving the manufacturing sector and the digital realm, facilitating rapid progress by contributing to the national economy. In the present context, as China approaches the later stages of industrialization, Chinese design has matured in its values and aesthetic outlook. The emphasis now lies in pursuing "universal values" that resonate with humanity at large rather than fixating solely on the "individualistic" aspects of Chinese culture. The pursuit of these "universal values" is achieved through a shared expression of commonality. It can be posited that over the past two decades, Chinese industrial design has traversed a transformative journey from a "convergence phenomenon" to an "assimilation phenomenon."

Manifestation of Chinese Values and Aesthetics in Industrial Design

While China's industrial design has yet to establish a distinct national and cultural style, numerous manufacturing enterprises have achieved global commercial success. Examining these companies' design styles from the perspective of Chinese culture can provide valuable insights for the development of a unique Chinese industrial design style.

Xiaomi Ecosystem - The Art of Humility and Balance:

In recent years, Xiaomi's ecosystem has emerged as a prominent player in the smart hardware industry, with over 50% of its revenue coming from the global market in 2022. This success is attributed to Xiaomi's robust business strategy, which capitalizes on China's expansive market. The Xiaomi ecological chain's products often outperform competitors in quantities due to their strong brand reputation, granting Xiaomi substantial bargaining power with suppliers. The products' high cost-effectiveness, in turn, fuels increased sales. Guided by this business model, Xiaomi's industrial design ethos aims to cater to the majority of users.

Li Ningning, the design director, articulated their philosophy, stating, "Our design mentality is to remain humble. While flashy designs may garner attention, saturating every product with extravagance can make a living space uncomfortable. Our goal is for Xiaomi's products to seamlessly integrate into any home environment, encouraging users to embrace Xiaomi's product line without the need for ostentatious designs." Xiaomi's design style aligns with a Chinese philosophy of humility and balance, emphasizing impartiality, eclecticism, and harmony, thereby achieving a harmonious product-environment and product-system relationship. In essence, this embodies a Chinese interpretation of "honest design."

SHEIN - Using no way as way

SHEIN has risen to prominence as a leading brand in the global fast-moving consumer goods sector. In 2021, it became the top iOS shopping app in 54 countries and regions. SHEIN's success is rooted in its well-established supply chain system in the Pearl River Delta region. Thanks to seamless integration across the supply chain, SHEIN's suppliers possess remarkable rapid- response capabilities, delivering goods within 7-10 days and accommodating small-scale orders ranging from 100 to 500 pieces.

Differing from traditional fashion brands, SHEIN lacks a signature design style. Instead, it relies on an 800-strong design team that harnesses big data to track real-time information on colors, fabrics, and styles. This data guides designers in their creative processes. Moreover, SHEIN has launched the SHEIN X designer incubation program, attracting thousands of designers worldwide and introducing tens of thousands of original products. By leveraging digital design tools and collaborative design, SHEIN manages to "use no way as way, have no

limitation as limitation. " This streamlined approach significantly reduces design process time within the fashion industry, which demands rapid product updates, thereby ensuring the enterprise's core competitiveness.

Conclusion

In the contemporary landscape, China's industrial design finds itself at a pivotal juncture. Against the backdrop of an impending wave of "China-Chic," the examination of China's industrial design trends takes on profound significance. Co-word analysis, serving as a tool of library and information science, offers a broader perspective for reconsidering the aesthetics and value judgments inherent in design. This perspective extends beyond the confines of specific cases, enabling a more comprehensive understanding of the evolving "language" of Chinese industrial design. This undertaking not only contributes novel insights to the field but also introduces a fresh research methodology, promising to enhance both the development of design practices and the efficacy of design education.

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Form-Finding in Turbulent Fluidic Environments Through Self-Assembly

Alejandro Puentes-Amézquita

Universidad del Rosario, Faculty of Creative Studies, Colombia
alejandro.puentes@urosario.edu.co

Abstract

This research aims to explore the potential of self-assembling systems as an autonomous design methodology for creating stable shapes in turbulent fluidic environments. By studying the interaction between these systems and fluids, we can better understand how stable shapes emerge in stochastic conditions. The development of physical form-finding autonomous systems based on self-assembling programmable modules has the potential to create structures that are better adapted to their surroundings, resulting in increased efficiency and functionality. This research seeks to investigate the role of self-assembling systems in the emergence of stable shapes in turbulent fluidic environments.

This paper contributes significantly to the theme of "Design Flow." It explores the use of self- assembling systems as an autonomous design method for creating stable shapes in turbulent fluidic environments. By studying the interaction between these systems and fluids, it investigates how stable shapes emerge in dynamic conditions. This research focuses on developing physical form-finding autonomous systems with self-assembling programmable modules, representing an evolving and adaptive approach to design. It emphasizes creating structures that better adapt to their surroundings, enhancing efficiency and functionality. Thus, the paper demonstrates how design, in a constant state of evolution, can reshape architectural and fluidic environments, aligning with the concept of "flow" in design processes.

Keywords

Self-assembly; form-finding systems; fractal growth; emergence; programmable matter; physical computing.

Introduction

The field of architecture is changing, especially in form-finding systems (Ekblaw & Paradiso, 2018). This shift is redefining architectural approaches, introducing the idea of autonomous form- finding systems. This transition emphasizes autonomous creation and design, departing from heavy external control. This project demonstrates the feasibility of these form-finding autonomous systems based on fractal geometries and self-assembly, using programmable modules to create architectures that can adapt to different conditions. Adding magnet-equipped programmable modules revitalizes the tangible computing system. This innovation employs two programming methods: deterministic and non-deterministic self-assembly (Tibbits, 2016). Deterministic follows a preset path, while non-deterministic impresses with its adaptability in experiments. This exploration blends technology and nature, revealing the innate ability of autonomous systems in chaotic fluidic settings. It hints at a future where architectural structures harmonize with self-assembly in fluidic landscapes.

Modules

The initial module design used hexagonal tessellation to encourage emergent behavior via local interactions. These interactions result in incremental growth patterns. We focused on the symmetrical snowflake formation among the numerous possible arrangements achievable with six identical modules.

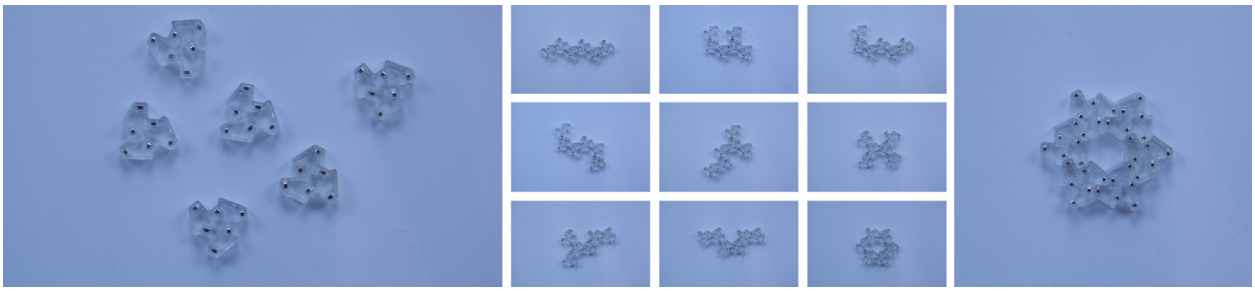

Figure 1. Modules, patterns, and the snowflake pattern.

Deterministic Self-assembly

The initial study explored deterministic self-assembly using tangible models. We designed a snowflake-like structure using six modular units, each with ring-configured internal magnets (as shown in figures 2 and 4). External forces or agitation disassembled and reconfigured the system, proving its ability to rebuild into a predefined structure.

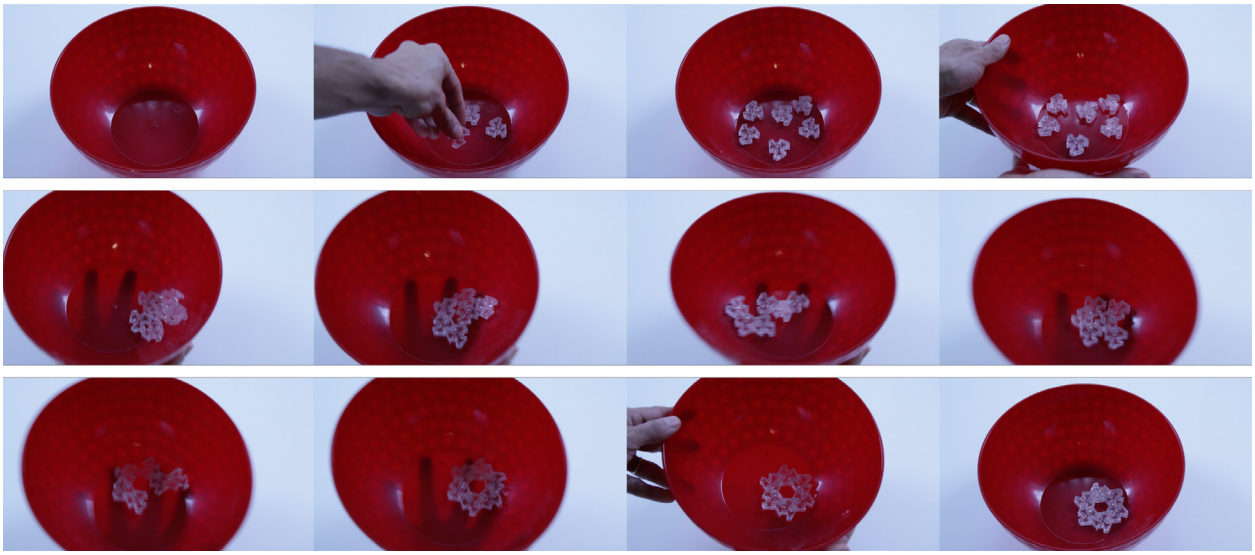

Figure 2. Deterministic Self-assembly.

Evolution of the Module

Following initial module testing, iterative design enhancements were made to improve overall system connectivity. We evaluated and systematically adjusted configurations to ensure compatibility and assembly with other components. Through experimentation and refinement, we optimized the module's geometry for maximum connectivity, verified through objective measurements and evaluations.

The design process resulted in two different modules that were developed for the experiments. The basic module,

Figure 3. Evolution of the Module.

which is the smallest component of the system and the snowflake module, which is based on the assemblage of six basic modules into the snowflake pattern. While the basic module has six slots, the snowflake has twelve slots that can be programmed with different magnets configurations and represents a second order of magnitude for the system.

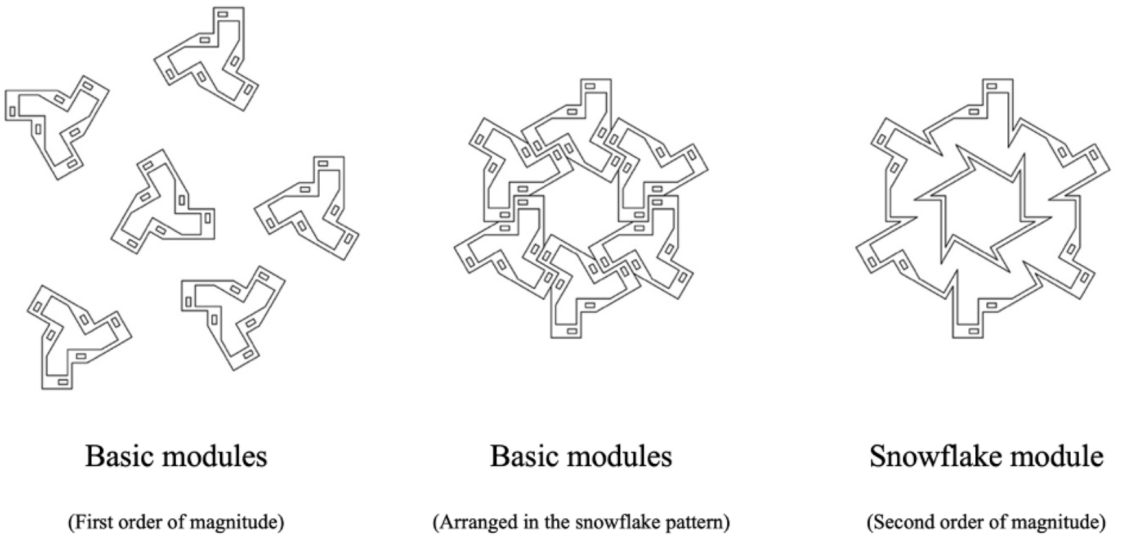

Figure 4. Modules.

Programming

Magnets enable slot programming with three options: North, South, or Neutral (empty) achieved by slot magnetic orientation adjustment, as shown in figures 5 and 8. This customization manipulates connectivity levels during module interaction, allowing precise control, from high to low connectivity, impacting the system's behavior and resultant structures significantly. This approach offers potential for complex structures, with precise control via programmed magnetic interactions. It extends applications to fields like robotics and materials science, introducing a new dimension of control to self-assembly systems, broadening technological possibilities.

At the upper-left corner of Figure 6, the data illustrates that two universal connectors have the capability to establish nine distinct strong bonds (sb). Conversely, at the opposite corner, it is evident that two ring connectors

are limited to forming merely two weak bonds (wb). Employing magnets offers a mechanism to conveniently regulate the system's fragility and connectivity.

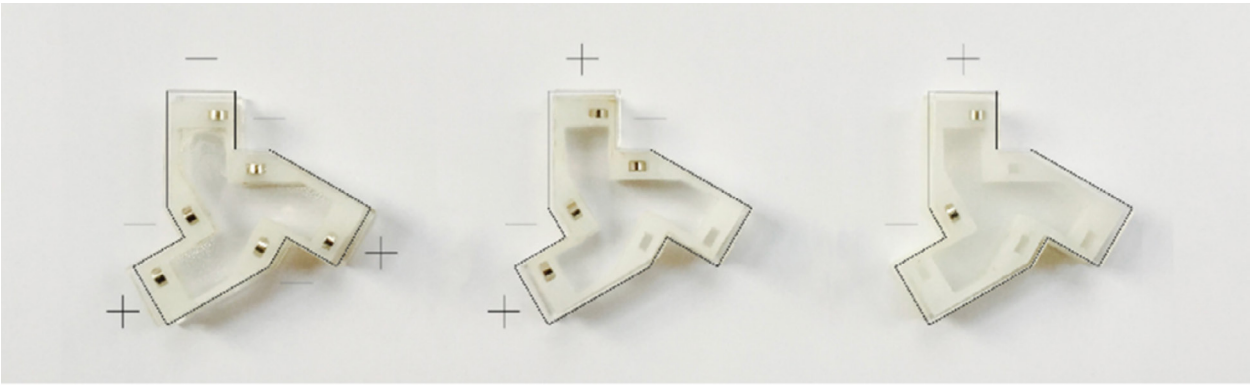

Figure 5. Basic Modules Programming.

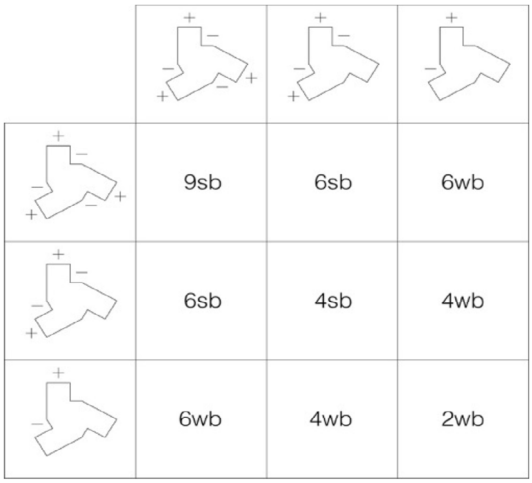

Figure 6. Matrix of possible bonds between modules.

Non-deterministic Self-assembly I

We used a 20-gallon fish tank for experiments. We observed the system's growth, self-regulation, bond formation, dissolution, and new organization patterns. We aimed to understand its tendency toward equilibrium in its environment, studying stability and vulnerability patterns.

We used a structure to trap air layers and employed two hydro-jets for turbulence. Figure 7 illustrates our modular self-assembly system adhering to physical dynamics, adapting to the environment, until achieving equilibrium.

Equilibrium signifies stability and the cessation of changes within a system, defining the ideal module configuration. After achieving equilibrium, we proceed with scanning to create a model of the adapted structure, optimizing it for specific environments. Systems like this one hold potential applications in architecture, civil engineering, industrial design, and robotics.

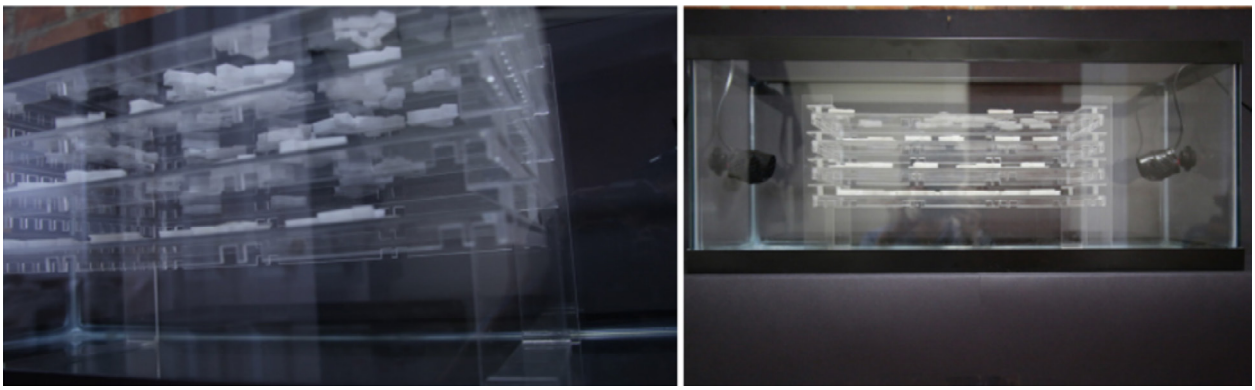

Figure 6. Experimental habitat before being filled with water.

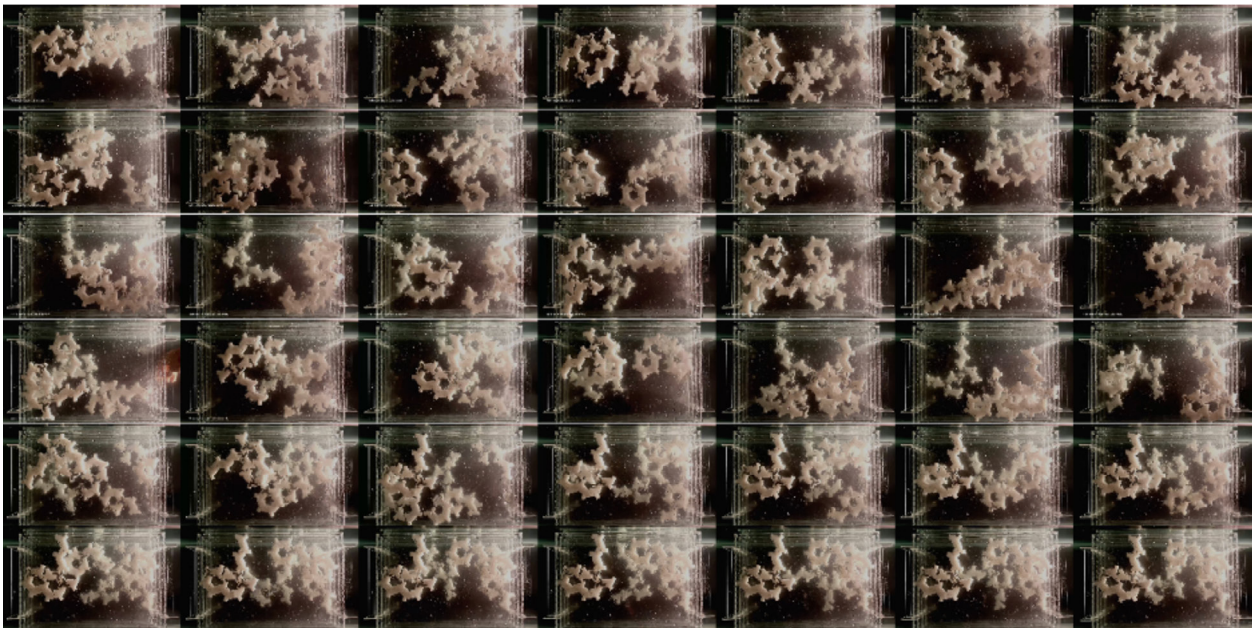

Figure 7. Non-deterministic self-assembly I.

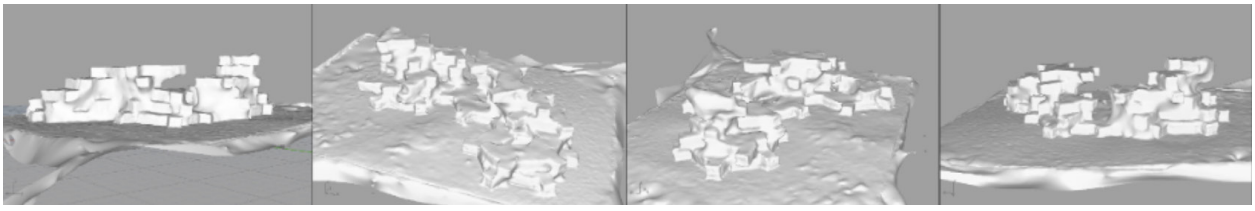

Figure 8. 3D model of the resulting configuration

Lastly, diverse experiments adjusted system connectivity and fragility to find optimal module configurations for cohesive structures.

Non-deterministic Self-assembly II

In the second experiment, non-deterministic self-assembly was tested outdoors in a lake using robust snowflake modules. Results aligned with expectations as the system moved towards stability, despite challenges in the vast lake environment. (Whitesides & Grzybowski, 2002)

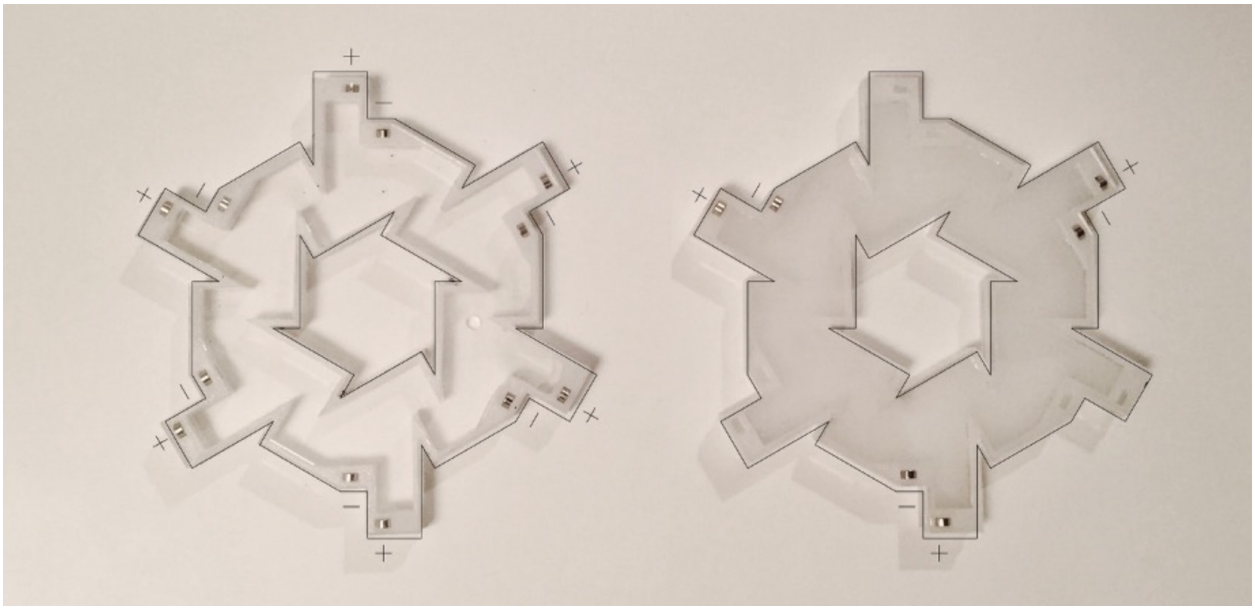

Figure 8. Snowflake modules programming

This experiment underscores the importance of accounting for the scale and complexity of the environment in self-assembly research. It also showcases the potential of self-assembly in natural settings, extending its applicability beyond controlled laboratory conditions.

Figure 8. Non-deterministic self-assembly II.

Self-assembly, the autonomous arrangement of components into structures, applies across materials science, nanotechnology, and robotics, but managing its complexity remains a challenge. Fractal self-assembly at the nanoscale has produced diverse structures, spurring interest in architectural robotics and challenging traditional self-assembly paradigms with its introduction of multiple scales. This novel framework aligns closely with organic growth patterns seen in plants and organisms, characterized by intricate fractal geometries. Looking ahead, the future of self-assembly, as explored in this research, holds promise and could be further propelled by emerging technologies, exemplified by Nisser et al.'s "Selective Self-Assembly Using Re- Programmable Magnetic Pixels" (Nisser et al., 2022), expanding the horizons of its applications.

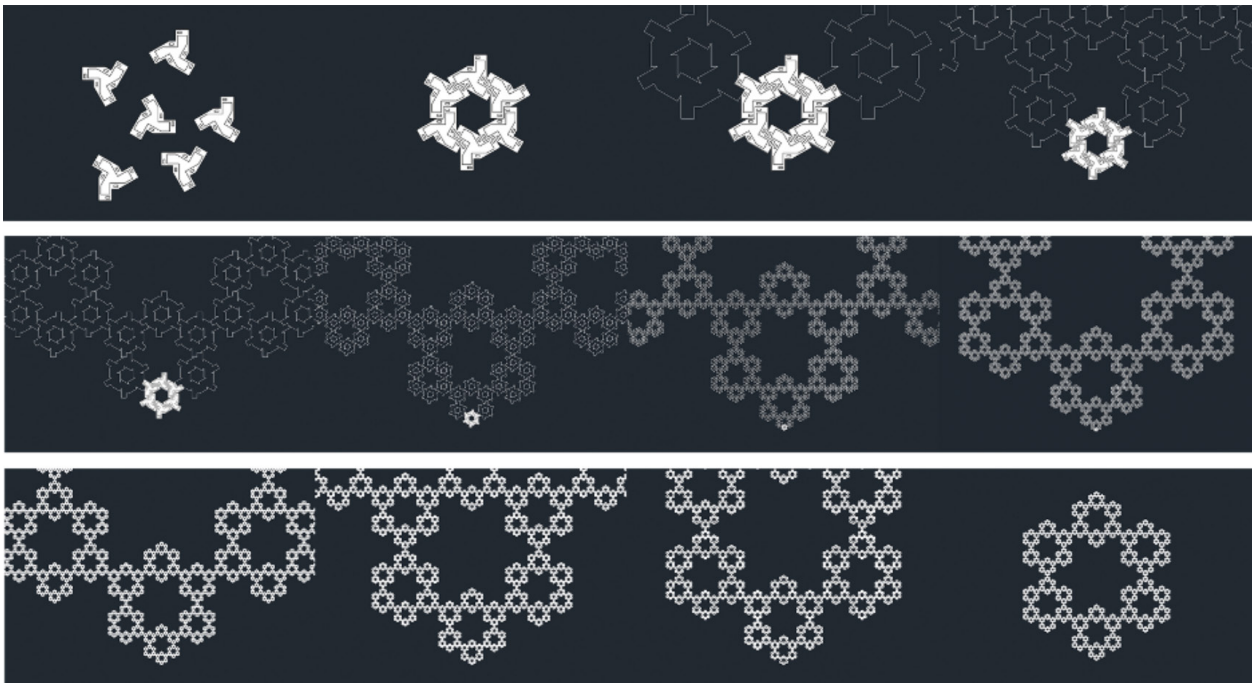

Figure 8. Snowflake modules programming

Conclusion

In the realm of form-finding in turbulent fluidic environments, self-assembly, including fractal growth, has illuminated a path to adaptive architectures. Meticulous study and experimentation unveiled the potential of self-assembling systems as versatile, autonomous design methodologies, capable of mimicking fractal growth patterns. The interplay between programmable modules and fluid dynamics revealed emergent behaviors, highlighting adaptable structures. This synergy of innovation and adaptation foresees architectural designs echoing the natural fluidic choreography of their surroundings. The findings emphasize understanding the equilibrium between complexity and stability and encourage considering fluidic environments' scale and intricacies. Across disciplines, the fusion of morphology, fluidic dynamics, and fractal growth presents captivating opportunities. Beyond architecture, insights could influence fields from industrial design to modular robotics, benefiting from self-assembly and fractal growth principles. In closing, the journey through turbulent fluidic environments via self-assembly has opened a gateway to innovative design paradigms, redefining architecture and beyond.

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Should the design process be re-imagined? The interplay of human creativity and AI innovation

Francesco Burlando[1], Xavier Ferrari Tumay[2], Federica Maria Lorusso[3]

[1]francesco.burlando@unige.it
[2]xavier.ferraritumay@unige.it
[3]federicamaria.lorusso@unige.it

Abstract

The paper explores the evolving relationship between human creativity and artificial intelligence (AI) innovation in the context of design processes. It addresses the increasing integration of technology into daily life and work processes, which has sparked concerns about the potential obsolescence of human capabilities. The emergence of AI-based software for text and image generation has raised questions about the value of human contribution even in the creative disciplines, which until recently seemed likely to be man's last stand of defense in the face of advancing machine capabilities. The paper discusses examples like ChatGPT and Midjourney's recent successes as instances of AI's creative potential. To investigate more deeply what role AIs play in the design process and what tasks are still the preserve of human designers, the paper presents a case study involving a workshop that explores the collaboration between designers and AI, using Italo Calvino's Invisible Cities as a theme. The study investigates the extent to which AI can replicate human creativity in translating mental images into designs. The design process involves using AI for text-to-image generation, employing Midjourney software, and adapting AI-generated text into prompts for image creation. The study emphasizes the creative input of human designers in guiding AI-generated content. In conclusion, the paper underscores the role of the designer as central in the design process, with AI tools serving as valuable aids for inspiration and concept generation. It highlights the complexity of generating specific graphic products through AI and emphasizes the need for skilled designers to harness AI's potential effectively.

Keywords

Artificial Intelligence, Design Process, Technology, Prompt Designer

Introduction

In the contemporary world, the ever-increasing and sometimes invasive incidence of technology in daily life and in the many facets of work processes proves to be a relevant issue. This trend is by no means foreign to the design context, where technological innovation is often accompanied by a kind of dystopian preoccupation, a premonition of the possible future obsolescence of human abilities (Keynes, 1933). However, it is crucial to point out that history has amply demonstrated that every industrial, technological or digital revolution that has marked the course of humankind has been followed by a significant improvement in the general welfare of the population (Frey & Osborne, 2013).

Over the past century, for example, average weekly working hours have steadily declined, accompanied by

better wages and generally more affluent lifestyles (Magnani, 2020). This evolving trend provides a solid basis for predicting that the same process of improvement may be repeated in the future, regardless of the type of technology involved and the field in which it is embedded.

However, the emergence of innovative Artificial Intelligence (AI)-based software dedicated to text and image generation has triggered new thinking about the value of human contribution. Until recently, technology had been able to replace humans in mainly repetitive, strenuous or dangerous activities. Yet, it is only on rare occasions that signs of what we might call creative thinking on the part of an AI could be observed. Examples such as AlphaGo, the Google program that defeated the world champion in the Chinese game of Go (Chouard, 2016), or Eugene Goostman, the AI that apparently passed the Turing test (Warwick & Shah, 2016), are still limited in their areas of application.

Homo artificialis and Contemporary Humanity

The concept of "Homo artificialis" is often discussed in different contexts to explore the relationship between humanity and technology and to understand how the use of tools and artifacts influences our nature and evolution (Incoronato, 2016).

It's important to underline how the philosophy of design is, in fact, a sub-discipline of the philosophy of technology. (Fregonese, 2019)

Furthermore, another crucial point concerns the large amount of studies on the ethics of technique and technology. This raises the question of the relationship between responsibility, human agents and technologies, especially considering how independent or almost human the latter have become.

Contemporary Man is immersed in artificiality in every aspect of his existence, even on a biological level. While it is sometimes argued that technology dehumanizes and that social networks are depersonalizing, opposite reflections emerge: technology humanizes and constitutes the fulcrum of our humanity. The central point of discussion concerns how technologies influence the social sphere and our way of thinking.

Over the last thirty years, the sociology of technology has seen considerable development, driven in part by the criticism of so-called "technological determinism", a concept that suggests that the development of technology and its consequences are controlled by an internal logic, beyond human control. This perspective has been replaced by a more nuanced view of the relationship between technology and society. (Salento, et al., 2018)

Digital technology represents only the latest step in this evolution. Everything artificial is, by definition, unnatural, as Simon indicated in The Sciences of the Artificial (1969). Simon asks whether we can develop science or knowledge relating to non-natural phenomena. He provides an initial definition of "artifact" as a synthetic or artificial object, the development of which is at the center of evolutionary activity. Richard Dawkins, known for the popular book The Selfish Gene (1976), states that technological evolution advances at such a speed as to surpass human biology. However, it is essential to consider the gap between our biological and technological evolution, as this gap has generated fears, fragility and a sense of inadequacy which, in turn, has stimulated human creativity through art, spirituality, philosophy, music, mathematics and science are all drivers of technological evolution. From this perspective, technology makes us more human. Engineers, architects,

designers and all those who work with technology must recognize their influence on the design of the new humanity. It is essential to discuss technology, design it and use it responsibly, since our deepest human essence lies within it. As a tool, artificial intelligence allows artists and designers to explore new aesthetic territories and generate results that push the frontiers of creativity further.

However, it is in the last period that much more significant progress has been made, which is shifting the balance between human capabilities and computational computing in the realm of creativity. The launch of ChatGPT in November 2022 is a striking example. This highly successful chatbot demonstrates the ability to produce text ranging from themes to poems, even scientific papers (Hill-Yardin et al., 2023). In a similar vein, text-to-image AIs such as Midjourney, Dall-E, or Stable Diffusion are demonstrating that they can generate graphic works that are often indistinguishable from those created by professional painters or illustrators (Roose, 2022).

Intriguing is the evolution that is taking place in the field of design. Technology is no longer seen merely as a means of translating imagination into concrete designs through 3D modeling, rendering, and post-production software. Rather, there is the possibility that technology may take on a more active role, even going so far as to replace the designer in the creative phase (Epstein et al., 2020). This evolution raises fundamental questions about the future of the designer figure itself: will he or she be destined to be completely replaced by technology, as has happened in many other professions, or will he or she have to adapt and learn to master these new innovative tools (Dang et al., 2022)? Will the creativity inherent in human intelligence continue to play an irreplaceable role in devising and translating mental images into designs, or will technology and AI completely take over human work (Hertzmann, 2020)?

Knowing how to communicate with machines will increasingly become a strategic skill. Currently, the first training courses are emerging for the figure of the "prompt designer", which is the profession responsible for creating the commands with which we give instructions to machines. The clearer we are in articulating these instructions, the better the results we will be able to obtain from the software, especially given the ongoing revolution (Zamfirescu-Pereira, 2023). This skill combines elements of science and humanistic culture and is expected to become as important a design tool as design thinking or double diamond. In the near future, this new profession will establish itself, requiring less technical skills but greater ability to communicate effectively with machines. Most likely, we will learn to use Chat GPT as naturally as we use smartphones to take photographs today. This ability to combine text and images is typical of social media professionals, and if a similar profession has existed for years, there is no reason why another profession based on the same skill but focused on different results shouldn't develop. AI could become a common and accessible technology like many others already available, but this does not exclude the existence of highly specialized experts. The prompts will not be simple formulas, but will require a creative, non-mechanical approach. Machines will remain catalysts and will not replace human beings.

Case study

"Will we have a machine capable of replacing the poet and the writer, of conceiving and composing poems and novels? I am thinking of a machine that brings into action [...] all those elements that we are wont to regard as the most jealous attributes of psychological intimacy, of lived experience, of the unpredictability of mood swings, the shudders and heartbreaks and inner illuminations (Calvino, 1967)."

In the lecture Cybernetics and Ghosts held at various forums in 1967, Calvino imagines the figure of the literary

autonomist: a machine capable of replacing the writer and thus making human beings obsolete even in their creative component. The writer himself points out how precisely the latter, in its various declinations, is the most jealous attribute of man, who would, in short, be willing to surrender his work to a machine if it is an exhausting, dangerous or tedious one, but who approaches with jealousy the advent of a machine capable of replacing human creative abilities (Antonello, 2005).

This very year (2023) marks the centenary of the birth of Italo Calvino, who was able to establish himself as one of the most influential Italian intellectuals of the second half of the 20th century. Among his most famous works are The Invisible Cities, published in 1972, a few years after the lecture mentioned earlier. The book consists of an anthology of short stories that, the writer imagines, are part of a dialogue between Marco Polo and the Tatar emperor Kublai Khan, who questions the explorer about the cities of his immense empire. The result is a succession of detailed depictions of imaginary fabulous, fantastic cities with the most diverse characteristics.

In order to better investigate the mechanisms of collaboration between designers and artificial intelligences and what are the dynamics that bring the roles and skills of the two figures to collaborate in the design process, the paper presents the case study of a workshop carried out by the University of Genoa that had as its main theme Calvino's Invisible Cities.

The text, in fact, has among its peculiarities the ability to force the reader into a work of imagination to create a mental depiction of the described scenarios. For this reason, it is configured as an ideal theme to bring into play the capabilities of the latest text-to-image artificial intelligences and investigate how far they are able to replace humans in the transposition of such mental representations and, above all, what should be the role of the designer in managing these innovative tools to arrive at the desired result.

The workshop was conducted under the mentorship of the authors and was attended by 30 young designers in the manner that is described in the previous section.

Design Process

The workshop started from the identification of the invisible cities that would be implemented. From this early stage, the role of artificial intelligence was already central. In fact, since it was decided to make ten final products, only five of them would have Calvino's original text as their initial brief. The other five cities were to be derived from texts authored by ChatGPT. Five of the ten prepared working groups therefore proceeded by each requesting ChatGPT to produce the text of an invisible city, as if it were to be an extra chapter written in the style of Italo Calvino.

From this first phase, it already became apparent that text-to-text artificial intelligence on its own was not always capable of accomplishing satisfactory work. The goal was, in fact, to obtain five texts that could have been exchanged for Calvino's, i.e., tales of invisible cities in front of the reading of which an ordinary person would have had difficulty recognizing a different authorship from that of the original book.

On the contrary, it often happened that the text produced by ChatGPT had a language strongly discordant from Calvino's. For example, the AI sometimes resorted to non-literate language, sometimes even used bulleted lists, which seems to be one of the recurring traits of its usus scribendi (Thorp, 2023). At other times, more simply, the

title it gave to the story, i.e., the name of the town, was not responsive to those proposed by Calvino, which are all classical women's names.

Once all the texts were obtained from which to start, the process aimed at making the related images was carried out. For this activity, it was decided to use Midjourney software (version 4) because of its good balance between ease of use and widely recognized ability to generate high-quality images (Roose, 2002; Ghosh & Fossas, 2022). In addition, there are several accounts in the literature of Modjourney's particular aptitude for making images related to architecture (Ploennigs & Berger, 2022; Radhakrishnan, 2023), a feature that makes it particularly adherent to the selected topic.

A focus on the operation of Midjourney becomes necessary at this point to make evident the human designer's input in the image development process.

AI text-to-image software makes use of machine learning, especially the GAN (General Adversarial Network) process. The latter is a learning method that allows neural networks to generate new data from the same data distribution used in the learning process (Goodfellow et al., 2014). This makes it possible to produce images from a huge amount of information with which the AI has been trained, but which is still unique and novel.

Access to Midjourney is provided by Discord, a third-party messaging service through which a request can be provided to the AI via a text message using the /image command. From the request, the software generates four images, and the user can decide whether to work further on one of them by modifying the prompt or by having an upscaling performed and obtaining, in either case, four new variants. There are some tricks that can be used to have more control over the output, such as the -chaos command that defines how similar or different the four images produced are, or the -seed command that allows the generated images to be associated with one of the 4294967295 versions that the software could have come up with from the same prompt, so that the same aesthetic can eventually be recalled later using the same seed at a different prompt. Moreover, the command ::x [...] ::y allows users to define different weights to be attributed to different parts of the prompt. In this way, the software will focus more on certain elements specifically. Finally, in addition to the commands that Midjourney itself provides, there are certain keywords identified by users that can direct the software toward high-quality production, such as the words "extreme quality," "cinematic lights," "4K," and "HDR" inserted at the end of the prompt. Similarly, through keywords one can indicate the graphic style or other elements.

It was then necessary to adapt Calvino's (and ChatGPT's) texts by extracting from them the essential representational features to be translated into an effective prompt for Midjourney. For example, the city of Zezenia created by ChatGPT presented the following text:

Zezenia is a city located on an island rising in the middle of the sea. The city is divided into two parts: the underground city and the aerial city.

The underground city is an intricate labyrinth of tunnels and galleries that stretch for miles beneath the surface of the island. Here the inhabitants conceal themselves from the eyes of visitors, living in a secret world protected from the rest of the world.

The aerial city, on the other hand, is a city built on giant trees, made up of towers, bridges and platforms. Here the inhabitants live in the treetops and move about on suspended bridges, secured by ropes, that connect the various platforms.

The towers of the aerial city of Zezenia are all works of art, decorated with mosaics, carvings and sculptures created by the inhabitants themselves. Each tower has its own special beauty and the atmosphere there is unique.

The city of Zezenia is also famous for its special light, a magical light that seems to emanate from within the stones, flowers and trees of the city. This light gives the city a fairy-tale, dreamlike atmosphere that almost seems to be out of this world.

This text was translated into numerous prompts that aimed to obtain the desired images through a variety of approaches. Some of them are given below as examples:

/imagine Overview of a city located on an island in the middle of the sea, that is built on giant trees, made up of towers, bridges, and platforms, the inhabitants of the city live among the treetops and move on suspended bridges, secured by ropes, that connect the various platforms , is also famous for its special light, a magical light that seems to emanate from within the stones, flowers, and trees of the city. This light gives the city a fairy-tale and dreamlike atmosphere that almost seems to belong to another world. That city has an underground and secret part, an intricate maze of galleries and tunnels that extend for kilometers beneath the surface of the island. Here, the inhabitants of that city hide from the eyes of visitors, living in a secret world protected from the rest of the world, extreme details, photorealistic, 4k, HDR --c 10 --s 50 --v 4

/imagine High definition 3d model of an island where its possible to see the surface part, that is built on giant trees, made up of towers, bridges, and platforms ::2 and the submerged secret part that has a lot of intricate maze of galleries and tunnels :4 --c 50 --v4

front view of a floating rock which have the underground part that is full of house and tunnels while the other part is above trees filled with bridges and ropes and is located on the top of the rock, extreme details, fairy tail lights, ocean, rock --s 100 --v 4

It can be noted that the approaches are very diverse, and in Fig.1 one can see the wide variety of images that was generated. The images shown in the figure are, in the same way as the prompts mentioned above, just a few explanatory examples, but the process of finding the correct prompt and the subsequent image editing that followed included a total of more than 100 prompts and more than 400 images generated.

Once the final desired image was obtained, a responsive 3D model was created through the use of Rhinoceros modeling software, followed by 3D printing of an exhibition model of the respective city.

Result & Conclusions

The models of the ten realized cities were exhibited, alongside an explanatory poster of the source text and the design process carried out, at Genoa BeDesign Week 2023. The exhibition was quite successful, with more than

200 visitors enjoying observing the works created. The exhibition, titled "Calvino Thefted," also invited visitors to try to guess which of the cities were taken from Calvino's original text and which, on the contrary, were the result of AI's exclusive work. This interactive approach was met with great interest and it was possible to observe that, except for people who had a deep knowledge of the original text of The Invisible Cities, visitors in general were unable to guess the authorship of all the works.

Wanting to make a conclusive argument about the contribution of AIs in the design process, and of the role of the designer in their use, it is evident from the previous paragraph how Midjoruney (the same could be said for any other text-to-image AI as well as ChatGPT), by itself, is nothing more than a tool that, if used wisely, can lead to the required results. Such results are undoubtedly characterized by a very high level of accuracy and aesthetic appeal, to the point of generating a great deal of popularity in the media and often going viral. However, each time one of these images goes viral, as in the most famous case of the photos depicting Putin and Trump being arrested (Stanley-Becker & Nix, 2023 March 24), what does not emerge is how many attempts and steps of prompt modification were necessary to arrive at the desired result. The hidden truth is that, as was amply demonstrated in the paper, it can take hundreds of attempts, edits, and steps to get to the desired result, not to mention the post-production work that is often necessary. In addition, for the creation of a generalist image, such as "the Pope playing basketball" (this image has also gone viral in the past year), the task can be easier: if the AI can clearly identify the Pope's features and manage to generate a good quality image, it matters little whether this is set in a sports hall or a playground, whether the figure is isolated or surrounded by other players, etc. In contrast, the task becomes much more complex and articulated when what one wants to achieve meets a very detailed and

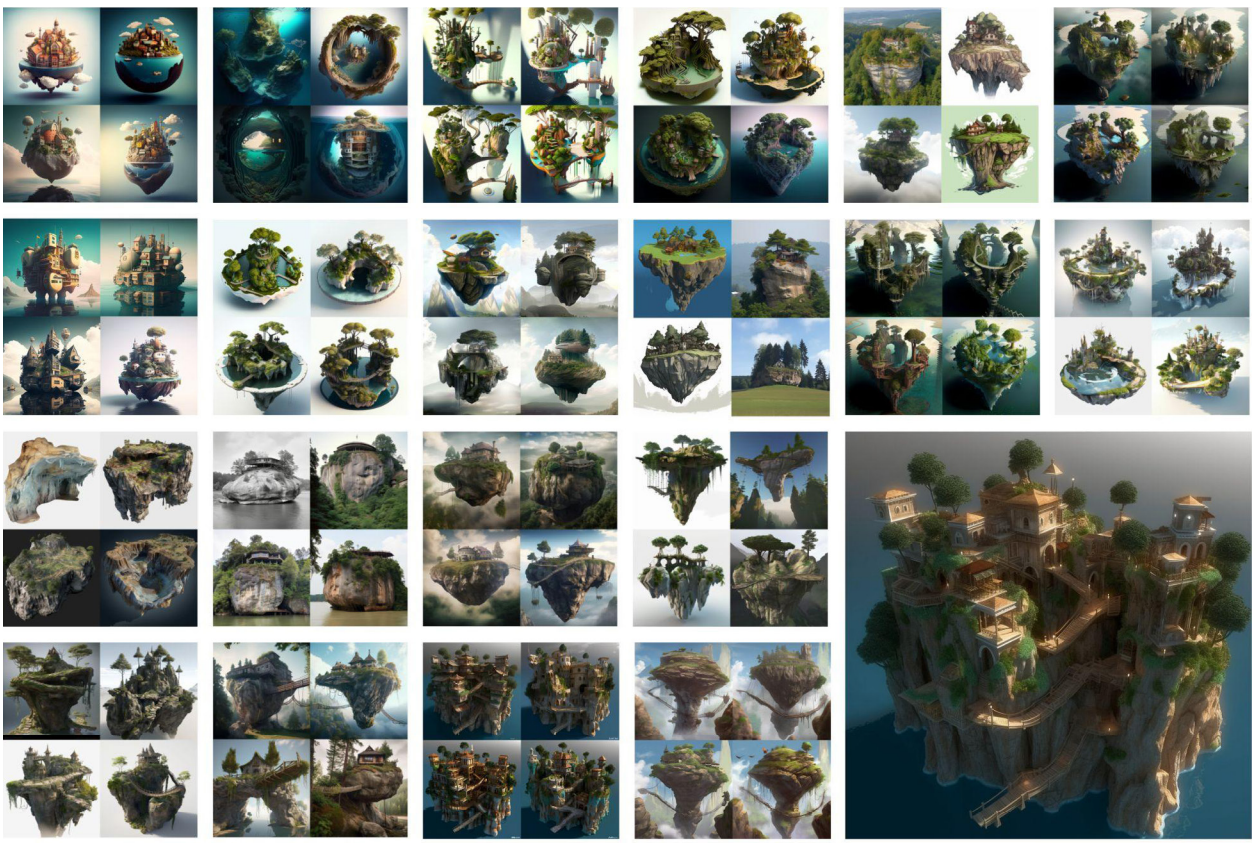

Figure 1. Some examples of the attempts that led to the final image (bottom right) of the city of Zezenia.

precise description. It could be argued, therefore, that AI can be at present a very useful and fascinating tool for the creation of inspirational concepts, but that we have major limitations in the generation of specific graphic products. The role of the designer remains, therefore, central within the design process, and the new AI tools sit within it as tools that may be more or less effective depending on the field, but that like all tools need a trained figure who can best manage them to achieve the desired result.

Further future research will investigate these mechanisms in more detail and, in particular, how the designer can make use of these tools as a form of help in involving users in the design process, since it may be inexperienced users who need support in generating visual concepts that the experienced designer can then use to bring the project to fruition.

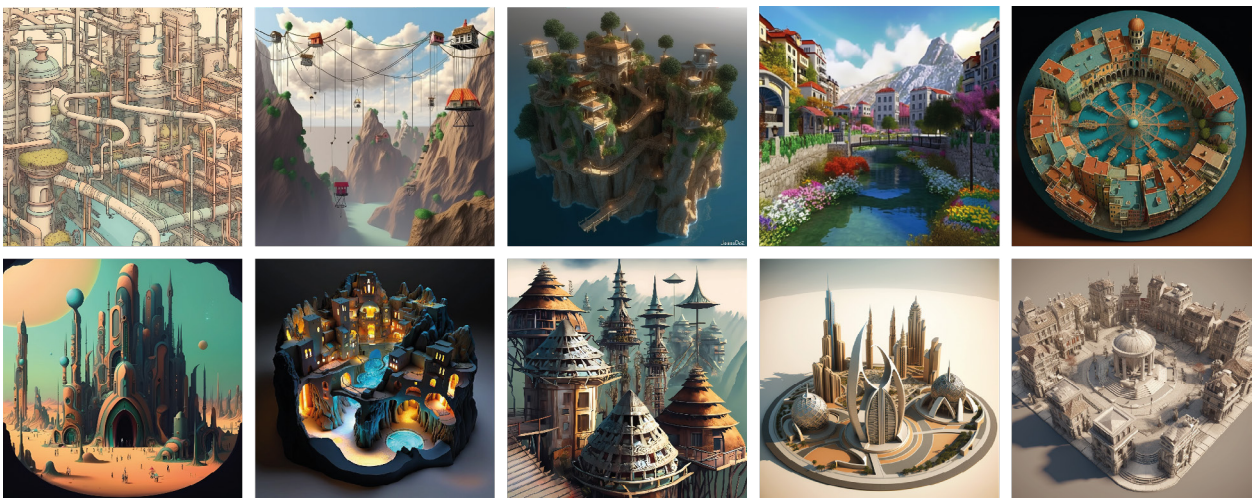

Figure 2. The final ten images of as many cities generated during the workshop

Figure 3. The exhibition of 3D models during LEAVE BLANK UNTIL FINAL ACCEPTANCE Design Week

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Gamification and Serious Games: Technological and Social Transformation through Video Game Interactions

Alberto Calleo

University of Bologna
alberto.calleo@unibo.it

Abstract
The relevance of video game's industry both for its market scale, social impact and cultural role is testified by industry reports, scientific research works, strategic government fundings and policies supporting the use of video games as drivers for cultural and social innovation. However, it emerges the need for a more profound connection between game design research and practices, cultural critique, and reflective design research. Observing video games as an expression of the contemporary commodity form, this contribution aims to discuss designers' contribution in shaping the changing technocultural sphere enforcing the cybernetic idea of mutual influence between social and technological systems. This contribution is part of an ongoing research on how video games represent a space for designer's intervention and a tool for speculative enquiry in design-driven innovation processes.

Keywords
Interaction Design; Gamification; Serious Games; Technological Determinism; Social Construction of Technology

Introduction

The relevance of video game's industry both for its market scale, social impact and cultural role is testified not only by industry reports, but also by the growing number of dedicated scientific research, strategic government fundings and national policies supporting the use of video games as drivers for cultural and social innovation. Reports published by national associations and research studies describe the economic impact and the diffusion of the industry around the globe describing a cartography dominated by established clusters in North America (Pilon & Tremblay, 2013), in the United Kingdom and Asia. Smaller regional clusters, or even sparse companies, are emerging even far from the main production hubs (Wolf, 2015) testifying the growth and the evolution of this productive sector. Institutions and national governments are both directly supporting the industry, for example with financial aids and tax breaks, and promoting the adoption of game-based practices to address issues outside of the entertainment sector (Ruffino, 2018a).

The "material turn" of game studies (Apperley & Jayemane, 2017) testifies the branching of the research on video games into a wider network of knowledge and disciplines with specific reference in the area of social sciences. In design literature, however, not much attention is dedicated to video games as a future space for designer's intervention in the changing production-consumption context triggered and shaped by digital technology innovations. It emerges the need for a more profound connection between game design research and practices, cultural critique, and reflective design research (Malazita & O'Donnell, 2023) to bridge the existing gap.

This contribution is part of an ongoing research on how video games have come to represent a space of intervention for designers and an instrument for speculative enquiry and anticipation in design-driven innovation processes. Video games represent a cultural form in which the characteristics of the transformative economy converge (Celaschi & Casoni, 2020; Pine II & Gilmore, 2013). Moreover, they represent the product of a complex industrial systems that merges physical and digital spaces. Here, two specific forms of game materialization - gamification and serious games - are discussed in relation to their role in the changing contemporary socio-economic context. The outcome serves as a preliminary framing for the development of the ongoing research.

Cybernetic interactions through Gamification and Serious Games

The increase of interest in the video game industry and its technologies must be contextualized within the economic scale of the video game market. It is estimated that in 2022 over 3 billion people play video games in a market which size is estimated to worth almost $200 billion (Newzoo, 2022). When considering gaming platforms, over half of the total revenues are estimated to be coming from mobile games. This market segmentation appears to be of particular interest since the mobile market, specifically that of games played on smartphones, has a significant shorter history compared to that of computer and console games. The development of the mobile game market, together with the evolution of new economic model of distribution and consumption had a significant boost in late 2007 with the launch of the iPhone and the opening of the App Store. Several studies have analyzed the evolution of business models in the video game industry (Lantano et al., 2022) and the evolving dynamics of virtual economies (Lehdonvirta & Castronova, 2014).

Observing such transformations in the video game industry from a design point of view allow to understand how the models and means of value production, consumption and exchange are transforming in contemporary technocultural society. The game market is a dynamic exchange field which materialize the experimental economy in which non-specialists are active actors of a "mainstream method for maximizing innovation" (Jagoda, 2020, p. 97) that has been made possible by technological transformation. Digital interfaces and networked digital systems have redefined the way users experience, navigate and interact with physical and digital spaces. In this context, video games open what has been defined as a "possibility space" (Squire, 2008) that enable the exploration of alternative ideas and behaviors. Game technologies, however, is often used to define experimental situation of which users are not always aware (Jagoda, 2020, p. 15). In the experimental economy, the production and consumption paradigms are no longer the ones that characterize the traditional industrial and post-industrial economy. In fact, in the experimental economy, commodities emerge from an iterative experimental process of production and re-production (Thomke, 2003; Thrift, 2008) rather than being a direct output of a linear process of problem solution. In designer's terms, the definition of the commodity form is a process of continuous innovation determined by socio-cultural, economic, environmental and technological variables (Celaschi, 2000, 2008). If the commodity form is an expression of the context, on the other way around, designer should consider how the commodity form can influence users' agency inside the experimental economy.

In the opening chapter of "Game Cultures. Computer Games as New Media" (Dovey & Kennedy, 2006), Jon Dovey and Hele W. Kennedy explore two opposite positions: the first one supports the idea that society shapes technological development (Williams, 1974/2003), the second one is that technology influence society (McLuhan, 1964/2015). As Dovey and Kennedy point out, new-media studies address this issue through the idea that the social and the technological systems, rather than being one dependent on the other, are actually intertwined through feedback loops like in cybernetic systems. The concept of a cybernetic loop of influences between

technology and society invites to reflect on the designers' contribution in the changing domain of human-computer interaction and at the same time, to analyze how designers' practice adapts and evolves under the influence of the technological environment.

In the next two sections, the perspective of technology determinism and social construction of technology (SCOT) will be explored through the analysis of gamification and serious games as game forms that materialize instances of the two positions through game mechanics and technologies. The intent is not to argue on a philosophical level the conceptual adherence of the two practices to one vision or the other. As it will be discussed, within gamification and serious games it's possible to draw examples that can be interpreted either as expression of technological determinism or as SCOT. At the same time, no general positive or negative connotation are associated to the two perspectives, although ethical implication will emerge as part of the discussion. The scope of this argument is to provide examples that highlight designers' contribution in shaping the changing interaction happening in human-computer-interaction (HCI) through video games enforcing the cybernetic idea of mutual influence between the social and technological sphere.

Gamification

The use of the term Gamification in the field of technology and human-machine interaction started spreading in 2008. One of the most referenced definition is that gamification is "the use of game design elements in non-game context" (Deterding et al., 2011). The game design elements are those used in most analogue and digital games and articulates along a growing scale of abstraction: from interfaces elements (badge and leaderboard) to game mechanics and dynamics. These components are applied in non-ludic context in order to achieve affective and motivational outcomes, behavioral outcomes, and (cognitive) learning outcomes (Krath et al., 2021). Specifically, as reported by Krath et al. (2021) studies on behavioral outcomes highlight the positive impact that gamification has when adopted for increasing engagement and improving performances. Gamification has become a popular term across many industries, and it has been proposed as a possible solution for solving even complex problems (McGonigal, 2011). However, criticisms have been made to gamification as it suggest a methodology that proposes easy to apply solution to complex issues (Bogost, 2014). Moreover, gamification has been criticized since its applications can leverage on human's cognitive and responsive mechanism not only to persuade and nudge towards positive or health attitudes, but also to exploit and influence users to corporation's profit or social control (Hon, 2022). It has been argued that, more than a design approach, gamification describes the form that contemporary economic and social technoculture is taking. Jagoda (2020) observes how Debord described spectacle as "a social relationship between people that is mediated by images" (Debord, 1967/2008) that broadcasted cultural and social expression of the late 1960s. Seemingly, gamification materializes contemporary economic and socio-cultural dynamics (Jagoda, 2020, p. 31). Compared to spectacle, gamification does so with the structural difference of game and network technologies. In this sense, Jagoda interprets gamification, not only as a design strategy, but as the manifestation of the contemporary economic, social and cultural environment that constitute a "formal and cultural counterpart to neoliberalism" (Jagoda, 2020, p. 63). By translating neoliberal values in mechanics of play, gamification emerges as a form of social determinism of technology, but, in the same time, it acts as mean of technological determinism of society, by leveraging on forms of nonconscious manipulation.

One of the most common applications of gamification is in sports and physical activity tracking. Not only specialized equipment for advanced sports practitioner, but also consumer gadget with tracking features saw

a growing diffusion in the electronic market. The ease of use of tracking application facilitates the collection of personal data relatively to general or specific activity. Such practice is generally defined as "lifelogging" and consists in tracking information relevant for the user in a digital diary. Active and passive data collection generate "lively data" which are big quantities of information describing a wide variety of aspects of human life (Lupton, 2016). With multiple sensors in our devices continuously tracking our physiological data, every aspect of our life can be measured and "as long as it ca be measured, it can be gamified and improved" (Hon, 2022, p.12). In the constant chase for personal improvement, of maximized performances, of the "best version of oneself", the quantification through personal analytics enables progress tracking, and gamification acts as a motivational nudge to keep pursuing goals. When motivation and commitment are not enough, a solution proposed by a product is generally available for purchase. In this sense, it could be argued that the quantified self is a product of technological determinism that uses gamification to encourage behavioral change. At the same time, users' data are collected and used to suggest custom products and services presented as something that can boost the charts and the leaderboards of personal analytics. Over time, gathered personal data accumulate and stratify. Users will eventually stop using tracking device - it has been estimated that abandonment rate for fitness tracker is 30% (Gartner, 2016). Gamification (or the lack of it) fails to transform the initial engagement with the technology in something different. The distance between the user and the technology does not change as the two parts do not influence each other (Ruffino, 2018b). One of the causes of tracking device abandonment is that they lack the capability to adapt to unforeseen changes and circumstances in users' lives (Clawson et al., 2015). The growing implementation of Artificial Intelligence technologies that are capable to predict, anticipate and adapt to users' needs and behaviors, could be considered a design strategy to activate a cybernetic connection between human and non-human agents. In context, the contribution of designers is to build meaningful interaction through user's data and to develop frameworks for technology adoption capable to adapt and interpret changes in users' lives and in the environment they live in. Together with self-tracking technologies improvement, the development of feedback loop across different physiological and psychological component is an area in which user experience design can significantly contribute (Chianella et al., 2021). The social dimension of data is a component on which gamification can leverage to build strong social relationships among users and between humans and machines.

Serious and Applied Games

Serious games are games designed with non-entertainment purposes. The original definition is attributed to Clark C. Abt (Abt, 1970) and has been widely adopted, reformulated and extended in literature (Laamarti et al., 2014; Michael & Chen, 2006; Susi et al., 2007). Related definition can be found in literature (games with a purpose, education games, game-based learning) that stress specific connotation and use context. Ian Bogost's definition of Persuasive games (2007) is built upon the representation system based on rules and interactions typical of video games for conveying a form of nonverbal persuasion that he calls "procedural rhetoric" (Bogost, 2007). Applied games is a term that has been proposed as a comprehensive definition for facilitating cross-disciplinary research and design innovation (Schmidt et al., 2015). In this contribution, the terms serious games and applied games will be used interchangeably since the discussion revolves around general approaches and it is geared to design applications.

Serious games have been developed for application in multiple areas with a particular focus on training and education. In the field of medical education and surgical training, for example, serious games are considered potentially valuable tools for their flexibility, operational cost and accessibility, even if more standardized assessment are generally required for full implementation (Graafland et al., 2012; Wang et al., 2016). With the

development of game technology, a growing number of applications are exploring the field of cultural heritage (Anderson et al., 2010; Mortara et al., 2014). Serious game have also been developed for training in other critical condition, such as fire service training (Williams-Bell et al., 2015) and aviation. Military and defense operations are, of course, among these critical scenarios. One video game that is frequently reported as an effective example (Laamarti et al., 2014) of serious game is America's Army (U.S. Army, 2002). America's Army is a free-to-play first-person shooter game developed and first published in 2002 by the U.S. Army to encourage recruitment among players. The support was discontinued in 2022. The "serious" aspect of the game, rather that referring to the actual dynamics of real military operations, that are carefully represented and simulated, is attributable to the enrolment scope of the games. Following this interpretation, America's Army appears to be an expression of technological determinism (as it should push users to join the military forces) rather than a technological tool materializing a social interest. However, the latter is equally arguable since a society that builds its defense strategy on a strong and technologically advanced military capability needs to construct such digital infrastructure: a technology that leverages on strategies of persuasion and social influence. America's Army represents the cybernetic loop between technological determinism and social construction of technology. It shows both a form of technology determinism in its capability to persuade individuals in joining the army, and an expression of socially constructed technology since it is the materialization of a technological tool giving answer to a social need.

The ethical implications of the designer's role are deeply connected with technological innovations. The problem is not only related to military applications, but it also extends to the social impact of the digitalization. Serious games and video games provoke emotional responses in users not only recurring to narrative representation of the storytelling which are typical also of other media, such as movies, but especially through actions and choices deliberately made by the user. In fact, the peculiarity of video games is that they are an action-based media (Galloway, 2006/2022). The actions of the operator (the gamer) and those of the machine are what activate the material change, and therefore the evolution, of the system (Galloway, 2006/2022). Through design decisions and techniques, games can evoke both positive and negative emotions into players (Isbister, 2016). For example, in games like Paper, Please (Pope, 2013), players are confronted with ethical decision within an altered moral and social systems. The player is asked to allow or deny access to the fictional country of Astorzska to migrants on the bases of their documents and other available information. The player's decisions will determine who will be allowed to enter the country or not with the risk of letting terrorists with falsified passports in and rejecting innocent people who don't have the necessary documentation. As it has been pointed out, the possibility of exploring different moral behaviors through deliberate ethical choices invites to develop a critical reflection on social values (Sicart, 2019). This exploration space of possibility is determined by game designers who structure a system in which players action acquire meaning (Salen & Zimmerman, 2004). In the same way, interaction designers define a space of possibility when designing human-machine interactions that intertwine physical and digital spaces with real and virtual experiences. Also, in designing game interfaces and virtual artifacts in games, designer shape the limits of interaction and player's agency inside the virtual world. The interface of Paper, Please defines the limits of the user's ability to intervein in the system. In this case, it translates the complex moral dilemmas raised by the narrative into a straightforward basic game mechanic: allow or deny access. At the same time, it provides worldbuilding elements that materialize the frustration of an over-bureaucratized political system with the use of a basic interface that clutters with documents, notes and manuals. As the previous example, it is possible to observe the cybernetic loop between SOCT and technological determinism materialized by the designed interface of the game.

Conclusion

As new technologies are developed and introduced to the market and in design practice, video games are changing the designers role of "dialectically mediate between needs and objects, production and consumptions" (Maldonado, 1991/2008, p.14, Author's translation). The convergence of multidisciplinary skills and professionalism that characterizes the video game industry makes it an important bearer of innovation and change. Moreover, with the intersection of many languages and models of human-computer interaction and the integration of artificial intelligence-based technologies it emerges the need to develop common methodologies and practices between the video game industry and other productive sectors. This contribution used the concept of cybernetic systems to frame the role of gamification, serious games, and video games in general in the ever-changing contemporary society characterized by technoculture. Future development of this ongoing research will explore how video games are reframing the space of designer intervention in the redefinition of alternative models of value production and exchange and how they can be used as tools for speculative enquiry and design research.

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Beyond Limits: Enhancing Creativity by Breaking Perceptual Blocks in Design Flow

Yating Li [1], Henry Ma[2], Elaine Wong[3]

[1]The Hong Kong Polytechnic University
yating.li@connect.polyu.hk
[2] The Hong Kong Polytechnic University
henry.ma@polyu.edu.hk
[3] The Hong Kong Polytechnic University
elaine-yl.wong@polyu.edu.hk

Abstract

This paper reviews perceptual blocks hindering designers' creativity in the design flow. Design flow is a problem-solving process. Designers always adopt creative thinking in the design flow. Designers' creative thinking is commonly confronted by barriers in their mind termed 'perceptual blocks'. Based on the review of breaking through perceptual blocks to creativity in the design process, this article builds a theoretical framework for enhancing creativity in the design flow. By recognizing and understanding these perceptual blocks, designers can become more aware of their limitations in the ideation phase of the design flow, surpassing their habitual ways of thinking to foster design innovation.

Keywords

Creativity; perceptual blocks; creative thinking; design flow; problem-solving.

Introduction

With the rapid development of technology and changes in the social environment, the problems designers encounter have become more sophisticated and complex. Creativity, a widely discussed topic, is increasingly demonstrating its significance in effective problem-solving. Despite having the aspiration to generate innovative solutions, diverse cognitive barriers impede problem solvers from engaging in creative thinking. To excel in utilizing creative thinking in problem-solving, it is beneficial for individuals to remain cognizant of these obstacles and implement appropriate strategies to overcome them. By the same token, overcoming perceptual blocks in the design process benefits designers' creative thinking.

Design Flow as a Problem-solving Process

Design flow inherently constitutes a problem-solving process. A complete problem-solving cycle comprises three essential components: given state, goal state, and operation (Greeno & Simon, 1988; Ormrod, 2020). The essence of the problem-solving process is explained as problem- solvers scrutinize and transform information, operating from a starting point to achieve a specific goal (Lovett, 2006). Previous research has identified two key elements in problem- solving: (1) the problem statement, where problem-solvers articulate all the relevant information to represent the task; and (2) search strategies, which are the approaches problem- solvers employ to explore alternative solutions (Simon & Newell, 1971; Newell, 1979; Greeno & Simon, 1988). From the problem-solving

perspective, the design flow encompasses two core components: defining the design problem and seeking design solutions. For instance, the double diamonds model from the British Design Council exemplifies this flow, where, after one or multiple rounds of the design process, designers strive to progress the problem by defining the issue as a given state and searching for solutions to reach a goal state.

The Basis for Reasoning in Problem-solving

The problem-solving process, from a cognitive perspective, is rooted in reasoning. Human reasoning draws upon experience and knowledge (Maier, 1930). For example, problem-solvers often employ heuristic approaches to aid decision-making, relying on analogizing previous experiences and knowledge to address current problems (Lenat, 1982). Nevertheless, prior experience and knowledge can act as both facilitators and barriers to thinking creatively in problem-solving. Reliance on the "representativeness" and "availability" biases in mindset may yield unsatisfactory solutions (Kahneman et al., 1982; Evans, 1989). Previous content in mind cannot serve as the basis for innovation, therefore freeing designers from established domain- specific knowledge and experience within the design flow facilitates them to think out of the box (Weisberg, 2006).

Perceptual Blocks in Ideating Solution

During the ideation phase of solution generation, problem-solvers often encounter mental barriers termed perceptual blocks, impeding the exploration of potential opportunities. In the problem-solving process, solution generation can be divided into two stages: idea generation, followed by idea implementation (Basadur, 1997; Mumford, 2001). The effectiveness of idea generation, including the abundance and diversity of alternative solutions, is expanded by confronting perceptual blocks, such as removing fictitious constraints or discovering novel approaches (Shah et al., 2003). Problem-solvers employ search strategies in the idea-generation phase, and the richness of search strategies hinges on the scope of their perceptual awareness; heightened perceptual consciousness facilitates ideating solutions (Block, 2011). Despite the inherent human tendency to rely on prior experience and knowledge, proficient designers demonstrate the ability to search for 'surprise', which helps them in avoiding routine behaviours (Schon, 1983). The originality of creativity in the design process is driven by the 'surprising' part (Dorst & Cross, 2001).

Being Aware of Perceptual Blocks

Being creative in problem-solving is challenging for individuals, as harnessing creative thinking necessitates problem-solvers to consistently confront the barriers in mindset. Presented here are four frequently recurring obstacles that require careful consideration by designers. Functional Fixedness: Impeding Insights with Assumptions Problem-solvers encounter function fixedness when they adhere to assumptions derived from their experiences in comprehending an object's functions. The term functional fixedness, originating from the concept of 'fixation' (Maier, 1930), then it is employed to describe problem- solvers who become entangled and ultimately fail to resolve an issue (Duncker & Lees, 1945). Schooler & Melcher have depicted the limitation of function fixedness as a 'content-induced set' within the mind (1995), resulting in an 'impasse' in problem resolution (Kaplan & Simon, 1990; Smith et al., 1995). Additionally, functional fixedness can obstruct 'insight' in problem-solving, leading problem-solvers to take action prematurely, without a comprehensive grasp of the actual problem (Sternberg & Davidson, 1995; Sawyer, 2011).

Mental Set: Bound by Rigidity of Mindset

The mental set refers to the inclination to adopt a fixed approach to specific problems, based on solutions applied

to analogous situations in the past (Öllinger et al., 2008). Mental set behaviours usually manifest in individuals with expertise and experience in a domain, potentially hindering the generation of innovative ideas due to their inflexible mindsets, which resist adaptation (Jersild, 1927). Problem-solvers may find themselves restricted by their domain-specific knowledge (Wiley, 1998), overlooking other pertinent information that could bear relevance to the problem.

Cognitive Miserliness: Reliance on Mental Shortcuts

During the problem-solving process, especially when grappling with unfamiliar challenges, individuals often engage in cognitive miserliness by resorting to mental shortcuts (Taylor, 1981). Cognitive miserliness is from the term "cognitive miser" which characterizes those who lack systematic processing and tend to conserve cognitive resources (Fiske & Taylor, 1991). It reflects the tendency to opt for simplicity, relying on accessible and applicable judgments (Stapel & Koomen, 1998), rather than more time-consuming and effort-intensive approaches. This inclination can lead to neglecting a comprehensive assessment of the current issue and hinder a nuanced comparison between the current and desired states, essential for identifying potential solutions.

Schematic Reasoning: Leaping to Previous Solutions for Familiar Issues

Developed through problem-solving expertise, schematic reasoning involves storing a repository of past solutions in long-term memory, thus alleviating the computational burden on short-term memory (Ericsson & Smith, 1991). Schematic reasoning plays a pivotal role for many experts in efficiently identifying and resolving problems. However, in the context presented here, the term describes problem-solvers who, when confronted with familiar issues, tend to bypass essential problem-solving processes and jump to an assumed goal stage based on prior solutions. Problem-solvers may find themselves confined by schematic reasoning, amplifying their reliance on previously acquired experiences and knowledge structures known as 'schemas' (Bartlett, 1932), potentially leading to the underestimation of other pertinent problem aspects (Hunt, 1994a, 1994b). The drawbacks of schematic reasoning may entangle problem-solvers in paradoxical dilemmas, and it can yield shallow resolutions for problem- solvers dealing with complex issues (Sternberg, 2013).

Enhancing Creative Thinking in Design Flow

Designers are often seen as creative problem-solvers, owing to their proclivity for ideation. Designers use creative thinking to have a conscious recognition of their preferred cognitive approaches, thus enabling them to transcend the boundaries of their problem-solving capabilities (Sternberg, 1999). Employing creative thinking fosters the enrichment of possibilities and the exploration of novel avenues (Treffinger et al., 2006).

Strategies to Breakthrough Perceptual Blocks

Prior research has emphasized the disruption of perceptual blocks and the cultivation of novel perspectives to foster creative thinking (Amabile, 1989). Creative thinking goes through abundant cognitive processes, however, it is worth noticing the need for people to invest scarce cognitive resources in solving the problem at hand (Mumford et al., 2012). The following paragraphs propose several thinking strategies as a theoretical framework.

For Functional Fixedness: Thinking Fluidly from a Broader Scale

Thinking fluidly on a broader scale during ideation can avoid only adopting the conventional definition of an object's functions. Previous studies have demonstrated that preconceptions about solution objects engender functional fixedness, leading problem-solvers astray (Duncker & Lees, 1945; Adamson, 1952). Problem-solvers

should avoid the influence of established solution functions and approach problems with fluidity, unburdened by specific function definitions (German & Defeyter, 2000). By embracing this mindset, designers can cultivate a fresh outlook when examining solutions.

For Mental Set: Thinking Flexibly from Domain Knowledge
Overcoming mental set requires the flexible exploration of various perspectives. Despite the efficiency gains associated with mental set, it is imperative for problem-solvers to recognize the dual role that mental set plays, not only facilitating efficiency but inhibiting 'insight' (Öllinger et al., 2008). To counter the rigidity of entrenched mindsets, problem-solvers must transcend the confines of their domain-specific knowledge, surmounting the limitations of an expertise-driven mental set (Wiley, 1998).

For Cognitive Miserliness: Motivating the Cognitive Miser Facet
The metaphor of a cognitive miser underscores both the finite nature of cognitive resources and the demand for efficient problem-solving (Corcoran & Mussweiler, 2010). Addressing cognitive miserliness necessitates warning cognitive shortcuts and motivates the cognitive miser facet. Motivation serves as a pivotal factor in selecting cognitive shortcuts during the thought process (Fiske & Russell, 2010). The desire for cognition motivates the enjoyment and effort invested in cognitive activities (Amabile et al., 1994). Advancing motivation can encourage individuals to stimulate their cognitive miser tendencies (Ebenbach & Keltner, 1998). Especially, activating cognitive miserliness by enhancing intrinsic motivation can propel problem-solvers toward becoming 'chronic' thinkers who derive satisfaction from cognitive engagement (Waller, 1999).

For Schematic Reasoning: Questioning Assumptions to Accurate Problem Recognition
Challenging assumptions enable problem-solvers to explore factors being overlooked. While some problem-solvers, in the course of expertise development, resort to memorizing an array of 'schemas' to overcome limitations but cannot apply them appropriately, then these schemas become resulting in 'knowledge in pieces' (DiSessa, 1983). Overreliance on previous solutions may hinder the resolution of novel issues. Consequently, individuals need to accurately grasp the crux of problems (Hunt, 1994b) to cultivate a creative thinking style that transcends historical experiences, necessitating a perpetual interrogation of assumptions (Dewey, 2022).

Discussion
It is argued that the cornerstone of creativity lies in the generation of exceptional, original, and innovative solutions to intricate, novel, and ill-defined problems (Mumford et al., 2012). When ideating solutions, designers should be aware of the adaptability of their knowledge and experience in this intricate cognitive process.

To go beyond cognitive limits, however, the mere application of strategies in creative thinking falls short of deeply eradicating perceptual blocks. It is of greater importance that strategies to approach creative thinking are internalized into a cohesive and tangible creative thinking style. As Dewey underscores: identifying tendencies in reasoning is crucial in order to recognize one's confines (Maier, 1930; Dewey, 2013). Consequently, designers aspiring to adopt a creative thinking style require decisively to choose to go beyond knowledge and experience as their preferred cognitive approach within the design flow.

While knowledge and experience stem from the problem solver's perceptual perspective, it is also crucial to consider a broader array of factors in the pursuit of enhancing creativity beyond limitations. Various other

elements influence the utilization of creative thinking: problem solvers' attitudes, encompassing the willingness to take calculated risks and tolerate ambiguity (Sternberg, 2009), as well as the presence of a supportive environment conducive to nurturing innovative ideas (Sternberg, 2003).

Conclusion

This article perceives the design flow as a problem-solving process and examines creative thinking from a cognitive perspective. It offers a deeper understanding of the prevalent perceptual blocks within the design flow and suggests strategies for their systematic identification. Overall, this review paper introduces a theoretical framework to overcome perceptual blocks that hinder creative problem-solving within the design flow.

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The Expression of Emotional Interaction Design in Museums in the Digital Era ——A Case Study of the British Museum

Wangwei[1], Mamin[2]

[1]Academy of Arts&Design,Tsinghua University,Beijing,China
E-mail,wangweiart@126.com
[2]Academy of Arts&Design,Tsinghua University,Beijing,China
E-mail, 52200343@qq.com

Abstract

In today's digital age, interaction design is one of great significance in museum design, emotional interaction design can also help museums collect information from visitors and improve display content to better meet the needs of visitors. Therefore, emotional interaction design is of great significance in museum display design, helping to create a better visitor experience. This article explores emotional and visual presentation methods suitable for digital media through the specific exhibition design of the British Museum.

Keywords

Digital Age, Emotionalization, Interaction Design, British Museum

Introduction

The interaction design of museums usually draws inspiration and sources from multiple aspects. Designers or curators need to understand and study the themes and types of exhibits related to museum projects to ensure that interaction design aligns with the exhibits. Curators and designers need to consider the needs and expectations of visitors to ensure that interaction design can provide meaningful experiences for visitors. In addition, designers can draw inspiration from other art exhibitions and museums to understand the latest interaction design trends and best practices, and refer to the latest technologies and methods in the fields of digital design and user experience design to ensure that the interaction design of museums is innovative and attractive. In the interactive design of museums, it is also necessary to coordinate with other design elements, such as exhibition space layout, lighting, and decoration. This requires designers to work closely with other museum staff to ensure that the interaction design is coordinated with the entire museum environment.

The British Museum is the world's first national museum open to the public. As a comprehensive museum, it collects various cultural relics and artworks from around the world, including Egyptian mummies, Greek and Roman sculptures, Chinese ceramics, African artifacts, and more, totaling over 8 million items. The research on the collections of the British Museum is a relatively important part, covering a variety of disciplines, including history, archaeology, art history, natural sciences, and so on. These studies not only help us better understand the collection itself, but also help us better understand the development and evolution of human civilization. Researchers at the British Museum often conduct archaeological excavations and research to discover and protect more cultural relics and prehistoric sites. In addition, they also use various technological means, such as

digital technology and imaging technology, to research and protect their collections, ensuring that these valuable cultural heritage could be continuously appreciated and learned by researchers and visitors. The research on the collections of the British Museum is very important, as it not only increases our understanding of human history and culture, but also provides valuable information and resources for future research and conservation work.

Specific Implementation of Emotional Interaction Design in Museums.

The definition of art in the digital age has been reinterpreted, its meaning has been continuously expanded, and its presentation forms are flexible and diverse. Traditional exhibition models are no longer suitable for displaying works. Collection management is a fundamental function of museums and a cornerstone of their various work. Collection management is a complex process that requires scientific methods and the participation of professionals. Museum displays in the digital era have shifted from past exhibitions to increased interaction and participatory experiences with visitors, which is also one of the manifestations of emotional interaction design. This transformation is aimed at attracting more viewers, while also better showcasing the exhibits, allowing the audience to better understand and appreciate them. In the display interaction design of the British Museum, the designer takes into account the needs and interests of the audience, as well as the characteristics and historical background of the exhibits, and utilizes digital technologies such as virtual reality, augmented reality, and interactive screens to increase the audience's sense of participation and interactivity. For example, in the exhibition hall, designers can use virtual reality technology to create a virtual scene, leading the audience through time and space, and experiencing the changes of history. In addition, the designers of the British Museum also used digital methods to address the issue of exhibition protection. Digital exhibits can provide viewers with more display methods and interactive experiences without damaging the original.

Using AR technology to explore and enhance reality

The British Museum adopts Augmented Reality AR (Augmented Reality AR) technology, which allows visitors to experience the virtual reality world from an emotional perspective through mobile devices such as smartphones during their visit. Visitors can also use AR devices to explore the exhibition hall, view 3D models, enter history, explore stories, and learn about and obtain cultural relics information.

Visitor computer interaction, also known as human-computer interaction, what is an interdisciplinary field between computer science and human behavior, aimed at enabling computer systems to better understand and respond to human needs, emotional states, and behaviors. It involves various ways of interaction between humans and computers, including input, output, feedback, and control, emphasizing the mutual influence and interaction between visitors and computers. The British Museum organizes and integrates the information of its collected artworks into computer devices, designs a more convenient user interface through human-computer interaction, and uses natural language processing technology to allow visitors to search for museum exhibits through voice or text, helping visitors and researchers to quickly understand the artworks of interest, improving their sense of body and visiting efficiency. The universal display screen is a common interactive device in museums, usually used to present exhibition information and multimedia content to visitors. At the Capitario Museum of Art in Rome, these screens are designed with highly customizable features to adjust to different exhibitions and themes. These screens typically use high-definition display technology to ensure clear image and video quality, and are equipped with touch screens to facilitate visitors' interaction and exploration with exhibition content. In addition, these screens can also be integrated with other devices and systems, such as audio systems, lighting systems, security systems, etc., to provide a more comprehensive and immersive

exhibition experience. Overall, these universal display screens are an important component of the interactive design of the Museed ' Art Cabiotorio in Rome, providing visitors with a more diverse, interesting, and interactive exhibition experience.

In September 2020, the British Museum launched an international touring exhibition - the Egyptian Mummy: Exploring Ancient Egyptian Life Tour, see Figure 1.The Egyptian Mummies Exploration of Ancient Egyptian Life Tour is an international touring exhibition launched by the British Museum, showcasing the history and vitality of ancient Egyptian life, as well as the cultural relics and art of ancient Egypt. The audience can learn about the process of making mummies and how ancient Egyptians regarded them as eternal beings. In addition, the exhibition will also showcase the trade and handicrafts of ancient Egypt, as well as aspects of religion and social structure. This touring exhibition will visit museums and art centers around the world, showcasing ancient Egyptian mummies and their related culture and history to the audience. The exhibits on display include precious cultural relics unearthed from ancient Egypt, such as models of pyramids, jewelry, mummies, violets, and mysterious masks, as well as ancient wooden utensils, showcasing the complexity of ancient Egyptian society, religion, culture, and economic life.

This exhibition provides visitors with the opportunity to join the research team of the British Museum and introduces six mummies that lived and died in Egypt from 3000 to 1800 years ago. The British Museum has adapted to the development of the times and invited some experts to explore ancient Egyptian culture in the form of images, images, and mobile exhibition halls, allowing visitors to have a deeper understanding of ancient Egyptian culture and enriching their cultural perspective. They used a new generation of CT scanners to answer questions and solve puzzles for curious visitors. CT scanners can present complex human remains and objects beneath mummy packages with scanned images in front of curious visitors, and can more accurately determine some key information, such as the gender, age, and health status of the mummy at the time of death. The exhibition of ancient Egyptian mummies shows us the unusual funeral traditions of people here during this period, preparing for the afterlife. These traditions attract us to explore the life along the Nile River thousands of years ago. At the same time, the exhibition has set up voice recognition and intelligent assistant devices, such as Amazon Echo or Google Home, allowing viewers to interact with intelligent assistants through voice and obtain more information.

The Cooper Hewitt National Design Museum in the United States has further innovated this display method at the British Museum, with the "The Pen" mobile device digital pen inside. As an exhibit at the Cooper Hewitt National Design Museum in the United States, it provides users with a new way of creation and expression through the use of advanced digital technology, allowing visitors to understand and familiarize themselves with the collection through emotional senses. When using the 'The Pen' mobile device digital pen, viewers and users can create digital paintings, notes, charts, and various other types of design works, and save their interested art works to the device or share them on other platforms. The emergence of this digital pen can not only improve the work efficiency of designers, but also to some extent change the development direction of the creative industry. Interactive design can create more realistic and vivid display effects through digital technologies such as virtual reality and augmented reality, thereby enhancing the audience's sense of experience. Viewers can immerse themselves in the historical and cultural background of the exhibits, gain a deeper understanding and experience, and actively seek the best learning mode. Compared to traditional displays, interactive design guides the audience to actively participate in the display, thereby improving audience engagement and interactivity.

Figure 1. Egyptian Mummies (Exploring Ancient Egyptian Life - International Tour Exhibition Exhibits)

Using media platforms to enhance emotional interaction and communication

The British Museum uses social media to facilitate interactive communication between people, such as Facebook, Twitter, etc., allowing visitors to communicate and share experiences in real- time online, as well as obtain the latest information about exhibitions, increasing the popularity of exhibitions. By using social media platforms to assist in the dissemination of exhibitions, the British Museum can establish effective connections and interactions with visitors, researchers, scholars, as well as museums and cultural institutions around the world. The British Museum has a large number of fans and followers on online platforms such as Facebook, Twitter, Instagram, and YouTube. Use these platforms to publish relevant images, videos, articles, and other content about exhibitions and artworks, showcasing museum collections and academic exchange activities to the public. These contents have aroused the interest of visitors and researchers, thereby promoting their visits and in-depth research exploration.

Secondly, the British Museum also utilizes interactive functions on social media platforms to communicate and interact with fans and followers. For example, museums often initiate topic discussions on Twitter, inviting tourists to share their museum experiences and opinions. In addition, the British Museum will regularly hold online Q&A activities to answer tourists' questions and doubts. These interactive activities have helped establish an open, friendly, and interactive community, promoting interaction and communication between museums and the public. The British Museum also utilizes social media platforms to promote its offline activities and exhibitions. Post photos and videos related to exhibitions on Instagram, promote events and lectures through Twitter, and more. These promotional activities help museums attract more tourists and visitors, while also increasing public attention and understanding of museum work. Overall, the British Museum has established good interaction and communication with the public through the use of social media, making it a modern, open, and interactive cultural institution.

The collections of major museums around the world contain a large number of archaeological artifacts and precious literature, which connect the process and experience of world civilization development. The use of emotional interaction design in museum display design is a reflection of comprehensive art design. In display design, emotional experience is widely applied to artistic design languages such as contrast, symmetry, and balance, so that visitors can see and feel the images of exhibits and collections in the museum space, and the colors and light reflected are effectively combined to form a unified whole. Architect Anthony said, "Only by experiencing the space firsthand, walking through it, and enjoying it with pleasure, can you truly appreciate its inherent qualities." For example, in recent years, the National Museum of China has been committed to the construction of a smart national museum, integrating ancient Chinese traditional culture with modern technology, promoting cloud services, and creating the central kitchen of the National Museum. The cloud national museum has gathered 56 virtual exhibition halls 100 exhibition themed websites, many cultural relics and boutique exhibitions showcasing the charm of China have taken to the cloud. I.M. Pei's design of the "Louvre Pyramid" at the Louvre in 1984 was an innovation and breakthrough in spatial design in museum display design; The Science Museum in London introduced a radio guidance system between 1960 and 1964. In 1964, visitors to the Museum received mobile radio equipment distributed by the museum, allowing them to hear targeted voice explanations. The above list demonstrates that museum display design plays a positive and balanced role in the development of museums, enabling visitors to have an idea of viewing the displayed items upon entering the museum. This is a very positive aspect of museum display interaction design.

The interactive design of art museums can enrich the meaning of space, deepen emotional experience and spatial cognition, and this experience is also more authentic and profound. When interactive design is used in art museum displays, it can provide visitors with a richer and more profound spatial experience. This is because interactive design can not only increase the participation of visitors in exhibitions, but also provide more creative and diverse display methods. Interactive design can allow visitors to have a deeper understanding of the exhibits. When visitors use interactive projection or virtual reality technology to view an exhibit, they can observe from different angles and perspectives, gaining a more comprehensive understanding of the details and characteristics of the exhibit. This interactive viewing method can allow visitors to have a deeper understanding of the story and meaning behind the exhibits, thereby improving their emotional experience and spatial cognition. Interactive design can enable visitors to participate more actively in exhibitions and bring more innovative and diverse display methods. When we visit exhibitions in museums, we often expect to see some interesting exhibits and understand their historical and cultural backgrounds. However, if the design of the exhibition is only static, it may make us feel monotonous. Therefore, emotional interactive design can bring rich spatial significance to museum exhibitions.

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Creative Methodologies for the Development of Spatial Intelligence in Environmental Design

Lin Chen[1], Juan Albert Estevan[2]

[1]Gengdan Institute of Beijing University of Technology , China
chenlin@gengdan.edu.cn
[2]Gengdan Institute of Beijing University of Technology , Spain
juanalbert@coac.net

Abstract

Recent environmental awareness requires a paradigm shift in space design education to one with greater focus on creativity as a capacity to cope with the complexity of our actual design challenges.The conception of new spaces requires new strategies in design education focusing not only on analytical and logical thinking but on "lateral thinking" (De Bono E. 1991), "divergent thinking" (Robinson K. 2001) and "emotional approaches" (Damasio A. 2005) fundamental for the development of spatial intelligence. These strategies can be developed through collective and individual drawing, mockups and photography to create a new environmental sensibility incorporating aspects of traditional Chinese design in the conception of new spaces.

The purpose of this contribution is to present a case study in which we worked with first grade students of Environmental Design in Gengdan Institute of Beijing University of Technology in the "Rethinking the Hutong" project (2018 and 2019). In this "project based" course students applied creative methodologies and experimental work creating a collective project redesigning and revaluing an important element of Beijing traditional architecture now endangered by urban speculation.

An important part of this teaching strategy for the development of spatial intelligence is the concept of atmosphere. We understand atmosphere when a strong experience of place and space is produced; when space evokes sensorial perceptions (warmth, light, sound…), embodiment (body mindfulness), compassion with the user (empathy) and specific cultural meaning (Pallasmaa, J. 2009). 'The essence of atmosphere is the haptic sense of being in the world in a specific place and moment, the actuality of existence' (Böhme, G. 2013).

In the development of spatial intelligence students learned that spatial definition not only depends on geometry and materials but also on light, touch, sound, smell and environmental factors. The learning shift occurs when instead of facing a project with an abstract 'concept', they start to work with real 'sensations'. For first degree students, facing a project with abstract concepts is difficult; it is easier for them to work with real sensations. Experimenting with atmospheres is very stimulating for spatial design students and we consider it fundamental for acquiring environmental design capabilities.

Keywords

Creativity; Design; Environment; Space; Atmosphere.

Introduction

Why this course? (our motivation)

The aim of this presentation is to present a case study in which we worked with first grade students of Environmental Design in Gengdan Institute of Beijing University of Technology in the "Rethinking the Hutong" project (2018-2023). In this "project based" course students applied creative methodologies and experimental work creating a collective project redesigning and revaluing an important element of Beijing traditional architecture now endangered by urban speculation.

Recent environmental awareness (climate change, pollution, city growth…) requires a paradigm shift in space design education to one with greater focus on creativity as a capacity to cope with the complexity of our actual design challenges (creation of more human environments, re-naturalization of urban spaces, new types of mobility, more efficient use of resources…)

We are on the brink of technological, ecological, social, and economic change that will fundamentally change the way we live and work. Taking into consideration that the scale of this change will be different from any that humanity has experienced before we think it is very important to train students how to think in new ways, how to be creative, how to find new connections and how to react in unstable conditions.

The development of spatial intelligence is basic to cope with these changes. Spatial intelligence in environmental design is the capacity to visualize, imagine, create and communicate space for environmental projects. Creativity as the capacity to develop new ideas with value is fundamental in the development of spatial intelligence.

Figure 1. Student proposals rethinking traditional Chinese house

China has a very rich cultural heritage reflecting a powerful sensitivity towards space design. The importance and special use of light and color, the use of perspective and visual structure, wooden construction systems, garden design, are some of the many elements of traditional Chinese space design. In the last years many of these design principles have been forgotten due to economic growth and fast urban development introducing standardized and foreign models of environmental design alien to Chinese culture.

We consider of great importance to teach through the development of creativity and space intelligence how students can rethink their traditional culture for new and modern environmental design requirements.

Methodologies

1.Learning the transition from two-dimensional to three-dimensional

Development of spatial thinking through freestyle drawing and collage. The exploratory drawings of abstract concepts develop the imagination and help students finding 2D patterns and structures that can become interesting spaces.

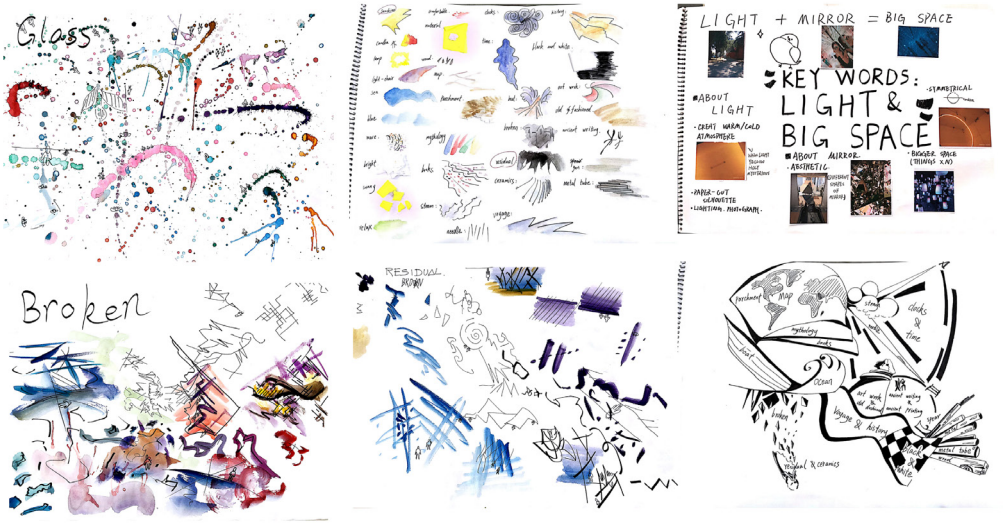

Figure 2. space exploratory drawings made by students

2. Learning by doing

The transition between 2D and 3D was made by students exploring with their own hands and with different materials.

They produced individual and collective mockups which were photographed alongside cutouts of human figures to develop new environmental sensibilities.

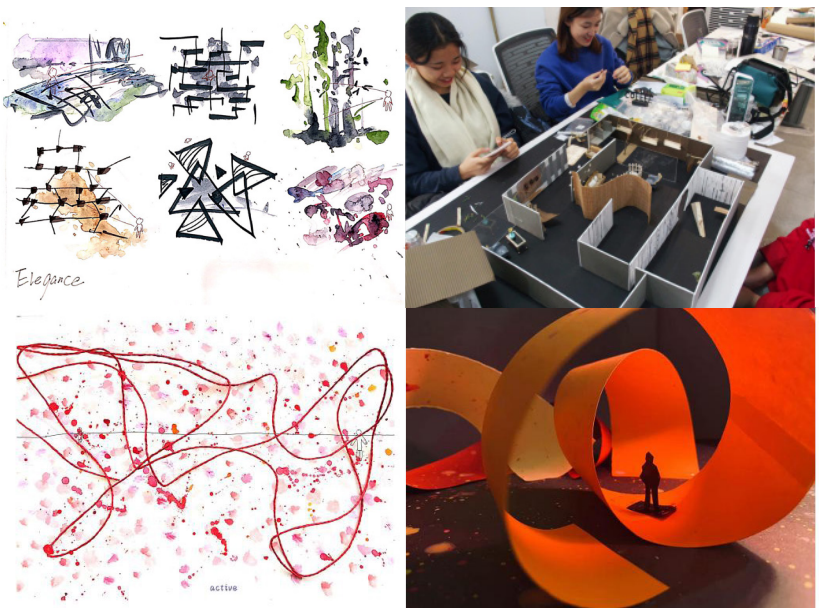

Figure 3. Working with the hands

3. Dynamic methodologies of active interaction

Students were always active participating in collective activities like making big drawing with ink about their feelings regarding environmental design problems or making personal presentations of their research.

Figure 4. Students realizing a collective 'sensory' drawing

4. Enhance the experience of space

The development of a heightened sensitivity towards the utilization of space is fostered as students explore how their bodily movements generate spatial dimensions through drawing.

Figure 5. Explore space with body painting

5. Learning by solving real problems

Students are dealing with real problems: the loss of traditional culture , the destruction of historical heritage, the lack of social interaction in modern cities, the homogenization of modern commercial space, etc.)

Considering and debating these aspects of our actual environment gives meaning to what they are learning.

Figure 6. Discussing the pros and cons of Beijing environment

6.Experiential learning
Considering and discussing about students personal experiences (interests, values, tastes, hobbies, etc.) was very important in optimizing the learning process. Student fell more motivated and make their project as part of themselves.
Experiencing new sensations in the design process was also very important in the realization of moodboards with different materials.

7. Emotional learning
The process of working with atmospheres in the development of new spaces, through drawings, photographs, and mockups, engages students in a sensorial learning experience that encompasses warmth, light, sound, embodiment (body mindfulness), and empathy towards the user.
Specific cultural meaning incorporating aspects of traditional Chinese design. The students carried out sensory activities related to traditional Chinese culture (tea ceremony, writing with Chinese ink, etc.)

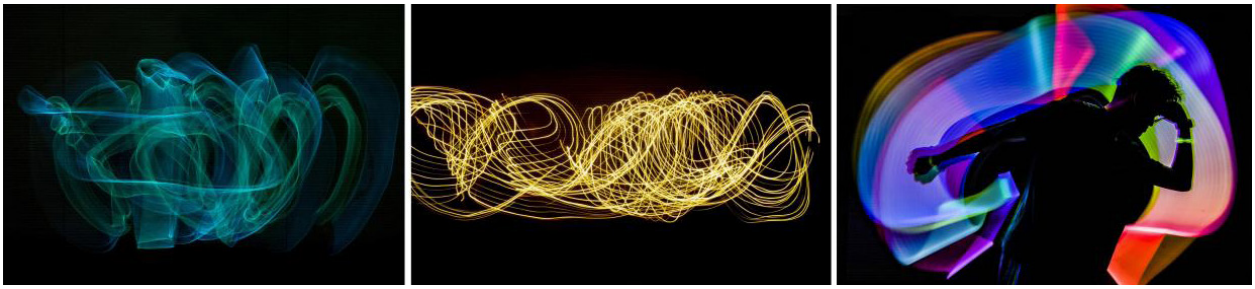

Figure 7. Students express emotion with light

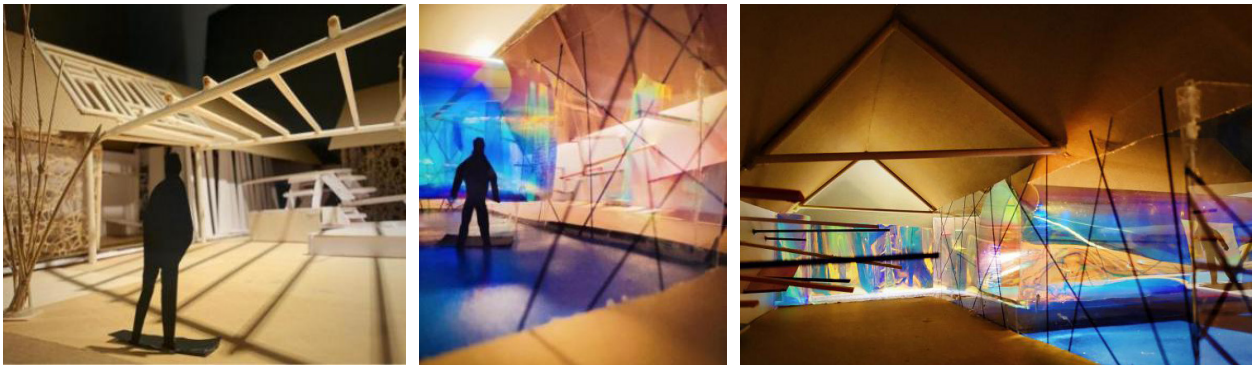

Figure 8. Creating atmospheric values in space design

Figure 9. Exploring space with Chinese ink-based writing

8. Continuous assessment and feedback
The students always knew about their evolution and about the group evolution through personal and collective feedback.

9. Result orientation with focus on the process.
The goal of the course was to redesign part of the old city that was suffering important destruction due to urban speculation. The final result was a collective model product of the process of integrating individual designs.

Figure 10. Student making a demonstration of Chinese tea ceremony

Figure 11. Group feedback

Figure 12. Different stages in the realization of individual designs

Conclusions

Teaching is more difficult for teachers because working with real problems, experiences and emotions implies dealing with complexity and uncertainty.This kind of teaching means more work for the teachers preparing and organizing materials and spaces for different activities.

This kind of teaching in not linear (not cause-effect, not one solution but different solutions…etc.) and this is a great difficulty for some Chinese students.We consider this 'uncertainty mood' as something positive for the development of creativity because many times certainty in design is a barrier to the development of new ideas.

Most of the students were very satisfied by the results of the first exploratory exercises and this motivated them to continue researching on different areas.Through drawing, collage, model, and other exploration attempts, freshmen learn to break with linear education.

In the development of spatial intelligence students learned that spatial definition not only depends on geometry

and materials but also on light, touch, sound, smell and environmental factors. The learning shift occurs when instead of facing a project with an abstract 'concept'， they start to work with real 'sensations'.

Experimenting with atmospheres is very stimulating for spatial design students and we consider it fundamental for acquiring environmental design capabilities.

At first, creating atmospheres is difficult for students with a strong rational approach to the project. Once they change to a more sensory approach they discover a wide range of possibilities to link their project with the environment.

Working with 'sensations' instead of 'rational abstract concepts' has been a positive change for students in the first stages of the project.

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A Study of Cultural Space Construction in Small Town Centers in Northwest China in the Context of Urban Renewal

Jing LI[1], Feng YE[2], Xuanzheng WANG[3], Yong Liao[4]

[1]School of urban planning and Municipal Engineering, Xi'an Polytechnic University,
lijing@xpu.edu.cn
[2]School of Design Art,Communication University of Zhejiang
yefeng@cuz.edu.cn
[3] School of Design,Central Academy of Fine Arts
wangxuanzheng@cafa.edu.cn
[4] Sichuan University
leooly@163.com

Abstract

This study explores the construction of cultural spaces within small towns in Northwest China, focusing on the unique challenges and opportunities presented by this distinct urban context. The paper identifies that these towns generally have a mix of commercial and residential areas, often characterized by a lack of infrastructure, parking facilities, and public transportation. The paper argue that the transformation of these spaces is often handled in a superficial manner, resulting in a lack of integration with the surrounding area and a loss of material and intangible culture. In response to these issues, this research proposes a shift towards a more sustainable and organic approach to urban renewal, one that respects the historical and cultural context of these towns. The paper presents an in-depth analysis of the concept of cultural spaces, the dynamics of organic renewal, and the interplay between these two aspects. It asserts that cultural space is not only the spiritual core of urban development but also a key strategy for urban revitalization. The paper concludes with a discussion of the implications of these findings for urban planning and policy-making, emphasizing the importance of cultural identity in shaping the perception, understanding, and design of built environments.

Keywords

Cultural Space Construction, Small Towns in Northwest China, Urban Renewal, Organic Renewal, Urban Cultural Identity

Introduction

Cultural space creation is linked to the historical accumulation and lineage of urban and rural development, representing not only works with a long history, but also the evolution of urban and rural development in modern times (Vale, 2018). Cultural spaces differ substantially between large cities, small towns, and villages, and their types and qualities are not the same (Grodach, Foster, & Murdoch, 2019). The general norms and general problems of the cultural space features of small town centers in Northwest China are the subject of this research.

At the moment, small towns in northwestern China generally have mixed commercial and residential areas with

"stores in front and houses at the back, and stores at the top," most of which are located in the center of small towns, which show a low-level, chaotic, and congested spatial form in urban landscape, and at the same time, there are many problems such as lack of infrastructure support, parking facilities, public transportation, and so on (Tan & Li, 2018; Song, Zenou, & Ding, 2018).

The renewal and transformation of small town centers are mostly protected by the "cage type" against the backdrop of the excess of the "incremental era" to the "stock era," that is, ignoring the integration of development with the surrounding area, focusing on the remodeling of street style or façade renovation, and ignoring the regeneration of material and intangible culture; or adopting rough overthrow and reconstruction, local residents resettled in other places (Huang & Tao, 2021; Wu & Zhang, 2017). Based on this, this paper changes the predicament of the cost limitation of small town renovation, the policy pressure of prohibiting forced demolition, and the social problems of demolition and resettlement of aboriginal people by changing the previous pattern of floating on the surface. When combined with the development status quo of small towns' center areas, it creates cohesion and symbiosis between the renewal area and the periphery, becoming a cultural identity card in the course of the city's modern development (Carter & Butler, 2021; Zhao & Zu, 2019).

Rational Analysis of Urban Organic Renewal under Cultural Orientation

Cultural spaces

Cultural space, i.e., the space of culture, is identified as a place where folk and traditional cultural activities are concentrated, but also as a period of time that is generally characterized by a cycle (period, season, schedule, etc.) or an event (Vale, 2018). After the 19th National Congress report, cultural confidence was proposed as the "fourth confidence" of socialism with Chinese characteristics, following road confidence, theoretical confidence, and institutional confidence, marking the culmination of the construction of space in the context of cultural prosperity.

These spaces, which add a humanistic flavor to the city and countryside, have become significant development objects. They are inclusive of public cultural space, urban cultural space, and community cultural space, together forming the city's local cultural characteristics system. They play a crucial role in safeguarding cultural diversity and have significant implications for gentrification and urban transformation processes. These processes often involve the displacement of arts and cultural industries, leading to potential alterations in cultural identity (Grodach, Foster, & Murdoch, 2019; Carter & Butler, 2021).

In the context of China's rapid urban expansion and landscape transformation, the development and preservation of these cultural spaces have become essential (Tan & Li, 2018). The regeneration of urban villages, for instance, can significantly impact neighborhood cohesion and cultural identity (Zhao & Zu, 2019). Additionally, strategies for housing renewal and reconstruction are pivotal for maintaining these cultural spaces and ensuring their sustainable development (Huang & Tao, 2021).

Organic Updates

Organic renewal, as proposed by academician Wu Liangyong, and Shalainen's theory of organic growth both

refer to the city as a living creature. This perspective is reflected in more recent urban studies, which often draw from biological metaphors to understand the complex dynamics of urban development (Vale, 2018; Wu & Zhang, 2017). Wu Liangyong believes that organisms are organically linked from the city to the building, in accordance with the city's internal order and law, and in accordance with the dynamic growth of the city's texture and trends. Adopting an acceptable urban scale, suitable building and space scales, and correctly handling the relationship between the present and future, as well as the relationship between the audience, based on the content and requirements of the renewal, are all key considerations in this organic approach. It investigates the renewal and growth of the city on the basis of sustainable development, continuously enhances the quality of urban planning, and makes the environment of the urban renewal area consistent with the overall environment of the city. The role of cultural identity in this process is particularly critical, shaping the perception, understanding, and design of built environments (Carter & Butler, 2021).

critical thinking

Interplay of cultural space and organic regeneration

(1) Cultural space is the spiritual core of urban development

The city consists of spaces carried by different functions for different groups' needs, and various needs, functions and spaces are divided into different levels according to scales, including urban areas, urban zones, urban units, urban neighborhoods, urban residences, and internal spaces of residences, and the units are slowly gathered and grown through the activities, interactions and behaviors of citizens' groups. In the process of aggregation, the scale of the spatial unit becomes larger, the population increases, and the functions are richer. Cultural space is the cohesive core unit of the spatial unit, which is the place for living and interacting in the neighborhood unit, and also the space for cultural identity and belonging that is shaped by the group interaction together. It is the central space of the block in the urban unit, the hub of public culture in the urban sub-district, and the representative of urban locality and inheritance in the urban area.

(2) Cultural space creation is a key strategy of urban revitalization.

Ilir Shalinen proposed "organic urban growth" in "The City: Its Development Decay and Future" in 1942, which is a type of "Adaptive Change" (Adaptive Change) with high flexibility to adjust to the complexity of the existing circumstances. strong adaptability to deal with the current quo's complexities. Saarinen (Saarinen, 1942) Organic urban regeneration is the essential transformation of city areas that are no longer fitted to the social life of an interconnected city in order for them to thrive and prosper once more. It primarily comprises the rehabilitation and continuance of various biological habitats, spatial environments, cultural environments, aesthetic environments, and recreational settings, among other things. Redevelopment, rehabilitation, revitalization, and historical preservation are the four modes of urban organic rejuvenation. Among these, physical space building primarily serves to compensate for a lack of infrastructure and public service facilities. To complete the process from primary perception to deep cultural identification, the creation of urban spiritual culture necessitates the construction of cultural space. Of course, social value is the primary evaluation indicator of urban renewal (see Table 1), and it is ultimately responsible for making the urban renewal region blend with the city as a whole.

Design standards	Norm	quantitative analysis	qualitative analysis
Local character preservation/ improvement	Whether local features appreciate in value	√	
	Updating the uniqueness of the region		√
Cultural Identity Shaping	Spiritual and cultural values, cultural identity of citizen groups		√
City Characterization	Collective impression of the city		√
Open space accessibility	Average walking distance to nearest open space	√	
	Open space accessibility	√	
	Barrier-free facilities serving the elderly, persons with disabilities and children		√
Non-residential development to changing Adaptability of non-residential development to changing needs	Adaptability to future changes		√
	Retainability of local characteristics	√	
Cultural space construction	Spatial places with cultural interaction and cultural functions	√	

Tab.1 Social indicators in urban renewal projects

Path of building cultural space in small towns in the context of organic regeneration

According to China's National Bureau of Statistics, there were 18,746 organized towns in 2019. However, small town growth in Northwest China faces serious issues like excessive building volume, disordered styles, and monotonous skylines dominated by ultra-wide high-rises. Given these problems, urban planning should respect overall city positioning, analyze the city's spirit and culture, and build a cultural system enriching community spaces. The costs and benefits of urban renewal that conserve some modern history while improving residents' environment and belonging should be balanced. Ultimately, planning should realize the city's characteristic development aims, inherit its historical qualities, and revitalize its vitality.

Building a cultural function system

The elucidation and organization of cultural elements forms the basis for developing a functional system that aligns with the specific needs and development trajectory of small towns. This system may encompass diverse cultural components including, but not limited to, cultural centers, libraries, folklore centers, bookstores, cultural creativity districts, digital cultural experience zones, and public spaces such as cultural plazas, folklore plazas, and fitness and leisure plazas (Whyte, 1980). This cultural function system, while grounded in the town's cultural elements, should remain adaptable and expansible, tailored to the unique characteristics and evolving needs of each small town (Montgomery, 1998). The system serves as a blueprint, guiding the design and construction of physical spaces that enhance the cultural vibrancy and social fabric of the community (Gehl, 2011). Ultimately, this approach ensures cultural assets are strategically leveraged in urban planning, fostering community engagement, enhancing quality of life, and supporting sustainable urban development.

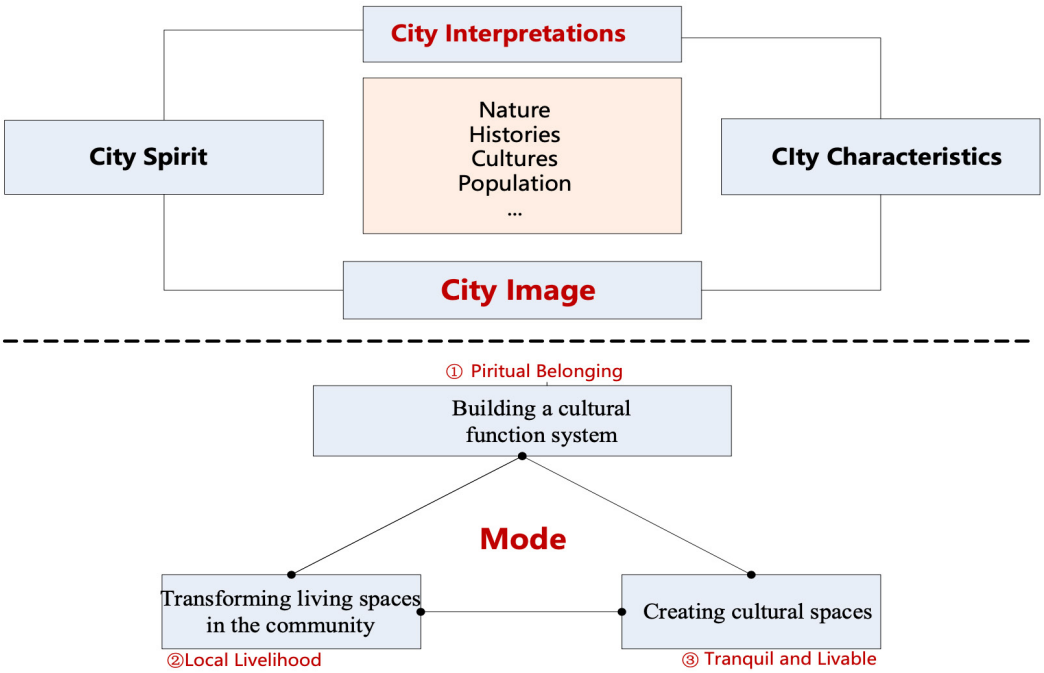

Figure 1. Path model of cultural space construction

Transforming living spaces in the community

Community living space is the main content of small town centers, and it is only by allowing urban citizens to live in peace that a greater degree of urban culture can be demonstrated. Therefore, the collective memory of local citizens and their groups should be preserved, and the places of collective memory should be appropriately remodeled and converted into living space units that are in line with the city's image and meet the needs of modern life. Retaining the form of mixed business in the community, supporting drainage, gas, heating, parking and other facilities, removing the wall and combining the externalization of the interaction space with the space for culture and nourishment.

Creating cultural spaces

Cultural spaces like small town centers encapsulate urban character, serving as public hubs and venues for folk practices within living areas (Mumford, 1961). Renewal should enhance, not eradicate these imprints shaping collective memory (Huyssen, 2003). It involves constructing spiritual places to foster cultural self-confidence from historical roots. The aim is reviving regional culture, reshaping geo-spatial networks (Lynch, 1960) and intertwining public and spiritual spaces. Effective regeneration retains inhabitants, necessitates minimal planning for enjoyable spaces, and fosters community cohesion cost-effectively (Carmona et al., 2003). Thus cultural spaces are vital not just for preserving history but also for optimal renewal strategies.

Conclusion

This study underscores the importance of cultural space construction in the context of small towns in Northwest China. The unique challenges these towns face, including mixed land use, lack of infrastructure, and superficial transformations, necessitate a fresh approach towards urban renewal. The paper advocates for an organic renewal approach, which treats cities as living organisms and emphasizes the need for urban renewal in sync

with the city's internal order and growth dynamics.

Importantly, cultural space is identified as the spiritual core of urban development and a key strategy for urban revitalization. The preservation of cultural spaces and their sustainable development play a significant role in maintaining neighborhood cohesion and cultural identity.

The study also underscores the importance of the interplay between cultural space and organic regeneration in urban planning, indicating that the right balance between the two can lead to more sustainable and culturally vibrant urban environments. The findings of this research hold significant implications for policy-makers, urban planners, and developers, urging them to create urban spaces that are not just physically functional but also culturally meaningful and sustainable.

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Transferability: Exploring ontological properties for design knowing

Ashley Hall1[1], Fernando Galdon[2]

[1]Royal College of Art, London, UK
[2]Central Academy of Fine Arts, Beijing, China
ashley.hall@rca.ac.uk

Abstract
The nature of design ontology continues to be explored as a crucial step in building closer relationships between the domains of the sciences, arts & humanities, and design. We focus thinking by design researchers including the co-authors to question the true nature of design ontology and its relationship to time, core design practices, reliability, and collaboration across domains. We examine how temporal relationships can drive a new definition of core domain level practices via an examination of Archer's wroughting and wrighting as core practices for design. Our exploration identifies transferability as being the ontological essence of design. However, this raises serious problems in terms of rigour and reliability. We propose an ontological mirror that explains the diverse nature of design while addressing serious rigour issues. This formally positions design as knowledge for future transformation.

Keywords
Design Ontology; Design Epistemology; Transferability; Design Futures.

Introduction

As the impacts of climate change draws larger numbers of researchers from increasingly diverse backgrounds into inter-and-trans disciplinary collaborations some central questions for knowledge production between the different domains of thinking remain unanswered. Design research has struggled to define a clear ontology being influenced by both the sciences and arts and humanities which sit either side. The sciences value reproducibility and generalisability while the arts and humanities value rich depth and qualitative practices providing both with a framework for rigour. One of the key attributes for design thinking appears to be its relationship with the future. Arguably a unique quality of designing is its capacity to abductively transform what comes next. Both design research and design practice appear more concerned with changing the 'world to be' rather than understanding 'the world as it is'. The relationship between design and time is worth exploring. While this is promising it raises key questions related to reliability; How can a domain of thinking claim rigour and reliability for a future focussed practice?

Time

When we speak of positioning domains of thinking Simon (1969), Chris Jones (1992) and Glanville (2005) have all positioned design in relation to what the authors have called a future prospective design (Galdon and Hall, 2019) or abductive mode of thinking (Douven, 2011) with time-based analogies for different forms of knowledge

production. Simon proposes the beginnings of a temporal relationship between design and the sciences where he describes the future speculative potential of design as:
"Design, on the other hand, is concerned with how things ought to be, with devising artefacts to attain goals. We might question whether the forms of reasoning that are appropriate to natural science are suitable also for design." (Simon 1969, p.115)

Simon also distinguished between a pre-set goal versus 'Designing without final goals' (Simon 1969, p.162) as a way of addressing complex, dynamic, emerging wicked problems (Rittel & Webber, 1973). This begins to open up a difference of reasoning between the natural sciences (and social and formal sciences) and what at the time was an emerging awareness of design thinking alongside a loosening of design as a problem-solution based linear activity. Previously a notable opportunity opened via CP Snow's 'two cultures' Rede lecture with the proposal of a 'vacant plot' for a future third culture coming into being (Snow, 1959). This was filled by Bruce Archer who proposed the term 'design thinking' in Time for a Revolution in Art and Design Education (1978). John Chris Jones further developed the idea and deepened the future orientated nature of design asking the question "Is designing an art, a science or a form of mathematics?" and answered:
"The main point of difference is that of timing. Both artists and scientists operate on the physical world as it exists in the present (whether it is real or symbolic), while mathematicians operate on abstract relationships that are independent of historical time. Designers, on the other hand, are forever bound to treat as real that which exists only in an imagined future and have to specify ways in which the foreseen thing can be made to exist." (Chris Jones, 1992, p.10)

Separating the points of difference between operating on the physical world as it exists at present verses being 'forever bound to treat that which exists only in an imagined future' ties design to a practice for tomorrows, and at the same time requires the need to specify ways for which these unforeseen things can be created. As we shall see later this provides a powerful opportunity to explore new trajectories for the epistemology-ontology of design while at the same time creating a significant problem when compared to repeatability or generalisability as the rigour qualities that constitute knowledge generation in the sciences. Glanville goes further when discussing time and proposes a 'forever ahead' type of new knowledge production which here is proposed for architecture but which he later claimed applied to all of design.

"Design science and history, the approaches that have dominated design research until relatively recently, are based in an approach that generates knowledge of... I propose that research in design (architecture) should forge a new type of knowledge, knowledge for, intended to help us act (better), to (more successfully) perform our activity as designers. This is one way of shaping our research so that it is based in design, sensitive to design, and designerly." (Glanville, 2005, p.112).

While acknowledging Cross's 'ways of knowing' (2001) he goes further to hint at the conversion of knowledge of, into knowledge for:
"Some will argue that there is a third kind of knowledge that converts knowledge of into knowledge for. I agree. It is commonly called technology, and I refer to it as transfer knowledge (or translation knowledge)." (Glanville, 2005, p.112).

Through his publications Glanville expanded on the implications of knowledge for what he called future

transformation and how this created important features of design knowledge as being always partial, incomplete, and subject to change, while at the same time having a capacity to be good enough for now. He separated Knowledge of (the sciences) from Knowledge for (design) while recognising the critical relationship one had to the other. Glanville's future transformation contrasts with Buckminster Fuller's (1992 (1927)) call for an anticipatory design science (which never fully materialised) in that it understands the future-critical nature of design. Fuller saw the future as a planned for activity where projections could be made and solutions at the ready, whereas for Simon, Chris Jones and Glanville these temporal reasonings point towards an 'always to be' that requires asking fundamentally challenging questions about knowledge being built in the present or retrieved from the past. What has emerged is a series of issues, one of which is serious and crucial to how we understand designing and design research. In addressing this issue, we explore the core practices of thinking domains and how this leads to a propositional ontological position for design thinking.

Wroughting and Wrighting Practices

In Time for a Revolution in Art and Design Education (1978), Bruce Archer proposed a convincing model for the core practices of the aforementioned three domains as: Arts and Humanities - Reading and writing, The Sciences - Reckoning and figuring, Design - Wroughting and wrighting.

Reading and writing captures the place of arts and humanities practices situated in the continuing now, whether they reference historical or future times. This ties both practices and time-space to a present backwards or present forward trajectory. Reckoning and figuring in the sciences encapsulates the essential role of exploring and investigating the world as it was or is, even if this allows projections for future events or activities from the now. Knowledge is built on a past observation irrespective of when it is intended to be used. For design wroughting and wrighting captures Simon's 'how things out to be', Chris Jones's 'forever bound to treat as real that which exists only in an imagined future' and Glanville's knowledge for (future transformation)' as a continuous and never-ending practice. This wroughts initial forms (for products, systems, or experiences) assembled into sets of forms wrighted through adjustments and corrections that steer towards what Simon called 'what out to be'. In many ways this contrasts with contemporary design practices as projects and products in linear formats.

Another useful comparison we can make is through the three thinking domains motivations for experimentation: Arts and Humanities - Experimenting to fail, The Sciences - Experimenting to test theories, Design - Experimenting when the route forwards is unclear.

In the arts and humanities debate, conjecture, argumentation, provocation, and reflection create a contemporary fluid subjective knowledgescape whereas in the sciences repeatability becomes an essential objective quality of trust and rigour. Reproducibility concretises knowledge and builds arboreal networks of knowledge that can be traversed.

Conversely, design is concerned with 'how things ought to be' (Simon), is 'forever bound to treat that which exists only in an imagined future' (Jones) and is focused on knowledge for future transformation (Glanville) as a way of addressing complex, dynamic, emerging wicked problems (Rittel & Webber, 1973). Consequently, it could be said that design researchers have little interest in repeatability and few examples exist in design research where a research project or findings are reproduced in order to test their validity. Common practice is to extend the research into a new space, develop, adapt, hybridise and combine the methods and approaches. Hence

the nature of design knowledge construction relies more on the ability to move or more accurately perhaps extend knowledge to other spaces and contexts rather that repeating a result. There are also practical limitations for viable reproducibility in a domain situated in socio-cultural contexts where capabilities continually shift indicating that reproducibility becomes impractical if not impossible. Participants cannot unknow a previous experience and particularly in complex scenarios may elicit alternative results on a different date or location.

Design Knowing

Previous work on design knowing contains thinking which connects in a number of different ways to explore the ontological properties of design research as transferability. In the context of HCI Zimmerman, Forlizzi and Evenson (2007) have also challenged the repeatability paradox "There can be no expectation that two designers given the same problem, or even the same problem framing, will produce identical or even similar artifacts" (Zimmerman, Forlizzi & Evenson, 2007, p7). Instead, they propose process, relevance, and extensibility. Through process Zimmerman et al brings the notion of rigour, however, they bring it from a disciplinarian perspective more aligned with the scientific method. Instead, we extend the notion of rigour into the capacity to effectively transfer and scale. In terms of relevance Zimmerman state that; "from what is true (the focus of behavioural scientists) to what is real (the focus of anthropologists)". We speculate this perspective and propose that design should focus on what is valuable for the purposes of transformation (the ontological focus of designers).

Binder and Redström (2006) review the three traditions of design research; design theory, design studies and sciences of the artificial taking the latter's (Herbert Simon's) call to change existing states into preferred states. They note that all three threads of knowledge production are incompatible yet contain an observer role akin to the 'knowledge for future transformation' that we derive from Glanville's second order cybernetic perspective. The future focus on what should be coincides with the future focus of transferability. It also highlights the gap between Simon's 'what should be' and how and when this is achieved.

Durrant et al (2015) in proposing a dialogical platform for disseminating research though design in a first-hand account of organising the experimental RTD conferences format provides a compelling example of a context for transferability and the unique position of design research.

These tally with some of our questions on the basis for rigour while the dialogical platform can encourage transferable dissemination of research in the context of the interactions between people and things. The authors also call for more diverse dissemination platforms that could enhance the reach of a transferable design ontology and call for more consensus:

"However, questioning around the relationship between the epistemology of design and science remains open and much debated. This is perhaps due to a lack of consensus on the epistemological and methodological frameworks that designers are using." (Durrant et al, 2015, p.9)

Through constructive design research Krogh and Koskinen (2020) propose 'drifting by intention' as part of the experiential approach and how knowledge can be understood through four belief systems. Drifting is explored though several PhD case studies and aims to begin closing the gap between Frayling's research through design (1993) and how it leads to knowledge production. It describes how drifting is viewed as an 'illegitimate practice or black art' by the methodic epistemic tradition that how it is viewed as needing regiment or elimination. Decision points or gates are identified as intervals to revaluate progress and trajectory. From a temporal point of view the

emphasis is placed on drifting in the now, and how looseness in design research can facilitate new opportunities and highlight inconsistencies as creative opportunities or new routes to explore. They state that: 'Knowledge has to be robust to survive in conversation, but the aim is not to create knowledge claims that would survive years or even centuries.' and 'Design ideas have to survive in dialogue⋯' (Krogh & Koskinen, 2020, p.43). This highlights a useful property of transferability in having conversational robustness.

Building on this and in the context of arguing against the intention binding approach of the preregistration movement Gaver et al (2022) discuss practice-based design in the context of HCI identifying the tension between intention and emergence characterising practice-based design research as emergent concurring with Archer's wroughting and wrighting. Earlier work by Gaver (2012) agrees that design is generative and design theory unfalsifiable in opposition to the Popperian scientific tradition. There are other similarities, and a parallel in a discussion of Suchman's influence from ethnomethodology (Garfinkel, 1984; Suchman, 2007) in the way that agents produce and maintain ongoing activity rather than conforming to an underlying law. The ethnomethodological view aligns with an ongoing 'in action' exploration but misses the temporal relationships and futures concern.

Dixon concurs with Gaver, Krough & Koskinen, and Zimmermen in highlight the need to advance beyond the traditional criteria of reliability, validity, and objectivity '⋯with the potentially special approach to knowledge claiming in design, there is also the possibility that the evolution might take on a different form here too.' (2023, p.127)

An Ontological Mirror

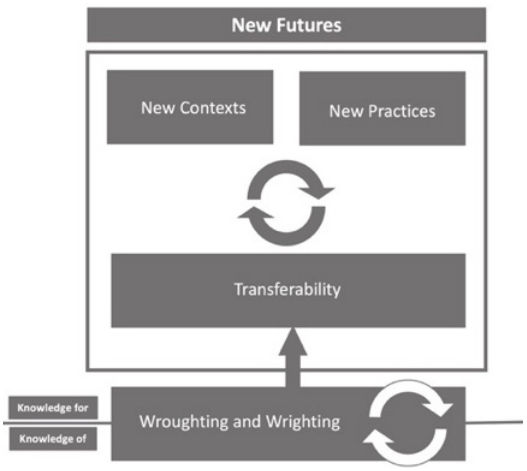
Based on the need for flexibility and adaptability we propose transferability as the primary ontological quality of design thinking as the basis for an epistemological landscape that is fluid and dynamic. We extend the Glanvillian concept of translational knowledge applied to knowledge of into knowledge for (Glanville, 2005) via core practices of wroughting and wrighting (Archer, 1978). Transferability operates in new contexts and practices via wroughting and wrighting between knowledge of and knowledge for in a series of intertwined circular relationships (Fig. 1a). The diagram in Fig.1b captures both the transferability interface between knowledge of and knowledge for. From this perspective, the authors have positioned design as a future prospective domain of thinking in the context of abductive reasoning (Galdon and Hall, 2019). We exchange a degree of accuracy for access to future contexts that are partial. Therefore, our output is probabilistic, and research is always preliminary in its nature.

We also recognise earlier work by Lincoln & Guba (1985) seeking to substantiate qualitative research through in-depth evidence gathering and the generation of trustworthiness criteria of credibility, transferability, dependability, and conformability. Nowell et al (2017) state that the researcher cannot know all the sites their work may transfer into and that only recipients can judge this aspect. The context of this emergence of transferability as a criterion of trustworthiness emerges in naturalistic inquiry via anthropology and social sciences providing a useful framework to enhance trust, however it addresses questions related to knowledge of now, rather than knowledge for future transformation explored through design practices for tomorrows.

At this point we can ask some challenging questions. How can a form of knowledge which is always 'for' have the same confidence as traditionally constructed knowledge built on reproduced experiments? With this in mind, is transferable designerly knowledge created in a different form to that which we conventionally accept? Do

the same rules apply to knowledge of as to apply to knowledge for? The proposition we put forwards indicates this is so and that there is scope to consider knowledge for future transformation as having different criteria as knowledge of. In this case how do we proceed? If we take Glanville's 'good enough is better than best' (2013), how do we know that transferable knowledge is good enough and how do we separate transferability from fantasy or speculation? What gives us the confidence to invest in a mode of thinking that we can support tackling complex future global issues? The answer potentially lies in the reciprocal nature of wroughting and wrighting and its circular ability to sense weak signals that feed back into continually amending the project at hand. In other words, prototyping. Design is always in a beta state.

If we accept this proposal that generates partial and subject to change knowledge, what reasoning can account for the potential reliability issues of transferability? Here we propose an ontological mirror (Fig. 1b) whose purpose is to position design as a reflection of the scientific domain. In this series of mirrored relationships, we see the collection of properties and their attributes. For example, 'Time: What ought to be' reasons 'Validation: a posteriori' and dependent on contextuality, determines 'transferability' as the mechanism while 'experimentation to reduce ambiguity and uncertainty' confirms futures trajectory.



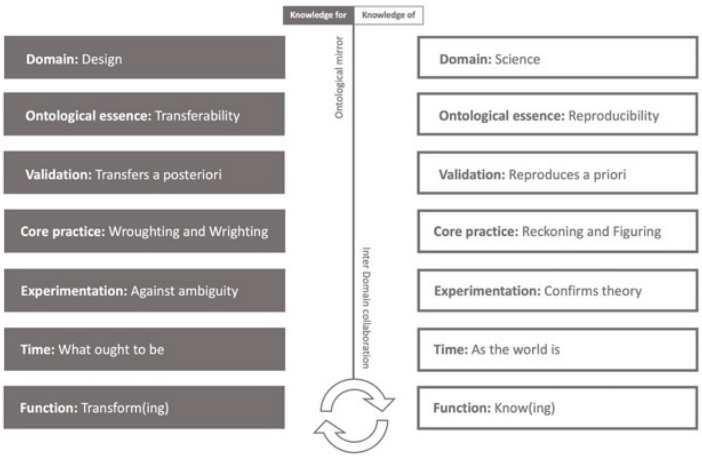


Figure 1a. How core design practices lead to transferability.

Figure 1b. Ontological mirror comparing the design and science domains of thinking

We offer the idea that continued transference is a sign of reliability akin to, but at the same time opposite to continuing to successfully reproduce an experiment. Therefore, as noted earlier, flexibility and adaptability are essential properties of design. Deploying transferred design research becomes knowledge confirmation rather than the retesting of results. One of the key properties of transferability is its ability to be transmitted and scale. This is essential for a mode of thinking that considers what ought to be in the future and builds the capacities, networks and information flows necessary to arrive at preferred futures as depicted in the futures cone (Hancock & Bezold, 1992).

Rigour

Rigour as understood in the sciences means discipline, where discipline guarantees the faithful repeatability of an experiment. However, in design this notion can strangle a practice that is fundamentally constructive and demands the possibility of emergence (Gaver et al, 2022). The emergence of a method, technology, or system

that can account for the new conditions of a context that is fluid, dynamic, ambiguous and uncertain, one which is never in balance, nor stable. While this condition remains in perpetual change, rigour transforms into the capacity to effectively transfer and scale. It creates a new form of reliability that supports abductive thinking and knowledge for future transformation.

As design knowledge (for) is determined by its impact which is conditional on levels of exchange a posteriori, we can only define rigour in the context of design as shown through: identification of impact on the recipient combined with a posteriori, flexibility within the design process and an understanding of the ability to translate knowledge into applications and systems in order to deliver impact.

Discussion

In beginning to answer our questions above 'How can a form of knowledge which is always 'for' have the same confidence as traditionally constructed knowledge built on reproduced experiments?' We reason that if continued reproducibility confirms a theory, then we can propose that continued transferability confirms bringing into being Simon's 'what ought to be'. The function of design is to transform; therefore, the only constant is change. In this context adaptability and flexibility leading to transferability becomes key. In this way we use the ontological mirror to reflect reproducibility as transferability.

Our second question 'Fundamentally with this in mind - is this knowledge at all and if so - is this transferable designerly knowledge in a different form to that that we conventionally accept? This challenges the traditional concept of in situ knowledge as reason (the Greek tradition), observation (the Lockian scientific tradition), or more contemporary phenomenological notions (the Husserlian or Heideggerian tradition) revolving around subjective experience or recursiveness as a regressive view of rigour. Instead, it positions transformation as future confirmation. Here we integrate transferability into a collective unity giving design a trajectory by integrating time. This approach to rigour via a recontextualization of knowledge as guiding and probabilistic in nature enhances the move from subjective to abductive reasoning.

In answering our third question 'Do the same rules apply to knowledge of as apply to knowledge for? We consider the nature and applicability of rules from one domain and invite the idea that they may instead be considered as oppositional pairs as described in the ontological mirror.

Finally, extensibility brings the notion of documentation; "Extensibility means that the design research has been described and documented in a way that the community can leverage the knowledge derived from the work" (Zimmerman, 2007, p8). The handover from extensibility becomes transferability, which is concerned with flexibility for adaptability.

Conclusions

We have explored a temporal narrative that brings to life design ontology as a future focussed mode of thinking continually delivering into designed futures. This has allowed the identification of transferability as the essence of a domain level practice. The critical role of recognising core design practices as wroughting and wrighting negotiates the dual role of interfaces and exchanges between design and the sciences and how design practices and contexts can be driven by transferability. By integrating complexity, uncertainty, ambiguity, and contextuality - which are indivisible in design practice - the potentials of transferability are established.

Our proposal of an ontological mirror has several purposes in answering the rigour issue where repeatability is irrelevant. Crucially the ontological mirror shows how rigour via repeatability takes on an inverse yet equal form in design practice for transferability in design as repeatability in the sciences. This leads us to propose knowledge into future transformation as the domain level epistemological activity and knowledge generation foundation for design thinking.

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Street Markets as Places of Value Creation in Neighborhoods: A Case of Hasanpaşa Bazaar Place

Seyda Senay Elmas[1], Miray Hamarat Dundar[2], Cigdem Kaya[3]

[1]Yildiz Technical University, Faculty of Art and Design, Department of Art
sselmas@yildiz.edu.tr
[2]Bahcesehir University, Faculty of Architecture and Design, Department of Industrial Design
miray.hamaratdundar@bau.edu.tr
[3]Istanbul Technical University, Faculty of Architecture, Department of Industrial Design
kayac@itu.edu.tr

Abstract

Throughout the history street markets have long been regarded as essential for meeting the needs of the people and considered as the public spaces where the most intense trade was made. Bazaars were held around significant locations of the cities where the local people could easily access. By bringing together customers and sellers, bazaars facilitate shopping experience and enhance community interaction. In this sense, bazaars which have long been popular for local shopping became the places where co-creation of value emerged. With this study, it was aimed to examine how value creation has emerged in street markets nowadays. In this direction, the Hasanpaşa Bazaar was chosen as a case study, because of its history of about one hundred years and bringing together different actors in one place. In order to gather data, observations and semi structured interviews were conducted with various stakeholders of the bazaar. The outcomes of the field study were examined and discussed in the scope of the social innovation framework, especially with a focus on social practice theory. At this stage, the findings of the study were categorized under three different sub-headings: (i) Being Seller in the Bazaar, (ii) Being Customer in the Bazaar, (iii) Interaction Elements in the Bazaar. Eventually, the result of the study revealed that the Hasanpaşa Bazaar as a social structure, affects human activities and creates various values in the neighborhood while it emerges a new ecosystem and its own behaviors. It also showed that the bazaar as a socially constructed space, transforms the dynamics of society and maintains social bonds among people through the interactions between different stakeholders.

Keywords

street market; social innovation; value creation; social practice theory

Introduction

The fundamental of the social practice theory is that social life is seen as a manifestation of planned actions by numerous individuals, which are linked and distributed in both time and space. Although there is no single theory of practice (Bourdieu 1977; Giddens, 1984; Schatzki, et al., 2001; Shove et al., 2012), this perspective offers valuable insights into understanding the complexities of social interactions. In this scope, everyday life can be defined and characterized by the rise, transformation and fall of social practices (Shove, Pantzar, and Watson, 2012). Consumption patterns are one of the important dynamics which are affected by the reproduction and

transformation of social practices (Shove et al., 2012). In this regard, the street market as a significant component of everyday life where social practices emerged; can be evaluated as examples of consumption patterns dynamics that have changed and evolved in everyday life.However, traditional street markets are not only economically based structures, but also urban spaces that reflect the daily life practices, culture, traditions, and customs of the society (Uzungören, 2021). There are many studies in the literature that demonstrate the role of street markets in daily life and neighborhoods both globally and in Turkey (Evers and Seale, 2015; Göktaş, 1994; Morales, Balkin and Persky, 1995; Özgüç and Mitchell, 2000; Topçu, 2006; Shepherd, 2009; Sherry, 1990; Stillerman, 2006; Tümertekin and Özgüç, 1998; Uzungören, 2021; Virani, 2020; Watson, 2009). They are places which create mutual benefits for both users and non-users of the market and serve economic and social function; its features like low fees, easy accessible locations, being accessible to everyone and being historical places where traditions still continue make the shopping from street markets a social and cultural experience for both buyers and sellers (Morales, et al., 1995).

When the studies on street markets are reviewed, it is seen that there is a gap in the literature; although street markets are considered as public places where everyday life practices and socialization take place, these concepts are not examined in the scope of social innovation. In this regard, to be discussed in the social innovation approach, the Hasanpaşa Bazaar was chosen as a case study to gain a better understanding of the interactions and value creations, due to its over one hundred year history and potential to bring together various actors in one place. In order to achieve this objective, the main research questions of this study were specified as (i) What kind of values are created and shared in the Hasanpaşa Bazaar? and (ii) How and in which steps value creation emerged in the bazaar? In order to examine these questions in detail, the field study was conducted through participant observations and interviews with various stakeholders in the field. After that, outcomes of the study, interactions and value creations emerged in the bazaar were analyzed and discussed from a social innovation perspective.

Method and procedure

In scope of the field study, first field selection was made. The Hasanpaşa Bazaar was designated as a study field which is a historical and popular street bazaar with a history of approximately 100 years, located in the Kadıköy district of Istanbul. The semi-enclosed market area is constructed with a reinforced concrete and steel system, offering an area 32 thousand 300 square meters, and the upper cover part of the structure was membrane (Karaaçar, 2022). From 2019, the Hasanpaşa Bazaar opens three times a week with different concepts which is operated by İSYÖN (Istanbul Management and Renewal Inc. served by Istanbul Metropolitan Municipality). On Tuesdays, it offers a general wet market and it continues its traditional and historical theme. As a second concept, on Fridays it opens as a flea market. With the different concept, on Sundays, bazaar brings various types of actors together: (i) cooperative societies; (ii) antique and second hand products and (iii) women's sale of handiworks (Figure 1). Thus, it was decided to choose a Sunday theme for the field study.

Figure 1. (a) Cooperative societies; (b) Antique and secondhand products; (c) Women's sale of handiworks

As the first category, there are different types of cooperative societies in the bazaar. These communities sell their own local products and seasonal fruit and vegetables from all over the Turkiye. As a second category, antique and secondhand product vendors sell various and attractive types of products such as brochettes, cloth, carpet, old boxes, vases, tableware, tapes, stamps, coins, instruments, etc. They have the biggest area in the bazaar. As the third and last category, womens take part with their handiworks. Women exhibit their handicrafts such as dolls, hats, paintings, vases, jewellery and souvenirs. During the bazaar, women continue their production behind the stalls.

After defining the field, data collection process is conducted through qualitative research methods. In this scope, as the first step, participant observation was made on Sundays in the field for two times during the bazaar hours. These observations were made to identify usage of spaces and interactions. During these observations which are supported with photography and videos, the field map also constituted a deeper understanding of interaction between various stakeholders. As the most important phase, semi-structured interviews have been conducted with various stakeholders from different perspectives, namely organizers, sellers and customers from the bazaar. Moreover, all the sellers who were interviewed, looked into their social media accounts and made unobtrusive observations on how they represented themselves. While selecting the participants, the snowball method was used, and asked interviewees to direct us to their different contacts in the bazaar. In this way, we reached 10 participants (which will be shown by using abbreviations P1-P10) from different positions. Five of them were sellers from different categories such as, handicraft, antique and second hand products, and cooperative societies. Two of the interviewees were responsible for the management of the bazaar. Also, three of the stakeholders were selected from customers according to their representation of different seller's categories. After the data collection is completed, the patterns of the textual and visual data obtained were analyzed by qualitative content analysis and categorized by thematic analysis method.

Findings

In the light of the literature review and the field study, it has been observed that the interactions between stakeholders in the market have led to different value creations. These value creations need to be examined in the context of each stakeholder, the specific elements of the Hasanpaşa Bazaar and its surroundings in urban scale. Accordingly, the findings of the study are categorized under three different sub-headings: (i) Being Seller in the Bazaar, (ii) Being Customer in the Bazaar, (iii) Interaction Elements in the Bazaar.

Being seller in the bazaar

The sellers characterize being in this bazaar with different keywords like color, surprise, energy and synergy, inspiration, solidarity spirit, positive side of Istanbul, open communication, and so on. These keywords represent that the bazaar has various meanings for sellers and indicates that there is socialization and solidarity among many stakeholders.

It was observed that there is strong solidarity and support between sellers. For instance, sellers overcome the challenge of not being able to leave their stands for daily needs by entrusting their stands and products to one another. Especially, women’s handicra Moreover, every seller's stand and their location in the bazaar is pre-determined and controlled by the bazaar's management. As observed, both sellers and customers are happy and feel secure in being in this well-organized place and they think that these kinds of regulations and controls are necessary for better shopping experience.

The observations and interviews showed that the bazaar place is not just a workplace but also a socializing place for sellers where they can meet new people and create networks. The majority of the sellers we interviewed stated that they appreciate the vibe of this venue, that they have fun together, and that they continue to interact with one another through social media even after the bazaar days: "Turning on music, dancing and singing are our favourite activities. We are having fun here together, it doesn't have to be a profit. Having fun is the best part." (P2)

Another insightful finding is that antique sellers provide a big advantage for the whole bazaar. It attracts local and foreign tourists to the bazaar thereby increasing the overall rate of purchase and sale in the bazaar. As various sellers have declared, most people are unaware of cooperatives and women's handicrafts categories in the Hasanpaşa Bazaar. They usually notice women's products when they come here for antique products. The antique market helps other sellers to be noticed and has a positive impact on sales. The Hasanpaşa Bazaar raises awareness about agriculture in Istanbul and brings producers and customers together thanks to cooperatives. It is also interesting to see that cooperative societies do not see themselves as a seller. During the interviews, cooperative societies emphasized that "we are producers, not sellers!" (P5)

It was also observed that the Hasanpaşa Bazaar is physically set up, while sellers and customers interact virtually through social media. Many sellers have Instagram profiles where they advertise and make announcements, aiming to maintain interaction with customers: "I have regular customers, customers who bring customers. We keep in touch with many of them through Instagram and social media. Otherwise, it would be very limited. When we announce on Instagram that we are here, people who know us come." (P1)

Being customer in the bazaar

When examining the motivation of the customers who are regular visitors of the bazaar, it is seen that there are several reasons. One of them is, they prefer Sunday's bazaar because it is less crowded and better structured compared with other markets. People are drawn to this location by this state of the market and the availability of sellers from all categories. Moreover, people see this place not just as a shopping place, but as an activity and socializing space. The bazaar place is pet and toddler friendly and it is available for everyone and in all weather conditions. For instance, the opportunity that it is an area where they can spend time with the family in the children's playground on the upper floor increases the preference of this place. In addition, having eateries, its central location and surroundings customize the market area and enable it to host people from different social backgrounds as an antique product seller mentioned: "Different layers of Istanbul come here, collectors from Feriköy, all kinds of people from different socio-economicsegmentsfromFikirtepeandCaddebostan." (P3)

The bazaar's proximity to the recently opened Museum Gazhane has efficiently attracted customers from the surrounding districts to this neighborhood and the bazaar. It has transformed into more than just a shopping destination, evolving into a cultural center: "There is also the significant impact of the Museum Gazhane being here. Actually, this place has become a Sunday event for us" (P9). Furthermore, Hasanpaşa Bazaar differs from other street markets due to its touristic value. Foreign tourists, in particular, prefer this bazaar for both shopping and visiting because of its historical significance. Local tourists from different cities in Turkey also visit this bazaar for shopping, as it offers better product quality, safety, and even more affordable prices compared to supermarkets.

Interaction elements in the bazaar

In the field study, it was observed that in addition to the interaction between people, the interior design of the space, non-human elements and the organizers directly affect and shape the functioning of the market. For the first highlight, the environmental and non-human aspects of the bazaar were analyzed. It was observed that metal wall hangers in the bazaar serve various purposes, such as storing personal items and showcasing products. Circular seating benches around the construction units have different functions for different stakeholders. Vendors use them to store their belongings behind their stands, while customers use them as resting spots. However, due to the insufficient seating areas for sellers, they often bring their own camping chairs or repurpose fruit and vegetable crates to create comfortable spaces for resting throughout the day.

As the second highlight, it was founded that Bazaar Cafe is an important networking place for both sellers and visitors. Beside serving street food (traditional street bazaar foods, like Turkish pancake) and beverages, it creates communication and interaction between all stakeholders. Formostcustomersitispartofthebazaar ritual:"Whenwe comehere,wedefinitelysitandeat Turkish pancakes." (P10) It has also been observed that since the sellers cannot leave their stands easily, they mostly meet their tea, coffee and even food needs with the help of peddlers. In this sense, peddlers have also developed different methods to provide fast service, such as using different trolleys and shopping carts. Sellers and peddlers can communicate with one another with intuitively created hand and body gestures.This type of communication method can provide important insights about the bazaar community.

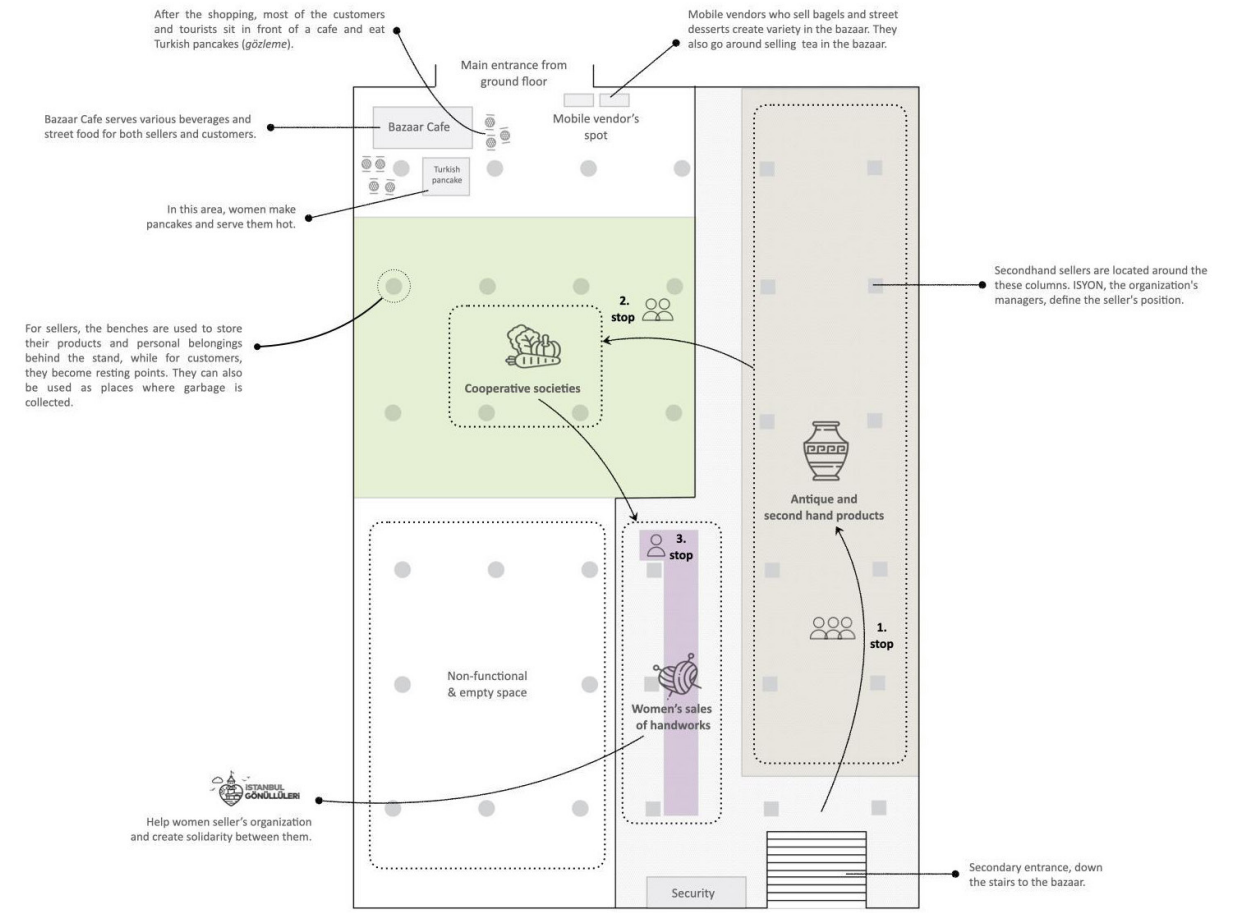

Figure 2. The map of interaction elements of the bazaar.

All of the above-mentioned interaction elements and patterns in the bazaar were drawn and described in detail in the map below (Figure 2) which shows the flow of interaction and highlights the location of non-human elements.

Conclusion

Human activity and the social structures that shape it are recursively related (Giddens, 1984). From this approach, it can be assumed that Hasanpaşa Bazaar as a social structure and its neighborhood affects each other recursively. It is seen that, being together with various stakeholders in one place, allows rapid interaction among members, establishes patterns of mutual obligation, and thus creates new values for the neighborhood. These value creations which emerge in the Hasanpaşa Bazaar are summarized from three different categories; being seller; being customer and the elements of interaction.

From the sellers perspective, the Hasanpaşa Bazaar becomes a socialization and solidarity place between different stakeholders. As seen in the being with antique seller situation, being together in the marketplace increases their recognition, and while enhancing their powerful sides, eliminating their weaknesses. In order to understand the ecosystem in the bazaar, it is seen that there is a need to specify how sellers define themselves. For instance, cooperative societies do not define themselves as sellers; instead, they prefer to be perceived as producers. This can change the whole ecosystem in the bazaar and this ecosystem creates its own behaviors, beliefs and values. For instance, it is seen that almost every seller uses social media for advertisement and sustainable interaction with customers. This tendency can be seen as a special solution that has emerged spontaneously with the impact of technology. Another promising finding was that sellers and peddlers' communication with one another is intuitively created by hand and body gestures. This type of communication method can provide important insights about the bazaar community. From customers' perspective, the bazaar is seen as not just as a shopping place, but as an activity and socializing open space where customers can spend their free time with their families and friends and even they can walk with their pets. The bazaar's central location and its popular surroundings directly influence customers' interest in the bazaar. As the last category, it can be highlighted that besides the interaction between people, the interior design of the space, non-human elements, seller's setting, cafes, and other peddlers all have a direct impact on and shape the functioning of the market. The Bazaar Cafe, which is not predefined and arose as a spontaneous formation, as a component of the bazaar ecosystem facilitates interaction and creates networks between all stakeholders.

When all these values created in the marketplace are evaluated holistically, it is concluded that the Hasanpaşa Bazaar cannot be considered only as a shopping place, but should be considered as public spaces where social innovation takes place. Although it has several shortcomings and disadvantages; the living social structure and special ecosystem of the Hasanpaşa Bazaar, where it functions within itself, constitutes a good example. This initial study explores the emergence of value creations at different stages in Hasanpasa Bazaar case. For further studies, these identified value creation elements can serve as a base for examining social innovation in other case studies.

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The Stage Art Design Flow Under Critical Design Thinking

Yuqing Chen[1], Yi Xiao *[1], Tie Ji[1], Wenyu Sun[2], Yi Ji[1]

[1]School of Design, Hunan University
Chenyuqing9@hnu.edu.cn
*[1]School of Design, Hunan University
yixiao_csee@hnu.edu.cn
[2]Shanghai Theatre Academy
554166456@qq.com

Abstract

Stage art design has been a comprehensive and evolving discipline throughout its developmental history, drawing extensively from various artistic fields such as painting, sculpture, architecture, industrial design, and folk art (Pavis, 1998). With the changing times, stage art design has evolved beyond being a mere backdrop for performing arts. Exploring how to harness the dynamism and proactiveness of design, promoting and innovating the aesthetics of design to keep it in sync with the times has become a prominent research theme. This article, rooted in the specifics of the field, expands the design process of stage art by incorporating interdisciplinary perspectives. It addresses current developmental trajectories and existing issues, employing methodologies from critical design, such as imagination, counterintuitive thinking, and humor to optimize the stage art design process, ultimately enhancing audience resonance and engagement. Finally, concrete practical case analyses serve as the research method, utilizing surveys as the data source. This approach helps verify the innovation and rationality of the proposed design process while discussing the challenges and future trends that lie ahead.

Keywords

Stage Art Design; Critical Design; Design Methodology; Sociality.

Introduction

Stage art design is an indispensable element in performing arts, encompassing scenery, props, costumes, makeup, and lighting to create a comprehensive visual experience (Brewster & Shafer, 2011). The primary task of stage art design is to use various artistic techniques to shape the physical environment, external appearances, and overall atmosphere according to the performance's content (Cao, 2019). In the early stages of its development, stage art design was considered a necessary support for performing arts, serving as the executor of the director's and playwright's creative vision. However, in the 21st century, there has been a shift in the terminology used to describe this field. International organizations like OISTAT (International Organization of Scenographers, Theatre Architects, and Technicians) have adopted the term "performance design" to reflect the evolving identity of stage art design (Chen, 2021). With the expansion of interdisciplinary theoretical research, advancements in design techniques, and the increasing sophistication of audiences' aesthetic sensibilities, new demands have emerged for stage art design. The need for design to be more proactive, immersive, and socially engaging has become apparent. Richard Schechner, a theater theorist, has argued that theater extends beyond

the stage and into everyday life, emphasizing the importance of cross-cultural, cross- genre, and interdisciplinary research in the field (Schechner, 2017). Given the capacity of critical design to guide designers in addressing social issues, attracting audience participation, and challenging conventional design, it is recommended that this design methodology be incorporated into the four stages of the stage art design process. This integration can help broaden designers' imaginations, encourage the use of counterintuitive design methods, employ humor and satire in presentation, and facilitate open assessment and reflection. By emphasizing a "challenge society" and "engage the audience" approach, critical design can enhance the expressive power of stage art design and create a more immersive and engaging experience for audiences.

Overview of Traditional Stage Art Design

Stage art design, as a crucial element in the realm of performing arts, serves as a significant conduit for communication, emotional fusion, and intellectual interaction between actors and audiences. Its principal characteristic lies in the demand for designers to employ diverse, comprehensive, and holistic creative means within a unified conceptual framework established by the entire creative team, based on the script's performance requirements (Qiao, 2019). The aim is to create artistic representations of spatial environments and character portrayals that effectively convey the overall performance ambiance and stimulate thoughtful reflection among viewers. Es Devlin, a British stage art designer, encouraged stage innovation during the U2 – Experience Innocence Tour 2018. She utilized new technologies to create unique stage settings, breaking through conventional design boundaries. Devlin emphasized audience interaction with the stage, enhancing the audience's sense of participation and immersion (Medina, 2020). Italian polymath director Stefano Boda dedicated his life to aesthetic research in music, movement, stage settings, and costumes. He harnessed the power of design in the opera "Teatro" as a means of expressing characters, eras, emotions, and ideas, presenting rich visual artistic content (Zhao, 2018). As design concepts and technologies continue to evolve and audience aesthetic standards rise, there is an increasing demand for innovation, social relevance, and interactivity in stage art design.

However, in the current landscape, stage art design faces certain challenges, primarily related to outdated conceptual thinking, hindering the creation of contemporary "original" works (Jin, 2021). These challenges are notably evident in both theoretical education and practical design. Firstly, existing courses in stage scenic art history still adhere to 1980s art and painting theory, which is no longer aligned with contemporary standards (Gao, 2011). Secondly, although the current level of design proficiency is high and stable, it often prioritizes visual aesthetics over innovative ideation. There's an emphasis on the artistic aspects of works while overlooking the societal aspects of thinking (Sun, 2011). The reinterpretation of classic plays sometimes exhibits a formalized trend, failing to fully integrate advanced design concepts and techniques, and consequently, failing to emotionally resonate with the audience.

In summary, despite its vitality and potential, stage art design grapples with issues like formulaic design thinking, a lack of societal perspective, and challenges in eliciting emotional resonance from audiences.

The Critical Design of Stage Art Design

Definition of Critical Design

Critical design, introduced by Anthony Dunne and Fiona Raby in the late 1990s while teaching in the field of interaction design at the Royal College of Art in the UK. Critical design as a design methodology. The aim of this design approach is not to create practical, usable products or solve specific problems but rather to pose

questions (Dunne & Raby, 2009). It seeks to stimulate thought, provoke audience discussion, and challenge issues in areas such as society, culture, technology, using imagination, counterintuitive methods, and humorous design approaches (Dai & Cui, 2020). This design thinking model places emphasis on sociocultural topics, audience engagement, and the challenging of traditional design or societal practices. Consequently, it prompts reflection on conventional design thinking and generates commentary on social and cultural phenomena (Dunne & Raby, 2013). Currently, critical design is predominantly applied in creative fields such as design and the arts, including industrial design, social innovation, education, environmental design, and sustainability, among others (Liene,2017).

Based on the concept of the "Critical Design Lab" proposed by Dunne and Raby, they developed a series of works using this methodology, including the 2009 design work "Designs for an Overpopulated Planet: Foragers" (Dunne & Raby, 2010). This work prompted the public to reflect on contemporary social phenomena such as overpopulation and food scarcity. In 2013, Dunne and Raby co-authored a book titled "Speculative Everything," introducing the concept and positioning of critical design to help the public understand it (Dunne & Raby, 2013). Matt Malpass, a lecturer at Central Saint Martins, has also been continuously exploring this field in his book "Critical Design in Context" (Malpass, 2019). In 2008, the project "Life Support" undertaken by the UK-based studio of Revital Cohen and Tuur Van Balen aimed to contemplate the coexistence of service-oriented animals with patients, establishing a natural life community (Cohen & Van, 2008). This design initiative integrated the principles of critical design with the realm of social innovation, challenging conventional social services and solutions. In summary, critical design, to a certain extent, opened new avenues for exploring issues, took the first step in critiquing design thinking, promoted diversified modes of thought, and further inspired comprehensive contemplation on design culture and behavior.

The Critical Design in Stage Art Design Works

In some classic design works from the past, elements of critical design thinking have already been incorporated. Outstanding stage art designers have effectively integrated sociocultural themes and audience engagement into performances by manipulating the dynamics between the audience and the performance space. This approach has resulted in more immersive experiences for the audience and a heightened awareness of societal issues within the context of the performance.

1. Performance Spaces. "Site-specific performances" are highly conducive to critical social awareness in the realm of theater. Designers choose a non-theatrical space for the performance, using the environment to indirectly convey a part of the performance's narrative (Andrew, 2013). This allows the audience to deepen their imagination of the space and experience it as if they were there, gradually transforming from passive spectators to active participants (Makeham, 2005). For example, the Greek "Experimental Theatre of Thrace" productions "Tea Time" and "Eat Time EUROPE," first performed in 2014, have received numerous awards. These performances directly address the pressing refugee crisis in Europe and were staged in unconventional locations such as the Evros River Delta and the Evros border region between Greece and Turkey (Archivio, 2020). Focused on shifting performances to the present environment through unique theater settings, fostering critical social awareness among the audience within the performance space (Pearson, 2017).

2. Spectatorship Relationship. In his work "Postdramatisches Theatre," (Lehmann, 2006) German professor Hans Thies Lehmann highlighted that the entire stage space forms a unified visual composition, with distinct

meanings assigned to various spatial areas. This approach breaks away from traditional delineation and division of theatrical space, as well as rigid prescriptions for audience gaze and actor positioning. It emphasizes autonomy and agency. "Punchdrunk" a theatre founded by British director Felix Barrett, premiered "Sleep No More" in London in 2003 (Worthen, 2012). In this production, actors were dispersed across six levels of the "McKittrick Hotel," which comprised 90 performance rooms. Actors moved between different performance spaces, and each audience member wore a white mask, engaging in "close-distance" interactions with actors and freely following their trajectories within the space. This "immersive" form of audience engagement fundamentally challenges the traditional proscenium arch theater experience. In terms of narrative, it employs illogical and unconventional thinking, breaking away from linear storytelling and opting for a parallel, multi-threaded performance approach. Designers can create immersive stage environments that stimulate active audience participation, making the audience an integral part of the theatrical work, thereby evoking emotional resonance and critical reflection (Cohen, 2002).

The exemplary design cases mentioned above, to a certain extent, applied the design logic of imagination and unconventional thinking inherent in critical design, unleashing boundless creativity, breaking free from conventional thought patterns, and generating design diversity. However, these design solutions have not yet fully and systematically demonstrated the stage art design process based on critical design principles.

Innovation Flow in Stage Art Design

Based on the common characteristics of various disciplines within stage art design, four fundamental design steps can be summarized. In these steps, traditional stage art designs often take place within a controlled space, with extensive "known" research carried out based on the director and playwright's intentions to optimize the design. In contrast, the design process under critical design thinking is characterized by uncertainty. It involves continuous imaginative exploration to investigate issues, employing unconventional design methods to analyze problems, and using humor and satire to present the design concept, ultimately creating socially resonant works. The outcomes of these two design approaches cannot be judged as better or worse; they represent different thinking modes in the study of the stage art design process，see Figure 1.

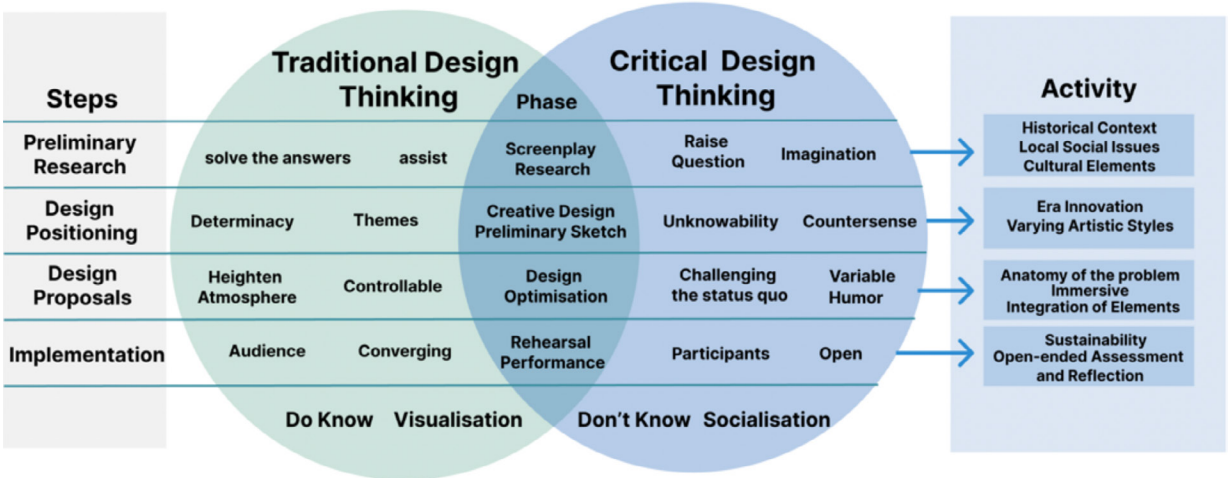


Figure 1. Traditional and Critical Design Approaches in Stage Art Design Patterns.

Analyzing the impact of critical design thinking on the stage art design process from four design stages, we can

elucidate the changes it has brought to the design flow.

1. Preliminary Research. Begin by understanding the overall theme, background, and plot of the performance, as well as the vision of the actors and director for stage art design. Incorporate the nourishment of critical design thinking, fostering a more imaginative expansion of critical thought. Use historical context, local social issues, and cultural elements as entry points to gain a deeper and more innovative understanding on a conceptual level.

2. Design Positioning. Utilize critical thinking to challenge traditional stage art design decisions and explore innovative design directions. Recognize that the thoughts and destinies portrayed in theater vary across different eras, requiring stage art design to innovate accordingly. In addition to traditional realism and romanticism styles, consider the symbolism, absurdity, and identity politics theories that have emerged in theater.

3. Design Concepts. Apply critical thinking and employ humor and satire in presentation. Promote different design concepts, visual elements, and sustainable materials. Combine various elements of stage design, such as sets, props, costumes, and lighting, in innovative ways (Dragasvic, 2005). Explore unique and expressive design concepts. Additionally, consider cross-disciplinary integration with other art forms like painting, sculpture, and photography to create immersive visual effects.

4. Implementation. After completing the design, engage in open evaluation and reflection promptly. Communicate with the director, actors, and other team members. Consider involving the audience or professionals in the assessment process to gather diverse feedback and opinions.

Case study

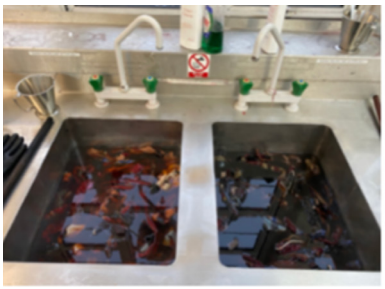
This design case involves a practical performance course lasting approximately 15 minutes, with the participation of 5 teams and a total of 22 students, see Figure 2. The preparation phase spanned approximately one month. I formed a design team with three students, and we divided responsibilities based on the critical design thinking framework. Following the conclusion of the performance, we distributed questionnaires to both participants and audience members and subsequently analyzed the survey results.

1. Preliminary Research. This project primarily focuses on the contemporary global issue of refugees, conducting divergent research enriched with ample imagination and exploring historical backgrounds. It encompasses divergent research methods and explores historical contexts. Based on the 1951 "Convention Relating to the Status of Refugees," it is understood that most refugees exist in a state of constant displacement, lacking a stable source of income, permanent housing, access to clean water, and food security. Frequent relocation becomes a routine aspect of their lives, often requiring them to carry all their belongings with them (Goodwin-Gill, 2001).

2. Design Positioning. The project adopts a "symbolism style" approach, using famous paintings as a point of entry for critical design, aiming to shed light on the refugee issue. The design draws inspiration from John William Waterhouse's painting "The Lady of Shalott", created in 1888 based on a narrative poem (John, 1883). The painting depicts a young woman longing for the love of Sir Lancelot but cursed to be trapped on an isolated island. In the design process, the narrative poem is adapted into dialogues, symbolically suggesting that while the lady is imprisoned by love, the confinement of the isolated island serves as a critical metaphor for refugee habitats.

Figure 2. A photo of some designers.

Figure 3. Sketches of Costume Design.



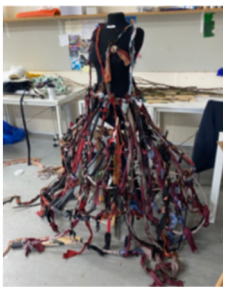


Figure 4. The costume making process.

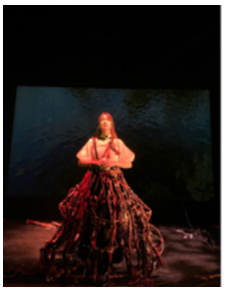


Figure 5. Live show photos.

3. Design Proposals. Costumes and props are often referred to as the "actor's second skin" and the "actor's second hand," holding significant importance in stage art design. Innovative costume design should focus on the innovation of costume style and craftsmanship. The fundamental purpose of this innovation is to shape both the internal and external aspects of characters, reflecting their era and personality, and even hinting at their destinies (Qiao, 2019). In the costume design process, see Figure 3, you can clearly see the use of unconventional design methods to turn what should be glamorous costumes into tattered pieces wrapped around the actors. Environmentally sustainable fabrics were chosen, and traditional Chinese hand-dyeing techniques were used to process them, see Figure 4, creating a unique texture that represents the harsh life of refugees, critically implying the constraints and hardships faced by the actor.

No.	Questionnaire content	Project Staff Mean	ıudience Mean
Qu.1	*How do you think this performance does in conveying social messages?*	4.13	3.93
Qu.2	*Did you feel more engaged and immersed after watching this performance?*	3.54	3.5
Qu.3	*Did the performance provoke you to think about and discuss social issues or themes?*	3.95	3.22
Qu.4	*Do you think the show presents novel design concepts or innovative visual elements?*	3.77	3.27
Qu.5	*Would you like to see more theatre arts design works using critical design concepts in the future?*	4.04	3.81

Table 1. Under Critical Design Flow Course Teaching Questionnaire.

4. Implementation. In the final performance, see Figure 5. The metaphorical scenography theory proposed by modern stage art designers Adolphe Appia and Gordon Craig was employed, incorporating projection image devices to create visual effects related to water, rendering the entire performance more conceptual and fluid (Cohen, 2002). The actress, dressed in heavy clothing, at times gazes into the distance with a sense of bewilderment, while at other times, she recites humorous and satirical lines, engaging in dialogue and conflict with the audience. She leads the audience into contemplation, as if both the audience and the actress are trapped on an endless sea, with no hope for the future yet a lingering sense of anticipation.

After the performance, a total of 44 questionnaire surveys were collected and analyzed using the Likert scale. Overall, the feedback scores received were in line with expectations. Questions 1 and 5 indicate that the audience could perceive the social messages conveyed by the performance and were eager to watch more stage art design works with critical design concepts.

Conclusion

In this paper, based on the traditional stage art design process, we address issues such as a lack of audience resonance, overly formulaic performances, and a disconnection from contemporary relevance in current stage art design works. We propose the introduction of the concept of critical design, employing methodologies like imagination, counterintuitive thinking, and humor and satire from critical design thinking. This approach enhances the proactive nature of design, moving away from being a mere "supporting role" for directors, playwrights, and actors. It stimulates designers' social awareness and critical thinking to avoid falling into conventional thinking patterns. Through design, it aims to gather audiences for public discussions, provoke conflicts, and encourage the expression of genuine thoughts. Furthermore, future research could delve deeper into designs related to social issues and identity politics. It could also expand into immersive virtual performances, encouraging audience participation and interaction.

Designers need to strike a balance between exploring social issues and expressing artistic diversity. This requires a significant investment of time and effort to stay attuned to theories in fields like society, culture, and art. Additionally, designers must confront the multiple challenges posed by production companies, audiences, and the industry in terms of acceptance and understanding.

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Research on the Application of Data in the Process of User Journey Mapping Construction

Jie Hou[1], Zhiqian Hu[2], Linghao Zhang[3]

[1]1013135806@qq.com
[2]1085915536@qq.com
[3]wowo.zlh@jiangnan.edu.cn

Abstract

In recent years, the organization and analysis of user journey maps have provided enterprises with crucial insights into understanding users and gaining a competitive advantage in the market. Data serves as a essential basis for the construction of user journey maps, however, there is no established systematic framework for guiding the application of data in this context until now. This study comprehensively employed methods such as surveys, interviews, and workshops to investigate the research requirements of design teams concerning the use of user journey maps and to outline data application objectives at different stages. Against the backdrop of merging quantitative and qualitative data, three strategies for applying different types of data in the construction of user journey maps are proposed. These strategies include using extensive background data to establish a shared understanding in the team, utilizing coherent behavioral data to depict the experiential journey, and employing multidimensional measurement data to assess user experiences. These strategies aim to enhance the comprehensiveness, efficiency, and objectivity of constructing user journey maps, thereby increasing their application value in service optimization and innovative experience design. In turn, assisting designers and enterprises in gaining more innovative insights and making more globally informed design decisions.

Keywords

User journey map; Data application; User research; Experience design

Introduction

User journey maps, regarded as a "service experience modeling tool," are widely employed in the fields of service and user experience design due to their ability to facilitate empathy among researchers, provide profound insights into user behavior, and promote cross-departmental communication and collaboration. The accuracy of data application during its construction process largely determine its value. However, with the complexity of user experience scenarios in the new era, the challenges of copious and convoluted data have led to many dilemmas that researchers often face when applying user journey maps to clarify more comprehensive user experience scenarios, such as which data should be collected to support the construction of user journey maps? How to efficiently and objectively condense this data and integrate it into a user journey map? Concurrently, the era of big data has ushered in a data-driven mindset, which has become a driving force in various academic disciplines. Big data analytics can aid in uncovering insights into user experiences (Holmlund et al.,2020). Therefore, this study, founded on the integration of data-driven thinking and design principles, proposes a systematic approach to the multichannel application of data within user journey maps. This approach combines the efficiency advantages of

big data with the insightful advantages of qualitative research, thereby empowering designers and businesses to gain more innovative insights and make more globally informed design decisions through user journey maps.

Overview of the user journey map

User journey maps, born in the era of the experience economy, serve as tools for visualizing the current-state or future-state experiences of users (Stickdorn et al., 2018). Their origins can be traced back to the field of marketing, where they were initially employed to analyze moments when customers are most likely to be influenced during product or service purchases. At that time, they were referred to as "cycle of service mapping" (Court et al., 2009). With the broadening scope of applications, user journey maps have found extensive use in various research domains, including healthcare service systems (Li and Jiang, 2021), product-service system improvements (Shiratori et al., 2021), museum experiences, and the design of their cultural derivative products (Wu et al., 2021; Jiang and He, 2023).

Regarding their structural forms, there are several notable examples exist. In 2009, Bruce D. Temkin created a user journey map for a visit to the LEGO company, featuring key elements such as "user personas," "user journeys," and "user experience assessments." Another example is the Starbucks user experience journey map established by Beckman in 2010, structured around "user personas," "user journeys," and "factors influencing experiences." The Nielsen Norman Group, a U.S. user experience research institution, introduced a user journey map construction framework in 2010 comprising three sections: "lens area," "experience area," and "insights area." In 2011, Adaptive Path, a customer experience design company, created a European railway user journey map that encompasses all stages of the user journey, interactive behaviors, experience needs analysis, experience assessments, and design opportunities.

As the forms of constructing user journey maps become increasingly diversified, specific, and comprehensive (Li, 2019), data from various channels have emerged as pivotal foundations for supporting this construction process. Canfield and Basso (2017) introduced an innovative way to constructing user journey maps by amalgamating users' cultural backgrounds and satisfaction data. In the context of big data analytics, Yang Huan (2019) devised a novel pathway for deriving user insights through data analysis, encompassing the creation of user personas, analysis of user experience journeys, and scenario analysis. Alvarez et al (2020) integrated observational data, explicit data (such as gender, age, motivations, abilities, and knowledge levels obtained from user perception and self-reports), and implicit data (including task completion and task performance derived from EEG and skin conductance tests) within user journey maps, thereby holistically portraying the storylines and experiential states of users installing new entertainment electronic devices.

A comprehensive review of the aforementioned studies reveals that while there is a substantial body of research mentioning user journey maps, much of it applies this tool as a design instrument in specific user experience studies. These studies predominantly focus on presenting the finalized mapping results, with limited descriptions of the construction process itself and the specific data sources. For individuals intending to utilize user journey maps , a detailed, systematic, and up-to-date guide on data application is notably lacking. Furthermore, in the current process of constructing user journey maps, data from qualitative research such as field surveys are still dominated. This methodology is no longer able to adapt to the sudden changes in business needs and the efficiency requirements of product iterations.

Investigation of data application content in user journey maps

In the first phase, we utilized questionnaires (75 responses) and conducted in-depth interviews (Fig.1) to gain insights into the fundamental understanding of user journey maps among designers. Additionally, we explored the current utilization of data in the process of constructing user journey maps (Fig.2) and identified the data application requirements at each stage. This enabled us to summarize the data application needs and objectives for the three stages of user journey map construction: design background awareness, experience journey routing, and user experience metrics. In total, we derived 17 key points (Table.1).

Figure 1. User interview

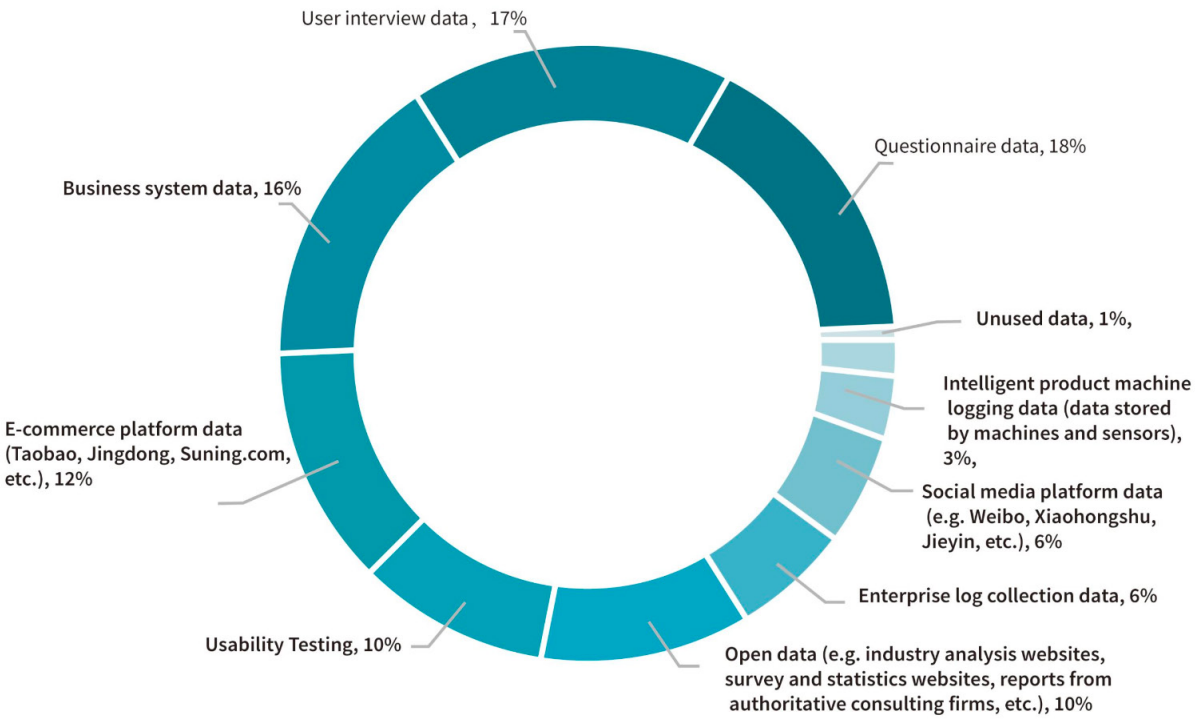

Figure 2. Survey on the Current Usage of Data in User Journey Maps

Table 1. Data application demands and targets for different construction phases

Stage Breakdown	Data application demand points summarised	Data application targets
Design Background Awareness	All participants could agree on the overall goals, needs and tasks of user journey mapping	Understanding the project background
	Capture more comprehensive data on the status of products and services	Get the full product picture
	Various sources, both internal and external of the organisations, provide broad access of data and information about the design object	
	Find out about the core values of the product, user needs and usage scenarios to which it responds	

	Collect data profiles of target users to develop user personas	Getting the full user picture
	Determine the layers and content to be included in the user journey map	Focused Journey Mapping Key Research
Experience Journey Routing	Rapid and holistic access to large amounts of data on user behaviour across the entire experience	Capture and handle user behaviour data in an automatic manner with the help of a technological platform
	Capture users' experiences online and offline	
	Ability to capture all the information about the user experience scenarios from the collected user data	Increase in comprehensiveness of data content
	Comprehensive understanding of the channel through which the user contacts the organisation during the experience journey	
	Build realistic and plausible user experience scenario stories	Assist in programming a coherent experiential journey
	Identify anomalous behaviours in the user experience	Exploring unusual experiential behaviours
User Experience Metrics	Measurement of the actual quality of the user's experience	Quantifying the subjective user experience
	Analysing the achievement of design goals at each stage of the user experience through data analysis	Link design goals and user experience
	Constant tracking and updating of data on the quality of the user experience	Improved advancement of journey map data

In the second phase, we invited five expert users, comprising three individuals with over five years of professional experience in the industry and two master's graduate students with involvement in household appliance product experience design projects, to construct a user journey map with the theme of user experience optimization design for a brand of smart air conditioner, using the different types of data information mentioned in the previous section. Then, we assessed and validated the rationality of data applications, subsequently refining data application strategies.

Ultimately, this study aligned the distinct categories of data and key points of data application within the user journey map to generate a design direction for data application(Fig. 3).

Data application pathways in the construction process of user journey maps

Drawing upon a comprehensive literature review and survey results, this study presents three pathways for the application of data in the process of constructing user journey maps(Fig.4).

4.1 Using extensive background data to establish a shared understanding in the team

In the initial phases of user journey map construction, all participants, including designers, product managers, and operations personnel, need to establish a shared understanding at the cognitive level regarding the application objectives of user journey maps, the current state of the design object, and target users. Therefore, collecting extensive data concerning business requirements, product information, and user characteristics is crucial. Building upon this foundation, it serves as a knowledge framework to facilitate collaborative efforts in subsequent user journey map analysis. These data sources can be categorized into four specific types:

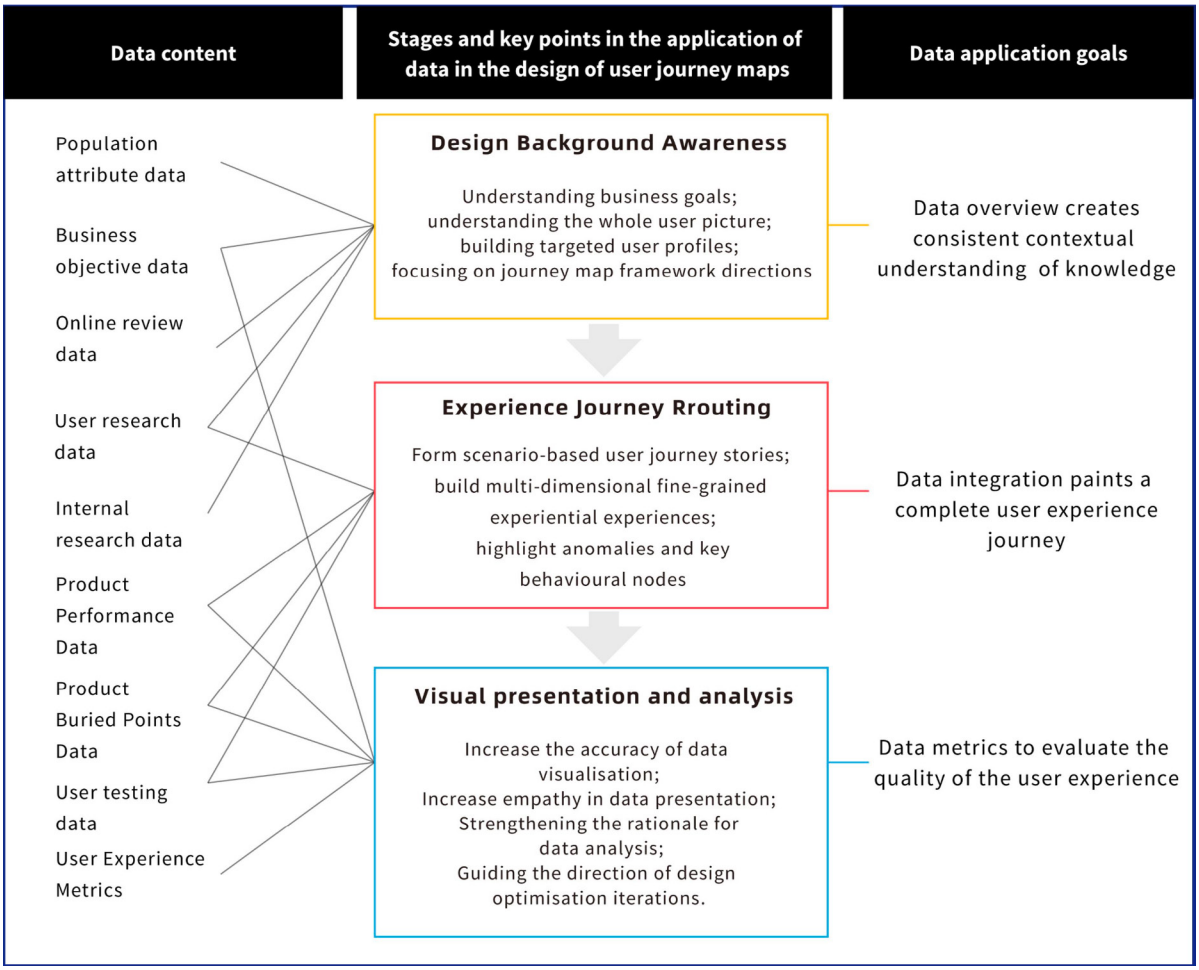

Figure 3. Application direction of the data in the user journey map

(1) Clearly defining targeted business data lays the foundation for the direction of journey map design. The genesis of the user journey map construction task often originates from the demands of enterprises for product business development. This necessitates that all members of the research team are capable, as a preliminary step, of deciphering the business objectives data derived from decision-makers or product managers. This enables a clear understanding of the requirements and purposes, forming the initial conceptual framework for the construction of the journey map.

(2)Establishing a product knowledge framework through comprehensive product data. Products, whether tangible goods or intangible services, serve as pivotal links between businesses and users. Gaining a comprehensive understanding of the product's overall landscape can assist researchers in identifying critical experiential stages when constructing user journey maps. Therefore, participants should gather data regarding product characteristics, core values, current stage (existing features and future plans), and industry trends from various sources, including enterprise business systems, internal organizational members, partners, and industry reports. Simultaneously, addressing knowledge gaps in their understanding of the product arising from limitations in their job roles.

(3)Gaining insight into fundamental user needs through evaluative feedback data. After attaining a

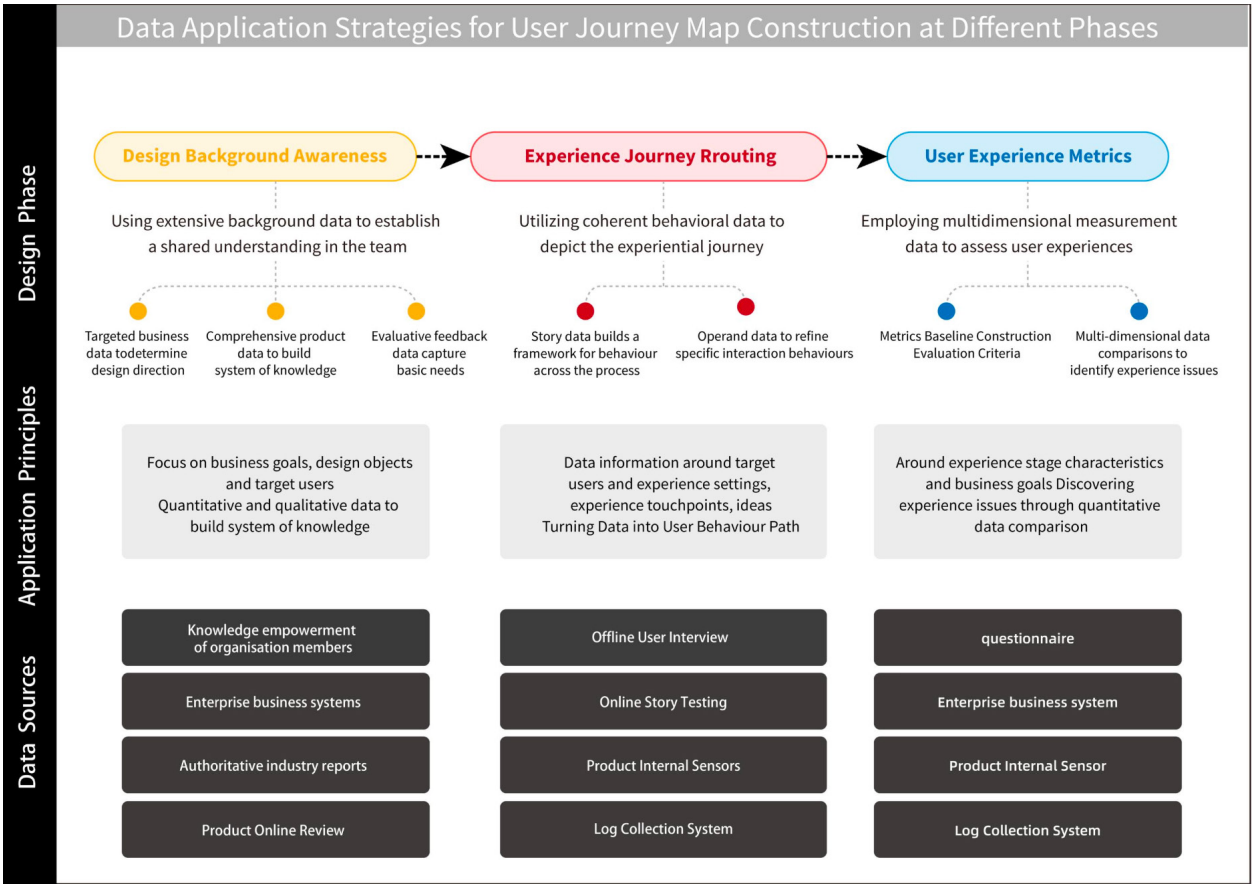

Figure 4. Data Application Strategies for User Journey Map Construction at Different Phases

comprehensive understanding of the product, the team should proceed to swiftly discern the focal points of user experiences from a user perspective. Researchers can leverage big data crawling techniques to extract and analyze user-generated product feedback data on online platforms (e.g.:text, images, and videos), in order to set up a fundamental understanding of the current sentiment, typical user opinions, and emotional tendencies related to the product. It facilitates a more precise delineation of the design framework for the user journey map and its key experiential phases.

(4) Refining tag-based data as needed to create target user personas. User personas should enable researchers to gain a clear understanding of target users' behaviors, aspirational visions, and underlying values, aligning this knowledge with the interpretation of experiential scenarios within their journey. Thus, data originating from various heterogeneous sources such as business backends, product terminal records, third-party data service platforms, containing information regarding user attributes (e.g., age, gender, occupation, geographic location), behavioral preferences (e.g., active periods, product feature usage frequency), and personal social networks (e.g., interests, skills), can assist designers in crafting refined, labeled virtual user personas within the user journey map.

4.2 Utilizing coherent behavioral data to depict the experiential journey

The construction of a user journey map involves the process of transforming multidimensional behavioral data of users into a comprehensive narrative of their entire experience journey. This process necessitates the ability to

enable researchers to gain a clear overview of key events that occur from the beginning to the end of the user's experience, the behavioral patterns followed, and any exceptional experience points encountered. So, at this stage, on the one hand, it is imperative to collect macro-level narrative data to build the behavioral framework of the user journey. This can be achieved through a combination of user interviews and storytelling methods to obtain scenario-based descriptive data about user experience events. On the other hand, considering specific experiential contexts, interaction details data between users and the product can be gained through product sensors, web tracking, and similar means, allowing for a more refined depiction of users' specific experiential behaviors within the journey map. Lastly, distill, reorganize and arrange these data to form a coherent user experience narrative.

4.3 Employing multidimensional measurement data to assess user experiences

The involvement of multichannel data provides researchers with a broader perspective and possibilities for observing the quality of the user experience throughout the entire process. These data enable a more intuitive quantification of users' diverse experiential dimensions and the evaluation of design value. At this stage, the content of data application primarily includes the following aspects: Firstly, deriving ideal experiential metrics based on project objectives to establish an experiential measurement baseline. This baseline is used to assess the degree of variance between user experience quality and design goals after the implementation of design solutions. Secondly, collecting multidimensional data on users' actual usage and assessments, including data from product log collection systems, questionnaire surveys, among others. This data is then compared with the target values in the measurement baseline to analyze experiential issues and guide the iterative direction of experience design.

Conclusion

In the context of service innovation and experience, any design tool or design concept requires constant refinement and development within the framework of the evolving societal landscape, user demands, and the open nature of design disciplines. This research systematically introduces the application methods and forms for the application of data from various channels in the process of constructing user journey maps. On the one hand, this effectively bridges the data gaps that design researchers face during the creation of user journey maps, enhancing their comprehensiveness and precision. On the other hand, the utilization of multi-channel data enhances the depth of interpretation of user experiences within the journey maps and widens the insights at both macro and micro levels of research perspectives. We hope it can aid researchers in better constructing user journey maps, gaining a deeper understanding of the reasons behind user behavior, and producing more valuable design insights in user experience innovation decisions.

Acknowledgments

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The strategic design process: a case of improving inclusiveness in China's public sector

Shiyi Li[1], Jun Hai[2], Nanqian Xu[3]

[1]Central Academy of Fine Arts
lishiyi85@gmail.com
[2] Central Academy of Fine Arts
junhai@cafa.edu.cn

Abstract

Building a smart transportation system always challenges public service designers to design innovative and inclusive services to meet the residents' diverse lifestyles. This case study examines a strategic design project in China that applied human-centered design (HCD) approaches, which are new to most Chinese city governments, to improve inclusiveness in the pre-planning phase. In the project, the design researchers successfully inspired designers to generate viable and inclusive service concepts by effectively interpreting the vulnerable users' needs. As a result, we identified three design activities useful in aligning stakeholders, increasing participation, and defining the inclusiveness scope within a complex collaborative context.

Keywords

Human-Centered Design; Public sector; Service design; Inclusive design

The context

A smart city is a trending concept in China with the rapid urban population growth. Benefiting from the Chinese government's 13th Five-Year Plan development strategy, Gui'an New District (GND) has drawn much investment from the Data industry. The city government planned to build an Intelligent transportation system (ITS) as the core of the city infrastructure. ITS refers to the transportation system deploying new-generation information technology to optimize the management and operation capacity, including the resource allocation capability, public decision-making capability, industry management capability, and public service capability. Design and innovation in the public sector usually need to consider all the citizens, including all kinds of vulnerable groups, to access the space or the service. The ITS aims to create new public spaces and introduce new technology to end-users' lives. To the extent of inclusiveness, it not only focuses on ensuring accessibility for disabled people but also needs to consider local residents' digital literature to comprehend new-gen services.

Moreover, the city economy's growth may draw many future immigrants. Those factors increase the complexity of design requirements for this public service design project. However, fulfilling a human-centered design process requires clearly defining the users' characteristics and specific needs from experience in the private sector, which is extensive and ambiguous in such a public design context.

The shift form of human-centered design (HCD)

The value of the human-centered design process has gained acknowledgment in addressing complex problems (Buchanan, 1992) , and the principle of "putting humans in the center" has extended its domains beyond traditional design (Norman, 1998; Jordan, 2002). Brown (2005) and Martin (2009) pushed the design boundary to a strategic level with the term design thinking. Meanwhile, design approaches are seen as the government's innovation tools for consciously creating meanings and values for citizens (Bason, 2010). Through further integration into city service design, the design's role in public-sector shifts towards facilitating co-creation work, guiding the team with a holistic picture of the complex problem, and providing prototyping and visualizing skills to make the abstract concept tangible (Buuren et al., 2020; Hyysalo et al., 2023; Mariotti et al., 2023; Villa Alvarez et al., 2022). The shift of design applications leads to the adaptation of design flow accordingly. For instance, by analyzing design activities in Helsinki city administration organizations, researchers identified six types of design activities. The "Design in participation and collaborative work" type emphasizes the designer's role more on facilitating the process and testing ideas rather than delivering concrete solutions (Hyysalo et al., 2023). When it comes to China's public context, applying HCD approaches is a fresh experiment that needs to adjust the process to really play a part in increasing citizen engagement in government-led projects.

Design flow adaptation challenges

To make the public transportation system well support the residents' lives, the first challenge was defining whose demands should be meet first. How to balance the conflicting needs between different groups of residents to keep equity? Further, the nature of a government administration as the client creates a design management challenge in term of reach a consensus. It takes effort to bridge the information gap both within the organization and across the stakeholders internally and externally. To accomplish these challenges, the adaptive design flow emphasizes increasing residents' participation, demonstrating holistic view of the complex system to facilitate collaboration across multi-disciplinary teams, and generating a visual tool to inform and evaluate ideation activities. In the next section, we examinate the design process of the case, which was aiming to narrow the design focuses to balance between the inclusiveness and the system efficiency. In the next section, we will analyze the case in three aspects: the adaptation of the process, the strategic considerations, and the effectiveness of the deliverables.

The case: process, consideration, and deliverables

Applied human-centered design process

In practice, the design researchers followed the "double diamond" design process model (The British Design Council 2006), derived from the studies on innovation projects in the private sector. IDEO has a similar HCD approach framework, including four stages (discover, define, develop, and deliver). Both design processes commonly integrated design thinking methods to transform thoughts from divergence to convergence to convert human needs into viable innovative ideas, see Figure 1.

In the traditional working process, the first "divergence to convergence" course usually works on capturing specific needs arising from the fieldwork. In this context, individual users' specific but fragmented needs were not persuasive enough for the administrators to distribute the resources. Thus, the research goal switched to identifying the intermediate variables between the users' mobile needs and their anticipating life mode, which set the transportation system under the city life quality context. In this case, "barriers to mobile in the city" and "mobility to stay a lifestyle" were the two intermediate variables to sort and cluster the needs under anticipating transportation experience modes. This tactic avoids the stereotype of describing users as disabled people or

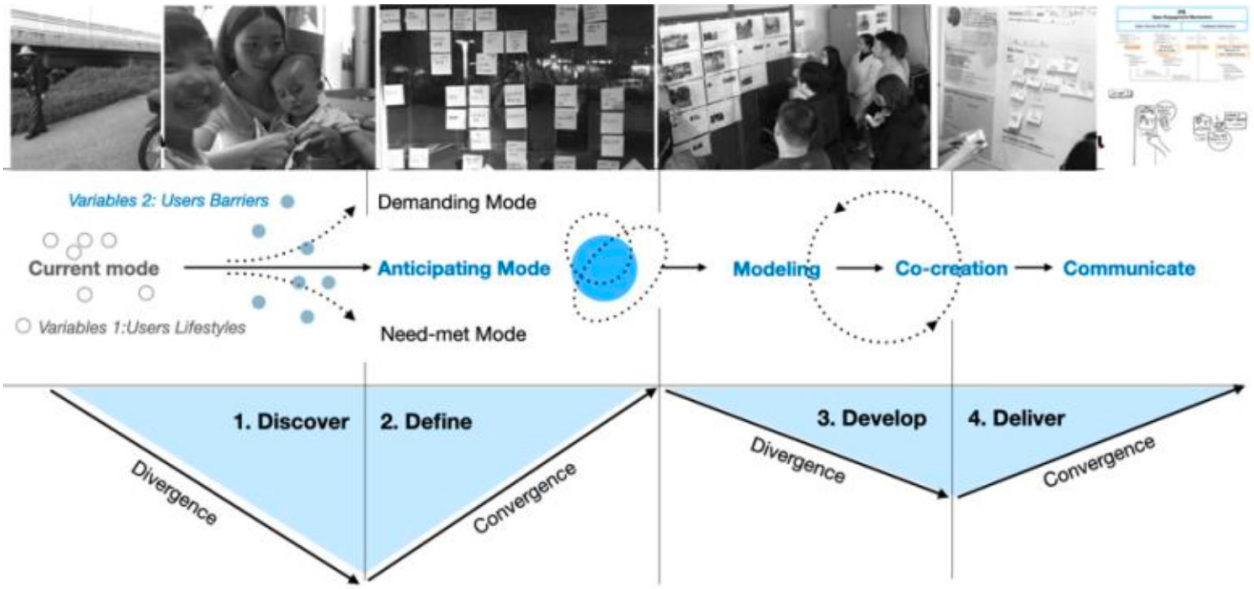

Figure 1. Design activities in the project compared with the design thinking process

illiterate women, which creates tension in needs priorities. We believe that new technology applications could create a temporary disabled situation for any of us, like a city dweller in China running out of a phone's battery could mean losing access to a bus due to the highly developed mobile payment network. The "modes" treated each resident's life satisfaction equally while specifying inclusiveness levels under each mode depending on the resource availabilities. This structured information was fed to the second "Divergence to Convergence" course, providing several easy-to-follow emphasizes for the residents, designers, and administrations for ideation and evaluation. With convincing and simplified design targets, the government administrators and service designers could collaborate toward the same goal rather than in an "Appeal-Gratification" mode. As a result, the designers received affirmative and elaborate user needs to generate concepts; the government decision-makers had valid criteria to evaluate the viability of those ideas.

Three important considerations in the strategic level

Stakeholders' interrelations analysis

Freeman(1984, p. 46) defined stakeholders as "any group or individual who can affect or is affected by the achievement of the organization's objectives," which broadens the remit of stakeholder management beyond the company shareholders (Littau et al., 2010; McGrath & Whitty, 2017). Stakeholder analysis as a tool has been used widely in police making, health management, and business management field (Brugha & Varvasovszky, 2000). In this project, to align stakeholders, we develop research tools to map their interrelation. The preliminary types of stakeholders arose (investors and supervisors, service providers, and end-users). See Figure 2. The residents were the end-users of this project, as well as external stakeholders. The government's functional departments are investors and supervisors. The exclusive service contractors comprised state-owned enterprises (SOE) (e.g., bus companies) and authorized private enterprises (PE) (e.g., online car-hailing platforms). The service providers and supervisors/investors were treated as internal stakeholders in the current transportation system. And the service providers usually helped to filter the end-user's demands based on their serviceability. However, the innovation of ITS would dramatically change this structure by enabling all three stakeholders to communicate freely, which

means that the design requirements should follow a different product proposition of the ITS. By mapping stakeholders, designers played a strategic consulting role to shift the design direction. The considering as to ITS's proposition is describing in the next section.

ITS proposition as to the stakeholder's interest

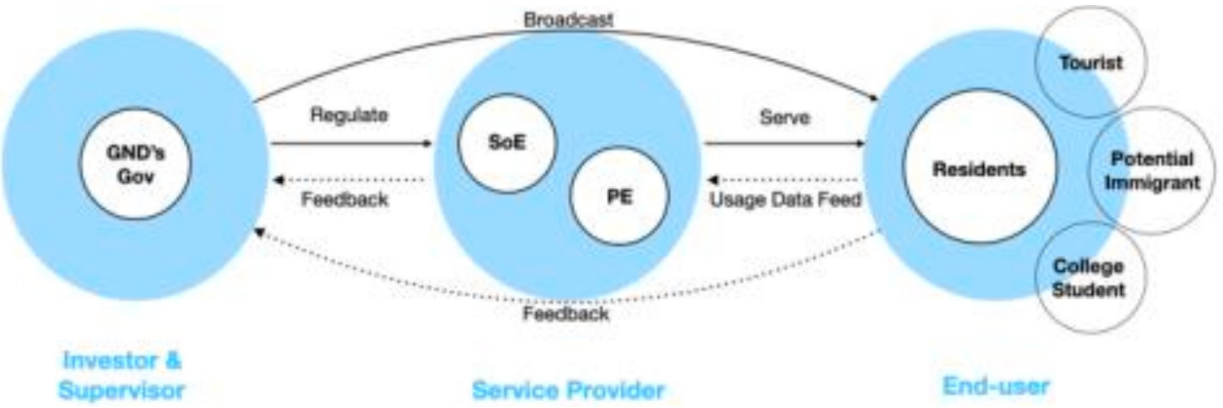

Figure 2. Interrelations among ITS stakeholders

As the core city infrastructure, ITS carries the resident's future life qualities. By 2030, Gui'an is foreseeing great changes in demographics and infrastructure, with the urban population growing by 690% and the rural population decreasing by 30%, according to the GND Development Plan 2013. The advanced technology has great potential to create various futuristic service scenarios. As mentioned, the stakeholder's interrelationship landscape would change after it is embedded. What could that be? What kind of value is ITS responsible for creating? To facilitate the information flow freely among the three parts, ITS uses its data potential to create a communication circulation with interfaces to communicate with the stakeholders. See Figure 3. The proposition of the interfaces is the service touchpoints located. In general, ITS is an enabler, using data management to support all service touchpoints, such as data-driven policy-making and design based on user data monitoring. The value brought by ITS is the capability to be dynamic and iterative for the city transportation system. The inclusive scope is considered in the next section to specify the design criteria further.

Inclusive scope: a framework for needs induction

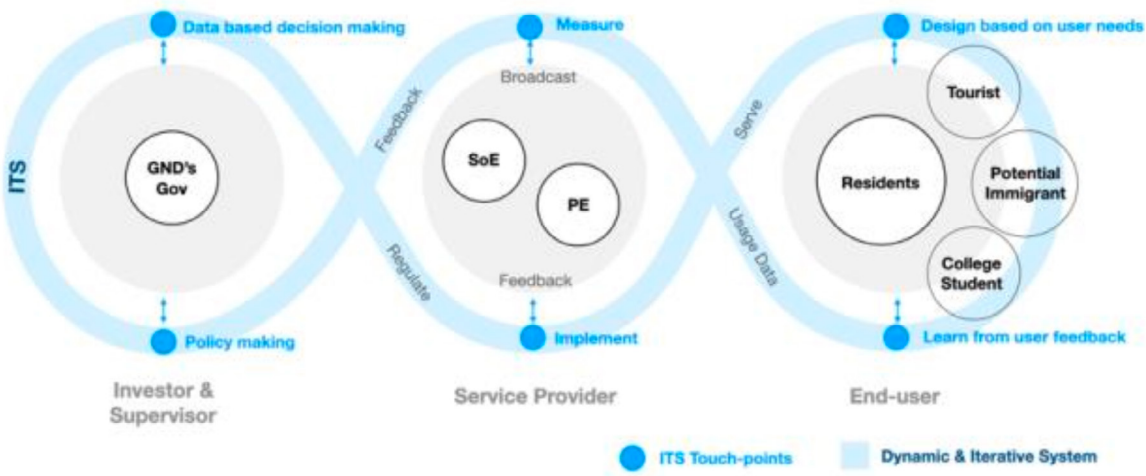

Figure 3. ITS enables stakeholders with a dynamic and iterative infrastructure

Eventually, designers need a clear scope to concept inclusive service. Whose demands should be met by the diverse resident types? How do we set rational standards for the decision-makers to reference? In this case, the design researchers refer to the theory of the "Human Needs Pyramid." Maslow (Maslow, 1943) describes human needs in five hierarchical levels. The physiological conditions are at the bottom of the hierarchy, followed by safety, social, and esteem needs. The top level is self-actualization. Later, the two lower levels are added to cognitive and aesthetic needs, and one higher level is added above-self-transcendence (Maslow, 1998). This project's physiological conditions are security and efficiency. See Figure 4. Those fundamental conditions are suited for universal design principles meant to meet the needs of all people, young and old, able and disabled (Nussbaumer, 2011). Yet, the users are less willing to pay the extra service fees. Then, the cognitive and aesthetic needs equal the need for comfort and predictability to ITS. Users consider them the key elements regarding the user experience and are likely to pay some extra fee for the operational services. So, the inclusive dividing line floats up and down within this zone. On the top, the needs like protecting social images and some kind of privacy. They do not consider them a "must-have" feature in the public transportation system, but they should be available for advanced and premium service systems. Based on this "human needs" ladder, it is easy to correlate the specific user needs with the data potentials and then generate design principles.

Viable concepts evaluated and delivered

I In this project, the deliverable is a part of the design process rather than a document at the end since the influence is considered the first. The findings and the frameworks mentioned before were communicated to other teams in several workshops. The delivery activities started even before the second course of the HCD process. So that the groups could be involved and co- create on the second course, see Figure 1. To sort and modify the ideas into the final concept design phase, the multidisciplinary teams use the need's hierarchy framework as the guideline to consider three categories simultaneously: inclusiveness scope, data technology involvement, and service design innovation.

Moreover, as an innovation design planning, the concepts were evaluated by three attributes: viability, desirability, and feasibility. Finally, as a public infrastructure, ITS must cover all the hierarchical levels of need. See in Figure 4. Through synthesizing and final development by the service designers, the implementation concepts are visualized in Figure 5. Those concepts have been written in the development agreement to implement with the consent of all stakeholders in the project.

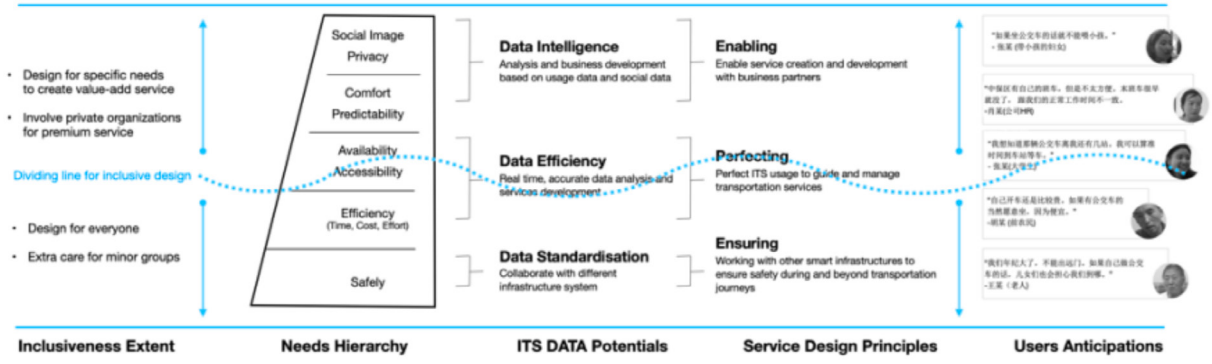

Figure 4. Needs hierarchy to inform inclusive design features

Figure 5. Selected concepts for implementation (Asian Development Bank, 2019)

Discussion and Conclusions

Innovation ideas generated in the pre-planning phase usually need many adaptations before implementation. How to stay human-centered along with the process is always challenging for innovation designers. That is why many creative ideas hardly go beyond the innovation labs or the academics. In this case, design researchers work as strategic planners to define challenges and explore opportunities. Their considerations are responsible for the project outcomes-the resident's satisfaction with ITS. In the project reflection, the three considerations are seen as critical activities to ease designers/design researchers to play strategic roles in such a context:

1. Understand the stakeholders' interrelations.
2. Clarify the project proposition for all players involved.
3. Set the design criteria to smoothen the rest of the human-centered design process.

Though this analysis is limited to one case study, the applied HCD approach in China's public sectors is rare. The strategic activities emphasizing stakeholder analysis and project proposition are expected to be tested by more HCD practitioners and strategic designers in the public sector.

Acknowledgments

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Ecological Speculative Design Methodology: Four Shifts - A Case Study of the "Unqualified" Factory

Erlu Ni

erlu_samantha@126.com

Abstract

The global value chain is in flux, driven by the confluence of the 2020 COVID-19 pandemic, climate crisis, and globalization's restructuring. Amid these trends, designers must respond with an ecological mindset, addressing the reshaped global value chain's profound implications. This article presents the "ecological-speculative-design" methodology, using the case study of the "Unqualified Factory" to illustrate four key shifts: (1) Shifting the design subject from "leather" to "leather value chain"; (2) Moving the design context from "consumer trade" to unveiling "ecological contradictions"; (3) Transforming the design method from " designing objects" to "ecological speculation" using multimedia Design; and (4) Advancing the design goals from "problem solving" to "public awareness transformation". By embracing these shifts, designers can inspire public dialogue and influence systemic change, thus contributing to a more sustainable future.

Keywords

Ecological design; Speculative design; global value chain; ecological crisis; sustainability; environmental impact; public awareness

Introduction

The tense interplay between the 2020 COVID-19 pandemic, climate crisis, and the global economic landscape has reshaped the distribution of the global value chain. This transformation is driven by three major trends: the continuous advancement of emerging technologies, the growing urgency of global climate issues, and the restructuring of globalization. The consequences of this transformation are profound, impacting individual lives, corporate strategies, and national approaches to sustainable development. Simultaneously, the global climate crisis has compelled stakeholders, including governments, civil society, and businesses, to recognize the imperative of environmental sustainability and take action.

Designers, on one hand, bear the responsibility of social and ecological stewardship, applying a more "global" and "ecological" mindset to tackle global challenges within the context of reshaping value chains. On the other hand, the evolving global value chain presents designers with fresh perspectives and avenues for intervention. This article employs the work "Unqualified Factory" as a case study, utilizing the "ecological-speculative-design" methodology as a research lens and tool. The design methodology undergoes four critical shifts, focusing on "leathering its value chain." It delves into and elucidates the underlying ecological contradictions, employing multimedia design techniques for ecological speculation, thus fostering a transformation in public crisis awareness.

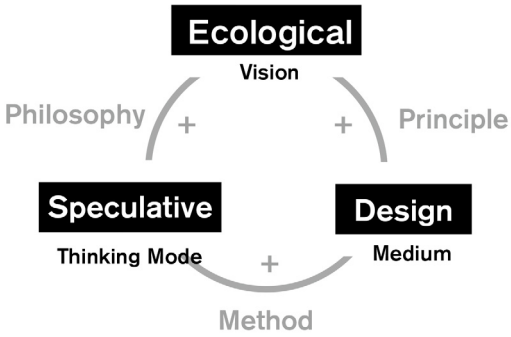

Figure 1. The figure shows the author's diagram of the "ecology-discernment-design" research relationship

1.Shifting the Design Subject from "Leather" to "Leather Value Chain"

Traditionally, designers were tasked with creating high-quality products or services using raw materials. However, design extends beyond the immediate product or outcome; it encompasses the entire value chain and resource dynamics that shape the design's formation, presence, distribution, or dissolution. To adopt a more ecologically conscious mindset and comprehensive design principles, we must shift our focus from isolated materials to the systems and industries underpinning design. Many designers have explored primary materials or components as entry points in their research. For instance, Mary Mattingly's work "Cobalt" investigates the production, distribution, and use of the metal element "cobalt." Similarly, Formafantasma's exhibition "Cambio" centers on the wood industry and its trade. These designers have recognized the significance of materials in broader supply chains, providing crucial insights into complex systems. This shift from material-centric to value chain-centric design allows us to comprehend the intricate networks behind resource utilization, facilitating discussions on ecological and social challenges arising from human resource consumption.

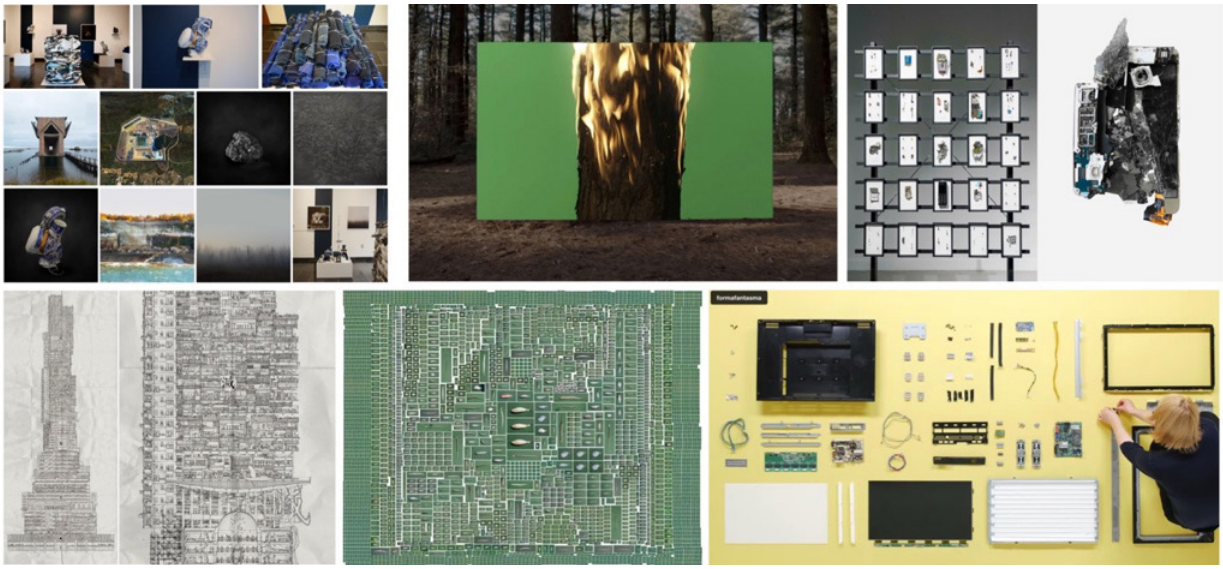

Figure 2. From left to right, top to bottom: Cobalt, Cambio, The Global Souvenir Shop, Bitter Pagoda, Equivalence - The Ecological Footprint of Fish, Ore Streams, images taken from the artist's website

In this context, I embarked on research in my hometown, starting with representative industries in Wenzhou,

China. I chose the leather value chain as my research subject. Leather serves as a central object connecting animal welfare, ecological impact, commodity output, and human trade. It functions both as a primary material and a continually processed commodity component. Leather and its industry have existed for centuries, evolving from early records and subsistence needs to becoming an integral part of daily life. Leather's durability and texture have made it ubiquitous in human existence. Moreover, the leather industry's close ties to natural environments, human life, and global trade confer it with special significance. The leather value chain, comprising cattle, hides, leather, and leather products, constitutes an integrated system, with each stage mutually influencing the others. Leather, more than any other material, embodies the complex relationships between humanity, nature, and life. Based on this analysis, I shifted the design and research focus from "leather" to the "leather value chain" and its associated systems.

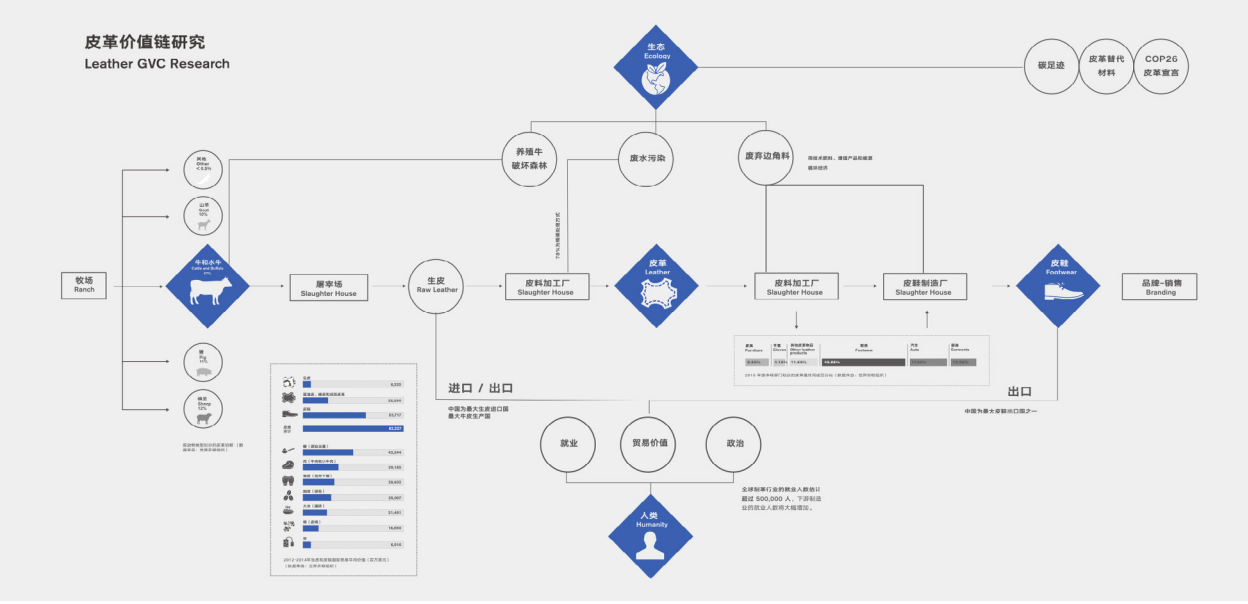

Figure 3. The image is an infographic of the leather value chain study drawn by the author

2.Shifting the Design Context from "Consumer Trade" to "Ecological Contradictions"

As the climate crisis looms ever closer, respecting the limited resources of the material world and taking proactive measures have become more critical than ever. The design context has shifted from the globalized production and consumption systems within the global value chain to the ecological impacts arising from the extraction, processing, shaping, assembly, distribution, disposal, recycling, or reuse of raw materials. The exhibition "Cambio," initiated by the Formafantasma design studio, presents an ongoing investigation into the management of the wood industry, revealing the complex network of illegal timber sources discovered at EU customs, thus exposing the intricate web of illegal international trade. By tracing the colonial history of the timber industry and its current operation methods, the exhibition highlights the ecological impact of design and the wood industry, prompting a reconsideration of the industry's existing practices. Designers play a critical role in our environment, analyzing the global value chain through an ecological lens, scrutinizing and subverting irrationalities within the chain, thereby embracing their responsibility to transcend boundaries.

I conducted field visits to more than ten local farms, slaughterhouses, leather processing factories, and leather

product factories in Wenzhou. I interviewed twenty professionals from the leather industry and worked in a leather production factory for three weeks, learning the entire leather processing workflow. During this process, I observed the various stages of leather production, from slaughtering and skinning cattle to the multiple processing steps involved. Compared to the consumer trade system of leather, the life industry's quantification, dissection, and underlying ecological contradictions become more apparent.

The leather production industry faces two unavoidable issues: ecological degradation and animal welfare concerns. Sustainable Apparel Coalition data reveals that leather ranks as the third-most environmentally impactful material in terms of production. Leather production often involves chrome tanning, which, if wastewater treatment is inadequate, can lead to significant environmental pollution and water resource consumption. Additionally, the rearing of cattle for both beef and leather is a major driver of deforestation. A January 2022 study by Stand.earth demonstrated the links between mainstream and luxury brands and Amazon deforestation. The production and trade of leather are inextricably linked to forest destruction and environmental consequences. Furthermore, the welfare of animals in the leather industry raises ethical concerns. Cattle are reared not solely for meat consumption but also for leather, leading to overcrowded farms and poor animal living conditions. These ecological and ethical issues exemplify the ecological contradictions present within the leather industry.

Figure 4. Image on the left taken by the author of Wenzhou cattle farms, slaughterhouses, tanneries, shoe factories in January-April 2022

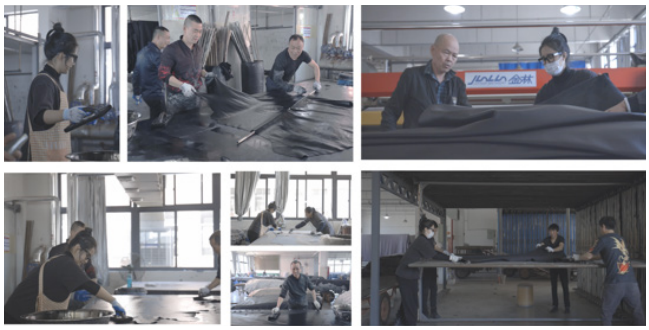

Figure 5. The image on the right is an infographic of the leather value chain study drawn by the author

3.Shifting the Design Method from "Designing Objects" to "Ecological Speculation" Using Multimedia Design

Designers have long employed storytelling as a powerful tool for transmitting ideas, fostering empathy, and sparking public discussion. Yet, as environmental and ecological concerns gain prominence, storytelling alone may not suffice in addressing the urgency of ecological crises. Designers must go beyond storytelling and embrace "ecological speculation." This speculative approach investigates potential ecological scenarios, instigating forward-thinking and proactivity in dealing with environmental challenges.

In my project "Unqualified Factory," I integrated multimedia design elements to create an immersive ecological experience. By doing so, I sought to raise awareness of the ecological contradictions within the leather value chain. Through a series of multimedia installations, I invited visitors to participate in an ecological speculation journey. This journey guided them through the life and death of cattle, the leather production process, the consequences of environmental degradation, and the societal implications of leather consumption. With each

multimedia installation, I encouraged visitors to consider the various ecological impacts associated with leather, from deforestation and pollution to animal welfare concerns. This immersive approach aimed to provoke a visceral response and stimulate proactive thinking about ecological sustainability.

Figure 6. Image of the work "The Unqualified Factory" in a book of images

Shift 4: Shifting the Design Goals from " Problem Solving" to "Public Awareness Transformation "
Designers possess the capacity to influence public opinion, mobilize collective action, and steer societal transformation. While individual awareness of ecological issues is essential, effecting meaningful change requires the dissemination of knowledge and the activation of public consciousness. As ecological speculation unfolds, designers must transition from cultivating private awareness to fostering public awareness. The power of collective awareness can shape policies, redirect corporate strategies, and influence consumer choices, thereby driving systemic change.

In the case of "Unqualified Factory," I employed a variety of strategies to transition from private to public awareness. The project was exhibited in public spaces, including art galleries, museums, and community centers, to maximize its accessibility. Additionally, I organized workshops, panel discussions, and educational programs to engage the public in discussions about the leather value chain's ecological implications. By inviting participation and dialogue, I aimed to empower individuals with knowledge and inspire them to advocate for change. Furthermore, I collaborated with local environmental organizations and policymakers to amplify the project's impact and advocate for more sustainable practices within the leather industry. Through these collective efforts, the project extended beyond the realm of private awareness, contributing to a broader discourse on ecological transformation.

Conclusion
The "Ecological-Speculative-Design" methodology, as demonstrated through the case study of "Unqualified Factory," offers a powerful framework for addressing ecological crises within the context of reshaping the global

value chain. By undergoing the four critical shifts—shifting the design subject from "leather" to "leather value chain," shifting the design context from "consumer trade" to "ecological contradictions," shifting the design method from " designing objects" to "ecological speculation" using multimedia Design, and shifting the design goals from "problem solving" to "public awareness transformation"—designers can play a pivotal role in fostering collective awareness, influencing systemic change, and contributing to a more sustainable and equitable future.

Through ecological speculative design and engagement with ecological contradictions, designers can catalyze discussions, inspire action, and ultimately shape the trajectory of the global value chain towards greater ecological responsibility and resilience. The "Unqualified Factory" project illustrates the potential of ecological speculative design to ignite public awareness, encourage dialogue, and drive positive ecological transformations within complex, interconnected systems. As designers continue to grapple with the challenges of the 21st century, the ecological-speculative-design methodology offers a promising path forward, one that leverages creativity and critical inquiry to address the pressing ecological issues of our time.

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From the perspective of cultural anthropology, The cause of variant characters in the Ma Wang Dui silk manuscripts

Yujuan Tang

TYJ2021@hunnu.edu.cn

Abstract

The Chinese character system, created in social groups and applied to social groups, is doomed by its origin, development and scope to be bound by strict rules and laws. However, due to the complexity and variability of human groups, the contradictions between rules of Chinese characters have changed, resulting in heterogeneous characters. Chinese characters with different characters are the window of dynamic changes in the formation and development of Chinese characters, from which we can see the function of Chinese characters in the specific history, environment and society. Therefore, the comprehensive analysis of different characters is the study and analysis of the smaller regional society and the larger human society in the context of the evolution of Chinese characters. From the perspective of cultural anthropology, starting with the basic structural elements of the font, this paper traces the historical and cultural origin process of Mawangdui variant characters, makes an in-depth analysis of the factors affecting the generation of variant characters, and makes an in-depth explanation from four aspects: regime change, font transition, cultural transition and tool evolution. This paper discusses the development of font design flow in the historical context from the perspective of interdisciplinary.

Keywords

Cultural anthropology; Heterologous writing; Mawangdui Bamboo Slips and Silk; seal character; Li-Calligraphy

Introduction

The emergence of writing is an important symbol of the birth of human civilization. In Ancient Society, published in 1877, American scholar Morgan said that civilized society "began with the invention of the phonetic alphabet and the use of writing." In the study of the origin of civilization, the region where early characters appeared corresponds to the cradle of early human civilization, and the evolution of characters in different regions constantly reflects and displays the requirements of aesthetic taste and the changes of inner spirit of corresponding cultural groups. As an important symbol of the Chinese nation, Chinese characters have engraved the record traces of the Chinese nation in practice, which has shown obvious gradual change in different historical periods. Since the Shang Dynasty, Chinese characters have undergone the evolution of oracle script, Jin script, seal script, official script and regular script. There must be a transition period between different fonts. With the changes of font structure and writing mode, the original font gradually transitioned to another font until a new font was born. In this special transitional period, people with different social status, cultural level, dialect area and professional identity will use Chinese characters, and they will transform and even create glyphs according to their own understanding and habits. These newly created Chinese characters are updating and destroying the structure of the original Chinese character system at any time【1】. In this kind of coexistence and struggle between new and old structures, different characters should be born.

variant characters in the Ma Wang Dui silk manuscripts

The most historical significance of Mawangdui silk manuscripts is the 28 silk manuscripts unearthed in Mawangdui No. 3 Han Tomb in Changsha, Hunan Province in early 1974, with about 120,000 words, covering a wide range of contents, including books on war, mathematics, six arts, various categories, Daoshu, and maps. This batch of silk manuscripts were written at different times, as early as the end of the Qin Dynasty, and as late as the Western Han Dynasty, and the typeface is mixed, showing a distinctive transitional period of Chinese character font replacement. Domestic scholars have studied and discussed the development of Chinese characters based on the collation of these cultural relics. Starting from the "dispatch book" study of Mawangdui No. 1 Han Tomb, Qiu Xigui analyzes the problems of Han and silk script in Mawangdui, points out the characters of ancient scribe and the relationship between ancient scribe and Qin seal style and cursive script. Wang Guiyuan's Study on the Formation System of Mawangdui Silk Texts makes an exhaustive analysis of Mawangdui Silk texts from the perspective of the conversion of ancient and modern Chinese characters, and deeply breaks down the transitional character of the formation system of Chinese characters. Chen Songchang's "Mawangdui Jian and Silk Text Compilation", published by Cultural Relics Publishing House in 2001, compiled the silk texts and bamboo slips (including the book, medical slips and wooden plates) from the Han tomb of Mawangdui, sampled according to the original photos, and included a total of 3226 single characters, 9566 heavy texts, 15 combined texts, and 39 doubtful characters. On the basis of Mawangdui Jian and Silk Text Compilation, Wei Xiaoyan organized and studied the heterotypic characters of Mawangdui. There are 1826 heterotypic characters, which are called heterotypic groups, of which 1715 are heterotypic groups, accounting for 93.92% of heterotypic groups. It shows that the font structure of different characters in Mawangdui slips and silks has been relatively stable in the process of Li transformation【2】.

Analysis on the cause of the evolution of variant characters in the Ma Wang Dui silk manuscripts

The alternation of political power in Qin and Han Dynasties brought about many innovations in economic system, ideology and culture, resulting in rapid changes in writing fonts, writing instruments, and the communication environment of fonts. From the perspective of cultural anthropology, this paper expounds the reasons for the formation of different characters by Ma Wang, and discusses how font users in the late Qin and early Han Dynasties were affected by the historical environment. Thus changing the writing, and how the result of writing acted on the development of typeface.

Font transition

According to the Record of the Grand Historian, the Book of Zen, Emperor Wudi of Han Dynasty "had an ancient bronze vessel, asked Shaojun, Shaojun said: 'This vessel is ten years in the Bai bed of Duke Huan of Qi. What has been done is done according to its engraving, and the fruit is Qi." The "ancient text" here refers to the bronze inscriptions of the pre-Qin period. In the study of ancient characters, the Chinese characters before the Qin Dynasty are usually called "seal style", which belongs to the ancient characters. The Chinese characters after the Qin dynasty are called "official style", which belongs to the modern script【3】. The silk slips unearthed in Mawangdui mainly come from the early Western Han Dynasty, which is the node of the conversion of ancient and modern characters, and also the transition period of seal script to official script. During this period, a large number of phonetic characters appeared, and the synthesis of sound and meaning became the main mode of configuration. The combination of strokes and the layout of components started from the perspective of writing convenience, and the factors such as side side unitization, stroke shape simplification, stroke length, straight, broken and oblique were greatly changed. The phenomenon of assimilation and alienation of components

increased significantly, and a large number of different characters emerged along with the trend.

Wang Guiyuan sorted out 1779 single characters in his study on the Chinese Character Configuration System in Mawangdui Silk Manuscripts, of which 1609 were combined characters and 1161 were combined characters based on sound and meaning, accounting for 73.52% of the combined characters. The phonograms synthesized by sound and meaning are composed of shape characters and phonograms, and the components of word formation need to converge with each other to control the font. This kind of control, condensed to the tip of the pen in the process of transmission, the small differences produced by the long, short, fat, thin, positive and oblique strokes, accumulated micro and huge, so that the original structure of Chinese characters began to change, the original structural motivation gradually collapsed, forming a prelude to the transformation. In the process of Li change. Different characters appear a lot in the transition period of fonts, which is the inevitable result of simplifying the font and improving the efficiency of text use. Although the transformation of seal script is the internal evolution of the font system, the contradiction of the straight strokes, the contradiction of the density of the structure, and the contradiction of the number of characters are amplified in the social communication, which promotes the metabolism of the development of Chinese characters.

Regime change

The change of regime led to a change in the official script. After the unification of the Qin Dynasty, the feudal political system began to mature, and the usage and application of characters expanded rapidly. In order to strengthen the centralization of power and facilitate the dissemination of information and written communication, the Emperor of Qin asked his Prime minister Li Si, who was good at calligraphy, to implement the policy of "writing in the same style". Based on the original big seal style, the small seal style was simplified and created. The small seal strokes are horizontal and vertical, the lines are round and even, and its rigorous and unified style is the embodiment of the strict order required after the unification of Qin.

In civil occasions, official script, which is more convenient to write, is in circulation. After the fall of the Qin Dynasty, the political power supporting small seal script disappeared, and the winding small seal script could not adapt to the needs of The Times and was gradually eliminated. Official script began to spread rapidly and replaced the seal script as the mainstream font. The regime is uncertain, the text starts from the wind, the folk weight is newly standardized as a new standard, and the different font characters appear frequently in this iteration.

The slips and silks unearthed in Mawangdui mainly come from the early Western Han Dynasty, and the early official script evolved just at this time when the Qin and Han dynasties changed. In order to stabilize the situation, the rulers of the early Han Dynasty implemented the state policy of rest and recuperation, light corvee and low taxes. After several generations of rulers, they have independent political and military rights to maintain the stability of the country, build water conservancy and develop agricultural handicraft industry at home, and the productive forces and economic conditions have been substantially recovered, which is called "rich at home and rich national power". In such a stable and prosperous social situation, characters needed to adapt to the development of political power and economic conditions, and abandoned the difficult from the easy in practice. The official script, which was originally only popular among the folk and easy to write, re-established its position in the new dynasty and became the mainstream font. It can be seen from the first copy of Laozi, the second copy of Laozi and the first copy of Yin-Yang and Five-Element Classic in Mawangdui Slips and silk that the seal script structure left over from the Qin Dynasty is gradually disintegrating. Although the combination of many characters

and the brushwork still have the seal meaning, the brushwork form has gradually taken on the characteristics of official script.

Cultural downward movement

During the Spring and Autumn Period, princes fought for hegemony and wars were frequent. New class forces overthrew the old system and ruling order and established a new system and ruling order. The slave society gradually disintegrated and the feudal society began to take shape. In this overwhelming storm of social change, social production relations underwent great changes, class contradictions became increasingly fierce, the old slave-owning class disappeared, the new landlord class rose, and the handicrafts and freed peasants formed asset merchants through asset accumulation. At the same time, the new system brought a new ideology and gave birth to a new social class, the Shi. Scholars come from all social strata and schools, and because of their different origins and different positions, they put forward different political views and ideas of governing the world. They wrote books, gathered disciples, and formed different schools. The phenomenon of "learning in the government" began to be replaced by the emerging private schools, the situation that the slave-owning class monopolized schools was broken, and education gradually went to the masses and to the people. The education target was also expanded from the aristocracy to the common people, teachers lectured everywhere, and students freely chose their teachers. Confucius, a great thinker at that time, advocated "education without class", and most of his 3,000 disciples were ordinary people. The emergence of scholars accelerated the spread of culture, making the knowledge that could only be reached by the aristocratic class move down to the common people, forming a culture move down.

The war disintegrated the monopoly of Zhou culture, and the local culture began to have a trend of localization. After the Warring States period, the use of characters can be divided into the western Qin system, the southern Chu system, the eastern Qi system, the northeast Yan system and the northern Jin system according to the region. According to the "Zuo Zhuan Zhaogong twenty-six years" records, 516 BC, the prince carries a large number of Zhou room books to flee to Chu, these books include the historical documents of the previous dynasty, the various vassals of the state's report, the Zhou dynasty lists the king's mandate documents and other precious documents. At this point, the state of Chu replaced the Zhou Dynasty, and the state of Song and Lu became the three major cultural centers at the same time.

Academic activities around the country are extremely active, educational thoughts are unprecedently liberated, and Chinese characters are increasingly accepted and used by the broad masses of the people. With the popularization and application of Chinese characters, the psychology of seeking simplicity and quickness makes people no longer adhere to the neat and beautiful shape, but dare to break the routine and develop in the direction of simple and easy to write. In the process of writing and communication, a variety of new fonts were formed due to hasty writing. According to historical records, at that time, the light "mei" character had 104 kinds of writing, and the "treasure" character had 194 kinds of writing, some of which showed traces of the shape structure of the writing, and even had individual characters similar to the official script writing. These simple writing methods may be accepted by the majority of people and become popular, and have been used by the people until the Qin Dynasty and the early Han Dynasty became the mainstream writing.

Tool evolution

The formation of font has a direct relationship with writing tools and writing materials. The unique charm of

Chinese characters is largely due to its special writing tools【4】. As Zong Baihua once wrote in "Aesthetic Thoughts of Chinese Calligraphy" : "There are two main factors that Chinese characters can become works of art, one is because the beginning of Chinese characters is pictographic, and the other is the pen that Chinese people use." The oracle-bone inscriptions of the Yin and Shang dynasties were engraved on the hard oracle bones with a knife, and the blade was not easy to change, so the font strokes were thin and square. The gold writing is cast on the bronze ware, the structure is rigorous, the writing is firm and the situation is dignified. As a traditional Chinese writing tool, the brush originated from the Yin Dynasty more than 3,000 years ago and was collectively called "brush" after the unification of the Qin Dynasty. The brush tube is made of hard materials such as bamboo and jade, and the tip is bound with animal hair. The pen tip is round and pointed, trimmed neatly and flexible. Therefore, when writing, it can be as strong as the wind, and be free. Han Dynasty official script tends to mature, in order to adapt to the character characteristics of official script, which is round and square and straight, and the momentum of stretching and spreading when writing, the length of Han Dynasty brush tube and the diameter of pen tip have increased moderately on the basis of Qin Dynasty, and they have mixed the beauty of seal script style between square inches, showing rich brushwork changes such as fat and thin, slow, thick and dry.

In addition to the use of rabbit brush pen, also popular Wolf hair, deer hair and other animal hair mixed made of "pen". "Jianli pen" adopts the "pillar method", which takes the hard rabbit hair as the pen column, and the soft wool covers the outside of the rabbit hair, so that the pen head is made, and the pen heart is strong and has strong water storage performance. Therefore, there can be more than 11,000 words unearthed in Mawangdui "Warring States Zongzong Family letters", the whole article has not seen a single bit of dry pen. The connection between the pen tip and the pen pole of the Western Han Dynasty has also been improved, the pen tip is incorporated into the bar, and the pen hair outside the cavity is shortened, which is more conducive to the tightening of the font muscles and bones when writing, and the pen edge is thick and firm【5】.

Writing materials are also crucial to the development of Chinese characters. The early official script was written on silk slips. The material of silk has an influence on the internal structure and external form of Chinese characters. By the Han Dynasty, China's silk weaving history had reached more than 1,000 years, and the government and private textile industry had a considerable scale. Weiyang Palace in the Western Han Dynasty had two weaving rooms, east and west, which still had an important economic position in the Eastern Han Dynasty. The folk textile industry is very prosperous, Shu is rich in Shu cloth, made by the odd brocade, Hexi corridor lush agriculture and silk industry developed. Silk is soft in texture, fine in texture, and ink can penetrate better. It is an excellent writing material. The manuscripts unearthed in Mawangdui, such as the second edition of Laozi, the Xiangma Classic, and the Jing Fa, all have "Zhu silk bars" formed by straight lines of red lines【6】. However, the Warring States Zongshu unearthed at the same period did not make a vermillion boundary column, and the whole text was interspersed with different crosswises, which had the beauty of nature.

conclusion

Chinese characters are based on the pictograms of things, and from the moment of their emergence, the dynamic scene it presents is the understanding and experience discrimination of the entire Chinese social group, and the dynamic result of the way of thinking produced by the Chinese people based on the land of China. It is not a symbol of instant solidification, but the Chinese people's long thinking about "objects", which permeates the emotion and value judgment of the Chinese nation.

The purpose of cultural anthropological research is to understand human groups from a cultural perspective, and how human perceptions, actions, and the results of those actions in turn affect human thinking and human interaction with other groups, making interaction the most fundamental aspect of anthropology. Chinese characters are the product of continuous interaction with the Chinese people over a long period of history, and the dynamic scene they present is the cognitive and experiential discernment of the entire Chinese social group. Although Mawangdui Jianfu heterographs are only a small part of the history of font development, they still present a comprehensive and holistic view of society and culture, and provide a new perspective and vision for design studies to gain insights into specific civilizations in the course of historical change.

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Hotel Smart and Healthy Guest Room Renovation Service Design

Yu WANG[1], Yong SUI[2], Shangqing GAO[3]

[1]Beijing Institute of Graphic Communication, Beijing 102600, China
wangyu@bigc.edu.cn
[2]Beijing Institute of Graphic Communication, Beijing 102600, China
suiyong@bigc.edu.cn
[3]CTR Market Research CO. Ltd., Beijing 100088, China
765051446@qq.com

Abstract

Service design improves user experience and service quality by planning and organizing the people, facilities, communication, materials, processes, and other related factors involved in services. This article is based on user experience to practice the smart health renovation design of hotel rooms, proposing that wisdom is the means and health is the purpose. Hotel room design should adopt situational strategies that provide appropriate feedback based on real-time sensing information for target users. With the improvement of living standards, people's demand for hardware quality and comfort in guest rooms has increased, but what guests most need is the improvement of the overall service quality of the hotel.

Keywords

service design, user experience, hotel guest room, smart and healthy

1 Introduction

XX Hotel Group was founded in South Guangdong in 2007 and is a professional industrial group under the Fortune 500 XX Group that integrates hotel planning, construction, and operation management. It has created the "N+1" model. Tianjin Dongli Lake XX Hotel is a large-scale comprehensive hotel that integrates luxurious rooms, conference butler services, complete entertainment and sports facilities, and characteristic hot springs. The Tianjin Happy Valley Theme Park is located opposite the XX Hotel in Dongli Lake, only one way away. [1,2] Due to the early planning and long construction time of the Dongli Lake XX Hotel decoration plan, the design style and facilities at that time can no longer meet the pursuit of fashion taste, personal health concerns, and aspirations for a smart life of guests.

Due to the close positioning, scale, and business model of XX Hotel in various parts of the country, taking Tianjin Donglihu XX Hotel (its subsidiary hotel) as an example for research has a certain degree of universal promotion and application significance. This case systematically adopts service and experience design methods, clarifies different user characteristics and needs, introduces intelligent products in hotel rooms to lay out a healthy check-in environment to increase customers' overall experience, and ultimately achieves the goal of making guests A solution that is generally satisfactory to the service provider and Party A. The project team plans progress and phased goals based on time nodes, uses sociological research methods to obtain qualitative and quantitative

data, clarifies the optimization design direction, and provides solutions based on factors such as user demand priority, Party A's planning, and field limitations. This article explores the application of service design in this practical case.

2 RELEVANT CONCEPTS IN THIS STUDY

Intelligent Hotel is a new generation of information technology that utilizes the Internet of Things, cloud computing, mobile Internet, and information smart terminals. Through automatic perception, timely transmission, and data mining analysis of various types of tourism information within the hotel, it achieves the digitization, informatization, and intelligence of the six primary elements of "food, accommodation, transportation, tourism, shopping, and entertainment" tourism in the hotel, Ultimately, providing passengers with comfortable and convenient experiences and services (Beijing Tourism Development Commission, 2012). [3] According to the "SB/T 10582- 2011 Technical Specification for Healthy Guestrooms", healthy guest rooms are designed with environmental protection, energy conservation, safety, hygiene, and comfort. They comprehensively improve the indoor environment, sleep quality, lighting, drinking water, and service items, providing consumers with a new accommodation environment. [4]

Service design improves user experience and service quality by planning and organizing the people, facilities, communication, materials, processes, and other related factors involved in services. Service design aims to design and plan a series of easy-to-use, satisfactory, reliable, and effective services for customers, widely used in various service industries. The output of service design can be tangible or intangible. Service design integrates people with other factors, such as communication, environment, behavior, materials, etc., and embodies the people-oriented concept. [5] Service design emphasizes the collaborative creation of stakeholders such as users and institutions and the active participation in the design output, delivery, and development process. Service design optimizes the comfortable experience at the user level by improving channels, touchpoints, and necessary visualization through design. At the institutional level, sustainable and meaningful value creation can be achieved by designing and optimizing processes, interfaces, and internal personnel experiences to coordinate internal operations and development. [6]

Experience design is a perspective aimed at helping stakeholders utilize the design process and products more effectively to solve problems. Using experience design as a framework for setting shared goals and standards, focusing on value creation and delivery. The purpose is to promote wise collaboration between enterprises and designers, unleash the power of design, and enable enterprises to participate, plan, and deliver customer experience based on value relationships (Patrick Newberry, 2013). [7] In service design, experience often appears as a design principle to evaluate the effectiveness of service design. The main design objects of service design are relationships and processes. In experiential design, experience exists as a design object, and the main design object of experiential design is feeling and influence. Service design emphasizes the initiative of the role of the giver, while experience design emphasizes the impact on the giver. Experience design must be distinct from the practicality and operability of service design. [8]

3 RESEARCH METHODS AND PROCESSES

3.1 Methods of Insight into Requirements

3.1.1 Background Analysis Methods.

Firstly, it is recommended to consult a large number of relevant literatures, including papers, books, research

reports, news, etc., conduct field surveys, examine the humanistic, historical, and economic environment of the participants, and visit relevant groups, critical stakeholders and experts, whose knowledge and perspectives are essential. By observing the state of an object in its natural environment through ethnography, first-hand information is obtained, and the culture of the observed object is described systematically. Researchers explain the minded people, things, behaviors, and environment from the perspective of the observed object and comprehensively analyze a multidimensional problem. [9] Log research is a qualitative data collection method for user behavior and experience. In log research, data is recorded in detail by participants regarding specific activities during a specified reporting period (a relatively long period). [10]

3.1.2 Situational Observation Methods.

Observing the subject's behavior in the natural environment they are experiencing, recording their behavior, or describing their behavior in the form of self-reporting by the subject. Researchers record interviews with people and observe the differences between people's words and actions through extensive behavioral observations. [11] The observation method is where researchers directly follow the words and actions of research subjects under natural conditions with a purpose and plan and analyze their psychological activities and behavioral patterns. The content of observation records includes basic information on the observation purpose, object, and time, as well as qualitative data such as the observed object's words, actions, and expressions. In addition, there is a comprehensive evaluation of the observation results by the observer. Unlike laboratory observation, natural observation (on-site observation) refers to the observance of research objects in real situations by researchers who do not attempt to influence what happens in that environment. It can be divided into participatory observation and non-participatory observation.

3.1.3 Subjective Investigation Methods.

The surveys can be used individually for descriptive, explanatory, and exploratory research. [12] Survey research is an essential tool in social research and is widely used in experiential design research. A questionnaire survey is a research tool composed of questions to collect information from respondents. Questionnaire surveys effectively measure the behavior, attitudes, preferences, viewpoints, and intentions of a relatively large number of participants, which is cheaper and faster than other methods. The interview method is a method in which the interviewee controls the conversation process based on the research purpose and collects information about the interviewee's motivation, attitude, values, and other aspects through conversation. The interview method should have a clear research purpose, focus on considering the method's validity, and the interviewer should control the implementation process. Focus group research aims to understand and determine the scope of individual thoughts and preferences. Participants are usually asked open-ended questions without answer restrictions and are hosted by skilled hosts in a comfortable and permissive environment. The problem is generally straightforward, brief, one- dimensional, and controversial.

3.1.4 Clue Tracking Methods.

The clue tracking method refers to the use of physical traces and archival data to collect data, and the way to obtain information is more covert, with participants usually not present. Physical traces include material signs and artifacts left over by behavior. The physical traces in design refer to the traces of use and the product, and the traces of use refer to the physical evidence retained by people after using or not using an item. Products refer to human creations, namely artificial objects such as architectural relics, paintings, and daily necessities. Archival data refers to various activity records or literature materials sourced from governments, institutions, individuals,

and other groups. Archival data means a rich source of information to discover clues, validate hypotheses, and test validity. Designers try to integrate multiple methods as much as possible to reduce or avoid problems caused by a single research method, making the research results more convincing.

This project uses the above research methods to analyze stakeholder needs.

3.2 Design Process

The British Design Council (2003) created the Double Demand Model, which describes the mindset used by designers and maps the divergent and convergent stages of the design process. Design thinking starts with a trigger, which may be an idea, some insights, market changes, macroeconomic changes, etc. [13]

Stage 1: Identify issues. From understanding phenomena and current situations, this stage is divergent and exploratory, exploring new problems. Through research methods such as observation and inquiry, customer behavior and business drivers will be revealed, and opportunities for further reflection will be identified.
Stage 2: Define the problem. Starting from a preliminary understanding, synthesize information and knowledge into insights. Define the real problem, focus on the most attractive opportunities, which are stages related to a shared vision and plans, evaluate the feasibility and impact of the project, and decide how to measure success or effectiveness.
Stage 3: Develop exploration. When the conceptual plan has a vision and goals, it is time to explore the best solution. Through investigation and verification, finding the best way to achieve goals is a divergent iterative process, ultimately evolving the correct answer into an executable development solution.
Stage 4: Delivery Plan. Analyze and validate all potential solutions from the previous stage individually and select the most suitable one or more. After the plan is determined, the delivery plan begins to be implemented. Discoveries during the execution process still affect policy changes.

The service design process cannot be separated from defining and solving problems. In this study, a double drill model was used to set the goals needed at each stage, but in practical operation, there were iterations and iterations.

3.3 Implementation Process

3.3.1 Insight and Discovery.

Not all research needs to start from scratch. When the research team wants to understand users and their experience with the product, wise use of publicly available information and interviews with professional consultants can save time and effort. We use theoretical and technical dimensions to understand the latest technology and application status, as well as the knowledge points that scholars pay attention to in academic research, from the official publication of articles, books, research reports, statistical data, and other materials. We put this part of the content in the "Smart Home Special Research" and "Green and Healthy Building Special Research" research reports, which will not be repeated here. A good background research is a good starting point for experiential design.

In addition, effective use of expert experience can gain sensitivity to user needs, and the value of reusing knowledge and expertise reflects the efficient operation of the industry. For professional consultants, there is generally no need for a complete formal invitation application. The author concisely describes the interview

content through a simple email or WeChat in advance and then schedules a one to two-hour conference call to explore the details, saving both parties time and quickly collecting essential research elements. Experts provide opinions and suggestions based on personal experience and industry expertise, clarifying the research direction. The author conducted telephone interviews with three experts, Lin X from Shanghai ETU Interface Design Co., Ltd., Qi X from Beijing CCTV Market Research Co., Ltd., and Huang X from Shenzhen Tencent Micro Architecture Open Platform. They have provided essential reference suggestions for our research direction, problem definition, and research methods from the perspectives of intelligent technology, market status, and public demand.

As a social commodity, hotel services are in a competitive market ecological environment. Understanding the strengths and weaknesses of competitors is crucial as it can help one discern strategic direction, positioning, and effectiveness. Direct competitors refer to products (business areas) with the same target users and similar content that constitute direct competition; Indirect competitors refer to target users who have certain commonalities and lack or cover content modules (business areas); Transferred competitors refer to specialized domain analysis (design domain) conducted as specific products with different target users. Based on the dimensions of positioning and hardware, we have selected 25 competitive hotels in first-tier developed cities such as Beijing, Shanghai, Nanjing, Hangzhou, and Chengdu from the existing competitive hotels in the market. Subsequently, we conducted a survey, analysis, and comparison from six aspects: their concept, market positioning, characteristics, strategic planning, target audience, and media control.

Dongli Lake XX Hotel's room renovation project belongs to the product development and evolution redesign stage. Competitors can be used as implementation prototypes for specific ideas to experience and test, and competitor research can also assist in answering design feasibility questions. Through public information and field research, we can obtain competitors' positioning and current situation, the application of new technologies and concepts, the disadvantages of competitors and our opportunities, the advantages of competitors, and our development direction. Competitive research, as one of the most compelling research methods, does not simply focus on the shortcomings and mistakes of competitors but helps us clarify our positioning and identify differentiated innovation opportunities.

A large amount of competitive hotel information was obtained through desktop research and telephone inquiries. Two typical competitive hotels, Orange Crystal Hotel and Purong Health Hotel were selected for a transfer competitive hotel tour. We extensively record the location, price, facilities, services, and guest evaluations of competitive hotels, then analyze competitive hotels' positioning and user groups. On the one hand, it helps team members enter this project's research status; on the other hand, it helps us define the scope and dimensions of the research. The competitive product inspection uses the physical evidence method to start with hardware layout and functional analysis, software information architecture, and visual analysis and experiences the actual check-in service with the mentality of users and researchers (see Table 1).

Orange Crystal Hotel focuses on fast hotels in cities, suitable for fast-paced white-collar companies or urban freelance youth who pursue fashion. The interior of the guest rooms is partially intelligent, and the equipment is more innovative than some 5-star hotels. The door card in the elevator can identify the floor, making residents feel safer. Swipe the card without inserting it to enter the room, and place it in the card slot to receive power. Welcome mode combines curtains, lighting, and music, displaying exclusive service information and regular programs on the ultra-clear, large-screen TV. Purong Health Hotel focuses on the physical examination and

	橘子水晶酒店	蒲绒健康酒店
目标人群	都市青年 公司白领	高端白领 商务人士
市场定位	中低端艺术主题酒店	中高端健康服务酒店
服务理念	酒店成为生活方式的再造	守护健康
服务特点	将城市建筑二次改造，使酒店融入当地生活，增强顾客的体验感	通过健康管家、智能硬件、体检等服务，为住客提供个性化的健康管理解决方案
设施情况	设备实现部分智能化（窗帘、光控、门卡等），面板或遥控操作；通过华住会App进行住房预定	配备直饮水、净化器等健康设备；智能光控、蓝牙音响；智能马桶；酒店App主要功能为住客健康管理
产品优势	客房设备简约 智能感应	考虑特殊人群 用户个性化定制

Table 1. Competitive Hotel Walkthrough (Drawn by Shangqing GAO)

treatment of high-end white-collar workers and business professionals around the technology park, with guest rooms positioned as auxiliary accommodation environments for physical examination and treatment. There is a dedicated direct drinking water and drainage system inside the guest room, and a variety of tea leaves, humidifiers, induction trash cans, floor drying racks, air conditioning and purifiers, Bluetooth speakers, and four lighting modes (functions and buttons are not clear) are provided for free in the freshness box. The toilet is equipped with toilet side supports and shower folding chairs for seniors or patients, and the high-end rooms have sweat steaming rooms, calligraphy tables, chairs, and utensils. The project team members drew guest room building diagrams, hardware facility layout diagrams, equipment panel plans, and software information architecture diagrams. At the same time, interviews were conducted with lobby managers, room managers, and servers regarding the hotel's service characteristics, customer characteristics, and needs. The two hotels have provided positive guidance and negative avoidance experiences for our design output from the perspectives of wisdom and health.

Next, we started to sort out the questions of the online questionnaire. We conducted several rounds of tests on our social media, reviewed the questions, and then modified and optimized the questionnaire to determine the target audience. We used paid questionnaire stars to conduct precise surveys of target customers and completed qualitative analysis based on quantitative data. It was found that in the hotel room scenario, the physiological and safety needs in Maslow's hierarchy of needs are still widely concerned, such as clean and humid air, purified drinking water, dried clothes, sound insulation, safety of the room, etc. Due to the increasing number of households purchasing intelligent products, such as smart toilets, body lights, smart televisions, electric curtains, etc., these independently running intelligent devices have gradually become people's basic and expected needs, and the timely user scenario intelligent linkage product function may become a charming (exciting) demand.

At the same time, the author uses text analysis to analyze the existing pain points of residents in Dianping. Conference group users whose institution bears the cost of accommodation s seldom give evaluations on online platforms, and business individuals with high service requirements usually communicate directly with hotel

managers to solve problems or dissatisfaction. The platform's evaluation users are mainly individual family guests, and most of the pain points are generated during the booking, check-in, and check-out process. For example, the platform did not notify hotels of reservation changes; The platform invoice needs to be consistent with the hotel's detailed official seal; Waiting time for check-in and check-out is too long; Problems caused by poor front desk service attitude or low efficiency. As for hotel rooms, the main issue is the hardware and usage issues in the room, bathroom, and balcony areas, such as poor WIFI signal; air conditioning only adjusts air without cooling, the unreasonable layout of the bathroom, control knob electrostatic problem; the outdoor balcony causes mosquito bites; problems caused by the lack of facilities such as cribs. Guests evaluate real-life issues based on a brief personal experience and cannot provide forward-looking suggestions. They can only offer points like phenomenon-level problems for improving hotel services. Gradual optimization needs to be carried out according to the classification and priority of the responsible department.

During the Dongli Lake XX Hotel field survey, a user survey was conducted by combining shadow observation, offline hotel experience, on-site survey questionnaire, and offline room service statistical table. Different stakeholders have different positions and perspectives, and choosing suitable interviewees within a limited time frame is essential. However, more than listening to users' one-sided opinions is required to support design decisions. Following the principles of interaction and co-creation in experiential design, we conducted in-depth interviews with the hotel's business department manager, front office manager, housekeeping manager, maintenance manager, and room attendant (see Figure 1) after a comprehensive and detailed tour of all buildings in the hospital, including the accommodation building, sports center, entertainment center, hot spring club, catering center, and conference center. We gained a comprehensive understanding of the service content of each department in the hotel, provided information on user types and routine needs, conflicts and contradictions with different frequencies, and conducted multiple follow-up visits during the design process to obtain professional opinions and suggestions to iterate the design plan.

Figure 1. Interview with Practitioners (on-site Interview Photos)
(a) Interview with Business Manager (b) Interview with Housekeeping Manager

The research determines the target users: 60% for conference groups, 25% for family individual customers, and 15% for business individual customers (including 10% for protocol individual customers). The conference group has the maximum quantity of people, driving the overall income of catering, accommodation, and entertainment through the conference. However, each individual participating in the conference group is passive consumption, with almost no secondary consumption demand, and the consumption of room equipment and items is relatively

high. In addition, such guests are severely affected by policies, and political activities or major celebrations can result in hotels being unable to accommodate such guests for several months. Family individual guests mainly stay during holidays, winter, and summer vacations, and their stay time does not conflict with conference group guests. The purpose of their stay is for the hotel's hot springs in winter and Happy Valley amusement in summer (Happy Valley is a large entertainment park located across the street from the hotel). However, the guest room services are complex, and many items are needed; the family guests are an active consumer group. Their consumption attitude is rational, and they generally believe that the hotel's catering fees are too high. Business individual guests have relatively high quality, primarily executives and businessmen, on official business trips. They have high requirements for room environment, require high-quality service, and consume less equipment. Although the number of such guests is small, they are the expected customers of the hotel and play an essential role in improving the overall service of the hotel. Combining research methods such as questionnaires, observations, and interviews, we identified these three types of target users' characteristics, needs, and pain points and design directions (see Table 2).

	会议团建	家庭散客	商务散客
人员情况	企业公司人员 体量大	带孩子或者三代出游	公司高管 商务人士
出行情况	进行团建、会议、餐宿	度假、亲子游 以自驾为主，节假日出游	自驾或出租
预订方式	直接与酒店商务部沟通，进行预定	官网或者第三方平台预定	官网或者第三方平台预定
需求情况	几乎无额外消费 客房配备物品消耗较多	餐饮服务 增加加湿器、净化器 物品配送，卫生	客房环境要求高，高品质服务，配备物品消耗少 个性化服务
酒店评价	用户评价较少	部分产品操作不灵，繁琐 认为酒店餐饮收费过高	网上用户评价较少
政策影响	遇到重大政治事件导致酒店不能正常接待	二孩政策，对儿童服务需求的增加	国家发改委、国家旅游局、国家工商总局联合规范酒店客房价格
总结	被动消费，要求少 带动酒店餐饮、住宿、娱乐等整体收入	主动消费，消费态度理性 服务频率高	客源稳定，有更多消费潜力 可提升酒店整体服务能力

Table 2. Analysis of Target User Behavior Needs (Drawn by Shangqing Gao, Zuwe Li, Chengzhong Chen, and Tian Gu)

3.3.2 Definition and Expression.

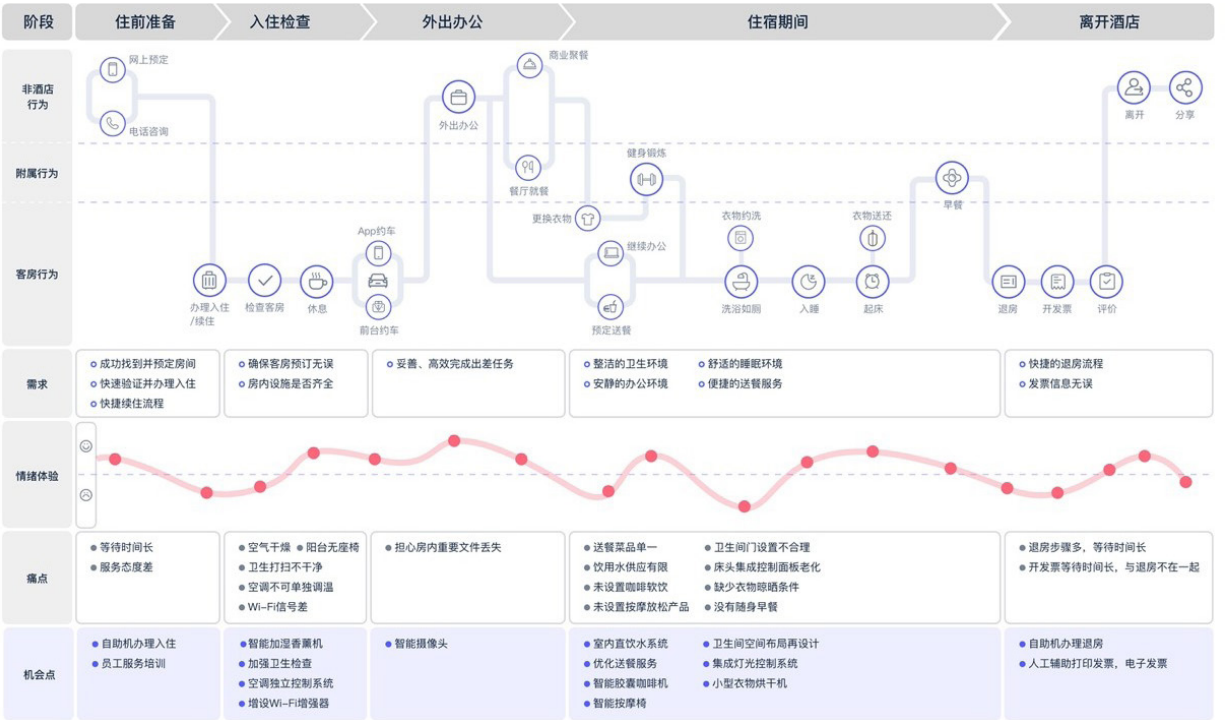
According to the experience design method, define and express the design of three types of hotel target users using service design tools such as user persona, experience journey map, and storyboard. Establishing personas for three categories of users (see Figure 2 for a simplified version) can help us pay attention to the differences in their needs and goals. When building solutions centered around users, we consider the differences in the requirements of each category of users, from general to particular, and provide specific implementable strategies from the primary to secondary levels.

Figure 2. Three Types of Target User Persona (Drawn by Jiali Ma and Shangqing Gao)

Requirements define experience touchpoints and process design. By systematically analyzing the experience process of each type of user (conference group users, family individual users, and business individual users), we identify the pain points brought by the current service contacts to users, clarify the needs of users at different stages of the experience process, and extract opportunities for service optimization based on specific contact needs (See Figure 3).

(a) Journey Map of Conference Group Users

(b) Journey Map of Family Individual Users

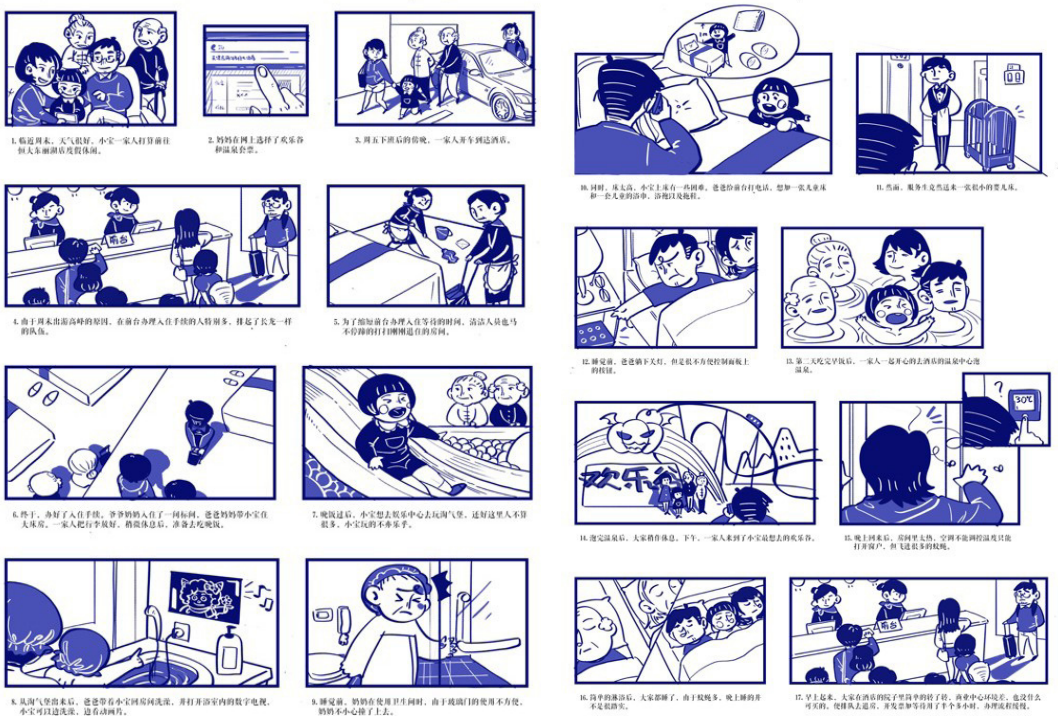


(c) Journey Map of Business Individual Users

Figure 3. Target User Experience Journey Map (Drawn by Yang Hongwei and Shangqing Gao)

(a) Storyboard of Conference Group Users

(b) Storyboard of Business Individual Users



(c) Storyboard of Family Individual Users

Figure 4. Target User Storyboards (Drawn by Yang Hongwei and Yunqin Deng)

Requirements determine the design of experience contexts, relationships, and behaviors. We described the current experience situation of three target users through storytelling methods, expressing the difficulties that users may encounter in vivid visual language, and how service providers interact with them (see Figure 4). Due to the significant differences in the experience processes of the three types of users, storytelling methods make it easier for team members to empathize with each user's experience and needs. As our team was mainly responsible for the hardware layout of guest rooms based on their needs, we payed special attention to the user's behavioral experience in the guest rooms to clarify design issues.

After sorting out the many pain points of users, we transformed them into feasible solutions (in line with our team's task scope): First, Plan the layout of product facilities; Second, Optimize the product control panel; Third, Build a mobile service platform (see Figure 5).

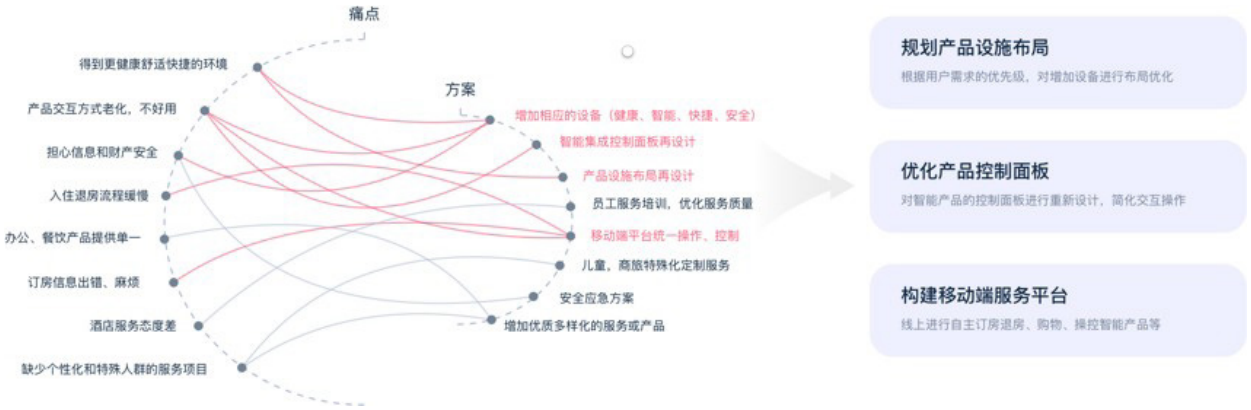


Figure 5. Design Direction Matching the Pain Points & Needs (Drawn by Shangqing Gao)

4 RENOVATION CHANNEL DESIGN OF SMART AND HEALTHY GUEST ROOM

The increasingly mature intelligent technology, the popularization of the Internet of Things and the Internet, and more affordable prices have led to the gradual entry of smart home products into ordinary people's homes. Smart home products can create personalized scenes and experiences by learning people's behavior habits at home. Like a person's five senses conveying information from the outside to the brain, making corresponding thinking and feedback, smart home is a systematic and holistic solution. There are three main ways to achieve intelligence in smart home products: directly obtaining human voice, gestures, and interface touch commands, which receive human body data through sensors, external data through the Internet, and internal data from other intelligent products through local area networks. The urgent needs of users for product experience and interaction are "interactivity," "security," and "scenario-based," which requires intelligent products to be interconnected and solve user accommodation problems comprehensively.

The initial renovation of some guest rooms and the purchase of some intelligent products by Party A of the project have caused many limitations and impacts on our subsequent design output. If the selected smart health mattress is too luxurious, many functions are unnecessary for the target user's hotel scenario. Through interviews with the guest room manager, it was learned that beds filled with sensors and wires will increase room attendants' requirements. Room attendants will flip the mattress every three months to maintain elasticity and cleanliness, while smart mattresses are single-sided and cannot work after flipping over. In addition, hotel guests are concerned about personal sleep or sexual-related confidential data leakage exploited by unscrupulous

merchants. Based on the above reasons, we suggest using intelligent health pillows instead of smart mattresses for free rental by residents. The smart health pillows can adjust the comfort of the cervical spine appropriately and monitor sleep data (such as sudden death alarms) with music, temperature-assisted sleep, and small-range massage functions. Compared to smart mattresses, the pillows are cheaper and more usable.

In addition, an on-site investigation found that the information exchange protocol among the smart items purchased in the early stage was not fully established, and there were inevitable conflicts between the related smart controls of various brands. If the guest opens the door for the first time and enters the room, the TV welcome interface and speaker welcome message will make people feel more friendly, but the welcome message appearing every time the guest enters the door will make people feel at a loss. For energy-saving, the vacant rooms usually have curtains closed and electrical appliances turned off. Guests entering the room trigger the curtains to open and shine in the sunlight. This application scenario may be suitable during the day but not at night. If the companions in the room are sleeping or changing clothes, the related actions between the door and the curtains are unsuitable. Guests can control their electrical appliances or answer simple questions through the smart speaker in the room. While watching TV, listening to music, or chatting, the voice or noise often triggers inappropriate responses from the speaker, such as "I don't understand what you mean" and "Please repeat it," making people pull a wry face.

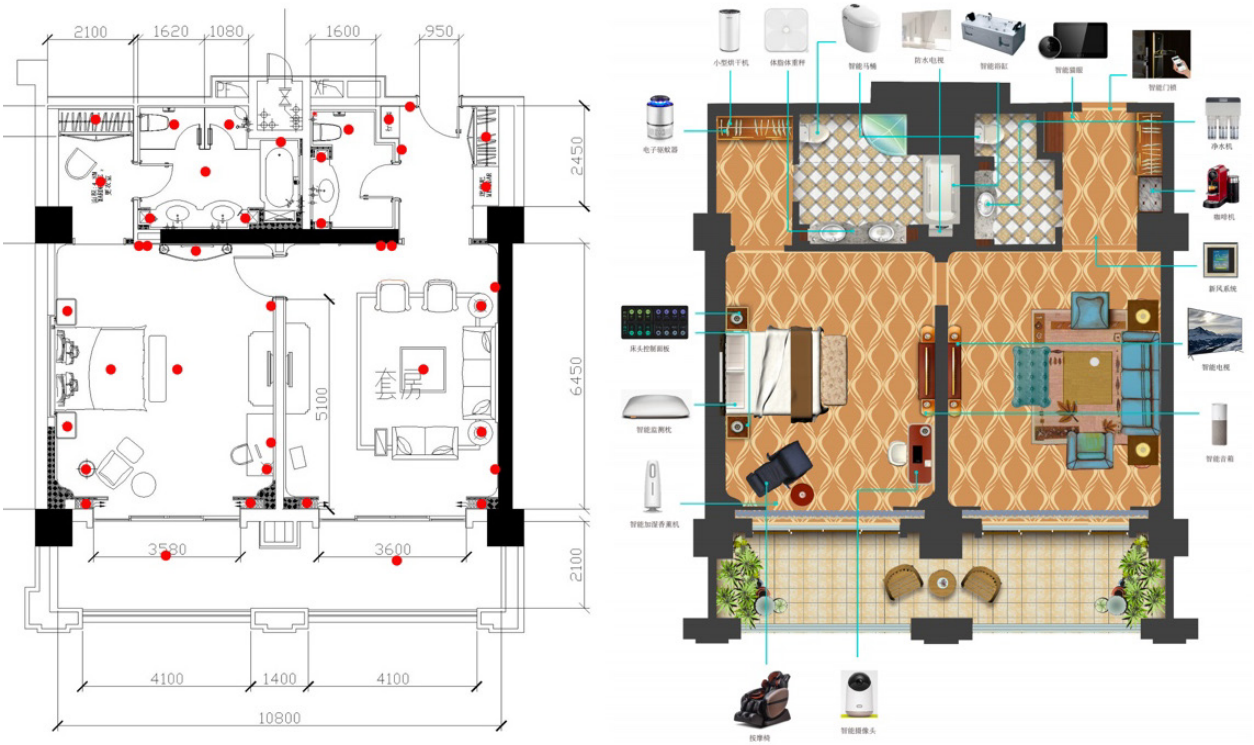
Based on extensive research work in the early stage and balancing the needs of stakeholders, the hardware for the renovation of smart and healthy hotel rooms is divided into three priority levels. The first-level products can meet most conference group and family guests' room needs. In contrast, business individual guests, as the ideal target users of hotels, have clearly defined their unique needs for intelligent health products (see Table 3). Complete the layout of all hotel room types, including lighting, touch panels, and smart hardware products (see Figure 6 and Figure 7), as well as the design of mobile software functions, information architecture, and interfaces (see Figure 8, Other design outputs can be found in the project report).

产品	空调新风一体机	净水系统	智能电视	电动窗帘	智能音箱	智能灯光	智能马桶	智能门锁	小型烘干机	电子防蚊器	智能加湿熏香机
布局	客房入口吊顶处	卫生间面盆处	电视柜墙面	床头墙面	电视柜上	床头 房间入口处	卫生间	房门处	衣柜中	衣柜中	茶几旁边
功能	净化室内空气 控温 反馈参数	直饮水	可联网 无线投屏	一键开关 远程控制 定时设置 情景模式	远程控制 情景模式	远程控制 情景模式	加热 清洗 触屏控制	NFC感应 房卡感应	烘干衣物 杀菌	驱除蚊蝇	恒湿控制 净化空气 定时 远程操控
需求程度	高	高	高	高	高	高	中	中	中	中	高
	中										
	低										

产品	体质体重秤	镜面电视	智能猫眼	魔镜	智能浴缸
布局	卫生间面盆下	浴缸墙壁上	房间门上	衣柜旁边	卫生间
功能	体重、基础代谢等 反馈参数	可联网 呈相	屏幕显示门 外环境	呈相 显示天气、时间等	按摩 设置水位、温度
需求程度	高	高	高	中	低
	中				
	低				

商务客房	产品	胶囊咖啡机	按摩椅	智能摄像头
	布局	茶水台	原沙发处	工作台上
	功能	冷热水调控 定时、远程控制	体型监测 按摩强度调控	远程控制 红外夜视
	需求程度	高	中	低
		中		
		低		

Table 3. Smart Hardware Configuration (Drawn by Shangqing Gao and Zuwei Li)



(a) Layout of Lights (b) Layout of Smart Products

Figure 5. Layout of Smart Hardware in Two-room Suite (Designed by Xinming Guo, Xiaoyi Fu, and Juxian Wei)

In addition to sorting out relatively straightforward general requirements, user research has also found that some detailed issues need to consider the interests of all parties to make choices, as listed below. Older people among individual family guests highly recognize the physical buttons and knob control panels in hotel rooms. It is due mainly to the habit of using commonly used physical buttons at home, and physical feedback, such as the position and sound of the physical buttons, allows older adults to clarify their operating results. But we found on site that some buttons or knobs in the guest room are no longer usable, and there are often "thugs" or even "sparks." The maintenance manager reported that the air in the north is dry, and chemical fiber carpets, fiber decorative surfaces, etc., in the room are prone to electrostatic reactions, causing a short circuit in the control panel. Frequent pressing and rotating can also cause the wires to detach from the control panel, forming a circuit breaker. In addition, due to the replacement of the fresh air system in the guest room and the plan to add intelligent electrical equipment, multiple control panels with different shapes are no longer suitable for the systematic needs of guest room control. Therefore, we have redesigned the touch panel (see Figure 7) and arranged it in an appropriate position on the room wall according to the general behavior of users in the guest room, which also serves as the entrance for sound collection. We design handheld touchscreens based on the commonly used functions of customers and follow the principle of functional visibility to design touchscreen button icons. In field research, it was found that almost all hotel room curtain remotes make it challenging to distinguish the front and back/up and down positions of the inner and outer curtains and window screens on the control panel. What is even more challenging to understand is the use of vertical "<>" "><" icons to represent the opening and closing status. Therefore, the scheme optimized the icons for curtains and window screening' opening and closing status.

(a) Hotel Room Wall Touch Panel (Distributed Voice Entry)

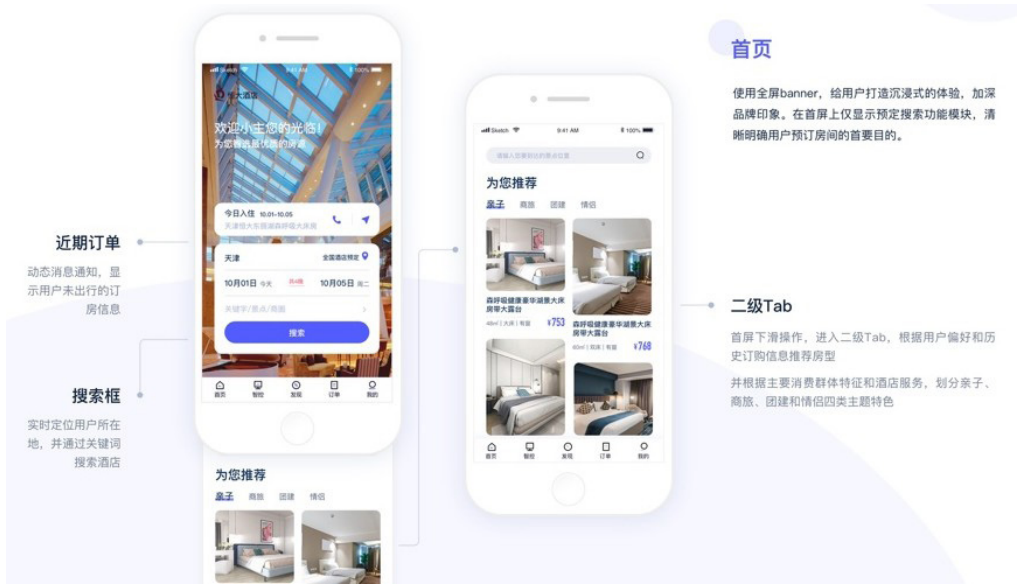
(b) Conventional Scenario Remote Control

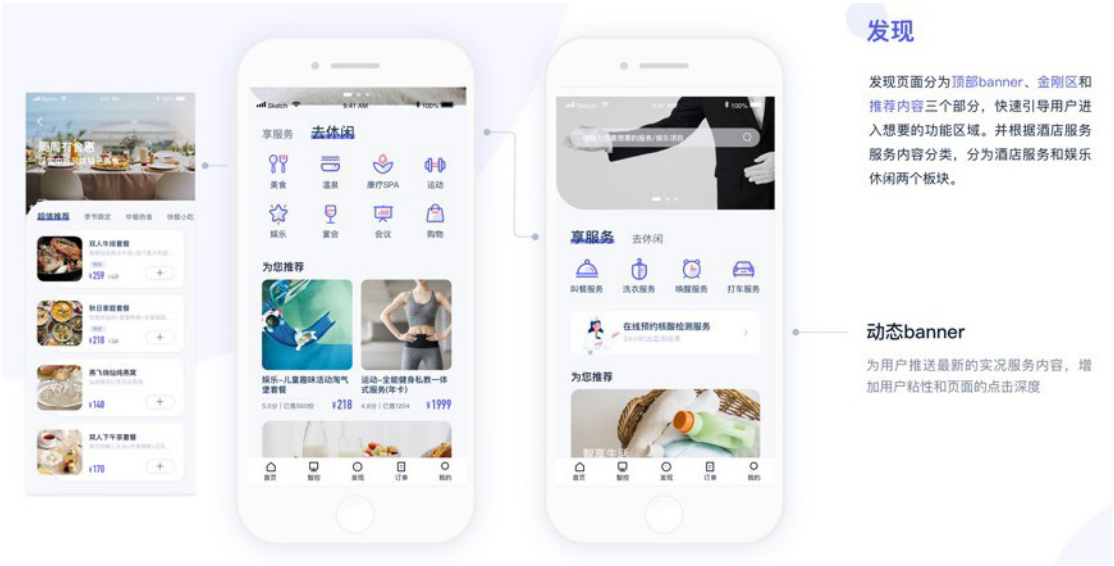
Figure 7. Touch Panel Design (Designed by Zuwei Li)

Some smart products in the guest room can be controlled through sound, such as opening and closing curtains, opening and closing TV or speaker, and other simple actions. Customers need to use standard Mandarin to pronounce keywords, which may be difficult for some users. Smart product sensors obtain environmental and user data and can predict user needs through system programs. For example, Customers open the night door while hall lights turn on and curtains get closed. For example, when someone opens the door while closing the curtains or turning on the TV, it does not trigger the opening of the curtains or the start of the TV greeting program for relatively complex settings such as the air conditioning fresh air system and specific scenario modes (work, sleep, romance, entertainment, etc.), which can be done through touch panels or mobile software. Remote control, such as temperature setting before returning to the store and opening doors for others when going out, can be achieved using mobile software.

The mobile software design has optimized the information architecture and interface design by combining the primary needs of three types of target users in experience journey analysis. The functions of booking rooms, querying historical orders, and managing invoices are integrated into the "orders" menu. The display and control functions of guest room equipment status are integrated into a "smart control" menu; The hotel services and activities, surrounding life, and other functions are integrated into a "discovery" menu. The information set closely related to the users becomes the 'My' menu (see Figure 8). The software interface design style is concise, the icon meaning is clear, and the interaction process meets user expectations and operations.

(a) Information Architecture





(b) Interfaces Design

Figure 7. Touch Panel Design (Designed by Shangqing Gao, You Zhou)

5 CONCLUSION AND DISCUSSION

With the improvement of people's living standards, the demand for travel and accommodation quality is increasing. Guests may think that star-rated hotels without intelligent products have outdated equipment and are less comfortable than their homes. However, compared to life scenarios, smart rooms have more singular and numerous users, and each user has few learning opportunities in smart products. In comparison, updating smart devices in hotels is also slower, and the system implementation cost is high. Although an individual's credit system is online and available for national departments to access, personal information such as physiological characteristics, behavioral habits, and preferences is not suitable for being "interconnected" by various institutions regarding morality and ethics. There is a certain contradiction between the convenience and comfort needs of smart and healthy rooms and residents' strong privacy protection needs from the perspective of "intelligence." Wisdom is the means, and health is the purpose. The hotel room intelligent control system is different from the hotel room scene. It is more suitable to adopt a situational strategy of real-time sensing information to provide appropriate feedback. What guests most need is to improve the hotel's overall service quality.

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Towards Digital Culture Ecosystem: Platform Enables the Flow of Chinese-Style Culture Data

Wangxuan Wen

Wenhangxuan@hnu.edu.cn 913

Abstract

The flow and linkage of culture data create the foundation for the digital culture ecosystem. In the process of establishing a digital culture ecosystem in China, the platform holds a unique and pivotal position. This paper will begin by providing a concise analysis of the key concepts: culture data and digital culture ecosystem. Subsequently, it will address the challenges currently faced in the construction of China's digital culture ecosystem and explore how platforms can offer potential solutions to these issues by introducing a platform oriented towards Chinese-style culture and examining two design cases that have emerged with its support. To conclude, the paper will outline the role and mechanisms through which platforms facilitate the flow of culture data within the digital culture ecosystem.

Keywords

Digital culture ecosystem; culture data; platform; Chinese style

Introduction

In the Internet era, digital space has emerged as the primary arena for cultural communication and competition. Chinese-style culture, representing China's rich historical heritage and national identity, stands at the forefront of global cultural competition. To strengthen China's cultural influence, addressing various challenges that arise when integrating Chinese-style culture into the digital culture ecosystem is imperative. These challenges encompass issues like the "isolation" of cultural databases, the lack of breakthroughs in cultural experiences, and the limited competitiveness of cultural products. These problems largely stem from the inadequate flow of Chinese-style culture data. In this context, digital culture platforms assume a crucial role within the digital culture ecosystem. A comprehensive exploration of platforms and their role mechanisms can contribute to enabling the flow of Chinese-style culture data and, consequently, help to identify and resolve the aforementioned challenges.

1.1 Culture Data

Culture data is the most basic element of digital culture ecosystem. Culture data are digital representations of culture, which can be defined as a collection of objects that reflect the behaviours, knowledge, facts, ideas, and norms of human collectives (Birukou et al., 2013). Transformative technologies such as Generative AI and Machine Learning (ML), combined with the data-driven design paradigm, have made it possible to extract new content from culture data (Cantamessa et al., 2020; Zheng & Cheng, 2022).

According to how it is generated, culture data can be divided into two types: digitalised culture data and digital-native culture data. The former is the result of digitalising non-digital culture objects, i.e., transcoding continuous

analogue signals into discrete numbers (Rab, 2007), such as digitally recorded songs, 3D models of ancient furniture, and motion capture of intangible cultural heritage (skill, dance, etc.). The latter refers to culture data generated directly in digital environments, such as Disney cartoons, digital paintings, VR games, and so on. Both types of culture data should be complemented by metadata, which contains essential descriptions and serves as an indispensable tool for comprehending, decoding, and editing culture data (Manovich, 2020).

In addition, Kumar (2020) expanded the scope of culture data to include data generated in all relevant socio-economic activities. Therefore, this paper suggests that the following types of data should be included in the research framework of culture data (as shown in Figure 1). (1) Cultural knowledge. The outcomes resulting from knowledge production activities based on cultural objects. It involves works such as the exploration of historical facts, comparative analyses of artistic styles, and the interpretation of cultural values. (2) Cultural products and experiences. The results of creative design activities based on cultural objects, such as texture design inspired by traditional crafts, VR games based on folklore activities, etc., which can be classified into two categories: cultural products and cultural experiences. (3) Evaluation and feedback. The records related to the distribution of culture data and the feedback received from the market. Metrics such as view counts, reposts, comments, and instances of recreation contribute to evaluating the effectiveness of culture data distribution.

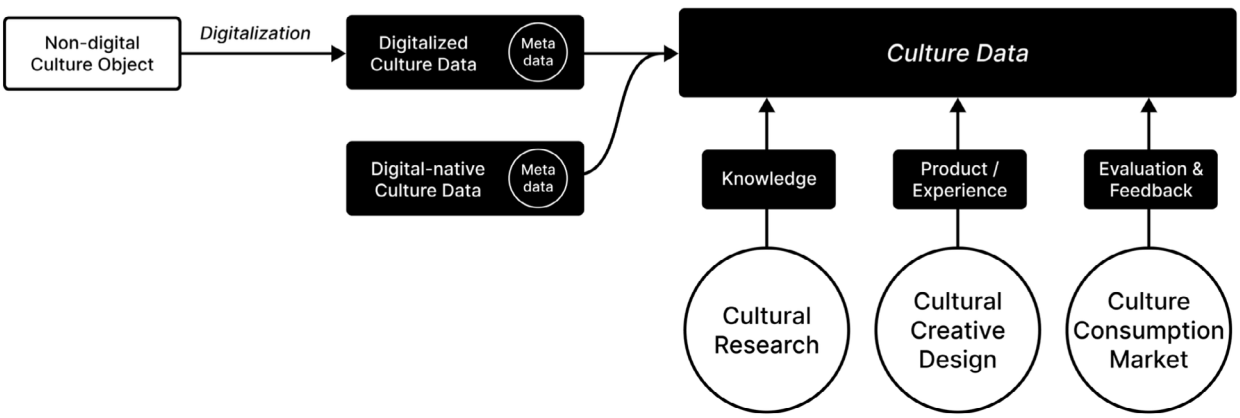

Figure 1. The concept of culture data

1.2 Digital Culture Ecosystem

Presently, cultural content is both generated and consumed in digital data format, aligning with Negroponte's foresight in Being Digital that all cultural content would shift "from atoms to bits" (Negroponte, 1995). This transformation results in a universally connected body of culture data, constituting a digital culture ecosystem.

The digital culture ecosystem has evolved to be complex, open, diverse, and interconnected. It now encompasses intricate physical networks, digital protocols, and data interfaces that establish connections between databases, platforms, consumers, and content, enabling the continuous flow of data among them. In recent years, with phenomena such as video replacing text as the predominant medium, there has been a substantial surge in the volume and velocity of data generated by the creative and cultural industries (Kumar, 2020).

1.3 Problems in The Digital Culture Ecosystem of China

China's digital culture ecosystem is experiencing robust growth. Over the span of 10 years, the number of Internet

users in China has surged from 600 million to well over 1.1 billion, with a predominant portion accessing digital culture products via mobile Internet. Among the 193 major listed Internet companies, more than half of them engage in businesses related to social networking, gaming, audio/video, and other facets of digital culture data (CAICT, 2022).

These statistics reflects China's solid foundation in establishing a digital culture ecosystem, namely. However, compared with the western digital culture ecosystem, which has a global influence, China's current digital culture ecosystem is still at a considerable disadvantage in several aspects:

(1) Innovation capacity. In 2022, China produced 160 TV series, while Netflix produced 398 TV series; In terms of 3A games (e.g., Black Myth: Wukong), Chinese game companies typically grapple with significantly longer development cycles in comparison to their north American counterparts. This reflects the absence of a professional data service chain in China's digital culture ecosystem.

(2) Standards system. In China, the lack of an effective and unified standards system hampers co-operation between the various sectors of digital cultural production. Committees formed by leading digital media companies wield considerable influence in setting standards for digital music formats, film profiles, storage media specifications, and so on. In general, data standards can help control the quality and format of culture data, thus improving the universality and usability.

(3) Governance and regulation. In recent years, copyright controversies and value-oriented disputes over digital cultural content have occurred repeatedly, and the trend of declining digital content quality and aesthetic vulgarity has been widely discussed. Ensuring the appropriate use of data and the timely removal of low-quality and harmful content is essential to the surviving of high-quality content.

(4) Culture display channels. The current culture display model, which is dominated by mobile devices, has its limitations in terms of realizing the inherent value of culture data and enhancing its visibility. However, when it comes to cultural exhibitions, creative performances, cultural experience equipment and public cultural services, there remains a noticeable gap between China and more developed nations.

2. Case-study: Platform Enables the Flow of Chinese-Style Culture Data

2.1 Design-oriented Chinese-style Digital Culture Platform

The "Chinese Design Style Classical Culture Elements and Archetypes Database" platform stores more than 20,000 entries of Chinese-style culture data in 10 categories, including over 2,000 entries of high-quality data that can be accessed through the Internet, covering high-definition 3D models, vector patterns and so on.

Figure 2 shows the platform's homepage, data browsing page and typical data display page. With the help of an easy-to-use interface, semantic search and smart recommendation, designers can quickly find the required cultural knowledge and design materials.

The platform collects culture data from multiple sources. (1) autonomous collection: cultural objects are digitalised using equipment such as 3D scanners; (2) online collection: culture data made publicly available by cultural institutions around the world are collected via the Internet; (3) data collaboration: by collaborating with

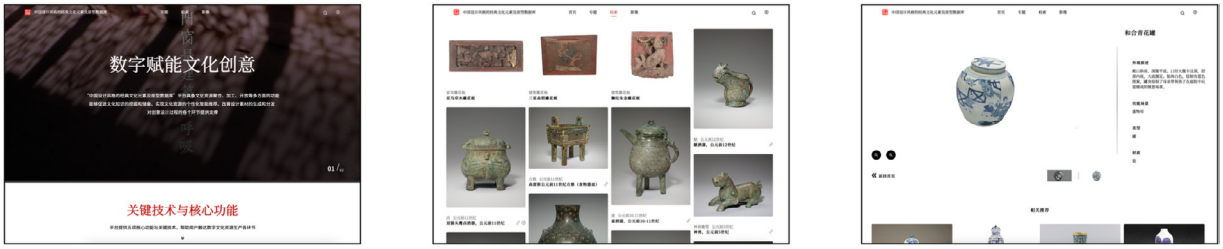

Figure 2. "Chinese Design Style Classical Culture Elements and Archetypes Database" platform pages

cultural institutions and museums, the platform brings together cultural data dispersed in various databases. In addition, the platform has linked thousands of cultural creative design cases by connecting with the "Pinwall" platform, and has enriched the inventory of cultural knowledge by including related research papers, reports, news, and so on.

The data standard established by the platform is compatible with common standards (e.g., DC, CDWA, etc.). Additionally, it augments metadata entries with elements specifically beneficial for creative design endeavours, encompassing details like colours, functions, and usage scenarios. In terms of data regulation, the platform ensures the authenticity of the data by means of professional revisions.

2.2 Design Enabled by the Platform and Culture Data

The first design case is an interactive video experience based on the Dong brocade weaving technique (a national ICH). The platform collects motion capture data of many ICH skills and folklore performances, including Dong brocade weaving, which can be used to dynamically reproduce the details of the skills and performances in a 3D environment. The designer obtained motion capture data from the platform, applied it to the development of interactive video. With the help of Leap Motion (a motion-control device), users follow the guidance to imitate the movements of weaving Dong brocade, meanwhile learning and enjoying. Figure 3 shows the path of culture data flowing between the platform and the cultural experience design.

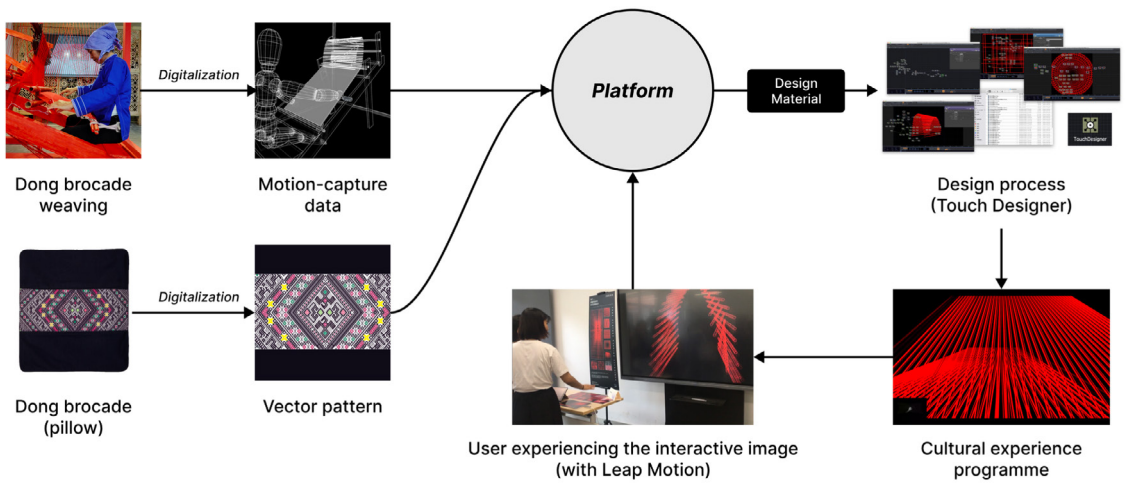

Figure 3. Data flow between the platform and design project "Interactive Image Design Based on The Weaving Technique of Dong Brocade".

The second design case is a mobile phone CMF design developed based on a variety of Song Dynasty ceramics. The platform's culture data inventory contains a large amount of ceramic data, including high-definition pictures, 3D models with texture, and descriptions of ceramic manufacturing processes. The designer researched the different artistic characteristics of Chinese ceramics in different historical periods through the platform, and selected Song Dynasty ceramics as the design object. Using the above materials as reference, the designer used Adobe Substance software to create PBR material so that it could be virtually applied to the surface of a mobile phone, while being visually realistic. Figure 4 shows the path of culture data flowing between the platform and the cultural creative product design.

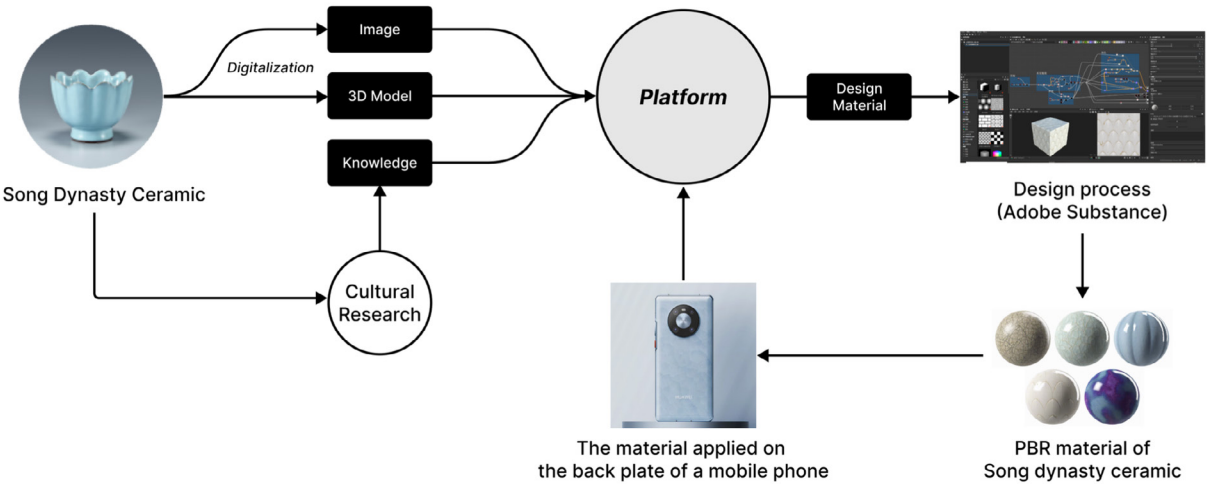

Figure 4. Data flow between the platform and design project "The Creation and Application of Procedural Song Dynasty Ceramic Material"

The above cases illustrate that the platform can enable the flow of culture data, to allow cultural data to be stored aggregately, and streamlines designers' access to essential design materials and cultural knowledge. Consequently, this contributes to improved efficiency in the creation of cultural experiences and cultural creative products, ultimately yielding benefits for the digital culture ecosystem.

3. How Platform Enables Data Flow and Benefits the Ecosystem

In digital culture ecosystem, most data exchanges, user behaviours and social connections take place on platforms (Dijck et al., 2018; Luo, 2022), which Poell et al. (2022) define as "data infrastructure". On this basis, scholars have pointed out that the "platformisation" model of cultural production, in which platforms are centralised for integrating resources and conducting data flows, has become mainstream (Nieborg & Poell, 2018). The evolution towards a platform-centred model indicates that the digital culture production and consumption has evolved from a one-way, one-to-many behaviour to an interconnected, many-to-many system. From the above case study, complemented by reviewing of literatures from Xiang (2022), Liu and Wang (2022), Nieborg and Poell (2018), the role of platforms in digital culture ecosystem can be summarised in four main capabilities. Through these capabilities, the platform can enable the flow of culture data from the data source to the consumer market and support activities such as cultural creative design and cultural research (as shown in the model in Figure 5).

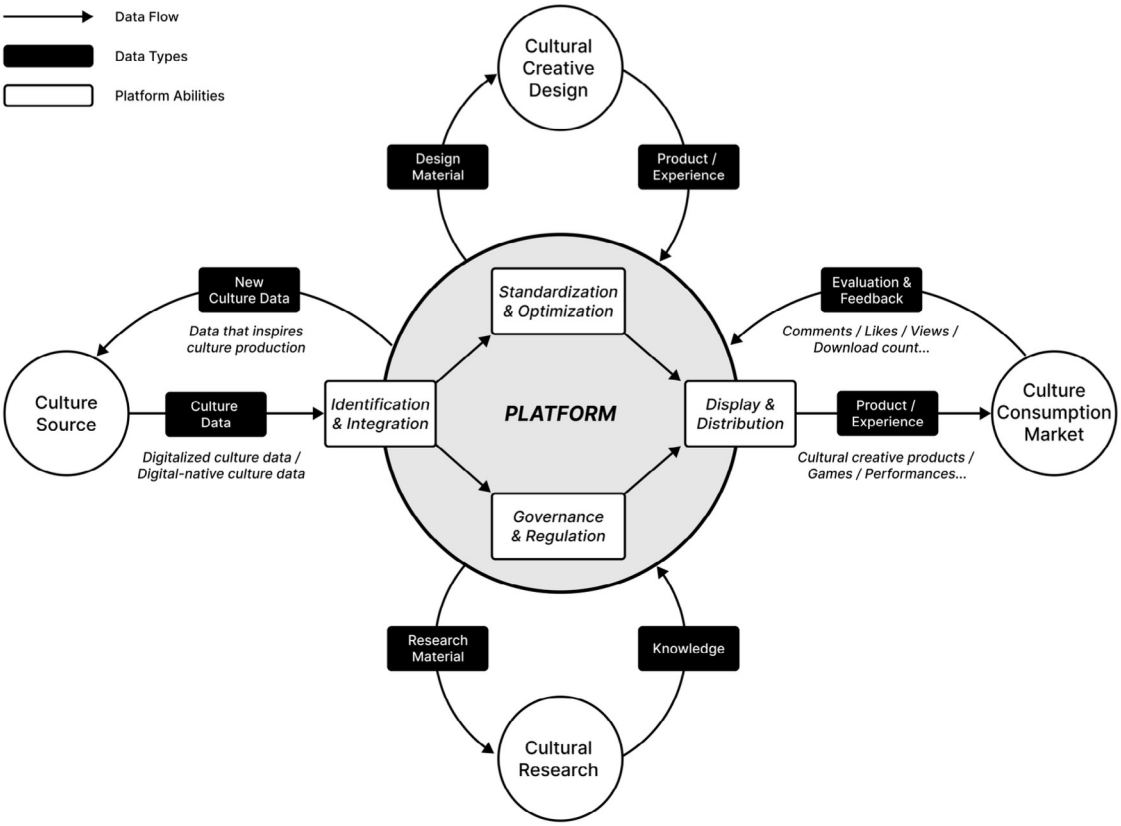

Figure 5. Model of digital culture platform enabling the culture data flow

(1) Data identification and integration. Digital culture platforms can identify and integrate cultural data. This capability can improve the disorganised and fragmented situation of culture data within the digital culture ecosystem, thus helping to build a data service chain, thereby enhancing the efficiency and coherence of digital culture production processes. For example, platforms like Epic Marketplace and Adobe Stock provides a large amount of pre-processed, curated, and categorised tools and materials, saving creative workers a lot of time and labour In addition, there are more specialised culture data providers such as Epidemic Sound, Artlist and Motion Array. These data services are important pipeline of culture data distribution, providing resources for creative work, improving the accessibility of culture data.

(2) Data standardisation and optimisation. The digital culture platform standardises culture data by establishing a standard system to facilitate data application and analysis. For example, it repairs missing data, supplements metadata, and converts data formats. The platform's ability to improve the quality, versatility and usability of culture data can provide support for the extensive linkage of culture databases, thereby solving the problem of "isolation". For example, the EDM standard has enabled Europeana platform to achieve the aggregated storage of about 60 million entries of culture data from more than 3,000 cultural organisations.

(3) Data governance and regulation. Digital culture platforms are the main body to implement data regulation, and they are obliged to review the cultural data incorporated to ensure that harmful and erroneous data do not contaminate the entire ecosystem. DRM, Blockchain and other technologies enable the platforms to register and trace data flow, thus providing a stable environment for the circulation of high-quality culture data.

(4) Data display and distribution. The digital culture platform is an important intermediary between the cultural production end and the cultural consumption market. At the same time, platforms can enhance the visibility of cultural content by analysing user needs and preferences to make distribution more accurate.

4. Conclusion

Based on the analysis of the key concepts: culture data and digital culture ecosystem, this paper analyses the role mechanism of digital culture platform in enabling the flow of culture data in digital culture ecosystem. Additionally, this study scrutinizes the prevalent challenges in the ongoing development of China's digital culture ecosystem, explores the potential solutions offered by digital culture platforms by examining two design cases (one cultural experience design and the other cultural and creative product design) produced with the support of the "Chinese Design Style Classical Culture Elements and Archetypes Database" platform.

Digital culture platforms function as intermediaries bridging the gap between the culture data production end and the culture consumption market, relying on four core capabilities: identification and processing, standardisation and optimisation, governance and regulation, display and distribution, while supporting activities such as cultural creative design and cultural research, thus benefiting the digital culture ecosystem.

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Sustainable Cultural Tourism: Gamification Experience Design of a Mobile Augmented Reality Application for Hongkong Tourists

Yuanli YU[1], Xinyi WANG[2]

[1]School of Design, Hong Kong Polytechnic University, Hong Kong 999077, China
22065357g @connect.polyu.hk
[2]School of Design, Hong Kong Polytechnic University, Hong Kong 999077, China
22047408g@connect.polyu.hk

Abstract

Hong Kong's tourism industry faces new challenges and opportunities in the post-epidemic era due to evolving consumer needs and technological advancements. To address these changes, the government aims to promote innovation, digitize tourism products, and enhance service intelligence. This study uses augmented reality (AR) and artificial intelligence (AI) technologies to develop a mobile application design strategy that optimizes visual performance and user experience. A mixed-method approach was employed to analyze tourist needs, including questionnaires, field research, user interviews, participatory workshops, and usability testing of urban tourism applications. The experimental study involved developing a gamified guided interactive interface prototype based on three tourist attractions in Yau Ma Tei, Hong Kong, using AR technology. The final application design aims to enhance the competitiveness and sustainability of the Hong Kong tourism industry by immersing tourists emotionally in the local culture, promoting cultural characteristics, and strengthening regional cultural confidence. This paper concludes that the mixed-method approach to analyzing tourist needs and applying AR and AI technologies, such as the "Layered Hong Kong" design, can significantly enhance the tourism experience. The study validates the method's applicability and provides valuable references for similar research endeavors.

Keywords

experience design; mobile augmented reality application; cultural tourism

Introduction

Hong Kong, a dynamic city known as the Pearl of the Orient, has faced significant challenges in its tourism industry due to social unrest and the COVID-19 outbreak (Zhang et al., 2021). To revitalize the industry, the government has focused on strategies targeting the younger generation, who seek unique and personalized experiences. However, current tourism apps need more integration with local culture and creativity, highlighting the need for innovation (Eugenio-Martin et al., 2006).

Gamification, applying game mechanics beyond their original domain, has shown potential in engaging customers, enhancing brand awareness, and fostering loyalty towards destinations. However, academic research on gamification in tourism is limited (Xu et al., 2017). Another technology, Augmented Reality, has been found to significantly enhance the tourist experience by providing valuable information, creating engagement, and offering commercial benefits Cranmer, (Cranmer et al., 2020). Successful implementations of AR in cultural

heritage tourism sites have been observed in countries like South Korea (Aluri et al., 2017) and Ireland (Lantos et al., 2012), providing immersive experiences connecting tourists to historical buildings and local culture (Richards et al., 2006).

However, there needs to be more research on Mobile Augmented Reality (MAR) applications for cultural tourism in Hong Kong. Existing MAR applications, such as the 'Hong Kong Disneyland - Magic Access' Mobile App and 'Discover Hong Kong' Mobile App, must exhibit cultural creativity, personalization, or real-time updates, often providing a poor user experience. To meet the demands of modern tourists, there is a need for a gamification-based MAR application that effectively integrates travel information, enhances visual and immersive experiences, and better caters to user needs in cultural tourism design (Wood et al., 2012).

Methodology

1. The gamification experience design process

This study's overall experience design process, as depicted in Figure 1, involved several phases. In the first phase, an initial concept for the Mobile Augmented Reality (MAR) tour was developed. The second phase focused on user research, including questionnaires, field trips, and interviews. Participatory workshops were also conducted to gain insights into user needs and experience goals. The third phase involved the analysis of user needs using collected data, which was then translated into application design requirements. In the fourth phase, the MAR experience design process was derived based on the previous phases' findings. Phase five encompassed the development of the information structure and interaction prototyping for the application design. The final phase involved usability testing to evaluate the application's user experience.

Figure 1. The six-phase of the experience design process.

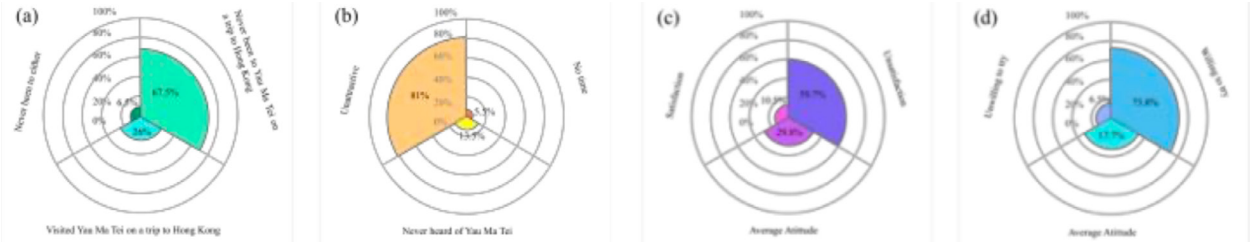

Figure 2. The proportion of tourists' views , (a) Proportion of visitors to Hong Kong who have been to Yau Ma Tei; (b) Factors affecting Hong Kong visitors to Yau Ma Tei; (c) User satisfaction with current Hong Kong tourist applications; (d) Acceptance level MAR Travel.

2.2. Survey Design

A survey was conducted among 124 participants aged 19 to 56, including mainland and local visitors—the survey aimed to gather quantitative information, comprising 26 online questions. The Questionnaire Star tool was utilized to collect specialized needs, including demographic information such as name, age, and gender, as well

as data related to the demand for Mobile Augmented Reality services and preferences for using applications during travel. Based on the collected data, it was found that approximately 68% of Hong Kong tourists still need to visit Yau Ma Tei (Figure 2a). Among those who have yet to visit, 81% indicated that the main reason is the lack of attractiveness of the area (Figure 2b). Furthermore, around 60% of users expressed dissatisfaction with the existing tourism applications in the Hong Kong market (Figure 2c). Regarding attitudes towards MAR tourism applications, 76% of tourists expressed willingness to try new tourism methods based on augmented reality technology (Figure 2d).

The study assessed factors influencing users' travel experiences and their demand for MAR tourism application functions using the Likert scale(figure 3). The results indicated that clear route guidance was the most significant factor, with 90% of respondents considering it necessary. Basic physical needs (80%) and language accessibility (70%) were also identified as influential factors. Regarding preferred information in tourism applications, 95% of respondents favored recommendations for local characteristic attractions, while 80% sought interesting travel routes and itineraries. Accurate traffic and navigation information were desired by 75% of participants. Other important expectations for MAR tourism included user feedback (72%), accessibility of information (64%), the excitement and pleasure of experiencing new technologies (87%), barrier- free travel experiences (71%), and access to official information and authentic travel experiences.

Figure 3. (a) The Likert Scale of User Needs Analysis in Hong Kong Tourism. (b)The diagram of the field study to Yau Ma Tei.

2.3 Field Study

A field observation was conducted to understand why Yau Ma Tei is unattractive to most Hong Kong tourists. Interviews with 20 tourist groups focused on destinations, travel preferences, local cultural tourism, and knowledge and expectations of Mobile Augmented Reality (MAR) travel applications. Each interview lasted 30-50 minutes, followed by a 20-30 minute preliminary concept evaluation, as shown in Figure 3b.

During the interviews, participants expressed significant interest in MAR tourism and provided positive feedback on their experiences in Hong Kong. Here are the key findings:

1) Factors affecting the user experience of Hong Kong tourists:
- Language and payment barriers with merchants and attractions were cited as detrimental to the experience.
- Difficulties in locating restrooms and ATMs were mentioned.
- Navigating Hong Kong's complex road system caused some visitors to feel lost.

2) Information preferred in tourism applications by Hong Kong visitors:
- Visitors desired better promotion of local cultural attractions, particularly in Yau Ma Tei.

- Tourists reported unfamiliarity with tourism applications for specific attractions.
- Disappointment arose when attractions were not operational or overcrowded during peak hours.
- Existing sources like the Red Book must be deemed adequate for effective travel planning.
3) Expectations of Hong Kong tourists regarding MAR Tours:
- Respondents wanted AR assistants to plan routes and provide travel tips.
- Switching to voice guidance and providing engaging content were suggested to understand historical attractions' local characteristics better.

2.4 Analysis

A participatory workshop was conducted with five participants, including designers, university students, and tourists. The workshop began with an introduction to the study's topic, research direction, and learning objectives. Participants brainstormed based on collected user research data and developed design solutions for various user needs (Figure 4a). Feedback was encouraged, including first impressions and the practicality of different ideas (Figure 4b).

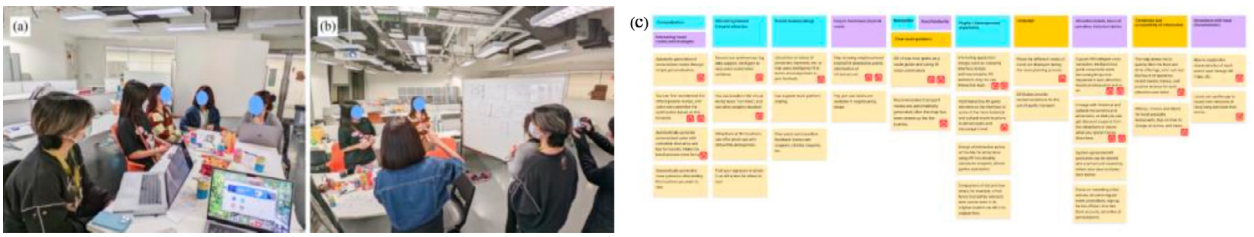

Figure 4. Selected phases in the participatory workshop, (a) Brainstorming phase, (b) Conceptual functional cassessment phase (c) Affinity diagram from user needs to design factory.

Each user can vote for the solution they think is the best. A total of 3 votes were allowed. Finally, based on the feedback from the participatory workshop, the user requirements and corresponding design features of the MAR HONG KONG cultural tourism app were identified, as shown in Figure 5c.

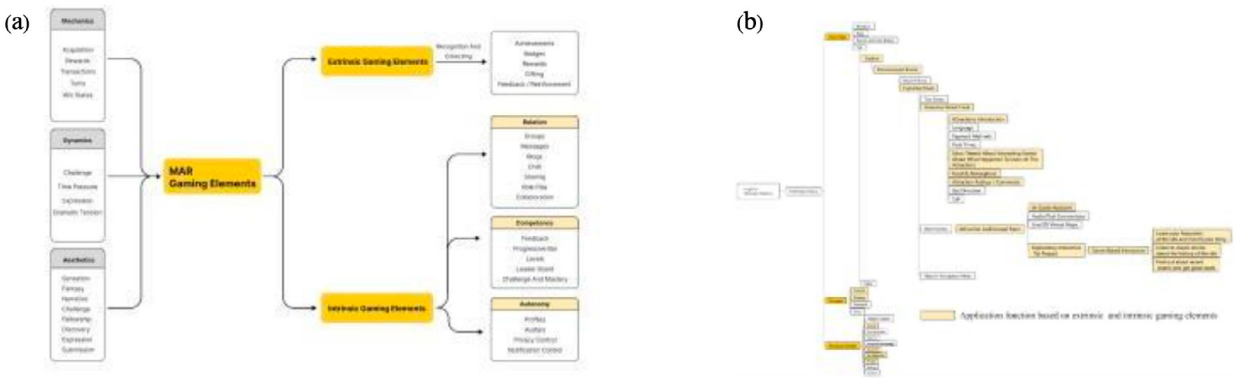

Figure 5. (a)The gamification design process of the 'Layered Hong Kong' MAR application; (b)The diagram of the application information structure

3. 'Layered Hong Kong' MAR gamification design strategy development

The MDA model provides a systematic approach to game design (Hunicke et al., 2004), dividing game systems

into Mechanics, Dynamics, and Aesthetics. Both extrinsic and intrinsic motivations should be considered when designing MAR gaming elements, as shown in Figure 5(a).

Extrinsic motivation enhances user satisfaction and immersion, emphasizing the value of extrinsic information and engagement through narrative or the five senses. Intrinsic motivation is driven by personal determination and autonomy. (Garone et al., 2019).

According to the "Layered Hong Kong" MAR gamification design strategy, the functions of external and internal game elements are added to the application information framework. The application's main functional pages and jump logic were sorted out in Figure 5(b).

4. Design implement

4.1 User testing based on Interactive Prototype

The app was designed as a mobile augmented reality application, enabling tourists to experience Hong Kong's local cultural characteristics and achieve Yau Ma Tei's adventure experience and tourism goals. A preliminary interaction prototype was designed based on the application information framework as shown on Figure 6(a).

Figure 6. (a)The Framework of Interactive Prototype. (b) Usability testing on the Interactive Prototype

Testing was conducted in April 2023 with four visitors to Yau Ma Tei, comprising two males and two females aged 20 to 39 from Mainland China. The testing took place in a comfortable café setting and involved semi-structured interviews. The goal was to gather user feedback on the application, including interaction, content formation, gameplay elements, and other relevant aspects. Optimize the app's user experience in terms of interface elements and interactions.

Participants were introduced to the application and its interactive prototype during the testing, as shown in Figure 6(b). The app provided access to tourist information and other users' opinions through a game, offering an engaging and immersive experience. Any encountered issues or problems were recorded for further analysis and design optimization.

User testing results provided valuable insights for prototyping High-Fi interactions in MAR tourism apps. Key findings include:

1) Flexibility and Autonomy: Personalized recommendations and customizable routes enhance user motivation and control.

2) Social Interaction: Users value social features for connecting and sharing experiences.

3) Entertainment Adventure: Game-like elements, exploration modes, and storytelling create a sense of adventure and accomplishment.

4) Ease of Use: Simplified visuals and interactions in AR views are preferred to minimize distractions and facilitate understanding.
5) Cultural Heritage: The app deepens users' understanding of Hong Kong's history and culture, fostering a stronger connection and appreciation. Gamification elements motivate exploration and knowledge acquisition.

4.2 Programme evaluation

Upon the user's initial login, they can select interest tags based on their travel preferences (Figure 7a). Regarding social interaction features, the backend system utilizes user preferences to push popular travel guides. Users can explore these guides on the designated page, express their liking or comment on them, and engage with other users by following them or interacting with their content. Additionally, users can view their travel itineraries. Clicking on a guide card allows users to access the detailed page, where they can customize their travel route based on the existing itinerary (Figure 7b). When users embark on a journey following a specific route, they can switch to an augmented reality (AR) map navigation mode for viewing and assistance with location (Figure 7d). These functionalities highlight the flexibility and user autonomy within the system.

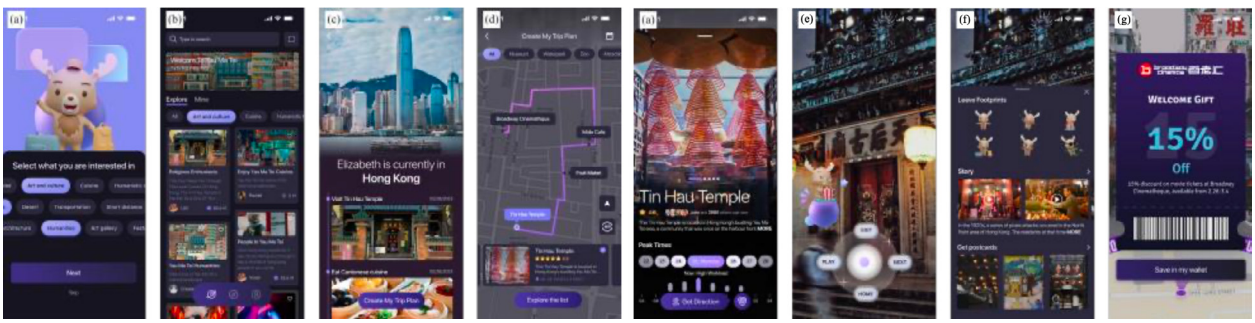

Figure 7. "Layered Hong Kong" MAR application Interactive Interface.

The users can click on any attraction card within the travel itinerary to view detailed information about that attraction. For instance, they can access user ratings, real-life photos, attraction descriptions, operating hours, peak periods, and reservation contact details (Figure 7e). When the users arrive at the attraction, they can engage with an AR assistant and participate in interactive games, leaving their virtual footprints (Figure 7f). Additionally, they can listen to AR- guided narratives featuring interesting stories shared and selected by local users and government sources. Users can also receive personalized and customized postcards by interacting with the AR assistant and checking in at the attraction (Figure 7g). When the user completes some tasks or explores particular attractions, the platform will give rewards, including coupons and discount cards. The clear visual interactive guidance reduces the learning curve for users. The interaction with the AR assistant, engaging in games and narratives, stimulates users' desire for adventure and exploration, thereby deepening their cultural and spiritual connection with the attraction. These features satisfy the Entertainment Adventure, Ease of Use, and Cultural Heritage characteristics of the application, as intended.

5. Results

In April 2023, the study conducted an evaluation study involving six participants (two females and four males) in low-fidelity prototyping. The study aimed to evaluate and test the Layered HK MAR application. Participants' interactions were observed and reflected upon during the testing process. The objective was to verify whether the design of the MAR travel application met the pre- set user experience objectives and enhanced their traveling

experience. In addition, we sought to understand further the sustainability implications of this design for Hong Kong's tourism industry.

Figure 8 More tourists gave us experience and feedback on the "Layered Hong Kong" MAR application during their Hong Kong travel journey; the use of the application could help them better understand the history and culture of Hong Kong, which in turn could stimulate their interest and enthusiasm in exploring Hong Kong.

	When	Needs	Application Features	Benefits
Tourists	Launch	Interesting travel routes and strategies Tourist review Personalisation	Preferred Tourism Information Automatic Generation Of Optimal Routes	Generate Traveller Interests Increased City Visibility Promoting Local History And Culture Information Conversion To Profit Promoting Business Co-Operation
	During	Atimulating interest in tourist attraction Simple user interface Playful exxperience Audio and video support Easy to meet basic physical needs Language Attractions with local characteristics Timeliness and accessibility of information	Virtual Reality/3D Technology Pecific Games/Role Play Intelligent AR Mini-Assistants Participatory Interaction Multiple Navigation Modes In-Game Rewards/Merchant Coupon Rewards	Engagement/interact Enhance Immersion experiences Entertainment tool Enjoyment tourism process Better understand local culture
	After	Better understanding of local culture Enjoyable travelling experience	Introducing Local Attractions Groups/Messages/Chat Sharing/Blogs Feedback, Reviews And Ratings	Enhance the spiritual link between visitors and Hong Kong Generate other tourist interests Share experiences Recall memories

Figure 8. User feedback on the "Layered Hong Kong" MAR application.

6.Discussion

It is essential to acknowledge the limitations of this study: (1) The sample size for user research was relatively small, with only 8 participants involved in interviews and 6 in the final evaluation. Although observations during user research were conducted in the natural environment of Yau Ma Tei, the small scope of the design means that it may only represent some tourist attractions in Hong Kong. (2) Most of the participants in the interviews and prototype evaluations were mainland Chinese students in the university, which may limit the generalizability of the findings. Regarding methodology, the IMI scale used to measure intrinsic motivation and internalization potential does not have clear reference values. (3) The IMI scale was not used in the early iterations of the design process, so it is difficult to determine which specific design elements are related to high intrinsic motivation.

More extensive and diverse samples should be recruited to address these limitations in future research, and observations should be conducted in a broader range of tourist attractions in Hong Kong. Alternative measurement tools or reference values should also be considered to improve the reliability and validity of the findings. Finally, the IMI scale should be used from the early stages of the design process better to understand the relationship between design elements and intrinsic motivation.

7.Conclusion

Innovative MAR travel apps have the potential to provide immersive travel experiences and promote Hong Kong's local culture. This study aims to identify essential elements of MAR tourism apps, enhancing users' autonomy and competence, stimulating curiosity and adventure, and deepening their cultural-spiritual connection with attractions. The goal is to attract more tourists to Yau Ma Tei and achieve sustainable tourism development in

Hong Kong. Findings indicate that mobile AR offers adventure and autonomy, allowing users to explore Yau Ma Tei at their own pace. Combining gamification with sustainable cultural tourism principles can enhance the user experience and promote cultural exchange and sustainable tourism. Future work will expand user research and cover more Hong Kong attractions to drive cultural tourism's sustainable development.

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Characterisation and Scenario Creation of Landscape Bridges on the Jincheng Greenway under the Perspective of Tour-Art-Learning

Zhang Mengli[1], Wang Wei[2], Yin Fei[3]

[1]Southwest Jiaotong University 610031
[2]Southwest Jiaotong University 610031
[3]Chengdu Design Consulting Group 310041

Abstract

As the first place to propose the concept of Park City, accelerating the construction of a beautiful and livable park city is the strategic goal of Chengdu's development. In the construction of a park city, scene building is one of the core strategies. By analyzing the concept of Tour-Art-Learning, combining with a large number of design practices in Jincheng greenway bridge landscape, this paper sums up the three impression characteristics of landscape bridges, discusses the scene construction and construction methods of Jincheng greenway, and discusses the ideas and methods of park landscape bridge planning guided by the concept of Tour-Art-Learning.

Keywords

Tour-art-learning; Park city;Bridge landscape; Scene construction

Introduction

Since the reform and opening up, China has accumulated many environmental problems in the process of over-developed urbanisation. "We should highlight the characteristics of park cities and take ecological values into account", General Secretary Xi Jinping proposed the concept of "park city" for Chengdu for the first time in February 2018 [1]. Since Chengdu proposed to build a park city that practices the new development concept, people have been placed at the forefront of urban and industrial development. Scene theory fills the fault between people and city and industry, and makes "people, city and industry" become a smooth development trajectory [2]. From the "first place" to the "demonstration area", innovate the "greenway + scene" mode, encourage the innovation of "park +". New forms and modes are encouraged to create diversified park scenes to meet the diversified needs of the public and create a beautiful new life for the public. Therefore, the creation of diversified scenarios in park cities occupies an important position in urban planning.

Research Background

Park city is a modern urban form with a high degree of harmony and unity among people, city, environment and industry, a new model for sustainable urban construction in the new era, and a new process for the development of China's human habitat [3]. In the context of the park city, Chengdu Jincheng Greenway is given a new theoretical core and create a new goal, the scene of the bridge landscape creation as a new direction of exploration, in order to better explore the bridge landscape planning new theories and methods, to create a new scene of diversification of the bridge of the park greenway.

Throughout the past and present, landscape design from not for the public and gradually to the public and design changes, today's landscape design needs to fully take into account the needs of different levels of people. Bridge landscape is also the same, in order to meet the people's recreation and aesthetic needs, bridge landscape gradually from the connection of traffic and gradually to the integration of humanities, the establishment of the city's image of the symbol of change. Comprehensive research results at home and abroad, there is a relative lack of theoretical research on the bridge landscape scene, so it is of great practical significance to take the bridge landscape as a way to create the scene.

The concept of Tour-Art-Learning

Bridge Tour - Connectivity

"Tour" refers to recreation (Recreation), with the purpose of travel excursion behaviour, it makes people feel free and happy, to obtain the experience of satisfaction, and more and more become the explicit or implicit needs of our aspirations for a better life, is the modern society, people relax the spirit and the body of a way of leisure [4]. Jincheng greenway is an important part of the ring city ecological park is quite characteristic, from the perspective of spatial form, for the "travel" and "tour" the whole process of experience, should actively explore the characteristics of human recreational behaviour and demand, the greenway landscape bridge in its linear ribbon type The greenway landscape bridge in its linear ribbon type makes it assume the function of connecting and carrying the ecological corridor of the ecological park around the city, improves the accessibility of open space, and meets the explicit or implicit needs of the leisure users. Greenway landscape bridge in the greenway system to become a point and point interconnection, point and surface mutual fusion, will be a region and another region connected, making the whole ring ecological park into a whole, rich spatial connotation at the same time to meet our aspirations for a better life.

Figure 1. Philosophy Model for Tour-Art-Learning.

Bridge Art - Recognisability

"Art" refers to the context of the new era, aims to create a unique regional culture, artistic atmosphere, or express the pursuit of a certain mood of life, can meet the current social diversification trend downstream of the physiological and psychological needs of the people, for these symbols with a strong cultural significance, not only enhances the recognisability of the scene, but also inspire the The sense of belonging and identity of urban residents [5]. Bridges and other types of buildings have common aesthetic attributes, which can reflect the humanistic connotation of the place and society [6]. Bridges must be recreated through the traditional art of regional culture from beauty to beauty and commonality, and must be innovated through the interactive art of behavioural psychology from man-machine engineering to human factors engineering, aiming to create a unique regional culture and artistic atmosphere.

bridge learning - with significance

"Learning" means to get something, to gain something. The "learning" here means that the "art of travelling" has a subtle role in education, so that travellers can learn through the "travel" and "travel". The "beauty" of object design and scene creation in "travelling" and "touring" can be used to construct and promote the knowledge of travellers in a variety of subject areas, and these processes will make the learners more engaged, and produce more meaningful and transferable knowledge in them. In the process of "travelling" and "touring", the interaction of characters and situations is achieved through the creation of scenarios. These processes will make the learners more engaged, and produce more meaningful and transferable knowledge in the learners, which will enable the travellers to achieve a healthy state of body movement, and at the same time, continue and promote the cultural characteristics through landscape design. Make travellers through the bridge landscape physical sense design and regional cultural scene to create in the subtle influence and education, broaden their horizons, cultivate their sensibilities, to meet the culture of leisure, entertainment, leisure and other psychological, activity requirements, to meet the demand for care and care of travellers psychological recovery. At the same time, the bridge to the city's beautification, living environment, especially for the improvement of recreational environment and ecological environment to play other urban landscape irreplaceable role.

Characterisation of the Bridge Scene of Tianfu Greenway under the Threshold of "Tour-Art-Learning"

Overall Distribution

The project is located in the centre of the city on both sides of the roundabout expressway, is an important part of the "three rings" of the Tianfu greenway system, 100 kilometres of first-class greenways, the whole ring closed, the whole ring line has been built across the road or across the river as many as 78 pedestrian bridges, all completed will be strung together with 121 featured gardens, strung together with the green space of Chengdu, strung together with the park city! Park City and a happy life. The landscape design style of the bridges along the whole ring road is divided into 3 kinds, the bridge design style in the west area is mostly ancient Sichuan style, the bridge design style in the south area is mostly modern style, and the bridge design style in the east area is mostly natural style.

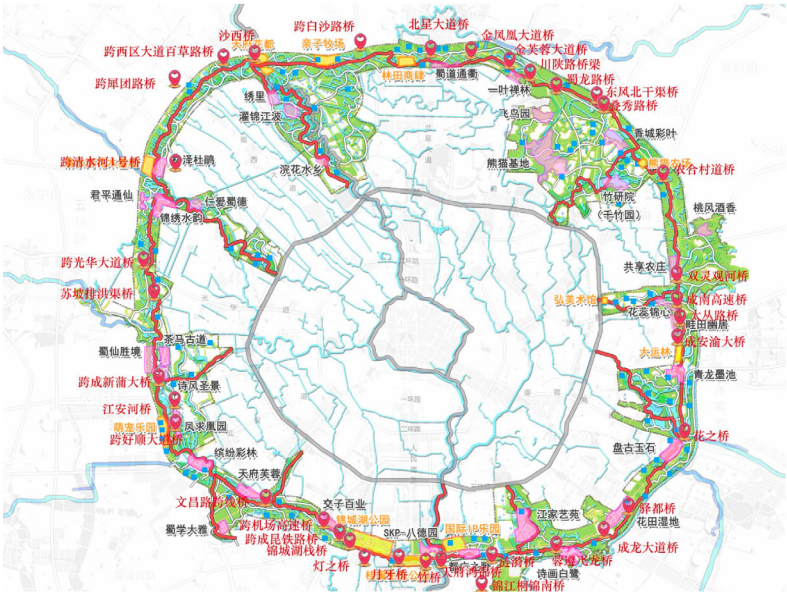


Figure 2. Distribution of completed landscape bridges in the Ring Road Ecological Park.

Characterisation of the "playfulness" of bridges in greenway landscapes

The author selects the bridges with the most characteristics of "Tourism, Art and Learning" in the Ring Road Ecological Park for analysis. It can be divided into the traffic "tour" feature of greenway landscape bridges connecting open space, the aesthetic "art" feature of greenway landscape bridges combining culture and art,

and the interactive "learning" feature of greenway landscape bridges advocating environmental education. "characteristics.

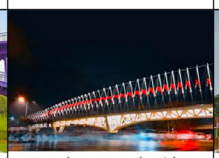
characterisation	Bridge Information		
Traffic "Tour" Characteristics of Greenway Landscape Bridges Linking Open Spaces.	 Cheng yu'an Bridge.	 Over Airport Expressway Bridge	 No. 1 across the Qingshui River Bridge
Greenway landscape bridge combined with the aesthetic "Art" characteristics of culture and art.	 Cross Jiannan Avenue Bridge	 Chuan-Shan Road Bridge	 Rhinoceros Road Bridge
Greenway Landscape Bridges Promote Interactive 'Learning' Characteristics of Environmental Education.	 Jiang'an River Bridge	 Wenchang Road Bridge	 Bacchus Road Bridge

Table 1. Greenway Landscape Bridges Combine Aesthetic "Tour-Art-Learning"Characteristics.

Design Practice of Landscape Bridge Creation under the Threshold of "Tour-Art- Learning"

In order to confirm the feasibility of the above theories and methods, this research team, under the advice and guidance of experts, takes the planning and design of the bridge of the first-level greenway of the North Lake of the Circular Ecological Park as an example of the spatial scene creation of the bridge landscape of the project.

Project Overview

Figure 2. Distribution of bridges on the North Lake Level 1 Greenway of the Circular Eco-Park.

position	number	name	reach	Property of land use	Existing bridge renovation	New bridge
First-class greenway bridge	*1*	Bridge over Dongfeng Nullah	nine tags	ecological restoration area	36m	
	2	Bridge over Drainage No. 2	nine tags	ecological restoration area		93m
	3	Bridge over Drainage No. 3	nine tags	ecological restoration area		25m
	4	Cross Tong Lok Main Row Bridge	nine tags	ecological restoration area		10m
	5	Bridge over North Branch Canal	nine tags	ecological restoration area		25m
	6	Lion Lake Trail Bridge	nine tags	ecological restoration area		360m

Table 2. Bridge statistics table.

The project is located in the wedge-shaped green area between Rongdu Avenue and Chengjinqing Expressway, which is the characteristic area of the eastern section of the Circum- City Ecological Park. Ring City Ecological Park is a ring-shaped landscape ecological space laid out along both sides of the Round City Expressway in the Tianfu Greenway system of "one axis, two mountains, three rings and seven belts" in Chengdu [3], which is the largest city centre park in the world, with a total area of about 133 square kilometres. Beihu Area inside the first level of greenway by the ring along the highway to connect to the third ring road, this project to collect six bridges that are located in the Beihu Area on top of the first level of greenway, is the first level of greenway across the river across the line, to ensure the continuity of key nodes, but also the Beihu Area landscape style and culture is an important carrier of the display.

Design proposal

Table 3. Bridge design programme table.

The six bridges in the design scheme have extracted Chengdu's regional culture for upgrading in different forms, shapes and materials. For example, the extraction of koi, pandas, bamboo, Yinxing and other elements, optimising the shape of the elements, highlighting the beauty of the bridge, so that visitors in the tour process, can experience the beauty of the scene creation, so as to achieve the needs of visitors in the tour process.

Conclusion

Through the analysis of the concept of playfulness, with "people-oriented" as the core, we aim to summarise the three major impression characteristics of landscape bridges, and explore the feasibility and necessity of the concept of playfulness in parks and urban recreational landscapes. In this paper, through the practice of planning and designing landscape bridges in the North Lake area of the Circum-City Ecological Park, we achieve the purpose of exploring the design of playfulness, actively exploring the new practice of harmonious integration of people and the environment, constructing the concept of sustainable development of green ecology, creating a diversified park scene, meeting the diversified needs of the public, and drawing a new scroll of the people for the better life in the new era.

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Research Review of Human-Machine Interaction Design and Intelligent Vehicle Cockpits

Zihan. ZHAO[1], Shutong. WANG[2], Xuanzheng.WANG[3]

[1] Central Academy of Fine Arts
zhaozihan931117@163.com
[2] Central Academy of Fine Arts
wangshutong@cafa.edu.cn
[3] Central Academy of Fine Arts
wangxuanzheng@cafa.edu.cn

Abstract

As an industrial product that combines the most advanced technologies, the part of automobile that generates user interaction is often reflected in the interior of the cockpit. With the continuous development of science and technology, the automobile cockpit has experienced two major stages: the mechanical era and the electronic era, and nowadays, with the progress of intelligentization and automation technology, the intelligent cockpit is covering the traditional automobile cockpit in a meaningful way. However, after combing through the current research status of intelligent cockpit, it is found that the number of Chinese high-level research literature on intelligent cockpit is extremely small, which is in obvious contrast with the number of English literature, which indicates that there is still a lot of research space in the field of intelligent cockpit in the Chinese academic field. This paper collects a large amount of Chinese and English literature through China Knowledge and Web of science, and carries out visual measurement analysis with the help of Citespace software, and summarizes the similarities and differences of the research trends of domestic and foreign researchers on intelligent cockpit and human-computer interaction design by means of comparative research, aiming to provide valuable references for researchers in the field of intelligent cockpit.

Keywords

intelligent vehicle cockpit; human-machine interaction; meaning overlay; interaction technology; interaction relationship

Introduction

Amidst the continuous evolution and development of the automotive industry, four emerging trends have become prominent: electrification, intelligence, interconnectivity and sharing (Ren Weiqun, 2021). Such trends demonstrate that the automobile industry is undergoing a profound and revolutionary change, with a shift towards a completely new stage of development. Vehicles have transcended their traditional role as mere mechanical products. Specifically, future automobiles are poised to transform into intelligent mobile spaces, playing a pivotal role in steering society towards the advancement of intelligent communities. Intelligent cockpits will remain central in shaping the overall vehicle user experience within the extensive transition towards intelligence-focused advancements. This trend will have a wide and profound impact not only on the automotive

industry itself, but also on other fields such as urban transportation, energy systems, sustainability and trip modes.

The evolutional path of intelligent cockpits

The mechanization era: Mechanical instrument panels and basic audio playback devices were mainly adopted in vehicle cockpit products in this period, with relatively simple functions and structures. Here, physical buttons were relied on for operations. Thus, only limited information was presented.

The electronization era: In the early 21st century, vehicle cockpit products underwent a notable shift from mechanical functions to electronic ones. Although traditional mechanical instruments were still present, small-sized center-control LCD displays gradually became popular. enhanced to provide drivers with more information and entertainment experience.

Meaning overlay in the context of the intelligence era

The intelligence era of cockpits, as represented by intelligent cockpits, can be described as a meaning overlay on the preceding electronization and mechanization eras. In terms of industrial products, intelligent cockpits exhibit a high degree of integration. Their evolution can be conceptualized as a progressive process whereby, through the ongoing integration and fusion of new technologies, the meanings and functionalities of previously disparate products are continually consolidated and superimposed.

"Technical overlay" serves as the foundational catalyst propelling the progression of meaning overlay. This evolution primarily hinges on shifts in user behavior and lifestyles triggered by advancements in technology. Meaning overlay can be comprehended as a process for humans to continuously evolve and cognitively upgrade modern life in the context of the times. In the context of meaning overlay, the essence of "meaning" becomes evident through the externalization of the evolution of product values and is likewise manifested in the externalization of cultural value's evolution. In essence, cultural value involves providing users with unique identifiers, so as to facilitate the expression and realization of their individualized meanings.

Hence, the research on intelligent cockpits finds its external manifestation in the study of the iterative development of technologies related to intelligent cockpits. However, the crux of the research lies in the exploration of the iterative evolution of users' demands within the context of the intelligence era. Such research also delves into how cockpits can establish a novel type of relationship with users through interactive behaviors.

Export and analysis of literature data related to HMI design and intelligent cockpits

The essence of intelligent cockpits lies in intelligent human-machine interaction (HMI). As a novel component in the early stage of the intelligence era, intelligent cockpits have not been extensively explored in high-level research in China, which can be attributed to a number of reasons. Intelligent cockpit concepts emerged relatively late in China, and research in this field is primarily driven by automotive companies. This industry-focused approach has posed challenges in terms of sharing academic research findings more widely. Conversely, a different trend is evident in other countries where a significantly larger volume of high-level research literature on intelligent cockpits has been produced compared to China. Therefore, by collecting a large amount of literature related to automotive HMI and intelligent cockpits from core journals both in China and other countries, the expectation was to learn and summarize the commonalities and differences in the research directions and

content between domestic and international studies.

To ensure the quality of literature, the selection criteria for core journals in CNKI was set to SCI, PKU Core Journals, and CSSCI, while that of Web of Science was set to SCI-EXPANDED, SSCI, and AHCI. Ultimately, a total of 553 articles on vehicle cockpits and human-machine interaction were collected from these core journals, and a visual quantitative analysis was conducted on the retrieved data using Citespace software.

Fig. 1 shows the keyword co-occurrence network map for intelligent interaction design of vehicle cockpits. As shown, "interaction design" was identified as the largest node in Chinese literature, followed by "automotive interior" and "user experience". "Design" was the largest node in English literature, followed by "human-machine interface" and "autonomous vehicle". "Automotive interior," "interaction design," and "intelligent cockpits" in Chinese literature, as well as "driving simulator," "human-machine interface," and "autonomous vehicle" in English literature, demonstrated strong connections with other influential keywords. These terms frequently serve as pivotal nodes in the communication pathways to other keywords, fostering a positive impact on the inter-citation relationships in the literature. From the obvious keywords shown in the figure, an observation can be made that most of the Chinese literature about HCI design largely concerns the technology of cockpits. In contrast, as shown by the keywords of "driver", "trust" and "behavior" in the English literature, international researchers pay more attention to the study of users.

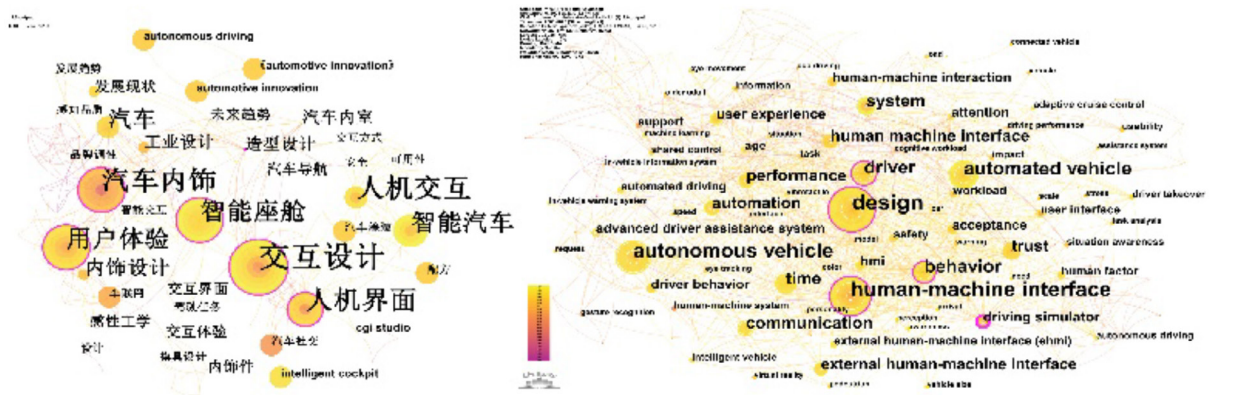

Figure 1. Co-occurrence map of HMI keywords

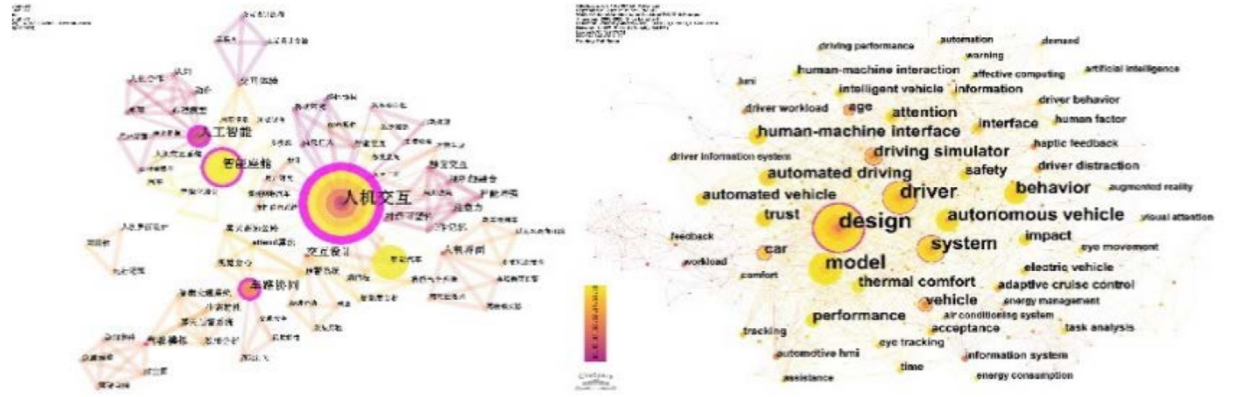

Figure 2. Co-occurrence map of intelligent cockpit keywords

Based on the frequency and centrality of the keywords, The most prominent keyword for intelligent cockpits in Chinese literature was "human-machine interaction," underscoring that HMI is the central research focus in the intelligent cockpit field. Additionally, "vehicle-road synergy" and "artificial intelligence," among others, represented secondary research hotspots. The research hotspots in English literature primarily revolved around keywords such as "design," "system," "driver," and "model." Fig. 2 leads to the following conclusion: Chinese literature predominantly emphasizes research on "interaction technology," whereas English literature centers more on "interaction relationship" within the field of intelligent cockpits

Technical overlay in intelligent interaction

Fig. 3 illustrates the core technologies included in intelligent cockpits, which mainly contains three major sections: software, hardware, and interaction technology. Here, HMI technology is involved in connecting and driving the hardware and software in cockpits, the main function of collecting the physiological, psychological and interactive information for drivers.

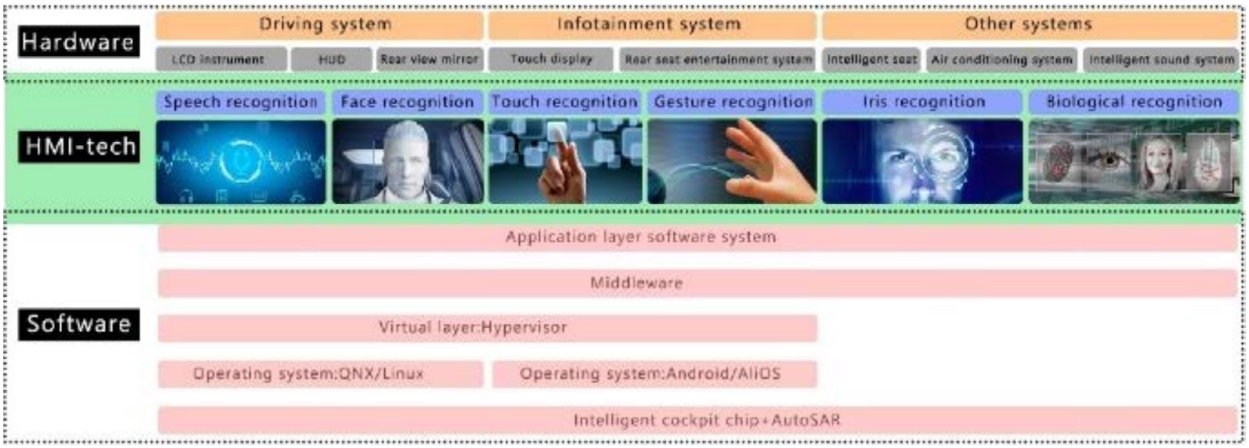

Figure 3. Core technologies in intelligent cockpits and the relationships

In 2020, Tan, Z. and his team suggested certain core issues that deserve further exploration, including: the acceptance level of ICV technology, the quality of ICV(in-vehicle human-vehicle interaction) human-machine interaction, and the ICV user experience. (Tan, Z., 2020). In the development path of efficiency-oriented HMI design, the utilization of bioelectrical signals can enable real-time synchronized communication between humans and machines. This approach provides real-time control interfaces and has the potential to control multiple functions simultaneously. With minimal human intervention required, this process can greatly enhance control efficiency (Singh, H. P., & Kumar, P. 2021). Z. Hu proposed a new concept, Driver Digital Twin (DDT), in 2022 (Z. Hu, 2022), intended to bridge the gap between the existing autonomous driving systems and fully digitalized systems, thereby facilitating construction of a complete driving-human cyber-physical system.

At present, information presentation has become complex and varied, including road-condition- based natural displays, assisted driving, multi-screen displays, interior and exterior information displays, and integration with mobile devices (Hao, T., 2019). The growing volume and complexity of information necessitate intelligent vehicles to provide ample space for effective information presentation. A team represented by Zhu, Y. designed a driver-specific interface that takes into account autopilot contexts, users' information needs, and their preferences for display areas. (Zhu, Y., 2023). Notably, their results underpin the feasibility of glass projection display, laying the

theoretical foundation for the development of a human-machine interaction system utilizing window glass as a carrier within intelligent cockpits.

Relational overlay in intelligent interaction

Since the 1960s, the rapid development of information systems has been the driver for an extensive range of HMI research, which is aimed at designing human-machine interfaces with ergonomic properties, the research and optimization of human-machine interaction relationships have emerged as a significant topic in the field of intelligent cockpit interaction design.

In 2004, Lee, J. D. and See, K. A. integrated the research on trust automation through a conceptual model, the dynamic nature of trust, the role of environment on trust, and the impact of display characteristics on trust were revealed. (Lee, J. D., 2004). In a study on airplane cockpits, Wenhai, W. U. and his team found that in a dynamic and rapidly changing environment, such design would only play a significantly weakened role or even a counterproductive role (Wenhai, W., 2016). Thus, an observation can be made that cockpits with a machine-takeover mode do not necessarily impose a positive impact on the human-machine interaction relationship, enhancing the adaptability between humans and machines is poised to be a future developmental trend in the field of human-machine interaction (Hoc, J.M., 2000). Shucong Yu et al. proposed a test and evaluation system for intelligent cockpits in 2022, which can quantify the user interaction experience of intelligent vehicle cockpits with a high degree of accuracy. It serves as a robust tool for assessing the performance of intelligent cockpits (Shucong Yu, 2022). To tackle the multifaceted aspect of human-machine interaction design in intelligent cockpits, a research team led by Li, W, in a 2022 study, proposed that human-machine interaction involving emotional perception is a forward-looking and demanding research area for the future. (Li, W, 2022). In 2018, Niu D, Terken J and Eggen B. suggested that one crucial aspect warranting comprehensive investigation regarding people's trust in automated systems is anthropomorphism. Anthropomorphizing information can elevate the perception of autonomous vehicles as social entities, thereby bolstering trust in these vehicles (Niu D, 2018).

Conclusion

The aim of the present study was to illustrate that the advancement of intelligent cockpits goes beyond straightforward technological upgrades and efficiency improvements. Its fundamental characteristic resides in the continuous iteration and cultivation of users' cognitive aspects. Primarily occurring at the lifestyle level, this process is poised to exert a profound influence on the predominance of users' mental factors. The success of meaning overlay relies largely on the enhancement of users' cognition and their satisfaction with experience, since this is directly engaged with users' needs and expectations in the context of different eras. Findings were made that Chinese literature on HMI design for intelligent cockpits primarily concerns "interaction technology", while English literature largely pertains to the "interaction relationship". Technical overlay is the fundamental driving force for the evolution of meaning overlay. The interaction relationship comprises numerous factors, namely the emotional connection between users and systems, the patterns of interaction, and the complexity of information transfer. Such factors can directly shape the user experience and system effectiveness. Therefore, the core of progress and advancement in the field of HMI in intelligent cockpits lies in the evolution of interaction relationships.

Intelligent cockpits are a significant carrier for the integration of emerging technology. As to future research in the field of intelligent cockpits, Chinese researchers should place more emphasis on the new human-machine

interaction relationship generated with the integration of technologies, and should take into account the comprehensiveness of user experience, including emotional factors, trust, and ergonomics of cockpit systems. The ethics surrounding new technologies should be examined through a human-centered approach to ensure the ethical and sustainable progression of intelligent cockpit technologies.

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A Semantic Expression Approach to Artifact Design from the Perspective of Embodied Cognition

Zhou Zirun[1], Xi Xiaochao[2]

[1] Beijing University of Posts and Telecommunications, 100876 Beijing
714851334@qq.com
[2] Beijing University of Posts and Telecommunications, 100876 Beijing
xixiaochao@bupt.edu.cn

Abstract

Nowadays, the theory of embodied cognition has gradually become a hot topic in design research. It emphasizes the unity of body, mind and environment, and designers can make use of embodiment, Contextualization and dynamics to give meaning to artifacts, and "decode" them through users' behaviors to realize the conveyance of embodied semantics. This paper applies the theory of embodied cognition to the design of Chinese artifacts, and proposes an idea of embodied design: to locate the design boundary by analyzing the user's self-recognition, usage behavior, environment experience and cultural identity, and to "encode" it with the help of the four means of design: anthropomorphism, sensory perception, imagery schema, and behavioral experience, so that it can be "encoded" with the user. With the help of the four design tools, the design is "coded" to produce perceptual, cognitive and behavioral associations with the users, and realize the embodied semantic expression. The design practice of three Baijiu drinking utensils is used as an example to verify the practical value of the design idea and provide designers with an in-depth excavation of the embodied design method.

Keywords

embodied cognition; design; Chinese artifacts; embodied semantic; embodied design method; Baijiu drinking utensils.

Introduction

In recent years, embodied cognition has been increasingly emphasized in the field of design. Its core idea is that the body is the origin of thinking (Xie, 2020) and intervenes in the cognition process through intuitive reliance, bodily functions, rational thinking, and motor ability(Guo & Sun, 2022). In 1979, Gibson put forward the theory of perceptual ecology, pointing out that mind and cognition are embodied, formed in the interaction between brain, body, and environment; human behavior, mind, and environment are integrated, and cognition is intrinsically linked to embodied structures and activity schemas(Li & Sheng, 2006). Modern research on embodied cognition focuses on, among others, embodied emotion(Yao & chen, 2019), body schema(He, 2009) and the relationship between body and experience(Xie & Ye, 2019), highlighting the strong connection with the concept of "human-centered" design, which is an ideal tool for analyzing designers' intentions, understanding user behavior, and building a connection between the two.

Embodied Theoretical Foundations of Artifact Design

From a broad perspective, embodied cognition not only emphasizes the influence of the body on the cognitive

process but also asserts that cognition is produced by the joint action of the body and the environment(Xie, 2020). Wang Lishen and Xie Lifang further summarized the three attributes of cognition in the embodied perspective: embodiment, context, and dynamics(Wang & Xie, 2021) as shown in Table 1. In addition, the cognitive process cannot avoid being influenced by other people. The cultural phenomenon formed by group cognition will, in turn, counteract individual cognition. Sun Yi and Wang Yuan(2021) suggest that "the cultural experiences and knowledge we acquire in our culture inevitably shape our worldview, adapting our minds to the current culture, and ultimately being reflected in human embodied behavior." (p. 136) Stimulation of the body will sometimes directly generate perceptions of things, but another part may require cultural immersion to produce perceptions. For example, Chinese people perceive the color red as joyful and pleasant, while Westerners usually tend to perceive it as angry or even evil(Zhu, 2011). This is summarized as "cultural filtering." Therefore, the embodiment, contextualization, dynamics, and cultural filtering of cognition together form an important theoretical foundation for the study of artifact design from the perspective of embodied cognition.

Attributes of Cognition	Description
Embodiment	The physical structure of the body and the senses influence the formation of cognition.
Contextualization	Cognition comes from the body's experience in a given situation and is influenced by the environment. The body and the environment are somewhat intertwined. Certain components of the environment may, as people become more familiar with them, become internalized as part of the “body” used for cognition and become extensions of human sensation.
Dynamics	The interplay of time, body, and environment affects and facilitates the adjustment and development of cognition. Cognition adjusts and develops in response to the dynamics of the body and the environment, and it is possible for cognitions that have been formed to be altered.

Table 1. Three Attributes of Cognition in the Embodied Perspective

Xie Yong summarized the three layers of association between product design and the user's embodied cognition, including perceptual-, cognitive-, and behavioral- layer associations(2021). (1) Perceptual layer association refers to the sensory migration without cognitive processing, including the material, touch, and information transfer of the product itself, which will directly affect the user's cognition. (2) Cognitive layer association refers to contextual imagination that is processed by the brain; that is, the user recognizes the shape and structure of the product and associates it with other familiar imagery, resulting in associative cognition. (3) Behavioral layer association refers to the physiological stimulation of the user by the behavior of the body and the product size. When the body interacts with the product, its shape, function, size, and resistance in use will affect the user's behavior, and the stimulation and feedback of this behavior to the body will, in turn, affect the user's subsequent behavior and thinking; that is, the behavioral stereotypes carried by the product itself will affect the user's cognition.

Accordingly, Van Rompay et al.(2015) propose four types of product design from the perspective of embodied cognition. (1) Anthropomorphism or familiarity, in which people tend to recognize human features in products, either consciously or unconsciously, and products that have a physical resemblance to people will, therefore, influence users' responses. It can be further categorized into "concrete physical resemblance (direct resemblance

to humans or animals)," "more abstract resemblance (resemblance to abstract features of human gestures)," and "resemblance to human limbs or movements." (2) Embodied imagery schema is a cognitive structure in which people process relevant experiences and information into some kind of routine based on sensation, intuition, and representation and store in long-term memory(Wang, 2006). Bodily experience can form an embodied imagery schema that is projected metaphorically into the understanding of things, which makes people comprehend the meaning or quality of things according to the spatial relationship of vision. (3) Meaningful sensory experience, where direct sensory stimulation is applied to the expression of the embodied product. (4) Embodiment of functional behavior, which affects the psychological feeling and subsequent behavior of the person using the product by designing their behavior and actions, the speed of movement, and the amount of force used when using the product.

Embodied Expression of the Semantics of Artifact Design

Embodied design of artifacts is the process of symbolizing perceptible elements and understanding and interpreting them through the act of use. In this process, designers "encode" various design elements according to the type of embodied cognition of the product and endow the artifacts with shapes, functions, and meanings; users "decode" them through various channels such as functional perception, experiential cognition, and emotional feedback, and so on. The whole process, as shown in Figure 1, includes three parts: the design means, the transfer mechanism, and the influencing factors of embodied semantics. Framework

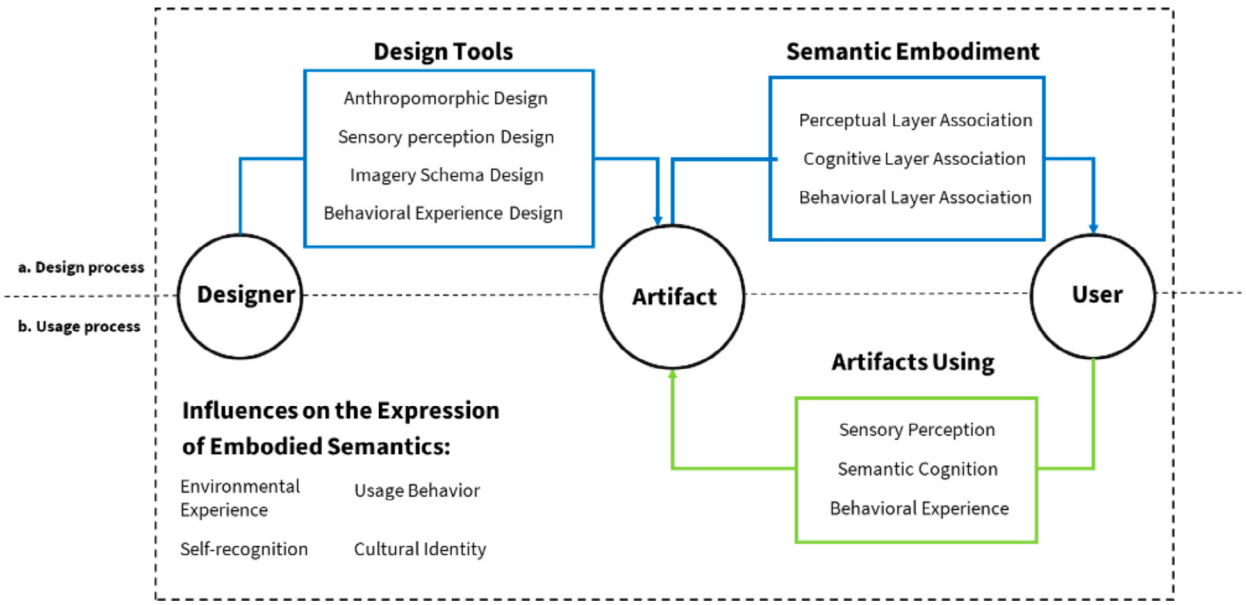

Figure 1. Semantic transfer process and mechanism of embodied artifact design

Design tools for embodied semantics

Designers, as the initiators in transferring embodied semantics, are often able to infuse design imagery into artifacts through four means: anthropomorphic, sensory perception, imagery schema, and behavioral experience designs, which correspond to the type of embodied cognition of the product, as shown in Figure 1(a).

Anthropomorphic design

Anthropomorphic design usually simulates the body or part of the body gesture, in the design of figurative or

abstract realization of semantic expression, giving objects some human psychological characteristics, so that the product has a "personality"(Liu & Xia, 2004). Designers can use it to influence user experience, allowing the user to produce emotional and psychological feedback in line with expectations. For example, the Dulcinea standing lamp designed by Mimmo Paladino, as shown in Figure. 2(a), simulates the posture of a person standing and bowing his head and is complemented by soft curves and approachable materials, which makes the user feel "gentle, safe, and non-aggressive." In addition to the role of anthropomorphism and emotional expression, anthropomorphic design also makes use of familiar things to create a sense of surprise and freshness.

Sensory perception design

Sensory perception design directly stimulates the user's sensory organs through the artifact's shape, color, material, and so on, triggering their psychological feelings or similar associative migration. These sensations include sight, hearing, touch, smell, taste, balance, movement, and so on. For instance, different textures of textiles will produce very different tactile stimuli, leading to different emotional responses(Yang et al.,2022). Touching silk gives a feeling of softness, gentleness, and delicacy, while cotton and linen fabrics appear rough, plain, and natural, as shown in Figure 2(b). Designers can weave products with unique embodied semantics by applying them in unique ways.

Image ry schema design

Imagery schema design expresses embodied semantics primarily through the spatial arrangement between the various components of the artifacts and between the artifacts and their contents. For example, artifacts that are close to each other in distance and similar in structure give people a sense of intimacy and dependency; artifacts that are surrounded by components often express a sense of security; artifacts that are gagged are often considered to be confined and contained; artifacts that are placed on top of each other in space have better quality. Designers can deal with the layout and form of components according to the design imagery and corresponding schema, giving the artifacts perceptible embodied semantics.

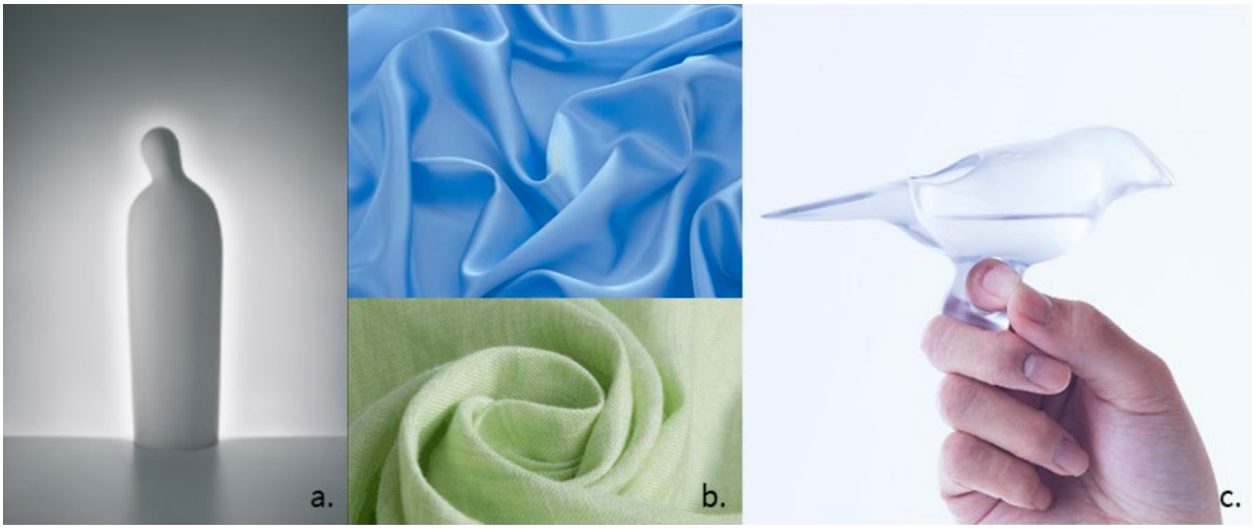

Figure 1. (a) Dulcinea lamp design; (b) Silk material; (c) Bird-shaped sake cups

Behavioral experience design

Designers also regulate usage behavior through the artifact's form to produce embodied cognition and trigger

psychological feedback that meets expectations. For example, the bird- shaped sake cup designed by Taki Product, as shown in Figure 2(c), employs anthropomorphic design methods in its shape to simulate the form of a standing bird; in terms of usage, the designer restricts the use of the cup by designing the handle at the bottom, so that the bird- shaped cup rests on the tip of a finger, and the sake must be consumed from the bird's beak. This design constrains the drinking behavior, subsequently allowing the drinker to maintain restraint and create a novel drinking experience.

Tran sfer mechanisms for embodied semantics

The four means combine and synergize with each other to jointly influence the semantic expression of the artifact embodiment and the cognitive effect of the user, involving three lays: perceptual, cognitive, and behavioral associations. First, perceptual association refers to the use of sensory stimuli to produce a mapping of the user's "body" that triggers embodied cognition. It often involves people's most immediate impressions and memories of the body itself. Second, cognitive association refers to artifacts that trigger multimodal perceptions and feelings, evoke perceptual and learning experiences, and achieve mental embodiment. Finally, the behavioral association regulates the use of artifacts—people's body movements and gestures—so that the user recalls a specific scene in interacting with the artifacts and, then, generates embodied associations related to it. These three types of associations are the channels of "communication and dialogue" between designers and users through the artifacts, highlighting the results of the embodied design semantics.

The three layers of association realize the transfer of embodied semantics between designers (encoders) and users (decoders). Designers can select different means, identify elements, and carry out practices according to the design objectives to ensure that users understand their design intentions as accurately as possible and achieve the desired semantic expression effect.(1) The design of triggering the perceptual association layer is often realized through the most direct mimetic and sensory stimuli, and users can naturally recall the corresponding vestibular sensory experiences such as visual, auditory, and dermatological senses, to understand the richer and more figurative semantics. (2) The cognitive association layer triggers more reliance on people's spatial perception(Gallese & Lakoff, 2005). Designers give the shape and function of artifacts a unique form to construct imagery schema; users rely on their spatial association ability and use actions to produce embodied experience. (3) The triggering of behavioral associations is, first, influenced by sensory and cognitive factors, and the semantics are accurately conveyed to people through the norms and constraints of artifact design on the use of behavior and are reflected in the psychological feedback and subsequent user behavior.

Influences on the expression of embodied semantics

Although designers will spare no effort to ensure that users can correctly understand the design intent and realize the embodiment of semantic cognition, this process is very complex. It is directly affected by the three attributes of embodied cognition and its "cultural filtration," which includes the following four main factors: self-knowledge, environmental experience, usage behavior, and cultural identity.

Self -recognition

Users' awareness and experience of their own senses constitute the primary source of embodied cognition. Their sensory experience and cognitive habits will directly affect the cognitive results when using the artifacts. Considering the famous poem "Liangzhou Lyrics" (凉州词), "At night, fine wine is poured into the glistening cup, before drinking, battle pipa sounds urge combat," the unique combination of wine and artifacts gives people a

wonderful sensory experience in terms of color, smell, and taste. In addition, an inherent experience of drinking wine has been formed by more than 1,000 years of singing.

Environmental experience

The environment in which the artifact is used also participates in constructing embodied cognition; in other words, embodied semantics is the result of the experience of the artifact itself in conjunction with the environment. For example, in summer, people prefer the coolness of iron cutleries, while, in winter, they tend to find them too cold and avoid touching them. In this example, different usage environments affect people's experience, indicating that environment and artifacts influence each other in producing embodied cognition. In addition, factors such as ambient light and sound can also cause changes in the perceived characteristics of the artifacts, indirectly affecting the user's embodied cognition of the artifacts.

Usage behavior

Designers give artifacts different functions and expect users to use them according to their design intent. However, when users use the artifacts, they tend to understand how the artifacts are used based on their past experiences and their own usage habits. This may result in a mismatch between the user's actual usage behavior and the designer's design intent.

One of the most vivid examples is the traditional Chinese tableware, chopsticks, which have adopted a "convergent functional design"(Wei, 2021). In addition to the standard four-finger action of picking up food, chopsticks can be used to perform more than 20 other actions, such as splitting, pinching, picking, plucking, tearing, and stabbing. Depending on the type of food, chopsticks can be used in a variety of new ways.

Cultural identity

The influence of the user's cultural identity on embodied cognition stems from its "cultural filtering." It consists of the overall perception of the current environment and the cultural identity acquired through historical inheritance. They make people generate the tendency to perceive product form and semantics and filter out the combination of one-sided cultural symbols from artifacts and environment to form embodied cognition with cultural characteristics. For example, the body shape of the Qing Dynasty " 福 " wine pot imitates the shape of the Chinese character " 寿 " . When the user drinks the wine in the pot, it evokes the imagery of imbibing "divine water" infused with "good fortune and longevity" into the body and being blessed by the gods(Sugiura, 2006). This example shows that only those who recognize the Chinese character " 福 " can have an embodied experience of "blessing."

These four factors work together to shape the user's embodied experience. In addition, they influence the designer's creative process and are inherent constraints that should be carefully considered. Designers often gather information about user experiences through observation, questionnaires, and semi-structured interviews to measure the expressive effect of embodied semantics and adjust the program according to the feedback. These include the following three points. (1) sensory perception: the user's intuitive perception or association of the artifact, (2) semantic cognition: the user's recognition of the semantics expressed by the artifact, and (3) behavioral experience: the associations and feelings generated by the user behavior in the process of using the artifact. as shown in Figure 1(b).

Design Ideas for the Artifact Embodiment

Designers can infuse embodied semantics into the shapes and functions of artifacts through anthropomorphic, sensory perception, imagery schema, and behavioral experience designs after fully understanding the use scenes, user characteristics, and cultural background of the artifacts. They can also use experience, environment, behavior, culture, and other factors to trigger perceptual, cognitive, and behavioral associations with the user to convey embodied semantics and obtain timely user feedback. Based on this, this paper proposes a process of embodied design for artifacts and attempts to put the process of embodied design into practice to verify and evaluate its feasibility.

Process of embodied design

In the design, it is necessary to, first, consider all kinds of influencing factors in the use scenario, clarify the layer of embodied semantic expression that is to be triggered, and choose appropriate design means. The process involves four steps, as shown in Figure 3. (1) The first step is to determine the specific scenarios and target users of the design. (2) The second step is to analyze the influencing factors of embodied semantics in different scenarios, including the user's own perceptual experience of this type of artifacts, their personal experience of the environment, and the possible behavioral characteristics of the artifacts when they are being used, as well as the user's cultural background and customs. This allows them to understand the limitations of the four influencing factors of self-perception, environmental experience, behavior, and cultural identity on the shape and function of the artifacts and to determine the design boundary. restrictions, and determine the design boundary. (3) The third step is to define the semantics to be expressed and correspond to the four influencing factors and, then, select the proposed triggering layers (perception, cognition, and behavior) and create the semantics using the corresponding embodied design tools, including anthropomorphism, sensory perception, imagery, and behavioral experience. (4) The fourth step is to evaluate the design results to obtain the users' sensory perception, semantic cognition, behavioral experience, and comprehensive feelings: how the artifact triggers the embodied association with them through user descriptions, how strongly the artifact triggers the embodied association through the users' evaluations, and compare the users' descriptions with the semantic expression of embodied intention.

To verify the expression effect of embodied semantics more intuitively, this paper considers the design of drinking utensils as an example and begins from the three layers of association to design three kinds of drinking utensils in the scene of "Baijiu (liquor) Bar," which is characterized by Chinese culture; then, it evaluates the expression effect of embodied semantics.

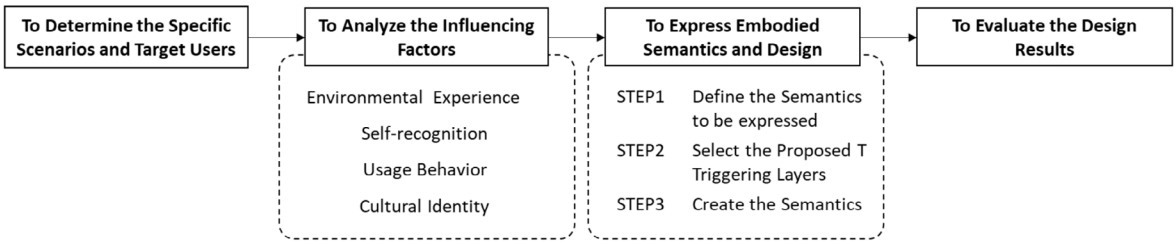

Figure 3. Embodied design flow

Embodied design practice

The Chinese have a long cultural history of drinking alcohol. In recent years, a new type of "Baijiu bar" has had

a great impact on the traditional bar concept, which mostly combines Eastern and Western cultural elements to create an avant - garde drinking experience. This new scenario has changed the design of the modern Chinese Baijiu bar. Through fieldwork and observation interviews in the case of the Hope & Sesame bar in Guangzhou, as well as a review of the history and cultural development of drinking in China, we summarize the factors of cultural identity, self- perception, environmental experience, and usage behavior that influence the embodied expression of drinkware design.

1. Analysis of influencing factors

The cultural identity factors of Baijiu drinking utensils come first from the idea of traditional Chinese wine culture: "following the ritual system, respecting nature, advocating moderation, focusing on elegance, enhancing socialization, and relieving worries with wine." They also coincide with the current concepts of "table culture," banquets and socializing, and drunkenness and hangovers. Coupled with the strong cellar aroma and more stimulating taste of Baijiu, they generally bring people a self-recognized notion of "strong" and "to be drank only with meals." The "Baijiu bar" creates a quiet and unique "social environment" through dim and warm lighting design, relaxing and soothing music, and the interweaving of fabric, leather, metal, wood and other materials, as shown in Figure 4. This softens the stereotypical image of Baijiu and, simultaneously, gives new life to the norms of drinking behavior such as etiquette (e.g., Shang Dynasty bronze wine vessels), the pleasure of drinking (e.g., " 流觞曲水 ": an activity in which the literati sit in order of seniority behind a small winding creek. Wine cups are floated down the creek. When a wine cup stops, the man closest to the cup is asked to drink the wine in the cup and write a poem), and moderation and restraint (e.g., the nine-dragon goblet).

Figure 4. Hope & Sesame Bar in Guangzhou

2. Embodied semantic expression and design

The design of the drinkware for the "Baijiu bar" starts from the perspective of "reconciling" people's stereotypical impression of Baijiu with the drinking environment. Subsequently, the design of the first "Mi Zhi Hua " wine glass starts from the layer of perceptual association and applies sensory perception design means on the coaster. Wrapping rice grains in undyed burlap creates the texture of a "rice sack," allowing the drinker to have a physical association with "grain." The embodied semantics of "natural" and "comfortable" are conveyed from both tactile and visual aspects, as shown in Figure 5(a). The second design of the "Offering" wine glass starts from the cognitive association layer and applies anthropomorphism and intentional schema design to trigger cognitive associations from the shape of the wine vessel and the spatial relationship between the components. In the shape, the anthropomorphic figure, which is supported by both hands, expresses the behavioral semantics of "offering," and the spatial pattern of "up" expresses the embodied semantics of "honoring the gods" in traditional rituals and sacrifices, as shown in Figure 5(b). The third wine cup design, "Holding the Goblet in Reverence," starts from the behavioral association layer and guides the drinker to generate behavioral embodied associations by lifting the cup and clinking the cups. The "two ears" for holding the goblet are designed based on the shape of the ancient wine vessel "Yu Shang." This design not only regulates the user's drinking behavior but also differentiates it from the "gulp" style of drinking with one hand and creates a psychological feeling of "moderation" and "respect," as shown in Figure 5(c).

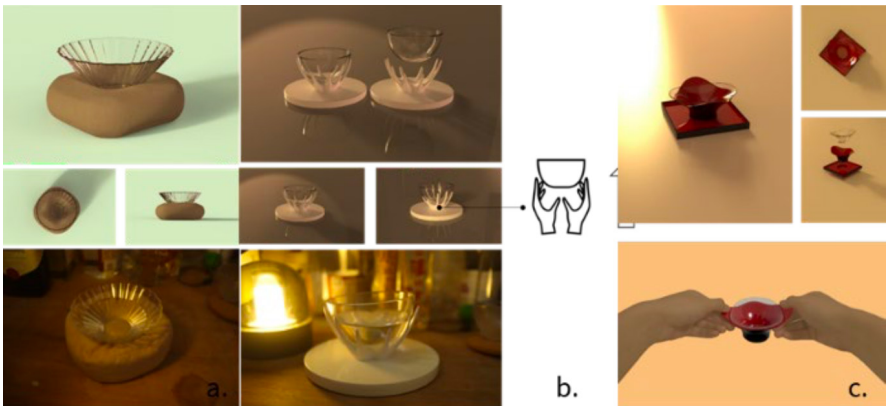

Figure 5. (a) Design of the "Mi Zhi Hua " wine cup; (b) Design of the "Offering" wine cup; (c) Design of the "Holding the Goblet in Reverence" wine cup

3. Semantic embodied effect feedback and evaluation

Ten subjects were invited to experience the three wine cups and evaluate the effect of their embodied semantic expressions. The collated results are shown in Table 2.

Wine cup	Test no.	Expected embodied objectives	Results achieved	Feedback not achieved	Estimation
"*Mi Zhi Hua*"		The Association of "Grain"	50%	The material is softer and more reminiscent of a sofa and a little harder to associate with a rice bag.	Average
	②	"Nature"	100%		Very satisfactory
	③	"Comfort"	100%		Very satisfactory
"Offering"	①	"Offer with both hands"	70%	The hand imagery is a bit hard to recognize, it would be more similar to a tree branch or a water droplet and would be somewhat aggressive at certain angles.	Satisfactory
	②	"Precious wine"	60%		Satisfactory
	③	"Worship of gods"	20%	It can create a feeling of respect, but it is difficult to associate it in that direction when you may not normally have that experience of honoring the gods.	Expectations not met
"Holding the Goblet in Reverence "	①	"Moderation "	20%	"The red color is reminiscent of a dipping saucer and creates a feeling of being in a hot pot restaurant."	Expectations not met
	②	"Respect"	100%		Very satisfactory

Table 2. Feedback results on the use of wine cups

From the test results, the wine glass designs corresponding to the three layers of association can accurately convey the semantics of embodiment. (1) In the test of the "Mi Zhi Hua " design that triggered the perceptual association, all ten subjects were able to feel the natural and comfortable embodied experience by using the wine glass, but the semantic meaning of "grain" could not be well recognized due to the bias of the designer's material choice. (2) In the design of "offering," which triggers cognitive associations, although there is a deviation in the recognition of the imagery of "hand," the subjects were able to understand the intended meaning of "offering" and "salute" after recognizing the hand movement. This further triggered the influence on the drinking experience and the cognition of Baijiu. The semantics of "honoring the gods" is difficult to recognize because of its distance from modern thinking. (3) Triggering the design based on behavioral association, "holding the goblet in reverence" will be affected by the perception and cognitive factors triggered by the goblet itself, resulting in a deviation of the communication effect. The semantics of "salute" could only be felt after repeated use.

Conclusions and Outlook

From the perspective of embodiment design theory, this paper explores the mechanism of semantic expression and transmission of artifact embodiment and, then, puts forward a new idea of artifact embodiment design, which includes three aspects. (1)Designers can express the semantics through four different design means, including anthropomorphic (i.e., simulating the body's gesture or expression), sensory experience (i.e., influencing the senses through materials), imagery schema (i.e., affecting feelings through spatial relations) and behavioral experience (i.e., impacting cognition through the act of use). (2)After using the artifact, the user will have a semantic embodied cognition through the three layers of perception, cognition, and behavior. (3)The process of embodiment is also influenced by the user's self-perception, environmental experience, usage behavior, and cultural identity. Designers can get the user's comprehensive experience through the latter's feedback on sensory perception, semantic cognition, and behavioral experience to analyze the design's embodiment effect. Integrating the process of design expression and feedback, this paper provides designers with a methodology for embodied design and evaluation and verifies it through the design practice of three wine cups.

Through theoretical research and design practice, this paper provides a new idea to apply the embodiment theory in artifact design, which can better realize the transmission of embodied meaning and has practical value. From the actual expression effect, the specific design method and its expression effect still need to be further demonstrated. In addition, it raises further issues that need to be carefully examined with more research and practice.

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Virtual Self Care: Explorations in using immersive technology to support positive mental health and wellbeing

Caleb Josey Fahey

Institute of Creativity and Innovation, Xiamen University
caleb.fahey@uca.ac.uk

Abstract

The purpose of this paper is to investigate the potential of virtual reality (VR) technology as a therapeutic tool for the promotion of mental health and well-being in adolescent students. At a time of increasing mental health concerns among this population, this study aims to explore the effectiveness of VR interventions in addressing these challenges. Using a mixed-methods approach that combines qualitative interviews and quantitative assessments, this research explores the experiential impact of VR-based interventions on stress reduction, emotional regulation, and overall mental well-being among adolescent participants. By analysing the subjective experiences elicited during VR immersion, this study seeks to elucidate the mechanisms underlying the potential therapeutic benefits of VR for this population. Findings from this research endeavour will not only shed light on the feasibility and acceptability of integrating VR technology into mental health interventions for adolescent students but will also provide insights into how to optimise VR environments to maximise their effectiveness in promoting mental wellbeing in educational settings.

Methodology

"Can virtual reality be a useful tool in supporting adolescent mental health and well- being?" The research aimed to assess the effectiveness, usability, or impact of VR in supporting adolescent mental health.

Participants in the study were 19 students from a London-based art college, aged 16-18 years. Participants were informed of the purpose of the study and gave their consent to take part in the research. Students discussed the ethical implications of their use of technology and their personal experiences of mental health and well- being. The students' feedback was discussed, and the students' experiences were recorded through interviews and surveys. This data was used to create an immersive experience, which was also tested with participants.

The ethical framework of this study was influenced by prior research (Fahey 2014) on our interactions with digital technology, and how this affects us psychologically. Students were interviewed individually, with our conversations recorded and observations made in note form. Students' computer and device usage was analysed over several weeks to select a range of students for the study, with device usage ranging from low to high. Discussions with students about any potential concerns took place in the weeks before the study began. Participants were worked with over an academic year (September 2021-June 2022). Ethical considerations were approved by the Research Ethics and Integrity Sub-Committee (REISC) at Goldsmiths, University of London. Within the college, students had access to additional pastoral staff who were appointed to support students'

mental health and well-being should they have any concerns.

By digitising therapeutic practices and getting participants to work on their mental health and well-being in virtual spaces, participants were given a new perspective on wellbeing. The proposed development of this research project is to explore the use of biofeedback to create virtual environments that respond to bodily functions.

Findings

Background

To take a Rhizomatic approach in mapping out this research project, some of the initial threads at the root of the project emerge from science fiction.

'What if a cyber brain could possibly generate its own ghost, and create a soul all by itself? And if it did, just what would be the importance of being human then?' (Ghost in the Shell, 1995, 00.42.43)

The themes presented in Ghost in the Shell (1995) are prophetic allegories for humankind's current relationship with technology and the possible future of a more cybernetic world. Haraway (2016) philosophises about the 'Spectre of the Ghost in the machine' (Haraway, 2016, p.11) stating that modern-day machines highlight the ambiguity between the natural and artificial. We currently live in a reality where machines are present in most day-to-day routines. In modern-day society, it is hard to escape the thrall of our devices, vibrating in our pockets and alerting us to an infinite possibility of connections. Virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) are some examples of technology that embody the balance between humans and machines. Research into creating human-like AI and developing more immersive virtual worlds present many ethical existential quandaries. As we become more embedded within the machine, it is fundamental that we instill technology with humanistic traits, or else we could be in danger of undermining our human nature.

Exploring Virtual Spaces

The first research stage in the study was to introduce the students to VR with a familiar experience. Each participant experienced different virtual worlds tailored to their interests. Stage two of the research introduced the students to a range of existing well-being apps, which focused on using games and meditative experiences to calm the mind. Stage three of the research was to apply the student feedback and build a new immersive experience.

"It puts you completely in it as opposed to you trying to put yourself in it through your sight or listening to something. I think by seeing it you're kind of forced to be in it, but in a good way. It doesn't leave you any room for your mind to wander." (Student Participant)

All students reported that the experiences altered their moods, stating that they felt calmer and sometimes energised and more creative; however, some students reported that the experiences were too stimulating and sometimes had the reverse effect. Considering that the student participants had previously had difficulty switching off during meditation, the fact that these experiences allowed them to take this practice into their lives is a strong indicator that VR therapy can extend from virtual realms and into everyday life.

Using the student feedback, the last stage of the research was to develop a new immersive experience. Working closely with therapists we developed the idea to mimic a self-hypnosis exercise called the 'control room technique' (Stagg 2015). The technique involves taking a patient down a staircase and into a relaxing space towards the control room of their mind, once the patient is in their control room, they are prompted to adjust

their thinking habits to better deal with stressors or difficulties. Using a recording of a therapist talking through the control room combined with a binaural audio track, an immersive 3D spatial soundscape was generated. The virtual world was built mainly in Unreal Engine and Cinema 4D, the design was developed to support the soundscape and to guide the participants through the experience. The students responded well to the immersive control room sequence and stated that it allowed them to alter their negative thought processes. Upon completing early beta versions of this experience, I realised this project was just in the early conceptual stages, sewing a seed for themes I want to explore in more detail with further research. This process was more of a reaction than a response; the brain's initial knee-jerk towards generating an artefact inspired by the research.

Technology's role in our daily lives is becoming embedded into our physiology. Wearable devices that alter our perception of the world move us towards manifesting Haraway's cyborg;
'This cyborg is our ontology; it gives us our politics. The cyborg is a condensed image of both imagination and material reality, the two joined centres structuring any possibility of historical transformation.' (Haraway, 2016, p. 4)
Considering the embodiment of technology in modern-day society, VR will likely be equally present in the future. Concerning supporting mental health, VR appears to be a valuable tool. The existing examples of VR software focused on well-being evidence that technology can make us more aware of our mental health and well- being. VR is a relatively new technology and how it gets adopted into our daily lives is yet to be seen. The students who participated in the study could use VR to foster a positive mental state and trigger discussions about their well-being. The students might not have considered using VR to support their mental health if they explored this independently, suggesting that the framework to introduce people to virtual therapy should be more available. We currently mostly access VR for gaming; however, the different applications are advancing, 'and it would not be surprising to see a flourishing ecosystem of metaverses before long' (Chalmers 2022 p186). There is much scope here to build new software that incorporates virtual therapeutic practices.

The human mind is complex, and our mental health and well-being are exceptionally subjective; therefore, we cannot say that using VR is a cure-all solution. The research carried out in this essay and the theories presented suggest that incorporating VR with therapeutic practices has great potential and can help foster positive mental attitudes. It is essential not to remove the human element when developing VR. Through discussion with the students involved in this study, we could summarise their experiences and discuss how they perceived these virtual worlds. In response to this research project, I am developing virtual experiences that combine self-hypnosis with immersive animated sequences. I plan to continue testing these environments with my students and believe that this research is the beginning of a much more in-depth exploration into how we can use VR to support our mental health and well-being.

To conclude the study, students answered the question: What importance do you feel technology will have in your future? The responses were a range of positive, negative, and neutral opinions. One of the students' answered
"As a generation becoming more dependent on the technological world, ways of living have changed to an unchangeable stance. I believe that technology will take over humankind's work and normal life. I think technology will be able to save lives medically and transform ways of communication. Additionally, I believe it will allow positive changes in education and virtual learning, however, we as humans should never overstep the line of technological power." (Student Participant)
It is clear from reading the students' answers that this study has provided them with a platform to consider how they interact with technology. Despite showing optimism for therapeutic, educational, and medical technological

applications, they are aware of the possible moral dilemmas surrounding being more connected to the machine.

Technology has immense power over society, and there is a danger that if we misuse technology, we could create more issues in the future; however, there is also the potential for what we can achieve with future developments. Overall, I am excited about how we can adopt new technologies into society. The problem is not with technology but more with how we access it. With companies such as Meta (Facebook) monopolising VR, we must ensure that we instill these virtual worlds with the raw elements which make us human by developing virtual societies where one can better themselves online rather than reflecting a consumerist society with a myriad of immersive advertisements. VR is a space with the capacity to provide freedom, freedom from the constraints of reality. We need to use this space to promote new ideas and support our human needs. The future of technology is ambiguous, which will hopefully continue to drive research in this field toward new horizons, presenting an interesting power struggle between the potential threat presented by VR and how we best adopt this technology. Whitehead celebrates the importance of scientific discovery and the profound impact it has on culture and society, and this is the exact sentiment of how scientists and researchers should strive to develop technology to benefit humankind "It is the business of the future to be dangerous, and it is under the merits of science that it equips the future for its duties" (Whitehead, 2011)

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From Imitating Nature to Transforming Nature: A New Typology of Biodesign

Haorui Tian[1], Li Zhang[2], Meng Zhang[3]

School of Art & Design, Guangdong University of Technology, Guangdong, China

[1] 1470459165@qq.com

[2] lizhang116@gdut.edu.cn

[3] 1340630804@qq.com

Correspondence should be addressed to Li Zhang; lizhang116@gdut.edu.cn

Abstract

By leveraging breakthrough innovations in contemporary biotechnology, biodesign—which echoes the symbiotic thinking of the 'Chthulucene'—has become one of the most popular strategies for change in light in light of the increasingly severe ecological crisis and globalization is facing challenges. Due to the diversity of human–nature relationships and the complexity of biological materials, basic research on biodesign remains scarce. In this paper, through analysis of case studies on the fields, types, and characteristics of biodesign combined with new biodesign practices and compared with traditional classification methods, a new typology of biodesign is proposed, comprised of the classifications biohacking, biomatrix manufacturing, biological hybrid interaction, and bioethical speculative, which provides differentiated positioning theories for subsequent biodesign practices and helps designers establish clearer and more accurate design practice strategies.

Keywords

Biodesign; biomaterial; sustainability; typology

Introduction

With the flourishing of emerging technologies represented by Nanotechnology, Biotechnology, Information Technology, and Cognitive Science (NBIC) convergence and their deep penetration into everyday life, the boundaries between design that focuses on human–technology interaction and other disciplines are gradually blurring. Moreover, new disciplinary characteristics, such as identifiable de-disciplinarity, inter-disciplinarity, and non-disciplinarity characteristics, have emerged (Bremner and Rodgers 2013). These provide fertile ground for developing design practices such as biodesign, speculative design, material design, and biological interaction. In the face of the increasingly severe ecological crisis that has become a global concern, biodesign, which echoes the Chthulucene (Haraway 2015) 'symbiosis' strategies, has become one of the most popular strategies for change. By leveraging breakthrough innovations in contemporary biotechnology, designers have the opportunity to exploit novel biomolecular structures, form new biomaterials, and expand new functions, thereby exploring the research potential of living organisms as design media (Melkozernov and Sorensen 2021).

This study focused on biodesign that emphasizes biomaterial-driven design, types, and characteristics of biodesign. Based on the second generation of biodesign2, a new typology of biodesign is proposed in comparison

to the first generation of biodesign classification1 that provides an epistemological basis and methodological foundation for subsequent biodesign practices.

Definition and Significance of Biodesign

Curator William Myers was the first to define biodesign, proposing that "biodesign uses living organisms or ecosystems as an essential part of the design to enhance the functionality of the design finished work" (Myers 2012). This is the first definition describing what constitutes biodesign in terms of 'living objects' (ecosystems) and 'bodies' (organisms). Notably, the year after the book was published, Carole Collet, a contemporary British biodesign scholar at the University of the Arts London, organized an exhibition with a biodesign theme called 'Alive' (Collet 2013) and proposed five new roles for designers and the relationships between these roles and nature. This became a key resource for subsequent biodesign research. As a quintessential representative of interdisciplinary cultural practice, biodesign integrates disciplinary knowledge in the fields of design, ecology, synthetic biology, computer technology, and digital and biomanufacturing technologies, among others. With support from technology, biokinetic energy, and design narratives to provide forward-looking solutions for the constantly accelerating deterioration of the human living environment. Biomaterial is a core component of the field of biodesign; however, due to the complexity of the biological species involved and the diversity of the human and biological/natural relationship, helping designers quickly and effectively understand and categorize the many types of biodesign is a fundamental task for the discipline area.

Updates in the Classification of Biodesign

Creative practices in the rapidly growing field of biodesign involve constantly exploring new means of 'sustainability' and the development of new biomaterials. As mentioned earlier, based on the five levels of relationships between designers and nature (i.e., imitation, collaboration, programming, combination, and imagination), Collet (2013) classified biodesign innovation projects into five categories: nature as an object of imitation, nature as a partner, programming nature, nature mixed with non-living and living technologies, and the conceptualization and imagination of nature. The 2013 classification considers the new hierarchical structure of biodesign, producing a creative map that dares to imagine new relationships between nature and biology and providing an innovative knowledge model for subsequent biodesign practices. Building on Collet's classification of biodesign, Camere and Karana (2017) placed biodesign under the theme of nature as a co-worker, combining the practice methods used with different objectives in classification, and according to the way from basic

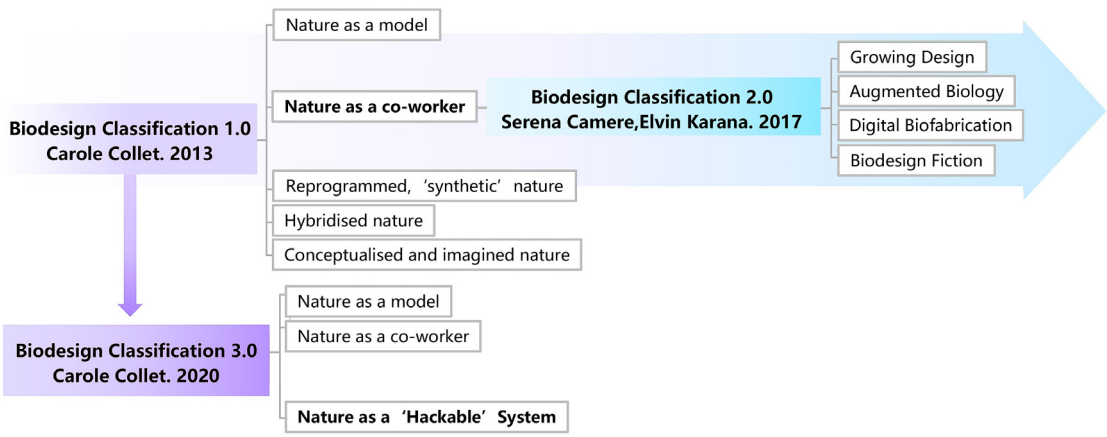

Figure 1. The classification and development of biodesign.

research to applied research. They proposed four types of biodesign: augmented biology, biodesign fiction, digital biofabrication, and growing design. Thus, their study provides a reference standard for the classification of biomaterials for their application in biodesign. The field of biodesign continued to bloom. By studying and using the strategies and tools of living systems for design, Collet (2021) revised the biodesign categories into three by building on the five categories he had developed in 2013, producing the categories of nature as an object of imitation, nature as a partner, and nature as 'hackable' systems (Figure 1). The new categorization framework was more conducive to integration with the use of future biomaterials in practice and established two understandings of critical importance: designers should be alert to ethical issues in biodesign, and biodesign has the potential to promote sustainable practice (Collet 2021).

However, given the update and iteration of the above-mentioned biodesign classification in technological development, as well as the gradual growth of the biomaterial application field, current designers lack relevant knowledge of materials and application methods in the practice of biodesign. To better help designers deepen their understanding of the application methods and types of biodesign practice, this study analyzed existing biodesign practice cases to optimize the existing biodesign classification and propose a new typological structure that provides theoretical guidance for the practice of biodesign.

Biodesign Project

Serial Number	Project Information	Project picture	Introduction	Serial Number	Project Information	Project picture	Introduction
1	***Florence*** (Helene Steiner et al. 2016)		Using an open-source board that receives bioelectrical signals to connect to the plant's electrodes, the plant's electrical response signals are measured and collected, creating an interface for human–plant interactions and conveying the plant's natural language.	9	***BioLogic*** (Lining Yao et al. 2015)		Using a bioprinting system to assemble nano cells into a synthetic bio-skin, the bacteria inside the bio-skin respond to the changes in sweat and body temperature produced by the body, and the flaps around the bio-skin open to help the body quickly reduce its temperature.
2	***Living Color Lab*** (Local Projects 2016)		Museum visitors are informed about the microscopic changes in modern science by coding the colour genes of bacteria and placing them in petri dishes. Computer vision presents the colour changes in the bacteria after the colony has completed its culture.	10	***Voice2Gene*** (Pat PataranUtaporn et al. 2017)		The Voice2Gene interactive device genetically engineers Escherichia coli to change the colour of the bacteria by receiving voice commands from the user in an attempt to explore non-traditional human–computer interaction and the link between language and biology.
3	***Zoa™*** (Modern Meadow 2017)		DNA is modified and placed in yeast cells to produce synthetic collagen through the fermentation process of yeast cells, which are processed into a new type of liquid leather to replace traditional animal leather.	11	***Nanomag-netic Plants*** (C-Laura Cinti C-LAB 2011)		When plant roots absorb nanoparticles, an invisible interactive interface is created. One can use external magnets to control the movement of the plant, helping to perceive the boundaries of the plant's behaviour and rethink the relationship between man and plant.
4	***Biolace*** (Carole 2012)		A project that uses biosynthesis to transform plants into functional plants to produce the living materials needed to meet the needs of future populations demonstrates the future potential of synthetic biotechnology and questions the pros and cons of this genetically modified technology.	12	***Aguahoja*** (Neri Oxman et al. 2014 - 2020)		Synthetic biomaterials are 3D printed and genetically programmed with digital computing to control the colour and pattern of the materials' surfaces and to control their natural decay, replacing traditional plastic materials.
5	***Silk Poems*** (Jen Bervin 2016)		The project inspires people to imagine the relationship between biology and cultural compatibility by printing a poem in a biosensor on silk through nanotechnology and by implanting it into the human bloodstream and human coexistence.	13	***HORTUS. PARIS: The Machinic Harvest*** (Ecologic Studio 2013)		Visitors control the air system of a photobioreactor to adjust the nutrients in the container to nourish the growth of algae as well as access information on the growth of algae in the bioreactor container using their smartphones. The project aims to question landscape planning and the suitability of areas such as the countryside after renovation and to enhance the materiality of the visitor experience as an urban gardener.
6	***TOTEMS*** (Neri Oxman et al. 2019)		Using a digital computing approach to control biosynthetic melanin, the sun's rays affect the changes in melanin in products, thus exploring the effect of climate change on ecosystems and inspiring designers to increase their sense of responsibility for biodiversity.	14	***Otaared*** (Neri Oxman et al. 2014)		Designed to control the growth of synthetic microbial materials in wearable devices through 3D printing and digital computing techniques, the Wonderers range of wearable devices offers interstellar explorers the feasibility of exploring other planets while investigating the symbiotic and complementary relationship between human technology and nature.
7	***Tree Column*** (Jennifer Hahn 2022)		Living mycelium materials are 3D-printed into strong and durable building structural elements through additive manufacturing technology and algorithmic design.	15	***Silk Pavilion*** (Neri Oxman et al. 2013)		Using a combination of computerised weaving techniques and bio-spinning, the project artificially alters environmental conditions to guide silkworms in their rotational movements to create 3D silk products. It also stimulates thinking about the possibility of using more humane methods to produce silk products and of collaborating with other organisms to create new materials.
8	***Flavorium*** (Eduard Georges Groutars et al. 2022)		The Flavorium bio-digital device is a computer programme used to create a comfortable habitat for Flavobacterium and uses the colour changes produced by the growth of Flavobacterium as a responsive material for the user interaction interface.				

Figure 2. Practical cases of biodesign, the pictures of the cases are from the Internet.

First, the collection of biodesign cases on Dezeen and Designboom design magazine website, the study sample was reduced to 15 biodesign practice cases by establishing four screening inclusionary criteria based on interaction mode, manufacturing technology, organism function, and design goal (Figure 2). Next, after collecting and summarizing the explanatory texts of the design cases, the word segmentation function of an online Word Cloud software was used to remove words with a frequency in the explanatory texts lower than 5, producing 32 high-frequency keywords related to biodesign features as classification references; frequency analysis was

performed on it (Figure 3). To provide the main data support for the biodesign classification proposed later in this paper, the size of the origin area of the keyword in the figure was used to represent the frequency.

Keywords	Frequency
Bio	62
Biomaterials	41
Plants	40
Growth	24
Bacillus	21
Aesthetics	14
Mycelium	14
Bacteria	13
System	12
Organism	10
Digital	10
Interface	9
Genes	9
Engineering	9
Synthetic	8
Space	8
Data	7
Information	7
Living organism	6
Mechanical	6
Lab	6
Signal	6
Language	6
Ethics	6
Imagine	5
Algorithm	5
Experience	5
Computers	5
Sensors	5
Speculative	5

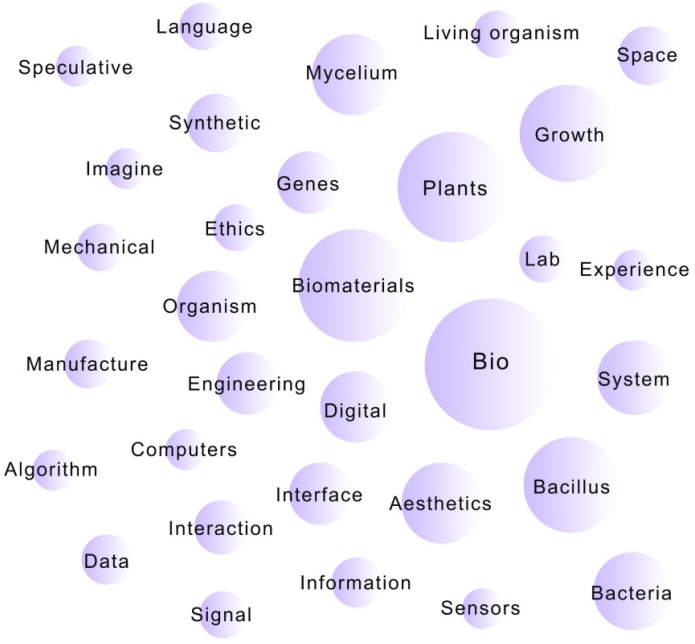

Figure 3. Frequency analysis of biodesign keywords, drawn by the author.

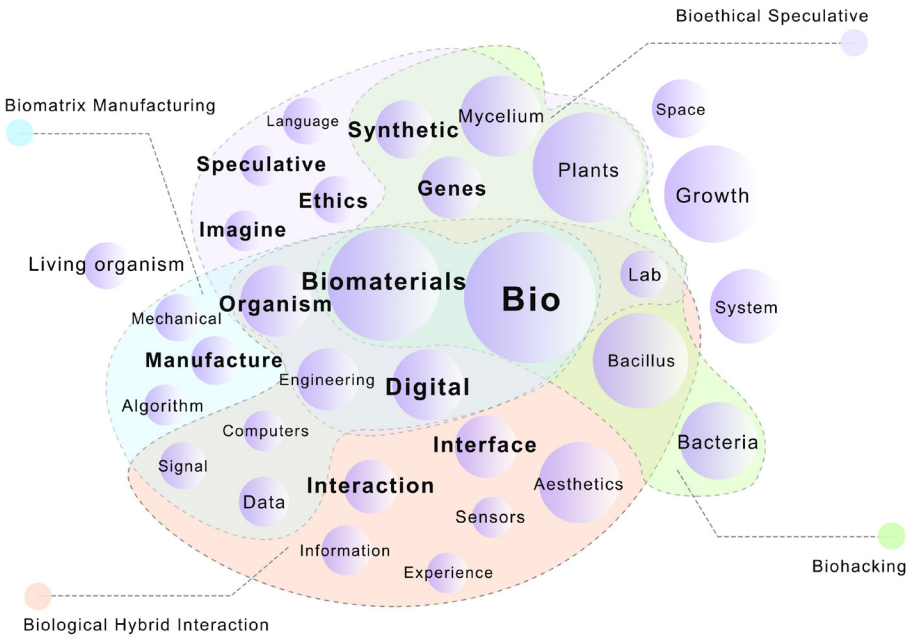

Figure 4. Keyword feature clustering for biodesign, drawn by the author.

Based on the keyword frequency analysis of the above fifteen bio-design cases, this paper clusters 32 high-frequency keywords related to bio-design features, and it can be learned that, in terms of interaction mode,

organisms act as sensors and interaction interfaces, transmitting digital signals through information units in response to changes in the user's behavior; in terms of design goals, it expanding from exploring the functional properties of organisms to reflecting on the ethical issues of biodesign In terms of production and manufacturing, there is a gradual shift from traditional mechanized production to the use of technologies such as additive manufacturing and digital computing to operate on the atomic structure of biomaterials; and in terms of design function, the genes of organisms are recorded in laboratories with the help of synthetic biotechnology as a means of generating new biomaterials and functions. Therefore, this paper proposes four new classifications of biodesign based on the four dimensions of interaction mode, design goals, manufacturing, and design functions, and then conducts a visual analysis of the keywords corresponding to these four different types and their characteristics (Figure 4), and finally get the 12 keywords of "biology, biomaterial, organism, synthesis, gene, manufacture, digital, interaction, interface, ethics, speculative, imagine" as the representative of each cluster features Key words. It is worth noting that some of the keywords in these four new categories overlap with each other, which reflects the practice features nature of biodesign as a multidisciplinary crossroads. While promoting the integration of design, organisms, and technology, Ethical issues related to biotechnology are also presented.

In summary, this paper proposes a new classification of biodesign based on the third category of biodesign proposed by Collet (2020)—nature as a 'hackable' system—and combines it with the second generation of biodesign practice classification method proposed by Camere and Karana (2017). According to the differences and characteristics of biomaterial processing methods, biodesign is divided into four categories in the order of reality to future (ease of implementation) (Figure 5): biohacking, biomatrix manufacturing, biological hybrid interaction and bioethical speculative, the details of which are described below.

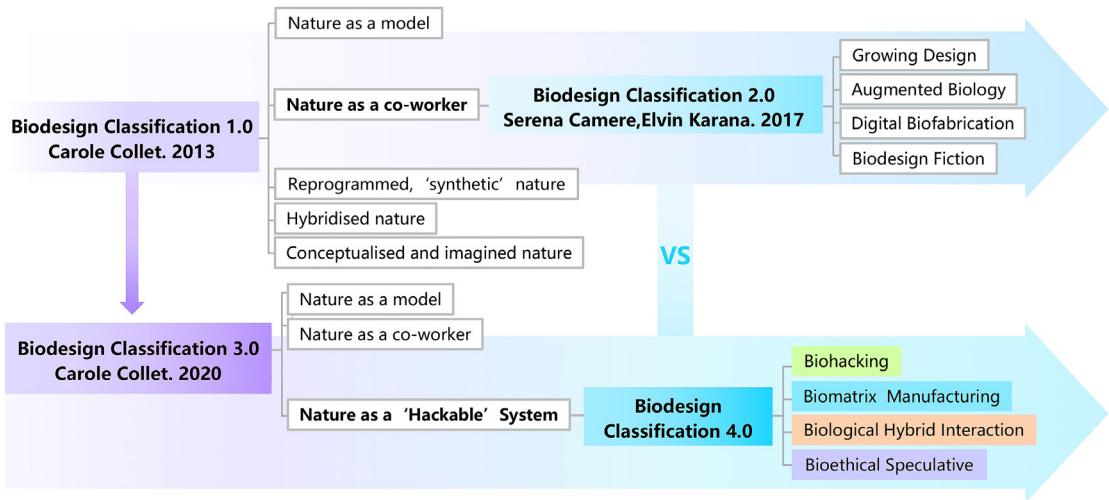

Figure 5. New classification of biodesign, drawn by the author.

The concept of 'Biohacking' means that designers use biosynthesis technology to synthesize new DNA information in laboratory test tubes, and carry out hacker-like creative programming on organisms, to change the cell structure to create new biomaterials and development of new functional modules. For example, the Modern Meadow company genetically modifies yeast DNA to produce synthetic collagen, which is processed into new liquid leather for making clothing fabrics, thus reducing the consumption of animal leather in the clothing industry (Modern Meadow 2017); 'Biomatrix manufacturing' is a concept derived from Neri Oxman's

Material Ecology in 2015, which refers to the design and manufacture of new biological products by designers who make full use of digital computing and biomanufacturing techniques in a matrix system (Oxman et al. 2015). For example, the Tree Column project uses bio-3D-printed living mycelium material that forms a building load-bearing element with natural insulation and fire retardant properties (Hahn 2022), effectively reducing the contamination of concrete processes that occurs in the traditional construction industry; 'Biological hybrid interaction' is a new research direction at the intersection of materials science, computer science, and biodesign. Researchers have found that living organisms in nature play a role in systemic behavioral interactions and information transfer in the system and that microbial materials, such as mycelium and algae, can perform the sensing function of the sensor, sensing and responding to changes in the outside world (Gough et al. 2021). In terms of interaction methods, biomaterials differ from traditional passive machine interaction. As living substances, when information interaction occurs with users, they can not only respond to the users' behavior but also actively send and process biological information to the user. From a passive reception to an active response, the involvement of living organisms continues to expand the field of application of human–computer interaction (HCI) and drive the emergence of a new subfield of bio–human–computer interaction (Bio-HCI). For example, in the Florence project, the designers used electrodes attached to a plant and an open-source board to receive bioelectrical signals to create an interface between plants and the HCI, conveying the 'natural language' of plants in a way that humans can understand. The natural and digital worlds coexist harmoniously through enhanced communication (Steiner 2016); 'Bioethical speculative' is an emerging genre of biodesign typology that is generating debate and exploring the control of life. This concept first appeared in Collet's study (2021). Bioethical speculative refers to the linking of design, art, and biotechnology using biomaterials as a prop medium to construct fictional scenarios of application to stimulate public participation, dialogue, and reflection on the potential ethical issues of biotechnology (Gough et al. 2021) and to help humanity re-examine the ethics of this control over nature and its social implications (Collet 2021) to improve the increasingly severe confrontational relationship between humans and nature. For example, Collet's Biolace Project which reforms plants into performance factories through biosynthesis technology to produce the living materials needed by future populations, demonstrates the future potential of synthetic biotechnology and questions the pros and cons of genetic modification technology (Collet 2012).

Conclusion

Creative Based on the disciplinary background of the rapid development of today's cutting-edge biotechnology and material innovation technology and through knowledge of archaeology and typology research in the literature and biodesign cases, relocate and think about the role of designers in the practice of biodesign from the perspective of "crackable biological systems", and the traditional classification of biodesign has been completed and upgraded, and a new biodesign typology has been proposed. That is, Biohacking; Biomatrix Manufacturing; Biological Hybrid Interaction; Bioethical Speculative. Along with a new definition and interpretation of the four biodesign classifications, this paper also presents a preliminary picture of the interrelationships between the four biodesign practices. Designers will be able to quickly locate project types and identify project goals, and clarify the relationship between biomaterials and design, to select appropriate practice methods and more targeted case references.

Acknowledgments

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Footnotes

[1]Building on the five relationships between designers and nature proposed in 2013, biodesign scholar Carole Collet adds a critical stance to examining the ethics of biodesign and the potential of biodesign to develop sustainably. In 2021, she proposed three new relationships between designers and nature. The designer uses bionic principles to learn from nature (nature as a model), cooperate with natural organisms (nature as a co-worker) and use synthetic biotechnology to modulate the genetic architecture of organisms to produce new substances (nature as a 'hackable' system).

[2]Serena Camere and Karana place the four categories of biodesign practice under the second category of Collet's five relationships between designer and nature—nature as a collaborator in the biomaterial design process. The four categories are growing design, augmented biology, digital biofabrication and biodesign fiction.

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Loc-globalisation Design: A New Approach to Systematically Reconciling Globalisation and Local Visions

Haipeng Tian[1], Lijun Chen[2], Yijin Huo[3], Vladimír Kočí[4], David Tichý[5]

[1] China Central Academy of Fine Arts
tianhaipeng@cafa.edu.cn; yijin.huo@network.rca.ac.uk
[2] Czech Technical University in Prague
chenliju@fa.cvut.cz; david.tichy@fa.cvut.cz
[3] University of Chemistry and Technology Prague
vlad.koci@vscht.cz

Abstract

The growth of globalisation has brought about dramatic changes in the lives of people around the world. It has led to economic growth, poverty reduction, and overall development in a number of countries, and has made it possible to formulate policies that take into account the interests of the wider global population. At the same time, however, globalisation has also increased global inequality, cultural homogenisation, loss of identity, increased consumption of non-renewable energy sources, increased greenhouse gas emissions, deforestation, and other negative impacts that have led to a more cautious attitude towards globalisation in recent years. In 2007, China's concept of "Ecological Civilisation" provided a clearer direction for sustainable development in various disciplines and fields. When the changes needed to address global climate disruption and social injustice are so widespread, the design discipline is contemplating how to engage more responsibly and systematically with the multiple levels of environmental and social crises in the new civilisation and how to explore design ecologies and interventions based on local natural ecologies, industries, and cultures that are more responsive to the visions of indigenous peoples and people in all regions of the world. Loc-globalisation Design (LGD) is a new field in design research, practice, and education. It is a systematic, holistic design based on the environment, indigenous people, and production lifestyles. This paper provides a comprehensive introduction to LGD, its framework and methodology, and demonstrates the application scenarios of LGD through a relevant case study. It also explores the future development direction of LGD, providing strong support and new ideas to promote the systematic localised development of the design discipline and to enable the design actions and tangible results to be acknowledged and communicated in the world.

Keywords

Loc-globalisation design; system design; ecosystems; globalisation; design approach.

Introduction

From climate emergencies, water scarcity, wars, global pandemics, and countless inequalities, we face a multitude of solution-resistant problems that traditional design processes are inadequate to address (Rittel & Webber, 1973). Globalisation, starting in the early 1990s, has rapidly impacted economies and societies worldwide, stemming from neo-liberal ideas and trade liberalisation (Gozgor et al., 2020). This has led to

both positive changes due to increased interconnectedness and negative impacts such as inequality and environmental degradation. Developed nations often prioritise self-interest, potentially neglecting poorer countries (StudySmarter, n.d.). In the discourse surrounding global development, scholars highlight local differences and cultural patterns within globalisation, giving rise to "glocalisation", which originated as a term used in Japanese business studies in the 1980s. It provides a fresh perspective on ongoing interactions between the global and the local (Cheng & Zeng, 2023). According to American sociologist Roland Robertson (1995), the terms "local" and "global" are not opposites but interrelated, and localisation is an aspect of globalisation. Conversely, globalisation occurs through close association with the various local contexts that emerge in the process. This perspective is prominent in sociology, tourism, and business, but not extensively in design (Cheng, 2017).

In recent years, the development of the design discipline has become increasingly linked to globalisation and local cultures, production relations, and environments. While the positive impact of globalisation on connecting the world and promoting local cultures is undeniable, its side effects of potentially eroding local and regional identities and bringing about homogenisation across places and regions are becoming increasingly evident. An increasing number of design firms are expanding overseas, as expanding markets and industrial bases offer the prospect of commercial growth. "Small worlds" of different cultures are spreading across the globe, bringing with them contemporary design and advanced manufacturing techniques, while simultaneously overshadowing what used to be a distinctly unique style and flair in national design forms (Hirst, 2010). Our current phase of economic, institutional, technological, environmental, and social progress is increasingly calling for a global design that honours the ecology of local environments and indigenous wisdom, and fuses historically and geographically specific forms of design expression into a new "global style". China introduced Ecological Civilisation (EC) in 2007, aiming for harmonious coexistence between humans and nature through long-term, systematic environmental and social reforms (Wang et al., 2014; Zhu, 2016). The design discipline's challenge lies in positively facing global and local issues while aligning with EC's principles, emphasising systematic localised development, addressing environmental and social crises, and making the design achievements better meet the needs of the people in their own countries and in various regions of the world. The design field urgently requires a new approach to address these complex challenges.

In 2021, "Loc-globalisation Design (LGD)" was launched by the Loc-globalisation Research (LGR) Studio of China Central Academy of Fine Arts (CAFA). LGD is an emerging field of design research, practice, and education, which is a systematic and holistic design based on the environment, indigenous people, production, and lifestyle. Through the re-conceptualisation and deconstruction of local ecosystems and the reshaping of local relations of living, production, and life through the lens of design, LGD promotes the systematic localised development of design disciplines, expands and reshapes established paradigms through the use of local environments and wisdom, explores the potential for local design projects to have a global impact, and enables design actions and tangible results to be acknowledged and communicated more broadly around the world. LGD research is one of the practical pathways to explore Chinese-style modernisation from a design perspective.

LGD

In the process of development, human society improves the ability of production and labour by adapting to nature and transforming it, sums up the laws, and seeks a balanced relationship between human beings and the environment in which they live to achieve the purpose of species continuity and cultural inheritance.

Design, as a global activity, affects the lives of almost all human beings on Earth (Hall & Cheng, 2018). In the face of the increasing contradictions and problems brought about by globalisation, the design discipline should systematically rethink its relationship with the local and global, as well as with local ecology. In recent years, the design discipline has developed the fields of global design, local design, systemic design, transition design, and regenerative design. Global design follows a universal creative blueprint that appeals to a wide variety of people by focusing on accessibility rather than targeting a specific market. It creates an inclusive identity based on the analysis of multiple datasets to achieve a global language that everyone can relate to and understand. Local design, on the other hand, is more personalised, and one of its main aims is to emphasise the differences between individuals. This often describes and enables diversity in small details. Local design shapes the characteristics of smaller communities and develops its own design rules (Biancardl, n.d.). Systemic design is a "cross-discipline" that integrates systems thinking and design practice (Sevaldson & Jones, 2019; Systemic Design Association, n.d.). It is a diverse field (Bistagnino & Peruccio, 2014) that focuses not only on the problem to be overcome, but also on the design process of the surrounding environment (natural and man-made) as well as other systems related to the problem (Appropedia, 2022). System design means having the necessary context to make decisions and being able to switch between a holistic understanding of the system and the needs of stakeholders and users (Bouganim, 2020). Transition design, as proposed by Irwin et al. (2015), focus on the premise that societies need to make transitions to more sustainable futures and argues that design plays a key role in these transitions. Transition design is concerned with the need for "cosmopolitan localism" (Manzini, 2009; Sachs, 1999), a way of life that is locally and regionally based, but global in its awareness and exchange of information and technology. Regenerative design, as a method for designing systems or solutions, aims to complement or mimic natural ecosystem processes that return energy from less usable forms to more usable forms (Ikerd, 2021). Regenerative design utilises holistic systems thinking to create resilient and equitable systems that combine the needs of society with the integrity of nature. Each of these design approaches discusses the relationship between design and local and global ecology from different perspectives and attempts to analyse and address current crises in a more systemic way. However, when we try to apply these design approaches locally, which are based on specific social backgrounds and contexts, the existing design approaches are not fully compatible and can address the differences and complexities of specific geographical issues due to the differences in geographic environments, cultural practices, and ways of thinking in different regions. Moreover, there is a lack of sufficient practical experience to test the validity of these theories.

Figure 1. Design-led local perspectives on globalised relationships (By authors).

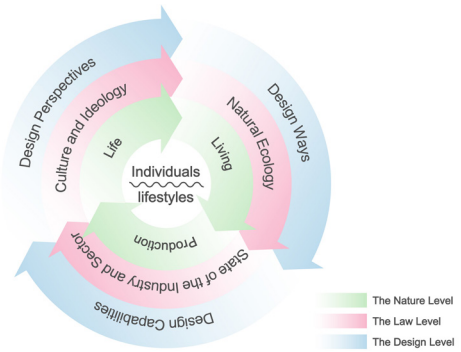

Figure 2. LGD Framework (By authors).

The proposed LGD helps bridge this gap. LGD believes that loc-globalisation and globalisation are symbiotic, with the development of globalisation providing the soil and research basis for LGR, which addresses the problems and results presented in the development of globalisation by combining the local wisdom environment and the nature of things to promote the benign development of globalisation and rectify the local problems arising from homogenisation. LGR is committed to taking the local area as the carrier, dynamically supplementing and perfecting the design methodology through local practice, systematically deconstructing and reconstructing the specific problems and achievements, and, on the basis of fully understanding and respecting the local natural environment, the people's needs for production and life, and the cultural inheritance vein, promoting the systematic localised development of design disciplines with LGD methodology through cross-disciplinary participation and practice; and finding the balance and innovation between local elements and global design contexts, to make design outcomes more in line with the visions of the people in their own countries and regions around the world, promote the inheritance and development of traditional cultures, explore the unique face, methods, and values of local design, and the potential of local design projects to generate global impact, make modern technologies more flexible and adaptable to local development needs, link more LGD paradigms and outcomes, explore new design-led globalisation relationships, and thus participate deeply in EC, see Figure 1.

Framework

The balanced interaction between the local and global can be seen as the realisation of vertical linkages, within which there are other equally important linkages that can be synthetically defined as horizontal linkages. These linkages connect distinct activities; however, if properly designed, they can give rise to symbiotic systems (capable of cooperating and reinforcing each other) and economies of scope (pursuit of efficiency and effectiveness through the symbiotic integration of different activities) (Manzini, 2005). The framework of LGD revolves around local people and their mapped lifestyles and explores the symbiotic relationships within the system from a design perspective at three levels, see Figure 2. Building a design system around local individuals and their lifestyles is a central part of LGD.

The framework is divided into three levels. The first nature level encompasses the Living, Production, and Life environments of local populations. It is only after fully understanding, grasping, and respecting the nature of locality that one can think of suitable methods and paths based on its characteristics. "Living" is a general term for all things that exist in nature to maintain their existence and development, and it is the process by which an individual or a group of people maintains their basic life needs, such as obtaining food, water, and shelter. "Production" is the process by which human beings, through labour and creativity, produce goods and provide services to meet subsistence and social needs. On the other hand, "Life" more broadly encompasses people's living and production activities, including social, cultural, emotional, and value aspects that affect the overall quality and well-being of individuals and society. These three interact with each other, with living requiring production to obtain resources, and production aiming to improve living conditions for a more meaningful and fulfilling life. Their interrelationship is also the deepest design logic of LGR.

The second level of law explores the inherent and inevitable connection between things and the inevitable tendency that determines their development, including Natural Ecology (NE), State of the Industry and Sector (SIS), and Culture and Ideology (CI). Globalisation has prompted modern companies to design out of context and inefficiently produce waste streams that are seriously "ecologically destructive". The nature manual is a timeless source of information, and through its biological and biochemical systems, many problems faced by

humans have been solved (Papanek, 1985). NE refers to natural systems on Earth, where various organisms and environmental elements interact and balance each other. SIS involves the organisation of human economic activities and production methods, including agriculture, industry, and services etc. On the other hand, CI includes various cultural elements such as values, beliefs, customs, and arts of society. These three interact and depend on each other, and together they form an integrated system of society that needs to summarise and make use of the laws and coordinate its development under the premise of sustainable development to achieve the harmonious coexistence of human society and nature.

The third level represents the embodiment of the first two levels at the design level. After grasping the essence and laws, designers should incorporate these understandings into the design process and build their matching ways, capabilities, and perspectives to constitute a complete design system. Design Ways are the systematic methods, strategies and operational steps used in the design process. It covers problem analysis, concept generation, prototyping, implementation, evaluation, and other aspects, and provides designers with systematic guidance to help them transform ideas into concrete design actions. Design Capabilities include creative thinking, professional skills, spatial perception, aesthetic concepts, communication skills, material application, and other qualities, which form the basis for achieving quality design. Design Perspectives are the views and concepts of the purpose, values, and meaning of design. It involves the designer's recognition and mastery of the local society, culture, environment, technology, economy, etc., as well as a systematic understanding and orientation of design interventions, which guides the goals and visions that should be pursued by the designer in applying their abilities and approaches. These three are closely linked and together shape the designer's professionalism and creative style, playing a key role in both systematic design processes and effective design interventions.

These three levels, and the parts within each, are interconnected, influence, and complement each other, drive each other's development, and thus constitute the symbiotic system of LGD. Design involves the development of products, tools, machines, artefacts, and other devices, an activity that has a profound and direct ecological impact. The design response must be positive and unified. Design must be a bridge between human needs, culture, and ecology (Papanek, 1995).

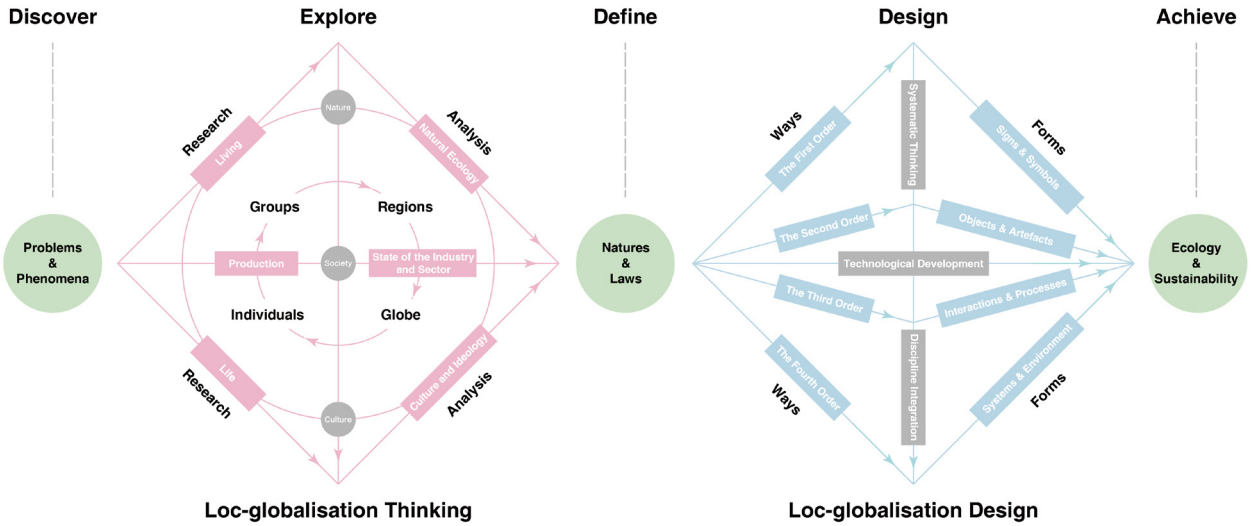

Figure 3. Design Process Model of LGD (By authors).

Methodology

The "Double Diamond", proposed in 2005 (Design Council, 2015), aims to guide designers to identify the right problems and find the right solutions within a disciplined design process. The model is characterised by dividing the design process into two phases, research and practice, and applying a dispersive approach to finding opportunities and then returning to the problem by focusing on each phase. The model effectively outlines the process and characteristics of design research and practice, and has not only been widely used in commercial design and design education but has also been cited and developed by many researchers of emerging design methods. Based on the Double Diamond, LGD proposes a new approach to summarise the design process into two stages: loc-globalisation thinking (research) and loc-globalisation design (practice), see Figure 3.

The first part of the design process involves the identification of problems and phenomena. The "problem" may be initiated by the design requestor, or may be a specific phenomenon observed by the designer at the beginning of the project. The "problem" may not be the "real problem" in the process, but as a start, whether the "problem" is finally solved or can be solved, can be seen as an important reference for the effectiveness of the LGD process.

The second part (Phase I) is the loc-globalisation thinking phase, also known as the research phase. The aim is to explore the "essence" behind problems and phenomena through loc-globalisation thinking and research methods. In this phase, a closed loop of four objects - individuals, groups, regions, and the globe - are located in the centre of the model, all of which are seen as participants or stakeholders in wicked problems. In traditional design, the design object is often a specific person or group of people, while LGD, based on the concept of "the differential mode of association (DMA)" in Chinese sociological research (Fei, 1992), believes that in the context of globalisation, individuals and groups, regions, and the globe form an indivisible community, and that any localised problem may be like ripples in a lake or the effect of butterfly wings that may spread to a far-reaching extent. Conversely, any link in DMA may also lead to specific problems. Therefore, at this stage, LGD takes the human living environment, production, and lifestyle, as well as regional and global NE, SIS, and CI under the scale effect as the research elements (i.e., the "three natures, three laws (TNTL)") and explores the systemic reasons behind wicked problems.

The third part is to build a design pathway based on the problems discovered and the laws and regulations summarised in the research. The "problems" here are the "real problems" discovered through the design research, which may be the conflicting interests in DMA or the unsustainability in TNTL. "Laws and regulations" are also established logically in the study of TNTL, which will become principles or inspirations in design practice.

The fourth part (Phase II) is the design output phase. Owing to the complexity of LGD, all four orders of design described in Buchanan's (2015) Design Evolution Theory can be applied to LGD practices, see Figure 4. The holistic design philosophy espoused by LGD addresses either local or systemic problems in different ways and steps, depending on the complexity of the design problem. In addition, by applying the concept of DMA, LGD is seen to be benign in the sense that it contributes to, or facilitates, the resolution of systemic problems. Thus, both traditional signage and visual communication design, materials and artefacts design, newer interaction and process design, and environmental and systems design will be common forms of LGD.

The fifth part is problem-solving, that is, realising the purpose of the design. It is not only about solving the problems posed at the beginning of the process, but also about finding the essential problems based on the

research process and independent values, and contributing to the formation of a benign and sustainable ecosystem (not limited to the natural ecosystem) through the design methodology. The criteria for judgement are based on the balance and alignment of local and global interests and are relative.

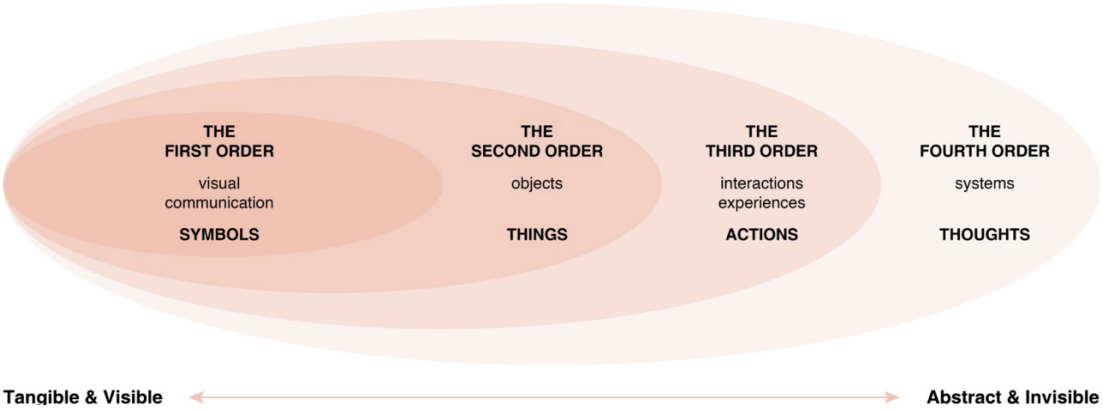

Figure 4. "Four Orders of Design" model (Buchanan, 2015, illustrated by authors).

Case Study

Based on the concept of LGD, CAFA, with the approval of China's Ministry of Culture and Tourism, established a national traditional craft workstation (NTCW) in Daoming Town, Chengdu, Sichuan Province, China in 2018, see Figure 5. The workstation analyses and researches from the perspective of the indigenous people, the dilemmas faced by their traditional way of living, production, and lifestyle in the process of modernisation and development deduce the root contradictions that exist in the region in terms of NE, SIS, and CI, see Figure 6.

Studying from the perspective of living, the indigenous people have historically made use of local natural resources, such as bamboo, lacquer trees and mulberry silkworms, to establish a way of living with regional characteristics, based on which they have continued to protect and transform the NE. However, modern aborigines are affected by the market economy and industrialisation, and an increasing number of young people are leaving the countryside. The long-standing ecological development model of aborigines adapting and transforming the natural environment for the purpose of living has encountered a bottleneck, and the development of the area by foreign populations or organisations has often neglected the long-term connection between the special local way of living and its NE, resulting in the two-way destruction of the way of living of the aborigines and the NE. From a production perspective, indigenous people's historical production activities based on their living needs have given rise to industrial projects such as Daoming bamboo weaving, Huayuan rattan weaving, Shu brocade, Shu embroidery, silver filigree, and lacquer art. These items are the focus of local intangible cultural heritage (ICH) protection, but due to the changes in the lifestyle of the aborigines and the local NE, the above items are gradually losing their basis for development. Reconstructing the links between living and production, NE and SIS are the focus of preserving and inheriting these ICH items and enabling the healthy development of their SIS. From the perspective of life, aborigines have historically led a sedentary and self-sufficient life and have built values and aesthetics of life in this stable lifestyle. However, with the accelerated development of industrialisation, the traditional way of life has been replaced by a new, fast, unstable, and market-oriented way, and the unique way of life of indigenous people and the unique cultural forms of the region have been violently impacted.

Figure 5. NTCW in Chengdu (By authors).

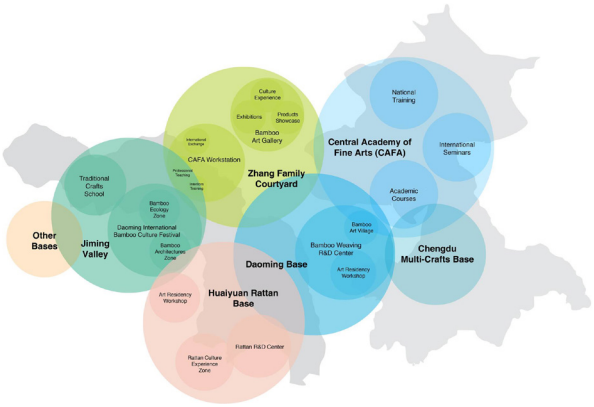

Figure 6. Main Projects of NTCW in Chengdu (By authors).

Based on the above research, the workstation focused on the reconstruction of the TNTL relationship. Based on the living needs of aboriginal people, we enhance the NE and infrastructure of the area through environmental design, systematic design, and architectural design, and explore the advantageous natural resources of the area to attract young aboriginal people to return to their hometown. By sending outstanding experts, teachers, and students to teach and practice in the region and inviting young aborigines to study at CAFA, the project promotes awareness of the aborigines and establishes a local view of globalisation and sustainable development. The reconstructed way of living based on the local NE contributes to a virtuous cycle of ecological and living relationships and gradually develops the area into an ideal place for people to experience the culture and NE of western Sichuan. From a production perspective, the workstation excavates, collates, and researches the techniques of local traditional handicrafts while popularising modern processing methods and innovative concepts among the inheritors of ICH. Through material research and development, technological innovation, product design, fashion design, and branding, the workstation enables ICH items, which have been gradually detached from daily use, to return to the daily lives of locals, promotes industrial upgrading, and is guided by the concepts of loc-globalisation, expanding the radius and influence of the industry through international events, activities, exhibitions, media, and tourism. Global resources will participate in local development, and local wisdom will contribute to global innovation. New modes of production give rise to new lifestyles, and an increasing number of aborigines organically integrate their traditional lifestyles with modern lifestyles, reviving their traditional cultures and forming new regional cultural forms with the participation of new technologies, concepts, and residents.

According to statistics, in 2021, the "bamboo" of Daoming Bamboo Art Village achieved a comprehensive output value of RMB 230 million, with an average annual growth rate of more than 11% compared to 2017. Over the past four years, it has received 622,000 tourists, driven a comprehensive tourism income of RMB 190 million, driven more than 6,000 people in the neighbourhood to seek employment nearby, and increased per capita disposable income from RMB 17,500 in 2017 to RMB 39,800 (Chengdu Daily Jin Guan News, 2022).

Conclusion

This paper explores the complex issues facing the globe and analyses the impact of globalisation on the economy, society, humanity, and environment of various places, triggering the concept of loc-globalisation and emphasising the importance of LGD. LGD has been proposed to fill the gaps in existing design approaches, emphasising the integration of local wisdom with global elements to achieve the EC goal. This paper introduces

the framework of LGD, including the three levels of Nature, Law and Design, and emphasises the importance of the balance of living, production, and life for design. LGD methodology proposes five parts to balance local and global interests and visions. Through a case study of NTCW, the systematic design was used to facilitate the return of indigenous people to their hometown, promote the development of ICH projects, and achieve growth in output value and social impact. This shows that LGD plays an essential role in systematically coordinating the ecological balance, cultural heritage, and technological advancement.

Acknowledgments

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Bodily Games: A Study on Body-Centric Approaches in Digital Jewelry Teaching

Zhilu Cheng

Beijing Institute of Fashion Technology
zhilucheng@qq.com

Abstract

In the contemporary digital era, jewelry design confronts unprecedented challenges and opportunities. The replicability and cost-efficient production of digital jewelry have led to a convergence and homogeneity in design forms available in the market. Many designs remain superficial, susceptible to external influences, lacking in both innovation and depth. Additionally, when applying digital technologies, jewelry designers often lack independent exploration and a systematic methodology. To address these issues, this paper introduces "Bodily Games," an innovative jewelry design teaching approach. Centering on the human body as a guiding thread, this method harnesses imaginative game to cultivate students' creative thinking. It encourages them to proactively delve into technology and establishes a structured digital jewelry design methodology. Through this approach, students can effectively transcend traditional design paradigms, venture into new realms of design, and thereby bring genuine innovation and transformation to the field of digital jewelry design.

Keywords

Body; Jewelry Design; Teaching Approaches; Jewelry Digitization

Introduction

In the new era of digitalization, jewelry design encounters unprecedented challenges, but it also brings about expansive opportunities for growth. It's vital to recognize that due to the ease of replication and cost efficiency of digital jewelry, market designs are becoming increasingly homogenous. This not only constrains the depth and innovation of designs but also renders many designers' passive in utilizing digital technologies, lacking a systematic methodology. To address this challenge, many educational institutions and research bodies have recently shifted their focus to the unique dimension of the human body, aiming to explore new design thoughts and methods by taking the body as a reference point in courses and studies. The body is viewed not just as an educational tool but also as a source of innovative inspiration. Particularly in the field of jewelry design, the study of the body needs to closely align with its essence and characteristics, constructing theories and practical methods across disciplines. This is because the body is the first place that the jewelry touches and is the first sensual gate—to the sights, sounds, smells, tastes, body, and mind. Body is what moves the internal context of the jewelry and what brings it out (Sirinkraporn,2023). Concurrently, with the information overload and sensory challenges brought about by rapid technological advancements, designers should deepen their sensitivity and understanding of bodily aesthetics to better anticipate future design transformations.

Everyone's body is unique, conveying diverse worldviews. The tangibility of our existence passes through a revisitation of the body, understood as a field for a project exploration of both analogical nature, through

the adoption of traditional goldsmith techniques and artisan production, and digital, through the use of new technologies and computerized tools (Scarpitti, 2021). The body isn't merely an object of biological study; it encompasses multiple dimensions including emotions, culture, and society. From a biological perspective, the body pertains to human anatomy and gender differences. The body and the data it represent has become central on issues of wellbeing and selfhood (Lupton, 2014). Seen from a perceptual and cognitive standpoint, it's tightly linked with our emotions and perceptions. Furthermore, the body's expression in culture, social interactions, and the environment holds profound significance. Within the context of art and design, bodily topics have garnered extensive attention, becoming a focal point of multidisciplinary research. Different disciplines interpret the body variably; for instance, art history focuses on the trends of embodiment, while theories on fashion evolution reflect upon the origins and societal implications of embodiment. Contemporary fashion research leans more towards methodologies rooted in the body.

Combining art and craft experimentation with digital technologies has shown great promise in benefitting previously less explored aspects of people's lives and identities. However, unlike the prominence in HCI of avant-garde practitioners in clothing and textiles home appliances and wearables, the more artis- tic exponents of digital jewelry have received less attention.

(Nantia, 2021). This paper endeavors to delve into the unique dimension of the body against the backdrop of digital jewelry design, integrating cross-disciplinary research methods to introduce novel thought processes and strategies to jewelry design education. We encourage students to approach from the perspective of the body, deepening their comprehension of bodily aesthetics to address the challenges of the digital age. This research aims to offer fresh viewpoints and strategies for jewelry design education and aspires to illuminate the field of jewelry design, propelling the industry towards a more innovative and profound direction.

Teaching Framework

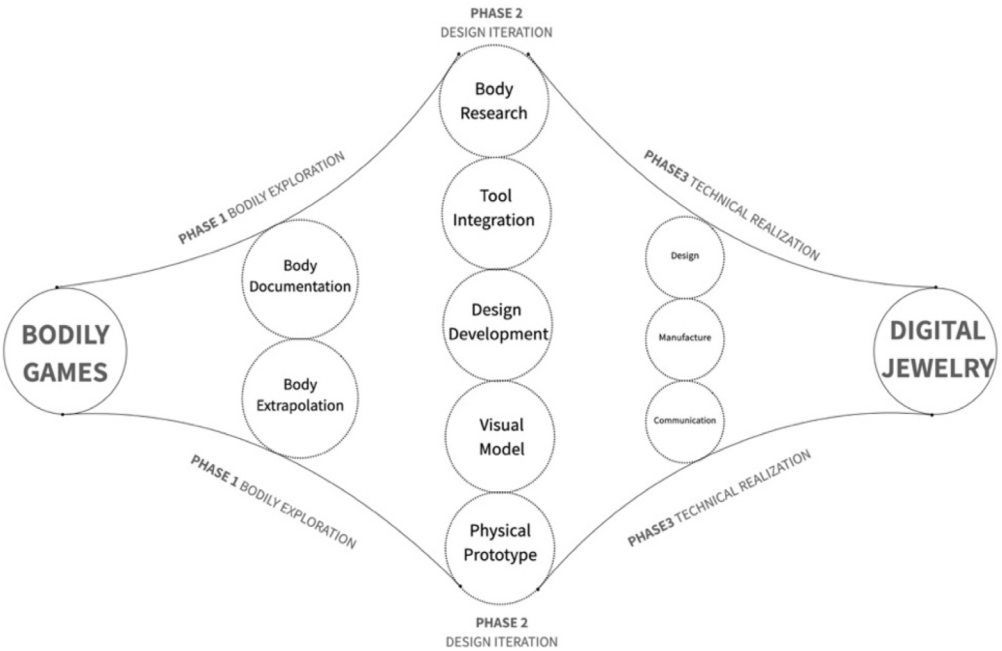

Figure 1. Teaching Framework of Body-Centric Approaches in Digital Jewelry

This paper, considering the characteristics of jewelry design education and the instructional path centered around the body, proposes a teaching framework and trajectory that progresses from "Bodily Exploration - Design Iteration – Technical Realization." The instructional model is partitioned into three phases. The initial phase is labeled "Bodily Exploration", characterized as the divergent exploration stage. Here, through a series of bodily game workshops, students are encouraged to undertake sensory explorations using the body as a guide. The subsequent phase, " Design Iteration ", is the stage of rational thought organization, comprising five steps: "Body Research - Tool Integration - Design Development - Visual Model - Physical Prototype". The concluding phase is titled "Technical Realization", where a cohesive digital technology from the design, manufacturing, and presentation fronts is applied to finalize the design solution and its visual construction. These three stages collectively constitute the fundamental trajectory for digital jewelry design instruction centered around the body.

Phase One: Bodily Exploration

At the inception of the instructional process, a divergent exploration method anchored on the body is employed. In collaboration with interdisciplinary approaches, a series of bodily game workshops are introduced. These workshops encourage students to utilize their bodies as tools for sensory exploration, assisting them in breaking traditional thought paradigms and deepening their understanding of design fundamentals. A focus on bodily integration is crucial as it not only allows us to interact with computers in novel ways, but also might help us in understanding our bodies better, and hence, ultimately ourselves (Mueller, 2017). In the digital age, this return to a body-centric, sensory-focused design methodology will unlock more possibilities for jewelry design.

Figure 2. Images of Body exploration workshops during the teaching process.

Workshop One: Bodily Information Mapping - Documenting the Body

Method: Participants can opt for objects of varying textures and materials to amplify tactile distinctions. To chronicle perceptions, coloured pencils, watercolours, oil pastels, or other painting tools can be used, enabling participants to convey their sensations more genuinely.

Content: Activities are divided into pairs. Person A closes their eyes while Person B instructs A to touch distinct items within the space. This arrangement aims to heighten perception, logging sensations and feelings towards each object. Subsequently, B prompts A to reiterate the previous touches to further reinforce the memory. At the culmination of this segment, every pair presents their sensory records as drawings and arranges them on the floor, crafting a makeshift exhibition.

Workshop Two: Body Card Game - Extrapolating the Body

Method: Use database retrieval tools and cards ingrained with body-related keywords. Paper cards, writing tools, and differently colored markers or stickers are provided to highlight and categorize diverse body-centric terms.

Content: Within this game, attendees delve into and project the multifaceted dimensions and potentialities of

the body. Ranging from basic biological constructs to the influences of emotion and socio-cultural aspects, the keyword cards serve as a medium to thoroughly explore the body's variegated facets. Discussions may arise regarding the body's interaction with technology, culture, and society and its impact on our daily lives. Through collaboration and categorization exercises, participants not only gain a refreshed understanding of the body but also propose novel perspectives and visions for its future evolution. This procedure seeks to foster innovative thinking and the exploration of the body's latent potential and cutting-edge progress.

Phase Two: Design Iteration

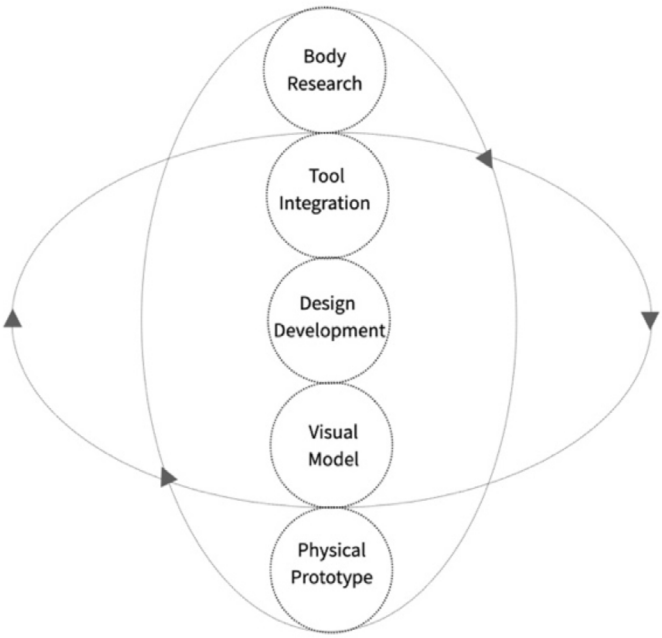

Figure 3. Circular design iteration framework.

The second phase is defined as "Design Iteration", emphasizing deep exploration and rational integration of design concepts. It encompasses five main stages: firstly, "Body Research", delving into the relationship between the body and jewelry to gather design inspirations that resonate with the human form; next is "Tool Integration", where appropriate tools and technologies are selected to offer essential support for the forthcoming design; subsequently, we enter the "Design Development" stage, synthesizing the findings from the initial two stages to form a preliminary design scheme; in the "Visual Model" stage, design proposals are visually rendered, providing clear references for physical production; finally, the production of the "Physical Prototype" is executed, transitioning the design from a conceptual state to a tangible, touchable product, priming it for further refinement and iterations. It's pivotal to note that the entire phase underscores the importance of cyclical iterations. Design schemes are not set in stone but are subject to revisions and refinements at each stage, ensuring that every step inches closer to the ultimate design objective.

Phase Three: Technical Realization

The third phase of this study predominantly zeroes in on the "Technical Realization" segment. Within this segment, design prototypes and concepts undergo deep integration, priming them for amalgamation with real-world scenarios; here, the application of digital technology stands paramount. Broadly, this phase unfolds around

three dimensions: design, production, and communication:
Design Dimension: The focus here is leveraging two-dimensional and three-dimensional digital design tools to further refine and enhance design concepts. Such technologies allow designers to accomplish high-precision modeling, structural simulation, and parametric design, aiming to balance aesthetics, utility, and manufacturability of the design.
Production Dimension: Post design verification, the production phase commences. Harnessing contemporary advanced manufacturing technologies, such as 3D printing, CNC machining, and CNC laser engraving, transitioning designs from the digital realm to physical entities is no longer challenging. These technologies not only ensure the precision and detail replication of the products but also facilitate rapid prototyping and subsequent adjustments.
Communication Dimension: With the completion of design and manufacturing, conveying the creation precisely to the target audience becomes pivotal. Modern technologies, like simulation animations, virtual reality, and augmented reality, offer a new platform for immersive displays. They provide the audience with a genuine and interactive experience, deepening their understanding of the design's significance and value.

Teaching Implementation Case Studies
Case Study 1: Documenting the Body

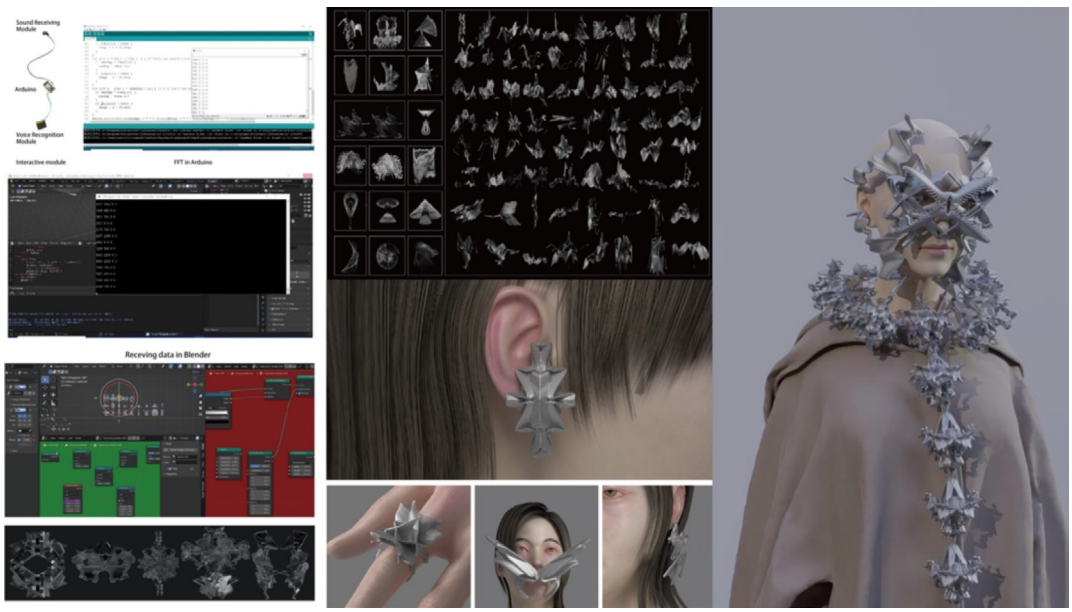

Figure 4. Case 1:The process of body jewelry based on digital technology.

While implementing this teaching framework, we observed impressive outcomes in digital jewelry design. Within the "Body Game" pedagogical structure, at the initial stage of bodily exploration, the designer employed participatory workshop tactics, accumulating voice data from 100 young participants as a foundational database. Subsequently, he used computer algorithms to meticulously analyze decibels, amplitude, frequency, and duration in these voices. This analysis paved the way for constructing data models in relevant 3D modeling software. Leveraging the Fast Fourier Transform algorithm, 3D models of the voice were generated in real- time. Upon the completion of these models, participants were invited for preliminary experiences and feedback, out of which a hundred prototype models were sifted. Based on audience feedback and the designer's artistic intuition,

further refinements were made, ultimately selecting jewelry designs with commercial potential for physical production.

Inspired by the body, this project successfully established an interactive bridge between audiences in the physical world and digital jewelry. Digital technologies, particularly Python programming, open-source algorithms, and data transfer techniques, emerged as potent tools for the designer to innovate in this domain. The project manifested a trajectory from the collection and application of bodily data to the interaction of virtual and tangible design, culminating in the creation of novel artistic and functional forms.

Case Study 2: Extrapolating the Body

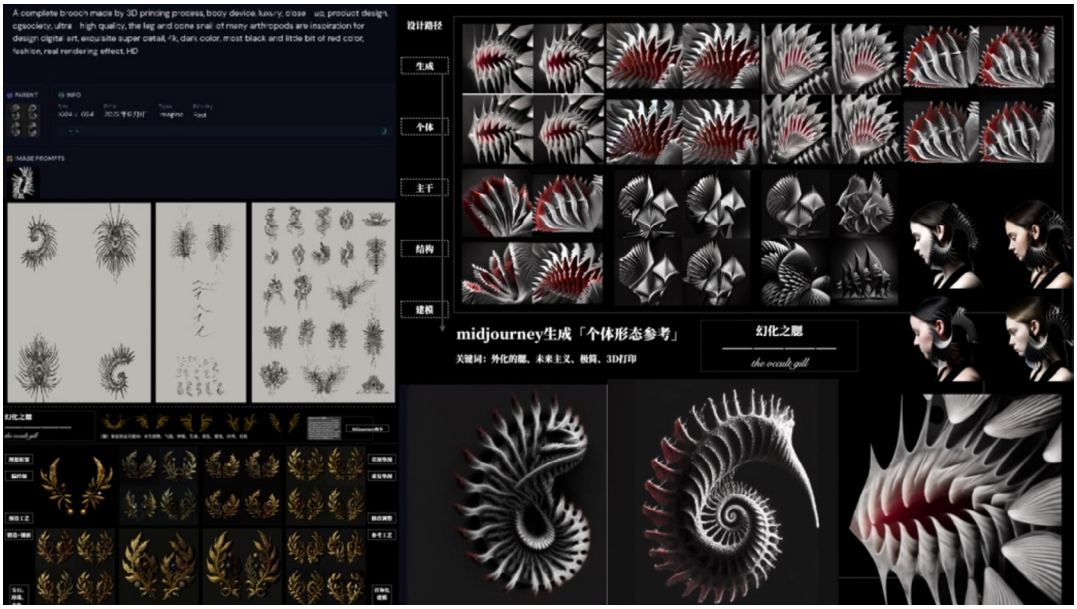

Figure 5. Case 2: the process of body jewelry based on AI image generation technology.

At the onset of the teaching framework, the "Bodily Scenario Game" presented designers with a unique narrative approach. Through narrative cards simulating fictional scenarios and real-time interactions with ChatGPT, this method enriched and refined the worldviews, narrative structures, and object design extrapolations of these scenarios. Such preliminary exploration solidified the foundation for subsequent design processes.

The subsequent design phase, ranging from bodily research to the final physical prototype, revolved around image generation technology, aiming for a collaborative design effort between humans and AI in the realm of bodily jewelry. This innovative approach, by introducing ChatGPT, crafted a bidirectional interaction with designers, intending to unearth fresh creative perspectives from a human-computer interaction standpoint, ultimately converging on the essence of craftsmanship. Throughout this phase, we witnessed the emergence of a series of narrative-driven jewelry designs and delineated the entire creation process from image sketching, instruction finalization, base image creation, to post- production adjustments of images.

Conclusion

In the context of digitalization, the dual challenges faced by jewelry design underscore the pressing need for a

profound exploration of core design values. The intimate relationship between jewelry and the body earmarks the body as a pivotal entry point for design discussions. The "Body Games" proposed in this paper isn't merely an educational strategy but also a research paradigm, accentuating the profound connections between jewelry design, the body, culture, and emotions. Surpassing the conventional perspectives on form and material, this methodology promotes an in-depth reflection on jewelry design, revealing the body's cardinal role in jewelry design. Through this fresh lens, we can holistically probe the future trajectories of jewelry design, offering new cognitive avenues for integrative innovation and diversified evolution in the field of jewelry design.

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An exploration of visual design culture in the context of the "space fever" era

Ding Fuhong

1272473184@qq.com

Abstract

In the 1950s and 1960s, influenced by the Cold War mentality, political groups represented by the Soviet Union and the United States launched a fierce arms race. During this period, space activities such as spacecraft, manned rockets, and human landings on the moon aroused people's yearning for space. Under this background, the consumerist society represented by the United States has produced strong and unique product designs. The wave of design culture formed under the background of "space fever" has profoundly affected the development of modern design. This article conducts an in-depth investigation and analysis of product design under the background of the "space craze" of the 1950s and 1960s through literature research, exploring the impact of the development background of the times on design and people's lives, showing the inseparable relationship between the times and design. Starting from three aspects of clothing, film and television, and automobile design, the relationship between the times and products is explained through the analysis of design cases, which also reflects the profound impact of design under the "space fever" on the development of modern design. At the same time, we also hope to arouse reflection among designers and consumers, and hope to find a balance between design and sustainable development through the joint efforts of designers and consumers.

Keywords

Space fever; consumerism; product design; visual culture design; automobile design

"Space fever" in the context of the Cold War

After World War II, the Cold War era came. Under the fierce competition between the two giants, the Soviet Union and the United States, the aviation and arms race intensified. From the launch of the first artificial satellite by the Soviet Union in 1957 to the establishment of the human space station in the 1980s, these 30 years Humanity

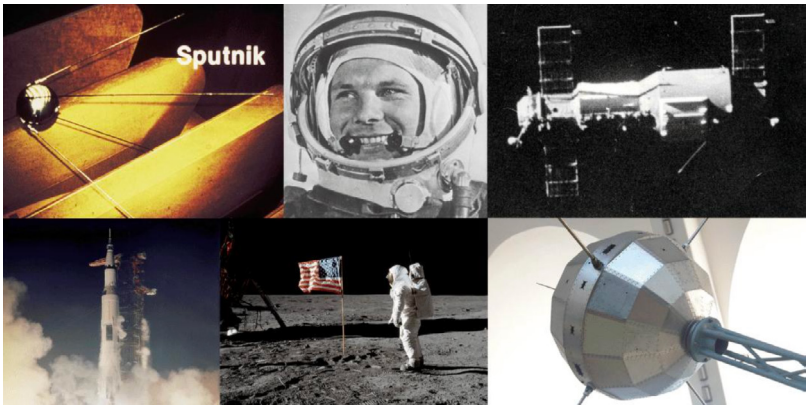

Figure 1. Soviet astronaut Gagarin and the American Apollo 11 successfully landed on the moon

has experienced many very important explorations, including Gagarin, the first astronaut to enter space, and the successful Apollo 11 moon landing,as shown in Figure 1.

In the 1950s and 1960s, under the influence of the space wave, people had unlimited reveries about space. This undoubtedly accelerated the change of people's aesthetics. During this period, stimulated by people's consumer demand, various fields began to explore and imagine the future life of human beings in space, and many classic works emerged.

Fashion design and film and television design under "space fever"

In 1964, Pierre Cardin had already begun to show his fantasy of cosmic clothing,as shown in Figure 2. He added plastic goggles to his helmet to imitate an astronaut's helmet. Geometric tailoring, metallic colors, leather shorts and plastic transparent dresses all added to his designs. The avant-garde feel of clothing. In 1969, the successful moon landing brought about the "Moon Landing Frenzy". Pierre Cardin was invited by NASA to visit the base and became the first designer in the world to try on Armstrong's famous space suit. Influenced by this experience, he later also designed NASA designed space suits.

Figure 2 shows the representative work of Andre Coureger, known as the "master of futurism". He abandoned traditional elegant female designs and used thick fabrics. In 1964, he launched the first set of space fashion, wearing The spacesuit model was like an alien, causing quite a sensation in the French fashion circle at the time.

Figure 2. Cosmic clothing designed by Pierre Cardin

Audrey Hepburn's classic "Moonlight Girl" image in the movie "The Little Mermaid" is still influencing the fashion industry. The cloche hat and sunglasses in the film were made by Andre Coureger. In 1965, Andre Coulage released the "Moon Girl Look", a silver-white ultra-short striped leotard and PVC Go-Go boots, which combined sports practicality and futuristic fantasy,as shown in Figure 3.

It can be seen that the space wave at that time had a profound impact on the clothing design industry. Designers were keen to discover new materials that conformed to the science fiction style of the space age to express people's daydreams about the future and the universe at that time. Since the space age, new materials such as PVC, highly reflective, and plastic have been widely used in the clothing industry.

The "space craze" of the 1960s also spread its influence to the film and television industry. Kubrick, the master of science fiction films, created the masterpiece "2001: A Space Odyssey" from 1963 to 1966. This film is the

most landmark classic in the history of science fiction films. The extremely realistic space scenes displayed and the philosophical issues conveyed in the movie aroused profound thinking. He used a large amount of classical background music to perfectly express the profound characteristics of space. The scene design, spaceships, space stations and other designs in the movie set a precedent for modern science fiction movies. Before this, American Hollywood had never involved such in-depth and highly realistic scene settings. "2001: A Space Odyssey" is undoubtedly the first science fiction movie. A good foundation has been laid for the development of the film. The spaceship in "Interstellar" released in 2014 can be seen as a tribute to "2001: A Space Odyssey". This also reflects that the film industry under the "space fever" is also profoundly affecting the development of the modern film industry,as shown in Figure 4.

Figure 3. Audrey Hepburn in "Moonlight" and "Moon Girl Look" sunglasses

Figure 4. "2001: A Space Odyssey" and "Interstellar"

Car design under "space fever"

After the end of World War II, automobile design quickly entered the stage of consumer production. Under the fierce market competition system, because General Motors in the United States took the lead in exploring automobile styling design, Henry Ford became the world's first automobile designer. And the "planned waste paper system" he proposed is still used by major car companies today. After the United States entered the "space craze" in the 1950s and 1960s, in order to meet the needs of the social consumer market at that time, it designed and produced a large number of "space-style" cars with unique styling characteristics, which were deeply loved by the mass consumers at that time. It has become a classic of automobile design to this day.

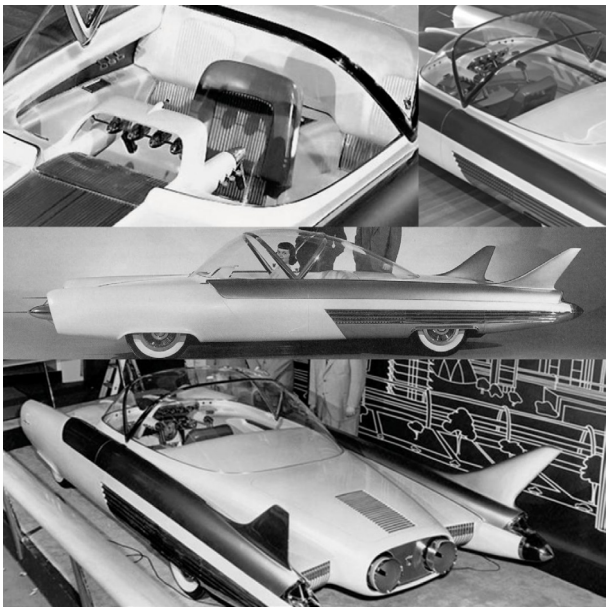

Figure 5. Ford FX Atom

The design of Ford FX Atom is like a spaceship, and the concept of interior design is very advanced,as shown in Figure 5. It has a hollow IP, a handle-type steering lever, an unprecedented layout design in which the driver's seat is in the middle and passengers are surrounded on both sides, and the minimalist partial design The empty U-shaped seat design, the fully transparent cabin, and the very voluminous doors are all so unreal, as if everything was predicted at the time, like a work created by a contemporary designer who traveled back in time. Among the many space-themed cars, the Cadillac ElDorado is undoubtedly the most representative car,s shown in Figure 6. This is a car designed with the concept of rockets and spaceships. Its exaggerated rear shape shows a high degree of resemblance to a space rocket, and the entire body is slender and very full and round. For car design at that time and even now, this shape is a very bold breakthrough. While combining space rockets with cars, hot red is also used as the theme color of the entire car body, which is very consistent with the design characteristics of the entire car.

Figure 6. Cadillac ElDorado

Fiat 600 is a multi-functional car, very suitable for family use or a group of close friends going outdoors,as shown in Figure 6. The rear space is extremely practical and forward-looking. Its space utilization is very extreme. The rear seat is a large U-shaped seat. Chair, its streamlined and soft seat features are very close to the characteristics of the space capsule at that time. Many current autonomous driving concepts and student works are quite similar to his. The picture on the right is an electric concept car released by the American new energy company Canoo in 2019. It can be seen that there are similarities in both the general layout and interior design. The place. It can be said that the interior design of cars at that time profoundly affected the development of modern car design, especially in the context of the rapid development of new energy vehicles. The near-space theme shape is undoubtedly the most representative and forward-looking design. Major new energy vehicles The brand also hopes to use such a unique design to show the characteristics of the brand.

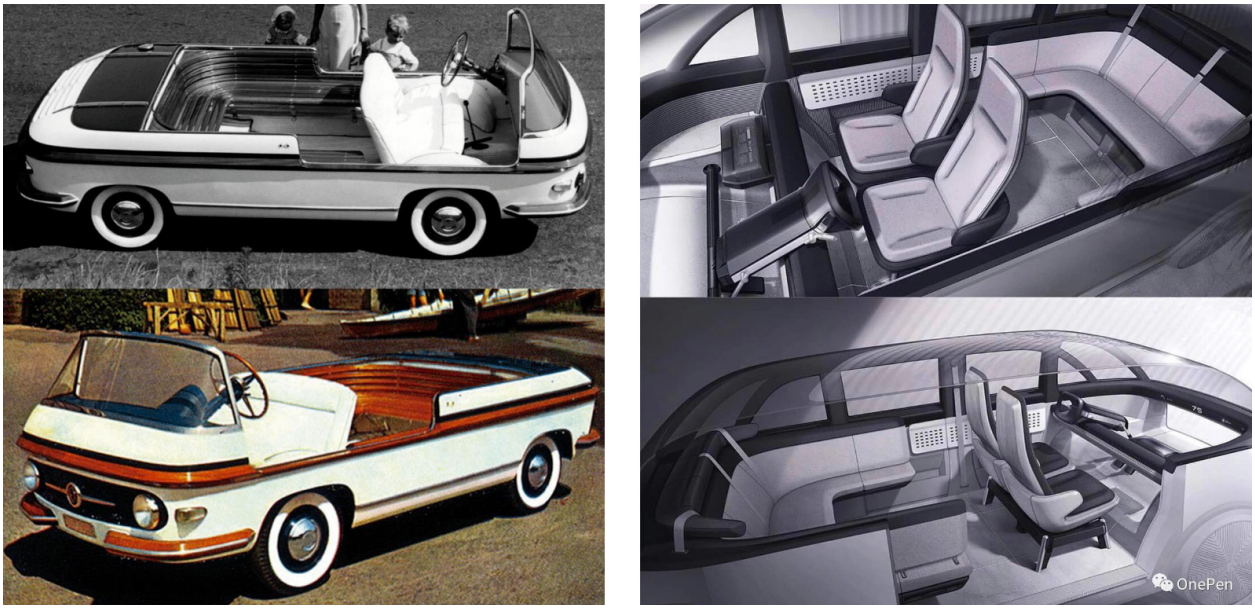

Figure 7. Fiat 600 vs. Canoo

"This is the best of times and the worst of times"
While admiring the bold car designs of the space age, we need to reflect on whether, in a commodity society, designs with unique styles are also reasonable? Is this exaggerated design for product sales a "redundant" design? After the end of World War II, under the influence of the competition mechanism of consumerist society, the United States brought cars into the palace of art and design. With the proposal of Harry Earl's "planned abolition", more and more models with unique appearance have been launched to stimulate people's consumption demand.

While people appreciate and enjoy the pleasure brought by consumption, the waste of the world's energy resources has also increased. Gradually intensify. The cars with various unique shapes produced under the "space fever" are the most representative products of the "planned abolition". The unique shapes of the cars under the "space fever" not only highlight the majesty of the aviation age, but also There is a hidden global energy crisis, and this time bomb finally broke out in the "oil crisis" of the 1970s. Under this crisis, people finally realized deeply that the unrestrained commodity consumption society has had a negative impact on global energy resources. serious harm. This awareness of energy crisis not only affects the industrial production system, but

also profoundly affects the field of industrial design. Therefore, people began to constantly reflect on whether the exaggerated designs that appeared during the "space fever" period were really necessary? In addition to meeting consumer needs, are there other factors that designers should consider during the design process?

Obviously, after the oil crisis, the exaggerated car designs under the "space fever" disappeared, and were replaced by more practical and compact models that gradually occupied the main market. The outbreak of the "oil crisis" greatly increased the public's awareness of energy and fuel conservation. , family passenger cars have gradually changed the previous overly decorated and overly simple designs, making car design gradually enter the track of mature development.

Conclusion

Now looking back at the designs under the "space craze", we have found many precious designs. Due to changes in the international environment, many designs have become exclusive to that era and we, as future generations, cannot copy them. From the perspective of global energy development, the "space boom" is undoubtedly a bad era. In that era, a large amount of energy was consumed, and the uncontrolled consumption of global resources undoubtedly reflected the shortcomings of the free economy of capitalist society. But from a design point of view, the "space fever" is undoubtedly the best era. It was a period of high creativity and inspiration.
Many classic designs were born that designers today are imitating. In contrast, , Today's large number of cars are seriously homogenized, and they are gradually losing the unique characteristics of car brands. This situation also makes us reflect on whether meeting consumer needs is the only answer for designers. Perhaps how to achieve a perfect balance between multiple needs is the key to good design.

After entering the 21st century, environmental problems have become increasingly serious. The consumer market not only pays attention to the design itself, but also pays more attention to the deep impact behind the design. In this context, as a designer, you should not just focus on new technologies. When discovering and exploring materials and new shapes, we should pay more attention to the sustainability behind the product and the rationality of the design. While ensuring that the ecological impact of the design is minimized, we should try our best to organically combine the form of the product with the ecological impact. , finding the perfect balance between the two, this is the good design that today's society needs.

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Building a new framework for service qualia evaluation: a user experience perspective

Li Wanqiang[1], Zhao Jiaqi[2], Hu Fei[3]

[1] College of Design and Innovation, Tongji University
lwq2023@tongji.edu.cn
[2] College of Design and Innovation, Tongji University
2231966@tongji.edu.cn
[3] College of Design and Innovation, Tongji University
hufei@ tongji.edu.cn

Abstract

In the era of service economy, how to effectively improve service qualia has become an important research issue, while user experience is a key factor reflecting service qualia. Existing research on service qualia evaluation mainly focuses on quality evaluation models under the field of service management and lacks an experiential reflection and evaluation framework from the perspective of service design. Through literature review, this paper explores the relationship between user experience and service qualia, and constructs an evaluation framework of service qualia under the perspective of user experience, which corresponds to the three levels of user cognition to the three phases of pre-service, mid-service, and post-service, and finally arrives at the degree to which users' expectations are fulfilled, i.e., exceeding the expectations is surprised qualia, meeting the expectations is general qualia, and falling below the expectations is disappointed qualia. This paper further elaborates and confirms the framework by analyzing the case of service transformation of Shenzhou Pregnant Mothers' Car. The framework provides a new theoretical perspective for service qualia evaluation, supports the optimization and improvement of service processes, and contributes to the development of service design methodology in the context of disciplinary cross-fertilization.

Keywords

Service design; service qualia; user experience; evaluation framework.

Introduction

With the rapid development of social productivity and the upgrading of industrial structure, the service industry has been vigorously developed, "service" has become a hot topic of research in various disciplines and service design has also emerged.

Service design is a design activity that considers the users as the main perspective, collaborates with multi-stakeholder to co-create, achieves the systematic innovation of service offerings, service process and service touchpoints through the comprehensive integration of elements innovation such as personnel, environmental, facilities, information, thus improving the service experience, service qualia and service value (Hu Fei et al., 2019).

According to the definition, improving service qualia is one of the main purposes of service design. However, how should service providers improve service qualia, and how have users

gained different levels of experience? This process is vague and under-discussed. Therefore, this paper comprehensively combed existing studies related to service qualia assessment and user experience metrics based on literature review, summarized the common points of the two. A new framework for service qualia assessment is constructed from the perspective of user experience, which is validated and specifically elaborated through case studies, providing new insights for practice and research in the service industry.

Literature Review

Research on service qualia evaluation

The concept of service qualia originates from service management in management science, which emphasizes the efficiency of the service, that is, the overall cognitive evaluation of the customer's expectations of the service in comparison with the perception of the service, including both the evaluation of the service results and the evaluation of the service process (Wang., 2009). The service qualia talked about in the field of service design pays more attention to feelings and experiences rather than just the quality in the physical dimension, so this paper defines service quality as service qualia. Liu (2015) proposed that "Design is to create a healthy and reasonable way of human existence, which aims to improve the qualia of life". Mapping to the field of service design, the main purpose of service design is to improve the qualia of service.

Juran (1974) categorized service quality according to the different types of quality into five parts: internal quality, hard quality, soft quality, immediate quality and psychological quality. Sasser, Olsen, and Wyckoff (1978) proposed that service qualia consist of the level of materials, the level of equipment, and the level of people, from the perspective of the service provider. Gronroos (1984) identified service qualia as including technical quality related to service outputs and functional quality related to service processes, further suggesting that the key to service success is the quality of service as perceived by the customer. Holbrook and Corfman (1985), based on the five methods of service qualia interpretation proposed by Garvin (1984), simplified them into subjective and objective methods, i.e., service qualia is divided into "human quality" and "mechanical quality".

Parasuraman, Zeithaml and Berry (1985, 1988) constructed a service quality evaluation model from the gap between customers' expectations and their perceptions and proposed a Service Quality Gap Analysis Model based on the Five Elements of Service Quality Evaluation Model. Carlton (1986) explored the relationship between service perception and service quality from the perspective of interaction between service providers and users, suggesting that service contact is a manifestation of service at the "moment of truth". Hong, C.S., et al. (2012) described the psychological influence mechanism of service qualia in interactive environments from three aspects: pre-service customer expectation and information influence, in-service customer- employee psychological interaction, and post-service customer psychological adjustment.

Research on user experience metrics

User experience, as a common basis for research in product development, interface design and service design, was first proposed by Norman, who pointed out that a successful user experience must firstly satisfy customer needs without harassing or annoying the user. Secondly, the product offered should be simple and elegant, so that the customer can use it with pleasure and delight. In addition, it should be able to bring the user additional

surprises. Pine II and Gilmore (2011) advocate that the evolution of human economic activity has shifted from the simple buying and selling of products (commerce) to a more complex emotional life experience. Therefore, UX focuses on how to create a high-quality experience, and designing a "pleasurable" qualia of life is exactly where the value of UX lies (Hu, 2009).

Hassenzahl (2001) proposed that UX includes ergonomic and hedonics qualities that make up the attractiveness of a product, and later further identified hedonic needs, emotions, and experiences as key qualities of interactive products. The Usability Professionals Association (UPA) (2015) broadened the context in which UX is associated, summarizing UX as all user perceptions comprising all aspects of interaction with a product, service, or business. In terms of the time- course division of user experience, Forlizzi and Battarbee (2004) defined user experience as a period of experience with a clear start and end time, and all the use experiences that occur during this period are called user experiences.

User experience has the characteristic of changing with the user's process of using the product, therefore, it is necessary to collect the data of user experience at different stages, mainly including the measurement of expectation experience, the measurement of immediate experience, and the measurement of long-term experience. At present, there are various effective measurement methods for user experience. Immediate experience measurement methods are usually based on questionnaires, user observation, physiological and psychological measurement, and other methods to measure the corresponding indicators. Long-term experience is more important for product or service improvement, and the measurement methods are also more systematic and diverse. Karapanos (2010) proposed the iScale method to assist users in recalling the experience process to make a self-report of the experience process over a period. Kujala et al. (2011) proposed a user experience curve measurement method to study the changes in users' experience of a product over a long period of time, and at the same time to be able to explain the reasons for the formation of user loyalty as well as to find out the reasons for the enhancement and degradation of user experience. EKarapanos et al. (2009) established a temporal model of user experience based on the qualitative analysis of DRM data , and divided the process of user acceptance and use of a new product into the stages of Orientation, Incorporation, and Identification. From the research of experience design, the implementation of user experience is from the function realization to the demand satisfaction to the higher user experience, i.e. to achieve the purpose (low) - to feel satisfied (medium) - to produce surprise (high).

The Possibility of Combining Service Qualia Assessment and User Experience Measurement

Through the literature review research on service qualia assessment and user experience metrics, this paper finds that there are many common points in the research of service qualia and user experience:

1. Both focus on the evaluation and feelings of the users.
2. Both contain instrumental (mechanical) and non-instrumental (human) dimensions.
3. Both have a timeline and a process of experience.
4. Both are closely related to the degree of fulfillment of the user's expectations.

Therefore, there exists a greater possibility of combination and exploration value of the two modeling systems, which can provide new solution ideas for the improvement of service qualia.

Meanwhile, scholars have already conducted research on the relationship between service qualia and user

perception. Gronroos (1982) proposed the concept of customer perceived service qualia according to the cognitive psychology theory, that service qualia is a kind of customer perception, which is determined by the comparison between customer's service expectation and perceived performance, so the evaluator of service qualia should be the customer rather than the enterprise. In the evaluation results of service qualia, it is generally believed that the results of customer evaluation of service qualia is no more than three kinds of results:

1. The service provided by the service provider has exceeded the customer's ideal Desired Service. In this case, the customer is happy.
2. The service provided by the service provider falls in the customer's Zone of Tolerance within the area of the service qualia. At this time, the customer is still satisfied.
3. The service provided by the service provider for the customer's services failed to meet the customer's minimum service requirements, that is, failed to meet the customer's expectations of the Adequate Service. At this time, the customer will be dissatisfied, resulting in complaints and other behaviors.

According to the previous research on service qualia, it can be found that the evaluation of service qualia depends largely on the degree of satisfaction of user expectations. With the help of the elements and framework of the existing research, the relationship between service qualia and user experience can be constructed, which is of great significance in clarifying the process of transferring service qualia, predicting the effect of transferring service qualia, and clarifying the key points of constructing service qualia.

Constructing an assessment framework for service qualia under the perspective of user experience

This paper constructs a framework for assessing service qualia, taking the commonalities identified in the literature review as the main elements regarding service qualia assessment and user experience research, with the degree of satisfaction of user expectations as the core indicator.

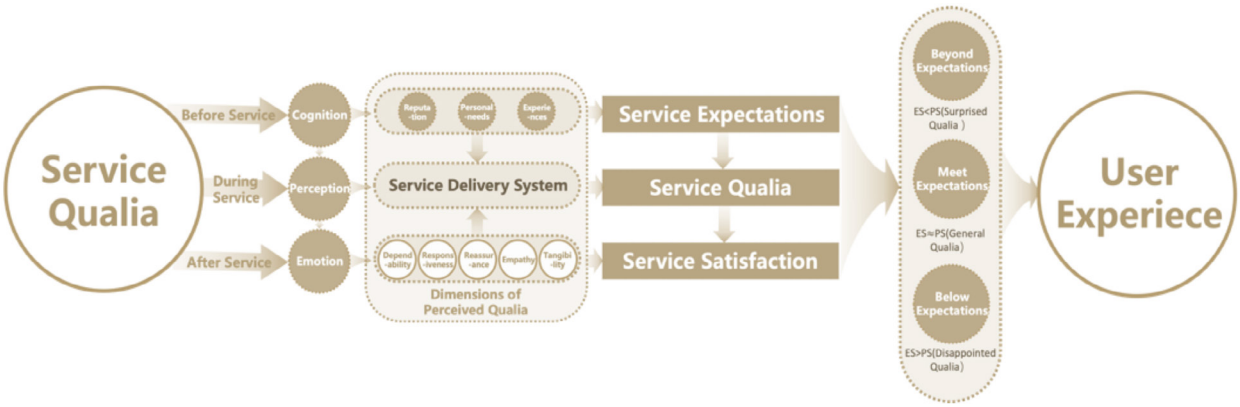

Figure 1. Assessment framework for service qualia in user experience perspective

First, this study divides the process of service into three stages based on the user's cognitive model (cognitive-perceptual-emotional) and matches it with the before, during, and after service. The cognition of the before-service mainly focuses on the service expectation of word-of-mouth, personal needs, and experience. The perception of the during-service mainly focuses on the service qualia of the service delivery system. The emotional experience of the after-service mainly focuses on the evaluation of the service satisfaction of the user experience. Based on the above process, the final output is the degree of satisfaction of the service to the user's

expectations, i.e., exceeding expectations is surprised qualia, meeting expectations is general qualia, and falling below expectations is disappointed qualia. Thus, the assessment framework of service qualia is formed (shown in Figure 1).

The model combines the theoretical research elements of service qualia and user experience, establishes the relationship and transmission path between the two, systematically integrates the existing theoretical models, shows the way through which the service qualia is transmitted to the user and generates different user experiences, and thus perceptualizes, metricizes, and describes the assessment of service qualia.

Case Study: Service Design of Shenzhou Pregnant Mothers' Car

Shenzhou Private Car is a private car application platform that integrates self-driving, private car and carpooling services. It relies on its own human and car ecosystem advantages to provide users with high-end taxi services that are on call and vehicles are always on standby. Shenzhou Pregnant Mothers Special Car Service is a high-quality, customized taxi service provided by Shenzhou Special Car to address the travel needs of pregnant mothers, a vulnerable group that requires special care. In the following, we will analyze the case to explain the service quality assessment framework constructed in this paper from the user experience perspective. According to the evaluation framework of service quality under the perspective of user experience constructed in this paper, service quality will be transmitted to users through the three stages of service before, during and after the service, in the different stages of service, users will produce different behaviours and psychological changes, and the service provider needs to provide users with appropriate service content as much as possible to meet the user's expectations of the service, and the final degree of fit between the service quality and the user's expectations will form the degree of fit between the final service quality and user expectations will form the user's overall user experience.

Before service: Preparedness to Exceed Service Expectations

In the case of Shenzhou Pregnant Mothers' Private Car, the service is aimed at pregnant women, the service provider is the Shenzhou Pregnant Mothers' Private Car platform, and the driver is an important contact point and personnel in the service. Before the service starts, the pregnant mother is in the psychological stage of cognition, understanding and judgement, and will have service expectations for the car service. At this time, pregnant mothers will learn about the reputation of the car service, the service provider and the experience level of the service provider, which will also affect the expectation level of pregnant mothers. On the service provider's side, in order to provide pregnant mothers with sufficiently intimate and on-point services, and create services that meet or even exceed their expectations, Shenzhou's special car for pregnant mothers will make sufficient preparations before they get on the car. After an order is placed by a pregnant mother, the driver of the Shenzhou Pregnant Mothers Car Service will use a virtual mobile phone number to determine the time and place of boarding and the expected arrival time with the pregnant mother, so as to provide the user with a safe, private and heart-flow experience. The driver will adjust the air inside the car in advance for the pregnant mother to keep the air fresh, to ensure that the pregnant mother gets a comfortable and pleasant air environment experience when traveling in the car. At the same time, a "pregnant woman inside" warning sticker is placed on the car to warn other vehicles encountered during the journey to ensure safe driving. These pre-service preparations take into account the needs of pregnant mothers, and provide them with a good first impression from the perspective of meeting/exceeding their expectations.

During service: Meticulous service delivery system standards

In the service, pregnant mothers will begin to formally perceive the service they receive and its quality, which will be passed on to them through the service delivery system. In Shenzhou's special car service for pregnant mothers, the service delivery system mainly consists of four aspects: driver, vehicle, service, and guarantee. The special car platform has standardized service construction for these four service elements. The standard for drivers consists of selection parameters, grooming and behaviour, which ensures the high quality of the driver's experience, professional ability, image, and reception behaviour. The standard for vehicles consists of basic parameters and vehicle appearance, the standard for services consists of driver driving, vehicle hardware, APP software and additional services, and the standard for guarantees stipulates the norms for driver guarantees, health guarantees, technical guarantees, privacy guarantees and first companion guarantees. The detailed specification of the service delivery system lays the foundation for the service quality perception of pregnant mothers.

At the specific operational level, the service elements will be combined with each other to deliver service quality to pregnant mothers. Before the pregnant mother gets into the car, the driver will open the door for her, assist her, and tell her how to fasten the seatbelt in a detailed and considerate experience; and with a comfortable temperature of 22 degrees Celsius inside the car, and the adjustment of the direction of the air vents, it brings a comfortable and detailed and considerate service experience to the pregnant woman, plays foetal education music for her, and pays attention to her life as a pregnant woman, as well as equips her with vomit bags, Swallow's House and other cooperative service products, so as to enable her to obtain the exclusive and considerate service experience for pregnant mothers at the whole scenario. Pregnant mothers can use the app's OBD system to monitor the car's speed during the journey, providing them with a safe experience in the whole process. After the pregnant mother gets off the bus, the driver will pick up, carry and deliver her luggage, turn on the high beams at night to escort her to her destination, and send the arrival information to the user who booked the bus at the first time, so that the pregnant mother can get a safe, high-quality service experience with humanistic care.

After service: Qualia evaluation of the total service experience

Despite the dynamic changes in the experience of the pregnant mother before and during the acceptance of the service, when the service is completed, the previous service and experience will be synthesized into an overall service emotional feeling and form a perception of the quality of this service, which will be contrasted with the previous user's expectations, and if the pregnant mother perceives an experience that exceeds her expectations during the service, the service is presented as a surprised quality (high quality). If the pregnant mother's previous expectations are met in the service, the service is perceived as general quality (medium quality). If the pregnant mother's previous expectations were not fulfilled in the service, the disappointed quality (low quality) is perceived.

Through the analysis of the case, it can be seen that user expectation is an important reference for users to evaluate the service quality, in order to improve the service quality, the service provider should try to create a service that exceeds the user's expectation on the basis of meeting the user's needs, and in this process, the elements of the service delivery system, the standard and its practice are important delivery channels, and the service provider can enhance the service delivery system through the stipulation and optimization of the service delivery system to improve the users' service perception.

Elements		Details
Drivers	Selection parameters	Possess at least 3 years of driving experience, good driving skills, medical assistance training, familiar with basic medical assistance knowledge related to pregnancy, etc.
	appearance	Drivers are required to wear formal attire (white shirt, tie, trousers, black leather shoes), maintain personal hygiene, neat facial grooming, etc. while in service.
	demeanour	We need to be full of energy and behave in a civilised manner. When passengers are dissatisfied with the service, we will listen to their criticisms with an open mind; when misunderstood, we will explain patiently and will not argue with the passengers.
Vehicles	basic parameter	Provide pregnant women with clean and comfortable vehicles priced at more than 150,000 yuan and new within three years; urban operation vehicles are mainly new energy models.
	vehicle appearance	Vehicle safety performance, ride space and other indicators should be significantly higher than the level of mainstream specialised vehicles, clean and hygienic carriages, providing free and convenient items for passengers, etc...
Services	chauffeur-driven	Strict adherence to norms: before picking up a pregnant woman, the windows must be opened and ventilated in advance; smooth driving, avoiding bumps and speeds of no more than 60 kilometres per hour (except in emergencies), and so on.
	Vehicle hardware	The interior of the vehicle is odourless, equipped with "pregnant woman inside" warning stickers, vomit bags, and plays foetal music at an appropriate volume.
	APP software	Exclusive functions for pregnant women's car use have been added, providing functions such as vehicle booking, vehicle use, vehicle monitoring and arrival reminders.
	Additional services	The first time you take a Shenzhou Pregnant Mum Special Car, you can get a RMB 100 mother and baby gift pack, and you can get mother and baby gifts for a cumulative number of rides without stopping.
Guarantee	Driver Protection	Physical examinations and driving ability inspections are conducted for drivers, and background information of drivers is verified in co-operation with the Public Security Department to ensure that drivers have no criminal records, etc.
	health protection	Vehicles are regularly inspected and maintained, and complete vehicle repair and maintenance files are established to ensure that vehicles are in good technical condition and have reliable safety performance.
	technical security	Installation of a vehicle system with a driving record function to achieve real-time monitoring of the vehicle's location and operating status; to avoid unsafe driving behaviour.
	Privacy Protection	Hide passengers' real numbers and go online with 170 virtual security numbers to ensure that passengers' mobile phone numbers are not leaked.
	advanced payment guarantee	Establishment of a safety and security fund to provide specialised insurance coverage for pregnant passengers, which should be higher than RMB 1 million.

Table 1. Diagram of the elements of the service delivery system of the Shenzhou Pregnant Mothers' Special Service

Conclusion

To promote the improvement of service qualia, this paper explores the path of improving service qualia under a new perspective. Through a literature review of user experience and service quality research, the theoretical commonalities between the two are found, from which an assessment framework of service quality under the perspective of user experience is constructed, followed by a case study of Shenzhou Pregnant Mothers' Specialized Vehicle, which further elaborates the content and application process of the framework.

This evaluation framework responds to how the service process affects the user experience through service qualia from the user experience perspective and provides a valuable reference for service industry practitioners to improve service qualia.

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An Integrated Theoretical Framework Based on Sketch Taxonomies to Enhance Sketching Activity Flow

Zhenyu Ma

Graduate School of Creative Thinking for Social Innovation, Musashino Art University
dcct21005bs@ct.musabi.ac.jp

Abstract
This study explores the role of sketching in the design process and addresses the need for a comprehensive sketch taxonomy. Sketching plays a vital role in design, aiding idea generation, problem visualization, and design inference. Existing sketch taxonomies fail to capture sketches' roles and diverse use cases, prompting the development of a Multi-Faceted Sketch Taxonomy (MFST). MFST is an integrated sketch taxonomy that visualizes design flow during sketch activities, facilitating better understanding and utilization of sketches in various design disciplines. The research method involves a literature review, logical reasoning, and Peirce's theory of inquiry. It aims to bridge the gap between design researchers and practitioners, providing designers with valuable insights and practical tools.

Keywords
Integrated Sketch Taxonomy， Design Sketch， Design Flow， Peirce's theory of inquiry， Multi-Faceted Sketch Taxonomy (MFST)

Introduction

Designers typically attribute great importance to sketching, but is there a necessity for sketching in the design process? One evident reason is the persistence of traditional customs, where design deliverables were traditionally provided in drawing format, facilitating communication with other stakeholders before the utilization of high-performance 3D modeling software or sketching software (Cross, 2006).

Sketching is recognized to serve various functions in the design process, including supporting the idea generation process (Lugt, 2005), externalizing and visualizing problems (Kernohan, 1981), and promoting design inference (Do & Gross, 1996), among others.

Sketch taxonomy is a critical method for describing the role of sketches in design. Simon stated, "Understanding a set of phenomena at an early stage is the first step in understanding what kinds of things are included in that set." While there is a wealth of literature on this topic, both in academia and the design industry, a complete understanding of the role of sketches in design remains elusive. Most existing taxonomies struggle to capture the diverse use cases of different types of sketches throughout the design process, highlighting the need for a comprehensive taxonomy to address this. However, bridging the gap between design researchers and designers requires more than just developing a generic sketch taxonomy for researchers. It also involves sharing the outcomes with designers and making them usable. Therefore, in this study, we believe that the development of

taxonomy can aid researchers and designers in better understanding the role of sketches in the design process, as well as their relationship with creative flow in theoretical analysis and practical settings.

However, for novice and inexperienced designers, understanding the relationship between sketch activities and the design process, as well as interpreting the design flow reflected through sketches, can be challenging. Many rely on intuition when expressing themselves through sketches.

Therefore, this study aims to bridge the research gap in design studies and materialize its contributions to actual designers. Specifically, we aim to provide designers with a clearer understanding of design flow during sketching activities. To achieve this, the author proposed a theoretical framework that visualizes the design flow inherent in sketch activities, with sketching serving as a design representation tool. We hope this will enable designers to comprehend better the role of sketches and how to utilize them in the design process effectively.

Research Method

Sketching is considered a typical activity in nearly every discipline related to design (Schön & Wiggins, 1992; Buxton, 2010). The focus of this research is not on specific disciplines such as industrial design, UX design, or service design but rather on any design process that incorporates sketching. Therefore, this study adopts a discipline-non-specific approach. Besides, the research methods consist of the following:

Literature review about design sketch and sketch taxonomy

A logical process involving abduction and deduction to explore how existing single- criteria sketch taxonomies can be aligned to gain a clear understanding and utilization of design flow in the design process using Peirce's cycle of abductive, deductive, and inductive reasoning.

Literature Review

Given the limited length of this paper and the brief introduction in the introduction section regarding sketch, its role in the design process, and a partial summary of relevant sketch taxonomy literature, this section will provide selective explanations.

Sketches are understood to play an intermediary role during the "sensemaking" process between designers and design tasks. They are primarily considered a form of "visual thinking" (Goldschmidt 1991, Goel 1995). Additionally, sketch communication evolves in tandem with thinking processes during sketch activities. Another approach to the concept of "sketch" views it as a means to facilitate limited human cognitive processing, serving as a tool for analyzing problems within the context of design situations through "reflective conversation" (Schön 1983).

Based on the above literature review, there are a total of 15 existing sketch taxonomies within the relevant design domains. However, these various sketch classification systems were proposed during a time when AI and digital sketching tools were less developed. In the current design context, this research suggests that existing sketch taxonomies are insufficient for a comprehensive analysis of the role of design sketches.

Peirce's cycle of abductive, deductive, and inductive reasoning

The generic sketch taxonomy in this study was proposed using Peirce's theory of inquiry. Peirce is sometimes known as "the father of pragmatism". Peirce's thought can be divided into early and later periods (Burks, 1946).

Only from the later period can it be explicitly related to inquiry, which is why this study has adopted Peirce's Late Theory of Abduction (Kruijff, 2005). Peirce considered the major premise, minor premise, and conclusion as representing RULES, CASES, and RESULTS, respectively. In the later period (Particularly in 1901, the radical change in understanding of abduction), it was here that Peirce's most mature explication of the method of scientific inquiry was born.

Fann has clearly outlined this process (Fann, 1970). This resulted in the new conception of the three types of reasoning as three interconnected and interdependent stages of scientific inquiry, the three types of reasoning are no longer necessarily confined to the syllogism, but rather are reinterpreted as three stages of inquiry as shown in Figure 1.

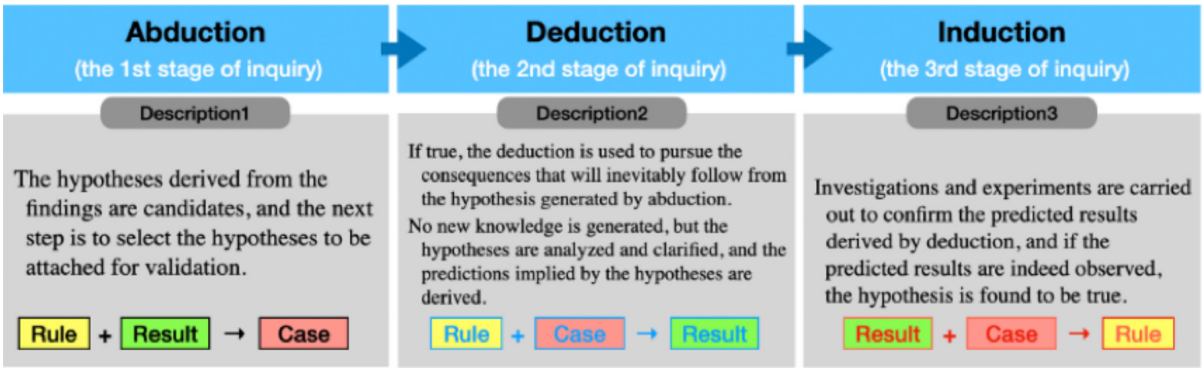

Figure 1. Peirce's cycle of abductive, deductive, and inductive reasoning in this study

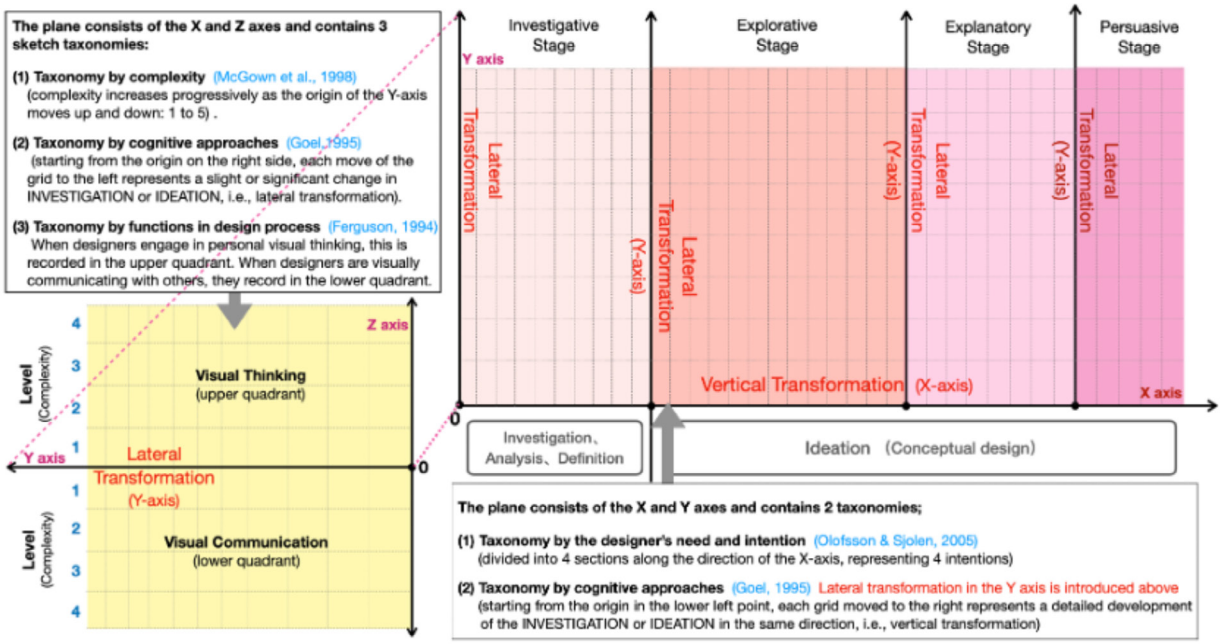

Figure 2. The theoretical framework of multi-faceted sketch taxonomy

Generic Multi-Faceted Sketch Taxonomy Theoretical Framework

The authors previously reviewed sketch taxonomies from different perspectives in different design disciplines and compared the similarities and differences in using sketches in traditional and contemporary design (MA,

2023). Considering that the classification criteria required by faceted theory must be tangentially related to each other, the authors chose four types of sketch taxonomies from the existing 15 types of sketch taxonomies as the important parameters for composing the generic taxonomy (Figure 2). They are the four types of complexity, cognitive approach, intention, and function, respectively introduced in the literature. In order to distinguish it from the extant single-criteria sketch taxonomy, this study named it the Multi-Faceted Sketch Taxonomy (MFST). The parameters that make up the MFST are the four types of sketches: complexity of the sketch, cognitive approach and intention of the designer, and the function of the sketch itself.

For design researchers, bridging the gap between single-criteria sketch taxonomy dispersion and its applicability across diverse disciplinary design processes is vital. The theoretical framework offers valuable scientific insights and guidance.

However, designers, particularly novices, have yet to benefit from translating academic research into practical design industry tools and guidance.

To enhance comprehension and confidence in sketching within diverse design disciplines and among novice designers, the authors have transformed their theoretical findings into the MFST design tool. MFST, operating within a simulated 3D space, facilitates the interpretation, recording, reflection, and guidance of sketching activities in the design process flow.

As a result, this study configured these four facets in a 3D spatial coordinate system, respectively, and the construction method is shown in the figure below.

Introduction to the Use of the MFST as a Design Tool

MFST, as a theoretical framework developed from a practical perspective, can reflect the following three correlated and orthogonal parameters affecting sketching behavior in designers' sketching activities.

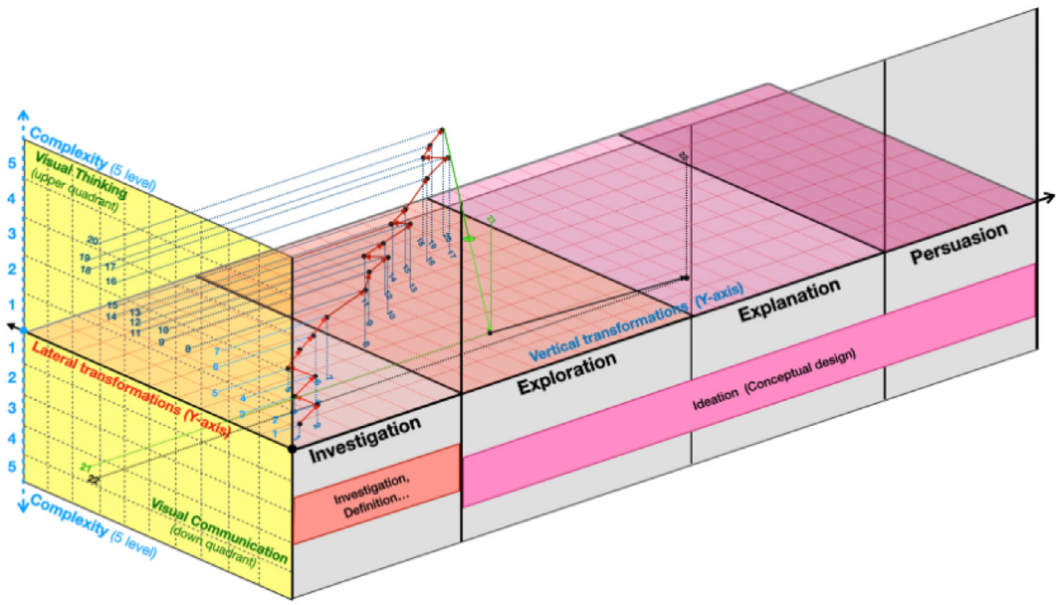

Figure 3. The simulated sample of how to use MFST to record and reflect sketching activities during the early design process

1) The authors applied Ferguson and Lugt's taxonomy of function to the X-axis and divided the X-axis into four parts.
2) Simultaneously, the lateral and vertical transformations of the cognitive method were configured on the Y-axis and X-axis, respectively. The development path of the ideas represented by the sketch is reflected in the small grid to record and represent the development trajectory of different cognitive combinations as the design process progresses.
3) The complexity of the five levels proposed by McGown was configured on the Z-axis, with the Y-axis as the starting point, and the levels in the upper and lower quadrants gradually increased simultaneously (1 to 5).
4) Select a part of Ferguson's taxonomy of functions, namely thinking and talking. The upper quadrant represents thinking i.e., when thinking personally, and the lower quadrant represents when communicating with others.

This MFST theoretical framework can provide semi-constructive guidance and a timed recording function for how sketch is used under the multiple facets in the early and middle stages of the design process, and even in some later stages.

Conclusion and Discussion

In conclusion, this study highlights the importance of sketching in the design process and the need for a comprehensive sketch taxonomy. The Multi-Faceted Sketch Taxonomy (MFST) offers an integrated theoretical framework that visualizes design flow during sketch activities, addressing the limitations of existing taxonomies. By integrating complexity, cognitive approach, intention, and function, MFST provides valuable guidance for designers in diverse disciplines. This research contributes to a better understanding of sketching's role and enhances its utilization in the design process from different design domains. It serves as a valuable resource for both design researchers and practitioners, bridging the gap between theory and practice in design studies.

Future research should refine the MFST, considering additional parameters for usability. Empirical studies are necessary to validate MFST's effectiveness in improving design flow for both novice and experienced designers. Comparative analyses with other taxonomies can provide insights into its advantages and limitations. Exploring digital tool integration and AI in sketching can enhance MFST's adaptability to evolving design practices, paving the way for further investigation into sketching's role and practical tools for designers.

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Cross-Border conservation for socio-environmental sustainability: a complex system perspective——Taking the Shenzhen-Hong Kong border as example

Yangyang PAN[1], Yu LIU[2]

[1] The Hong Kong Polytechnic University
panyangyangpyy2022@163.com
[2] The Hong Kong Polytechnic University
yuliu6325@gmail.com

Abstract

Under the "one country, two systems" principle, Hong Kong has maintained a high degree of autonomy, resulting in a border with mainland China. However, the border areas between Hong Kong and Shenzhen are clearly separated, with limited physical connections and restricted access for residents. This study aims to explore the development of the border area to establish new forms of cross-border connections and redefine the role of the Hong Kong Border, considering the interrelationship between the border and its residents. The research will focus on economic, social, and ecological aspects, using regional planning as a theoretical basis to propose strategies for balanced development and cooperation between Hong Kong and Shenzhen.

Keywords

border, system, Hong Kong, Shen Zhen, FCA

Introduction

The border region can be conceptualized as an expansive domain wherein the more developed side of the city exerts dominance over the movement of individuals, commodities, sustenance, and financial activities across the border, rendering it a highly dynamic milieu. As a result, this space becomes imbued with a sense of uncertainty, facilitating the emergence of distinctive attributes in the cities on either side. Understanding the dynamics of borders opens up possibilities for various scenarios and contributes to the exploration of progressive change (Steele et al., 2013). Border area development is a multidisciplinary field that encompasses political, economic, social, and cultural dimensions (Scott, 2010), therefore, the permeability of the border has an impact on cities on both sides. Through a comparison of the development of border regions in Shenzhen and Hong Kong, it becomes evident that the former has undergone a more significant transformation with a diverse range of land uses including factories, office buildings, and residential areas. This trend has led to steady economic growth and the availability of residential options within border areas. However, Hong Kong's border area remains largely undeveloped, consisting mainly of natural landscapes, farmland, and small settlements. Regional planning for borderland on the Hong Kong side, it plays a significant role in understanding the existence and evolving function of borders, both during their establishment and in subsequent years. It is fundamentally about anticipating and controlling the future by preparing plans that bring the future closer to the present and provide stability for citizens and the market (Granqvist et al., 2021). This approach enables the reconfiguration of future social space and fosters the exploration of combining regional planning with the border context (Ahern, 2011; Amin & Thrift,

2017). The study proposes a new approach to develop the Hong Kong border region by system thinking, with ecological preservation, Social integration and economic development, aiming to establish stronger connections with Shenzhen and achieve mutual growth by broadening the border's scope.

Background

The border region can be conceptualized as an expansive domain wherein the more developed side of the city exerts dominance over the movement of individuals, commodities, sustenance, and financial activities across the border, rendering it a highly dynamic milieu. As a result, this space becomes imbued with a sense of uncertainty, facilitating the emergence of distinctive attributes in the cities on either side. In this project, the author propose to redefine the relationship between the border area and residents to enable mutual development and interdependence. Despite the previous implementation of a three-stage reduction plan, which saw the Hong Kong Restricted Area diminish from 2,800 hectares to approximately 400 hectares as announced in 2008, issues stemming from imperfect planning persist, and restricted zones endure. Therefore, the author propose to establish new principles that redefine the role of the restricted zone, transforming it into an area where individuals can interact with nature, develop the economy of both regions while preserving ecology, and increase collaboration for the sustainable development of the border region shared by Shenzhen and Hong Kong.

Methodology

While maintaining the regional specificity of the border area, changing the relationship between the FCA development and border residents is foucs on research. So based on the literature review, author can summarize cross-border as an interdisciplinary collaboration. Cross-border collaboration was intended to promote the resolution of regional conflicts, to promote regional development through thoughtful planning, and to ease regional problems: social, ecological, economic(Tal Yaar-Waisel, 2018). Due to the special geographical location of the borderland, the author conducted the reseach by system thinking.

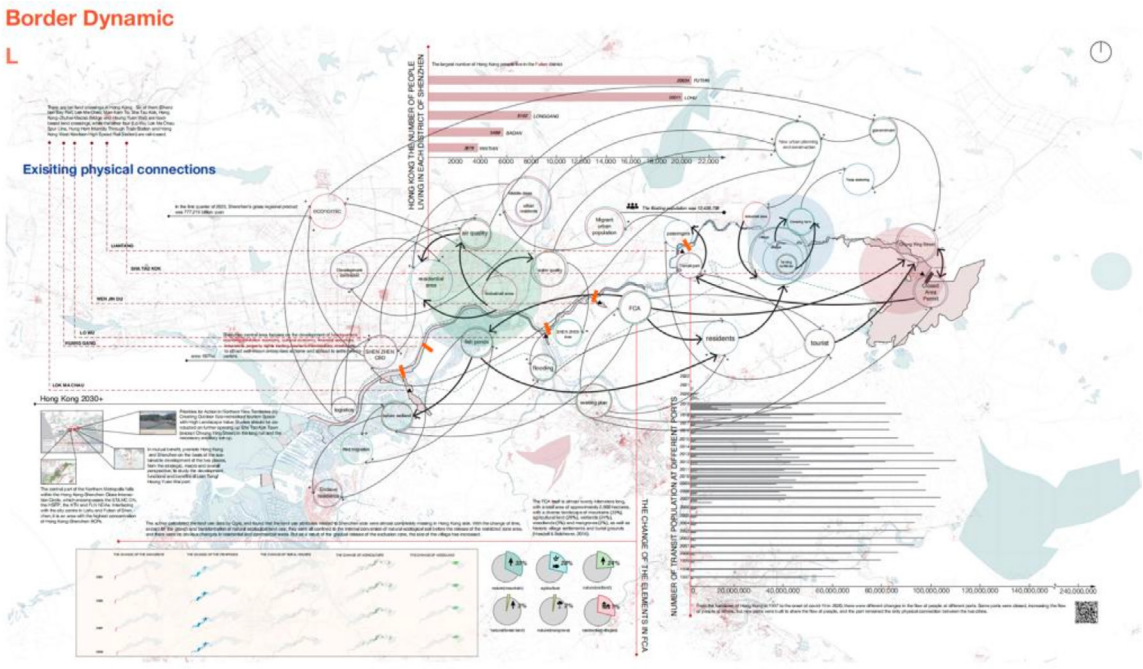

Figure 1. Border dynamic.

Context of general framework for the systemic inquiry

Systemic inquiry

Systems thinking is a holistic approach to problem-solving and decision-making that considers the interconnections and relationships within complex systems (Arnold & Wade, 2015). It recognizes that a system is more than the sum of its parts and focuses on understanding the behavior and dynamics of the system as a whole. This methods provides unique strengths that, when used together, can add value to program planning and evaluation by helping stakeholders explore systemic problems in different, but complementary, ways (Hassmiller et al., 2017). By approaching the analysis from the broadest perspective of the system (both sides of the border), it can identify leverage points(Figure 1). Consequently, it can be deduced that the three chosen areas on the Hong Kong border side will serve as the smallest scale study areas. Taking into account the interconnectedness of various elements within the system, key points are carefully selected as the pivotal areas requiring transit.

Outcomes

The whole study aims to explore the relationship between border and border residents, develop FCA in Hong Kong and narrow the gap of urban border, so as to achieve border cooperation between Shenzhen and Hong Kong and common development in the system. The authors propose different steps to achieve this vision.

According to the theory of systems thinking, different system perspectives are proposed for study areas of three different scales. In the FCA area on the Hong Kong side, the author selected three regions as the smallest scale (micro), namely Lok Ma Chau, Lin Ma Hang, and Sha Tau Kok. Strategies are proposed in the ecological, social, and economic aspects, respectively.

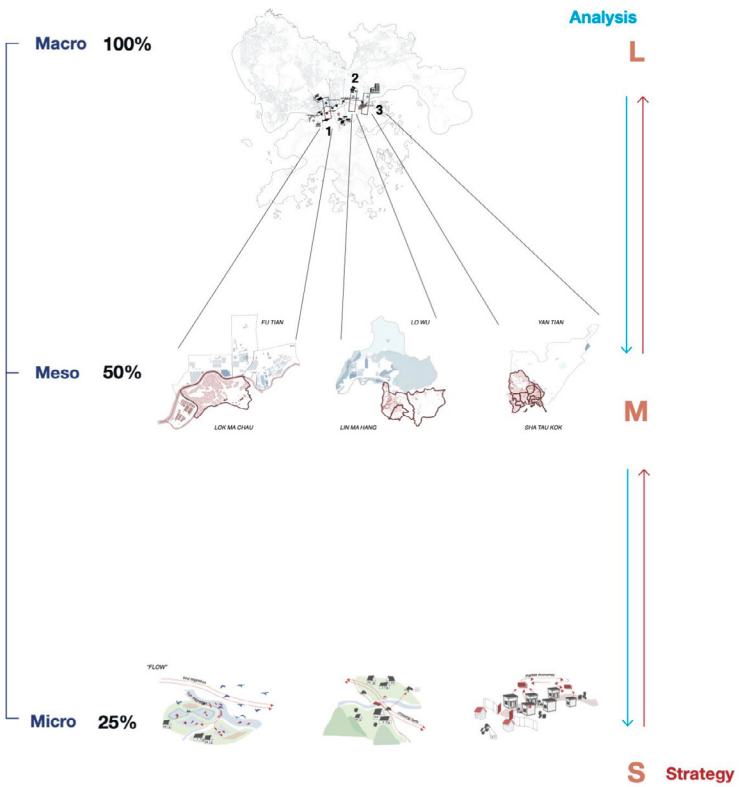

Figure 2. The framework of design flow.

"Systems thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static snapshots" (Meadows, 2008). Therefore, changing the system elements at the micro scale will affect the larger scale system (meso), which is the entire FCA area on the Hong Kong side. It can be inferred that the borderland of Hong Kong will develop in a more sustainable manner. Over time, this will also impact both sides of the border, Shenzhen and Hong Kong. The strategies under these different scales can be seen as three steps.

By combining Steps 1, 2, and 3(Figure2), a "cycle" is established within the borderland. The border of the FCA on the Hong Kong side will be developed to a certain extent. As mentioned by the author before, the border of Shenzhen is mostly factories and residential areas with pollution and resource needs. Therefore, the development of the relevant FCA can balance pollution and resource supply. Meanwhile, this state of balance will loop back to the whole system, in which the two cities cooperate and co-depend on each other, thus establishing a "cross-border" and generating new connections in the border area.

Conclusion

The border region can be conceptualized as an expansive domain wherein the more developed side of the city exerts dominance over the movement of individuals, commodities, sustenance, and financial activities across the border, rendering it a highly dynamic milieu. As a result, this space becomes imbued with a sense of uncertainty, facilitating the emergence of distinctive attributes in the cities on either side. When the FCA region of Hong Kong develops and a variety of urban connection modes are adopted, the quality of life of border residents will also be improved, thus alleviating the development imbalance between Hong Kong and Shenzhen. When the development degree of the two border areas is similar, the border restrictions will decrease, leading to increased border mobility. The author propose to establish new principles that redefine the role of the restricted zone, transforming it into an area where individuals can interact with nature, develop the economy and social of both regions while preserving ecology, and increase collaboration for the sustainable development of the border region shared by Shenzhen and Hong Kong.

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Synesthesia in Design: Visualizing Literary Vocabulary Online

Jing ZHANG[1] , Liangliang QIANG[2]

[1] Central Academy of Fine Arts
gin.zhangjing@icloud.com
[2]The Hong Kong University of Science and Technology(Guangzhou)
lqiang686@connect.hkust-gz.edu.cn

Abstract

The term "synaesthesia," originating from Greek, refers to the phenomenon where one sensory stimulus triggers perceptions in unrelated senses. This induces a concurrent experience. In the contemporary information-driven era, imaginative sparks are constant, accompanied by a demand for intricate experiences. This inspires diverse sensory connectivity designs and related tools, spanning various arts.

Addressing cognitive limitations in this age, synaesthesia emerges as a cognitive tool. The study examines existing synaesthetic designs, exploring generative design akin to synaesthetic logic. Practical application involves visualizing "Emily Dickinson's Complete Poetry" to understand synaesthesia's value in visual design and thinking.

Synaesthesia diversifies cognitive dimensions and enhances information processing. It also introduces "partial randomness" for innovative visual design. This paper contributes to the discourse on synaesthetic thinking in visual design, fostering innovation.

Keywords

Associative perception; Generative Design; Partial Randomization, Visualization Experiments; Literary Geography.

Introduction

Karl Mannheim said, "Human affairs are always imbued with thoughts of desire. When imagination cannot find satisfaction in reality, it seeks refuge in an ivory tower constructed of wishes."

Traditional graphic design's rules, materials, and techniques are waning in competitiveness and application scope. Graphic design serves information, following strict norms for precision. This study explores synesthetic thinking's facets — multisensory perception and partial randomness — to uncover novel potential in visual communication.

Trigger effects of association on the senses

Synaesthesia is a phenomenon in which sensory stimuli elicit perceptions in unrelated senses. The stimuli triggering synaesthesia are termed inducers, and the resulting sensations caused by these inducers are referred to as concurrent experiences.

Researchers, utilizing neuroimaging techniques, have identified differences in brain structures between synaesthetes and non-synaesthetes. These disparities largely stem from innate genetic inheritance. The following table enumerates research findings by Sean Day concerning real physiological synaesthesia.

The discussion then shifts to three characteristics of synaesthesia — stability, tangible projections, and passivity— to further differentiate between synaesthesia and association.

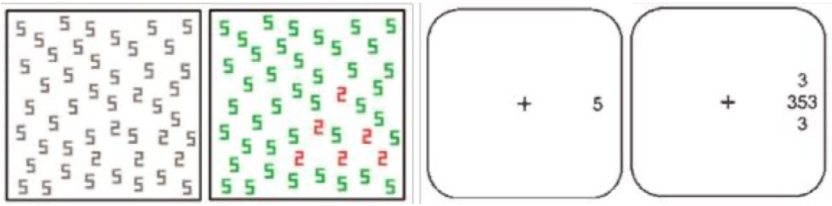

Figure 1. Experiment to determine the ability to isolate visual areas

Following formation, synaesthesia displays strong stability and projects onto tangible objects. Concurrent experiences generated by randomly occurring inducers generally remain constant. In an experiment assessing visual segregation capacity, grapheme-color synaesthetes can swiftly identify hidden patterns within white-on-black text. In this instance, the numeral "2" is concealed within the numeral "5" (left1 in Figure 1). For synaesthetes, distinguishing the triangle formed by the arrangement of the numeral "2" is highlighted through color differentiation (left2 in Figure 1). While focusing on the central object (denoted by the "+" sign), a single numeral situated at the periphery can be easily perceived through peripheral vision (left3 in Figure 1). If additional numerals surround the digit (left4 in Figure 1), they become relatively unclear for non-synaesthetes, yet synaesthetes can deduce the numeral based on the central digit's color.

Drawing from the research across these two dimensions, synaesthesia is a naturally occurring, genetically embedded, random perceptual mechanism through which a minority of individuals experience the world.

Associative Phenomena and Generative Design

Based on the revelation that the properties of association are not based on experience, are illogical, trigger irregularity, and unpredictability, the author argues that generative design in contemporary artwork is logically similar.

The "musical dice game" was popular in Western Europe in the 18th century. For example (Figure 2). The Musical Dice Game consists of a 176-bar round dance, two numbered squares, and several instructions for playing the game. each bar of the 176-bar score is labeled with the number of bars and separated by a double vertical line. The two numbered squares indicate that the game is divided into two sequential parts, and the numbers inside the squares indicate the number of bars. The game is played with two dice, the first roll of which selects the bar to be played against column A of the square, the second selects it from

Figure 2. Musikalisches Würfelspiel|Composition Dice

column B, and so on, starting with the first square and ending with the second. 5In this method of composition, the complementary elements of chance and necessity are the highlights. Musical dice games are early examples of generative art systems.

Experimenting with Visual Generation as an Example of Associative Literature

The Complete Poems of Emily Dickinson (Fig. 3 left), mentioned in Chapter 2 of this paper, is regarded as one of the pioneers of nineteenth- century modernist poetry, and is based on The Complete Poems of Emily Dickinson (Fig.3 left), which was compiled and published by the editor, Thomas H. Johnson, after Dickinson's death, and the translation of Fulbright scholar Prof. Pohlung. The Complete Poems of Emily Dickinson (Fig.3 right) as a blueprint to study the change of language culture and vocabulary weights after the change of time; formulate the rules with the characteristics of association, and make use of them to transform and generate the contents of the poems in line with the information age, and build an associative world belonging to the present and even to the future through the means of information visualization.

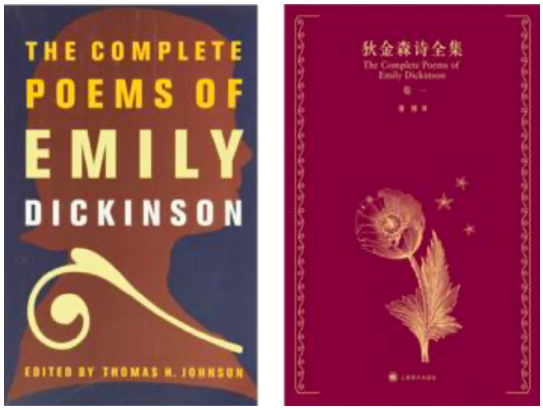

Figure 3. The Complete Poems of Emily Dickinson

Visual Transformation Rule Building in an Associative Context Quasi-association accounts for 59.7% of Dickinson's poetry, and the structure of the collection, which has a certain rule format to follow, is a creation that exerts maximum freedom within its limits. The process of building up all Dickinson's quasi-associative poems is divided into three parts: 'Recollection', i.e. imagining a subject or a concrete object image - 'Understanding', i.e. thinking deeply about the subject identified in the first stage - 'Resolution', i.e. the content derived from the second stage of understanding Emotional expressions, mostly prayers of praise, repentance and prayer, emphasize introspection on specific things, forgiveness of original sins and self-forgiveness in order to achieve one's wishes.

In summary, Dickinson's poems follow the meditative structure of "recollection" - "understanding" - "resolution", and if we take this as the infrastructure to complete the information visualization experiments in the twenty-first century, the process of image building can be summarized as follows: "Theme" Imagine a theme or a concrete image - "Transformation" i.e., the first stage of the process can be summarized as follows. -Transformation" is the characterization of the first stage of visual translation of the theme - "Generation" is the formulation of rules and the reorganization of the translated material based on the rules.

An experiment in the associative generation of new contexts

《The Complete Poems of Emily Dickinson》 provides a Subject Index (Figure 3), which organizes 68 thematic locations and 440 thematic words that have appeared in the entire collection of poems, and the author uses the Subject Index as a basic database to capture the material separately and regard it as a way to connect with the information age. Key Frames.

After targeting users through username search, we collect avatar information, number of fans and subscriptions. The avatar is the first face of individual public platform, and the number of fans and subscribers is the influence of their behavior and radiation range. Color extraction is used as a means of updating elements to visualize the

avatar part of the theme vocabulary. Taking the theme word "Air Air" as an example (Fig. 4), the color impression is preserved to the maximum extent, and the color area that accounts for the largest proportion of the word is divided out, and then the gradient technique is used to integrate it (Fig. 5). After extraction, the vocabulary fan base, the number of subscriptions and the frequency of vocabulary appearing in the collection of poems are placed into the three axes. Based on the above rules, the color image space organized by the data is completed (Figure 6).

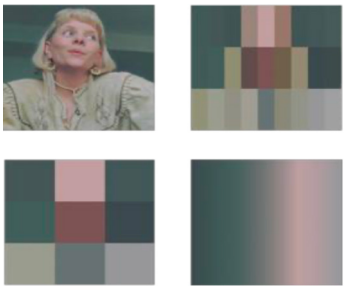

Figure 4. "Air" color image extraction

Figure 5. Thematic vocabulary color image

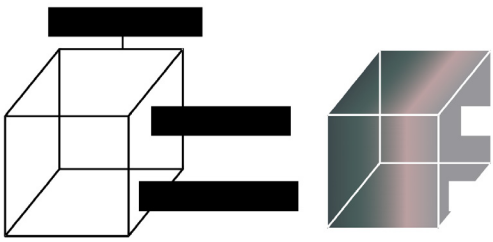

Figure 6. "Air" stereoscopic imag

The concept of geography has developed to the present day, which does not only refer to the geographical environment with naturalness, but also includes the territorial environment with cultural attributes; at the same time, as a spatial concept, geography has a spatial nature, which is embodied as a physical area in the geographic sense, and involves a metaphorical space in the sociological sense, which makes the studies of literary geography and territorial literature, regional literature, literary space, and geographic criticism mutually intermingled, and also makes the This makes the study of literary geography and regional literature, regional literature, literary space, geographical criticism and so on mixed, and also makes the positioning of literary geography difficult to be unified. The correlation of literary and geographic space with the idea of association can be regarded as a mechanism for examining geography, in another dimension. The informational context temporarily divorces geography from its functional and physical nature, and the translated image serves as a co-expression of geography by text and vision.

By retrieving the location-specific latitude and longitude information on Google Maps, the author converted the text into data, and then compressed it according to the division of the latitude and longitude grid into the relative location mapping of the locations of the poetry collection (Figure 7). The spatial material module is organically combined with and thematic locations. The theme vocabulary is divided into 68 groups according to the location of occurrence, and 68 groups of theme vocabulary stereo spaces are generated by the above rule of transforming the vocabulary color image into stereo image (Fig. 8); and then the same groups

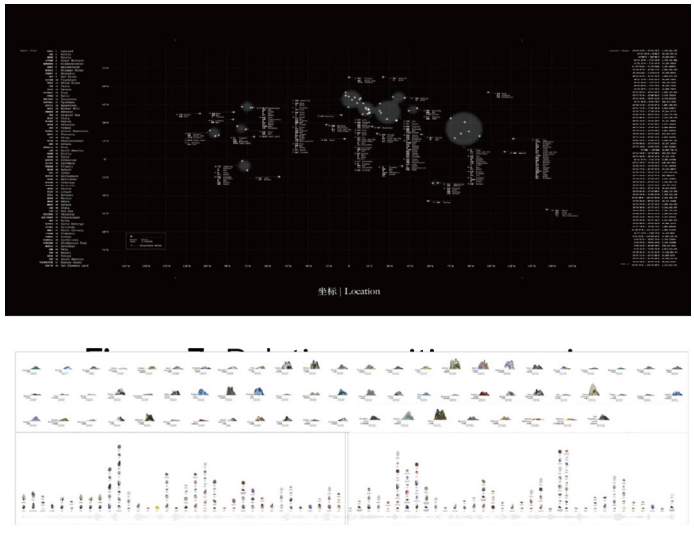

Figure 7. 68 sets of three-dimensional spaces

of stereo image spaces are respectively placed in the relative locations to complete the modern new language description of the spatial dimension.

Conclusion

Amidst continual technological evolution, the image's reality has lost its once- central excellence criterion. Gradually, images settle in memory, losing freshness. In today's pursuit of rigid, outcome-driven precision, introducing randomness transforms elements from passive monomers to a macroscopic, nuanced perspective. This reinvigorates elements, replacing "construction" with "growth." Design adapts openly, enhancing adaptability and output, positively impacting graphic design's future. Responding to multisensory needs and embracing "partial randomness" in creation fosters a tool for preparatory thinking, bridging the natural and logical worlds.

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Design Study of Global Submarine Cable System: a Perspective of Three Types of Flow

SONG Jin[1], HE Lida[2]

[1]Design School, Central Academy of Fine Arts, Beijing, China
songjeanzaaa@gmail.com
[2]Design School, Central Academy of Fine Arts, Beijing, China
helidaa@foxmail.com

Abstract
"Flow" can be also understood as mobility, liquid, and similar concepts, it offers insights into the modern world. Design itself can be seen as a form of flow that influences various aspects of our lives. "Design flow" refers to a methodology for system design and represents interdisciplinary design thinking. In our rapidly changing world, the global submarine cable network, a complex and often overlooked infrastructure, has gained strategic significance. Despite the growing attention to systems and flow in design, submarine cable system design hasn't received the attention it deserves. Therefore, this study focuses on submarine cable design and tries to break down the flow behind the design into three types: it is not only a flow of material pipelines; and it also facilitates the global flow of internet data; more importantly, these materials and data will shape new global dynamics in politics, governance, and power. Through the lens of these three types of flow, we can have a deeper understanding of the complex system design behind the global submarine cable network and broaden the scope of design exploration.

Keywords
submarine cable; system design; complex system; design flow.

Introduction: Global Submarine Cable Network as a Complex System

In 2018, Amazon, Meta, and China Mobile (3 modern technology companies) agreed to cooperate to build a transnational submarine cable connecting California to Singapore, Malaysia, and Hong Kong. However, due to a series of measures taken by the United States (US) government to hinder China's participation, China Mobile eventually had to withdraw from the alliance. In 2021, Amazon and Meta reaffirmed the project, this time with no China's investment and no connection to Hong Kong. But a year later, just because the project had earlier involved Chinese companies, the US government dismissed it outright on the grounds of information security, even though most of the 12,000km-long submarine cable had already been built, which means hundreds of millions of dollars of investment has been wiped out.

The focus of this incident is undoubtedly the submarine cable. The Internet we use every day is based on a cable network that spans nearly 1.4 million kilometers above the world's seabed. This network serves as the internet's essential lifeline, carrying approximately 99% of the world's intercontinental communication data traffic. While global scholars have increasingly turned their attention to submarine cables since the 21st century,

most discussions primarily revolved around the engineering and natural geography aspects related to their construction and operation. In the past couple of years, as global dynamics have shifted, political, economic, and human geography fields have started to pay more heed to the submarine cable network. Media coverage has also brought it to the forefront of public awareness. However, as the strategic importance of the global submarine cable network becomes more pronounced, design as an interdisciplinary subject has yet to fully engage with it. In prior discussions, a research perspective of flow was mentioned by Xie Yongshun et al. (2023) in relevant discussions [2], although Flow has been a topic in design, it often refers to a style, shape, and function of small- scale design. In recent years, the attention to the keywords of System and Flow in design has continued to increase. Therefore, this paper attempts to understand the system design behind the global submarine cable network as a large-scale complex system from the perspective of material flow, information flow, and power flow.

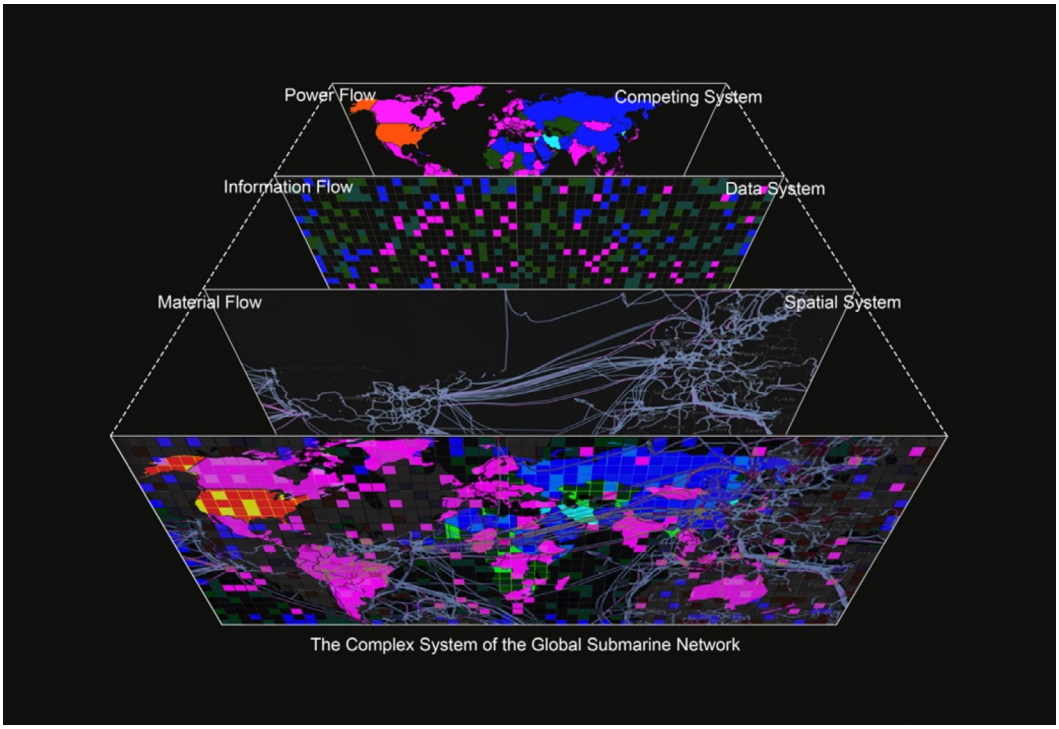

Figure 1. The structure diagram of this study, by Song Jin.

Material Flow: As a Spatial System of Ocean Reconfiguration

Submarine cables are both tangible and concealed in nature. In 2015, Trevor Paglen, a geographer and artist, led a scuba diving expedition off the Miami coast with a single mission: to capture the physical infrastructure of the Internet, the transcontinental communication cables linking continents. His dual identity as a geographer provided the theoretical and technical expertise needed for this endeavor. He utilized professional search and positioning technology to map out the search area and underwent scuba diving training and navigation education. Eventually, he embarked on the risky mission of photographing these submerged cables. [3] These streamlined pipelines run across the ocean's continental shelf, resembling deep-sea pythons that connect continents.

The global submarine cable network has its origins in the mid-19th century during the era of telephones and telegraphs. Since the successful laying of the world's first submarine communication cable in 1850, it has

expanded and gradually evolved into a worldwide undersea cable network [4]. Continents, once separated by oceans, are now physically linked, enabling intercontinental information transmission through this network of material pipelines navigating the oceanic geography. Simultaneously, nations assert their presence and allocate marine geographic space through these cables as materials. Hence, the submarine cable network primarily functions as a material-based network with connectivity attributes. Its design involves engineering principles, materials, modeling, and processes. Considerations encompass efficient data transmission, resilience against seawater corrosion and shark damage, and cost- efficiency. Beyond cable design, it extends to infrastructure design, including information collection, encoding, storage, optimization, and management. The design of the submarine cable network as a material network transcends mere stylistic choices for individual components; instead, it constitutes a large-scale system design rooted in the reconstruction of the global marine geographic space under the nation's internal surveillance as a material foundation.

Information Flow: As a Data System of Security Control

The submarine cable network, as a large-scale connectivity infrastructure and physical network, plays a critical role in facilitating global Internet communication and is closely tied to national data security. Accurate knowledge of cable locations can pose a security threat, as it enables potential disruptions and data theft. Consequently, the precise distribution of cables is a tightly guarded secret for each government, and hostile actors often go to great lengths to uncover this information. In 2014, artist Ingrid Burrington developed the interactive website "Submarine Cable Taps" to illustrate the extent to which organizations like the UK Government Communications Headquarters (GCHQ) collaborated with companies like Vodafone and BT Cable to intercept data from submarine cables. This surveillance, based on information from the Snowden Papers, highlights large-scale monitoring. [5] Data collection occurs both at sea and on land, for instance, the National Security Agency (NSA) and AT&T initiated the "FAIRVIEW" program in the 1980s, monitoring billions of emails, phone calls, and online chats of foreign citizens in the United States through AT&T's critical data access points.[6]

In today's digital capitalism era, data has emerged as the fifth factor of production. Data can be transformed into valuable information, which, in turn, accumulates capital. Mastering data equates to controlling the lifeblood of both capital and power, making it a pivotal asset in contemporary competition. Protecting data security is tantamount to safeguarding national security. Therefore, submarine cable design extends beyond physical infrastructure to encompass information and data systems built on this material foundation. This level of design is more abstract and covert than material design, focusing on the overarching system's mechanisms and pervading all facets of governance.

Power Flow: As a Competing System of National Game

In an era of technological rivalry among major powers, the submarine cable network, serving as both a physical space system and an information data system, has become entangled in significant geopolitical issues. Its precursor, the ARPANET, developed by the U.S. Department of Defense Advanced Research Projects Agency (DARPA) in 1969, was primarily military-focused. The United States has played a leading role in transitioning the Internet from a closed national military project to a global, commercialized, and civilianized entity, resulting in its long- standing dominance and even unilateral control over the Internet. [7] Notably, the United States, along with French and Japanese companies, has maintained a lasting dominance in the global cable market. However, as China entered the global market successfully, the U.S. began taking measures to prevent Chinese firms from participating in the world's Internet backbone networks, citing national data security concerns. Over the past five

years, amid rising tensions and perceived "espionage risks," the U.S. has even attempted to dismantle decades-old cable networks established through international cooperation between China and the U.S. While the U.S. has managed to hinder China's ascent in the global submarine cable market, China continues to strive for a competitive edge and focuses on expanding its influence in areas where its commercial and political power can radiate.

Growing concerns and remarks about the submarine cable market potentially splitting into East and West are emerging. As April Herlevi, a Sino-U.S. foreign economic policy expert, points out, "One of the biggest risks at present is the move toward a bifurcated network. Could this lead to a fragmented system without connectivity and a quasi-Cold War between Eastern and Western groups?" This underscores that both the physical infrastructure network and the information data system mechanism, as governance tools, ultimately serve national strategies and power competitions. Above the submarine cables lie multiple carefully designed systems, with the invisible power struggle representing the top layer that governs all systems. It influences material and information systems, escalates geopolitical conflicts, and raises the possibility of a new global Cold War. However, it's important to note that these concerns have not materialized into reality; they are expressions of apprehension and caution.

Conclusion

Since the era of neoliberalism, the concept of "flow" has often been reduced to a superficial representation, masking the underlying logic that shapes today's world. This paper analyzes the global submarine cable network as a global infrastructure, where "flow" takes on three distinct forms as proposed in this study. Together, these three forms constitute a superimposed state system, akin to Benjamin H. Bratton's concept of the "Stack" [8]. This is not a simple system but a new kind of complex giant system, as described by Qian Xuesen [9]. Firstly, Trevor Paglen's work is not mere stylized creation but a profound exploration that unveils the material foundation of abstract systems. Discovering this material basis is essential to understanding today's world, and our current era is defined by flow, with material flow serving as its fundamental underpinning. The dismantling of city walls as traditional boundaries has paved the way for material flow, just as architect Cedric Price metaphorically put it, cities have evolved from boiled eggs to poached eggs and now resemble scrambled eggs[10]. People, goods, and infrastructure flow freely, forming a large-scale global material space system. Secondly, today's world is characterized by continuous large-scale data monitoring, with submarine cables serving as carriers. And the occupancy of resources is no longer just about materials, but more about data. This shift aligns with Manuel Castells' concept of "the rise of the network society," where "flowing time and space" define society[11]. The information network created by new media transcends temporal constraints, enabling synchronous communication across vast distances, imparting a more abstract nature to material space, and leading to the emergence of an information data system. Thirdly, amid the unprecedented changes of this century, competition among major powers related to the submarine cable network intensified, and this is evident in the undercurrent of power competition within the complex giant system. From a design research perspective, contemporary design research should not be confined to the scale of specific objects or a design element but should expand to the system level. The system has effectively become the foundation for shaping our real lives, necessitating a response from design. In this paper, the global submarine cable network is deconstructed into three layers of a superimposed complex system for analysis, aiming to introduce a more comprehensive, large- scale research perspective and methodology into design, thereby broadening the scope of design exploration.

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Research on the dematerialization of fashion curation and its strategy

Wang Menghan

Central Academy of Fine Arts
418945877@qq.com

Abstract

Influenced by the pandemic, traditional offline fashion curatorial methods have proven inadequate in addressing the current dematerialization trend, driven by both advancements in Internet technology and people's increasing demand for spiritual and cultural enrichment. This study focuses on dematerialized fashion curating, its research subject encompassing not only clothing-related fashion content but also digital curatorial practices. It summarize the characteristics of domestic media and immaterial fashion curation while proposing more suitable strategies for contemporary fashion curation. Firstly, this paper presents a comprehensive overview of the historical development of dematerialized fashion curatorial exhibitions and discuss its evolution through a social history lens. Secondly, this paper investigates the current state of dematerialized fashion curatorial development, analyses both its content and curatorial form, thereby exploring potential insights for present and future developments in fashion curation. Finally, building upon the aforementioned research, this paper discusses strategies for fashion curation from three perspectives: timely responses to fashion trends, mediatization and communication within the realm of fashion, as well as narrative construction in cyberspace. The aim is to construct an approach to dematerialized-oriented fashion curation while uncovering new possibilities for future endeavors.

Keywords

Fashion; Fashion curator; Dematerialization.

Introduction

Fashion curation is a significant discipline that demands a distinct level of professionalism. By examining recent fashion exhibitions, it becomes apparent that there has been a noteworthy transformation in the field of fashion curation - shifting away from the conventional presentation of tangible fashion artifacts towards fostering a dialogue between intangible cultural elements and ephemeral objects. This transition can be described as the dematerialization of fashion curation, which unfolds across two dimensions: the dematerialization of fashion content and the evolution of curatorial practices within the realm of fashion. Fashion curating is essentially a critical practice, a means of providing a critique of an increasingly complex, interesting, and pervasive part(Byrd, 2019), based on the advancement of the information society and social media, it has become extensively integrated into people's lives. Consequently, contemporary fashion expression places greater emphasis on fashion itself, thereby transforming critical fashion curation into a means of knowledge production. By continuously generating fashion discourse, it employs its unique allure to engage the audience in active participation rather than relying solely on rigid educational dialogues. The information technology developed in 21st-century has facilitated diverse curatorial approaches which give rise to a new phase as the global outbreak

of coronavirus at the end of 2019 compelled institutions to explore possibilities for online exhibitions and other display forms. This paper will concentrate on dematerialization as a novel strategy within the developmental process of fashion curation while exploring additional prospects for future endeavors.

The three developmental stages of dematerialized fashion curation.

In the first stage before 1970, when the fashion industry serves as an important part of material production and capital development, as well as the characteristics of the bourgeoisie to manifest identity, there was no obvious non-material change and fashion exhibitions predominantly revolved around conventional displays of historical clothing. In the second stage spanning from the 1970s to the 1990s, take the V&A's 1971 exhibition Fashion: An anthology by Cecil Beaton for example, this phase repositioned the discourse and practice of fashion curation beyond mere clothing, embraced a more immersive theatrical experience(Clark J., 2014). However, compared with the overall social environment, the dematerialization of fashion curation has just started. In the third stage after the 21st century, the rapid development of digital technology has promoted the shift to dematerialization and spawned a series of concepts related to immaterial. By calibrating the concept of "Clothes" in 1944, MoMa's 2017 exhibition "ITEMS: Is Fashion Modern?" no longer simply equates fashion with fashion, but greatly expands the scope and possibility of fashion discourse, and regards fashion as a perspective and approach to broader social issues(Paola Antonelli, 2017). Fashion curation gradually began to turn to the stage of dematerialization. Due to the impact of the pandemic, 2019 has become an important node for people to turn their attention to virtual curation.

The current state and challenges of curating dematerialized fashion

The discussion on the dematerialization of fashion can be divided into two categories: the content of fashion and the form of fashion curation. Fashion curation focuses more on the fashion text in a broad sense and presents a more diversified orientation on the meaning behind the dematerialization of fashion itself.

The dematerialization of fashion content

In terms of content, finding innovative ways to revolutionize virtual experiences will bring more diverse possibilities for the subversive development of digital virtual fashion no matter it is the ensuing of digital fashion shows or the crypto art of Non-Fungible Token (NFT). In terms of cultural ideology, the connotation of fashion today has transcended beyond clothing and expanded its influence to encompass multicultural aspects such as values, lifestyle, taste, and aesthetic concepts. In May 2021, designer Edouard Vermeulen's fashion collection inspired by the Madonna statue in Antwerp's Notre Dame Cathedral embodies a profound reverence for history and culture while offering a fresh perspective on individuals' spiritual beliefs. Its primary focus lies in addressing the psychological and spiritual needs of individuals through dematerialization. Roland Barthes once emphasized that fashion emerges as a result of the amalgamation between clothing and its societal context(Barthes, 2014). He further elucidated this phenomenon by highlighting the distinctive structure of symbols and meanings inherent in fashion.

The dematerialization of fashion curatorial form

With the continuous development of technology, virtual game world is starting to emerge as a new market for the fashion industry. For instance, the online shopping platform NET-A-PORTER recently organized a Fashion Show on "Gather up! Animal Friends." This innovative virtual design approach effectively harnesses the potential of collective creative initiatives. In terms of curatorial platforms, several digital curatorial platforms such as

the digital project "MoMuMedia," which digitally presents fashion collections have emerged. Furthermore, Central Academy of Fine Arts (CAFA) has also developed a virtual curatorial platform, but this type of curatorial platform still offers significant potential for enhancement in terms of its tools. In terms of the comprehensive exhibition experience, fashion curating has gradually evolved into a means for engaging the public in cultural analysis, thereby generating fashion knowledge throughout the curation process. Moreover, driven by the continuous development of the experience economy, brands now strive to create more participatory and immersive experiences within exhibitions to offer audiences all-encompassing sensory encounters that facilitate brand culture dissemination. This also introduces innovative curatorial concepts for fashion exhibitions where viewers are no longer mere spectators but active participants. In conclusion, fashion exhibitions begun to try to explain the side of fashion beyond materialization. Therefore, it is necessary to discuss the curatorial strategy of immaterial fashion.

Research on dematerialized fashion curating strategy

According to current research, three strategies which are well-suited for dematerialized fashion curation were proposed in this paper.

A proactive strategy to promptly address fashion trends.

From collections' perspective, taking the "Rapid Response Collecting" mechanism initiated by V&A in 2014 as an illustrative example, collections prioritize addressing the immediate issues arising from objects and their newsworthiness. This approach enables them to respond to pivotal moments in contemporary society, thereby uncovering and engaging in discussions about life's truths. For instance, Christian Louboutin Fifi serves as a reflection of the challenges faced by people of color, while Pussyhat, a pink knitted hat symbolizing global women's unity and collective action, possesses collection value that transcends its materiality. From a thematic perspective, curators can use the relationship between fashion and society as an entry point for their theme. For example, MoMu's "Fashion Ball" project planned for 2021 places differently sized colored balls in various locations throughout the city. When models wearing different styles of fashion stand on these balls, they become part of an exhibition that blends seamlessly with the surrounding environment. Fashion is at the heart of Antwerp's story, and "Fashion Ball" encourages a positive and enjoyable way of life to activate the city during these challenging times. A fashion curator should possess a profound understanding of fashion and demonstrate a strong commitment to humanistic care. They should diligently stay updated with current trends, discern the essence of fashion through ordinary objects in daily life, and exhibit prompt reactions and articulate expressions within the realm of fashion.

A communication strategy using fashion as a medium

Walter Benjamin, a German philosopher and cultural critic, the view of fashion is that "wherever it has stirred in the bushes of long ago, there is an air of topic"(Benjamin, 2009). The characteristic of fashion is what lends the exhibition a distinctive experiential quality, and with the advent of Internet media, particularly social media platforms, fashion has become highly mediated. The Gucci brand centennial exhibition "Gucci Original" was held in Shanghai in 2021, exemplifying a strategic approach to garner attention and sustain popularity. It captivated audiences through high-quality WeChat posts and visually appealing exhibition materials, then the exhibition's visibility soared as extensive visuals were shared across various social media platforms along with engaging promotional content. Notably, a post featuring a girl donning Hanfu attire while attending the Gucci exhibition sparked a trend of incorporating Hanfu fashion into this prestigious event, stimulating fervent discussions on

their seamless integration. We used to talk about how to produce consumers, but now we may focus on how to help creators. With the democratization of creativity and communication, it is possible to establish a consensus with creators through shared labels, images, and needs. By utilizing fashion's inherent communicative function and leveraging social media platforms, curators can not only facilitate more convenient implementation and efficient dissemination of fashion exhibitions but also actively engage in the process of fashion curation.

Constructing fashion narrative strategy in cyberspace

The two crucial elements in developing a fashion narrative strategy in cyberspace are the articulation of fashion perspectives and the creation of virtual environments. In 2020, an online exhibition called "IN/OUT" was conducted in the perspective of curator. However, due to the inconvenience of web browsing, tweets showcasing exhibition items on WeChat public accounts replaced website viewing. Therefore, it became essential to effectively articulate the core views of the exhibition. Considering today's communication advantages offered by various social media platforms, when planning for the "TU TU TU " online exhibition in 2022, H5 is used for production exhibition. This reduced user difficulty in accessing and efficiently presenting exhibitions; however, modular editors limited visual design experience. In the context of digitizing offline exhibitions, the VR exhibition of the "David Bowie is" app offers a superior presentation of both the exhibition experience and design. This utilization of technology represents a significant breakthrough; however, it is currently limited to documenting iconic exhibitions. Due to the substantial human and material resources required for producing such AR exhibitions, curators can explore new curatorial ideas by considering spatial narrative methods and audience experiences.

Conclusion

Dematerialized fashion curation has emerged as a pivotal component of the fashion industry, gradually replacing offline exhibitions. However, its future trajectory does not solely revolve around virtualizing fashion items through online exhibitions; instead, it aims to offer a more diverse and immersive fashion cultural experience. Fashion curation has evolved into an intellectually stimulating, visually captivating, creatively engaging, and participatory strategy. As curators, we should embark on broader explorations beyond the confines of materialistic aspects such as museum practices, historical clothing, and renowned designers. A proficient fashion curator must possess a keen sensitivity towards fashion trends along with a fundamental sense of social responsibility. By effectively harnessing the inherent allure and communicative potential of fashion itself, we can delve into the intricacies of conveying narratives and fostering engagement on new media platforms while maximizing our unique advantages as curators. This amalgamation will undoubtedly infuse fresh inspiration into the realms of both the fashion industry and art while enriching the lives of our audience members. Employing these three strategies in unison enables curators to swiftly grasp contemporary issues within fashion culture and society at large while formulating innovative curatorial programs.

Acknowledgments

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Working Flows Between Digital and Material

Virginia Ellyn Melnyk

Tongji University
Vemelnyk@Buffalo.edu

Abstract

This paper explores the design flows of inspiration from parametric design principles in textile pattern designs, focusing on the potential of computational tools to enhance creativity and innovation. Designed using Grasshopper in Rhino3D as a computational tool to develop parametric knitting patterns, through manipulating design parameters such as stitch placement, density, and scale, the study investigates the possibilities of creating visually appealing and customizable textile patterns. Results: The study demonstrates the flow from digital design to fabrication by hand and craft. Expressing the interplay between digital design tools and the tactile craft and tradition of textiles, highlighting the fusion of technology and tradition. The use of computational tools offers designers greater control and flexibility, enabling exploration of a wide range of design possibilities. Conclusions: The parametric design offers unique ways to iteration and innovate textile design patterns for enhancing creativity and innovation in various fields such as including interior design, fashion, and textile art. The study emphasizes the transformative capacity of computational tools to advance the design process and yet result in hand craft, which may be more accessible and approachable for artists. This approach opens up opportunities for personalized and responsive designs, revolutionizing the way textiles are conceptualized and integrated into design.

Keywords

Craft, Fabrication, Parametric Design, Digital Design, Textiles

Introduction

Textiles and technology have a rich history of influence and symbiosis. Notably the between early computers and Jacquard looms, which inspired the early punch cards used on computers. Ada Lovelace, recognized this potential of Charles Babbage's Analytical Engine, a precursor to modern computers, and wrote extensively about its capabilities (Lovelace, 1843).

This project further explores this relationship by utilizing computational design tools to develop patterns for knitting. These patterns are ultimately knit by hand integrating a flow of design from digital to physical connecting the computer to crafting.

The project results in a folding wall design which is tactical and expressive. Allowing the making process to expand beyond just the computational design process. Merging multiple fields into interdisciplinary expression.

Parametric Design

The integration of parametric design principles in textile creation brings a new dimension to the field. In the

book "The Digital Turn in Architecture", Mario Carpo, highlights the significance of parametric design theory in architecture and design practices. Parametric design enables designers to create highly complex and adaptive patterns that respond to various parameters, such as environmental conditions or user preferences (Carpo, 2012). This approach allows for the possible creation of dynamic, responsive textiles that can transform their appearance and behavior based on specific inputs.

"The Craftsman", by Richard Sennett, emphasizes the importance of hands-on engagement and tangible skills in the creative process (Sennett, 2008). Parametric design tools provide a new type of craftsman-ship where the tool are now computers and the trained hand is trained to control the computational tools (McCullough, 1998). These computational design often leave much of the designs to digital fabrication for speed and precision. Although this is an easy flow of work. What happens to the handmade creativity from the Craftsman? Can it be merged with digital design? In this case study the attempt is to work from digital to physical and embrace the handmade as part of the workflow and process.

Knitting

Knitting is a versatile and widely practiced textile craft that has been used for centuries to create fabrics, garments, and decorative items. Knitting involves interlocking loops of yarn to form a fabric structure. One notable aspect of knitting is the use of knitting patterns, which serve as guides for creating specific designs and textures are often in a sort of binary code and many domestic knitting machines use punch cards. These machines consist of a needle bed with a series of latch-hook needles. The machine operates by feeding the yarn across the needle bed using a carriage, which creates new stitches as it moves along.

"Hand-Manipulated Stitches for Machine Knitters" by Susan Guagliumi explores the techniques and possibilities of using these machines to create intricate stitch patterns while still using many manual techniques to manipulate these patterns (Guagliumi, 1996)One of these designs used in this project is based on simple float and stich pattern. A float is when a needle is inactive and not stitch is made.

Computational Design

To begin the digital pattern design, a grid spreading definition was employed in Grasshopper, manipulating a series of lines around attractor points. In Grasshopper a set of parallel lines are determined as the base. This could resemble the wales or vertical columns of stitches stacked in alignment. Attractor points were randomly scattered across this set of lines. The attractor points were used to create spreading in the lines. This is done by reversing the relationship of closest point and line. The lines were divided in to a set of points along the line, which would then measure a distance between those points and the closest point. The inverted relationship would be that where the points on the line was closest to the point it would then actually move father away, and those points on the line which are farther would move very little. This creates a spreading effect. See Figure 1.

These lines then would not translate exactly to stitches, but to proportion of density versus transparency. The next step with the Grasshopper code was to overlay a grid in the opposite direction to represent the courses of the knit rows. Which could overlay the stitch types of either float or stitch.

To achieve the triangular shape panels, a technique known as narrowing was employed. This involved transferring stitches at the edge of the material every few rows, reducing the number of needles and narrowing the width. Starting with a full width of 108 stitches, the stitches at the edges were transferred to the neighboring

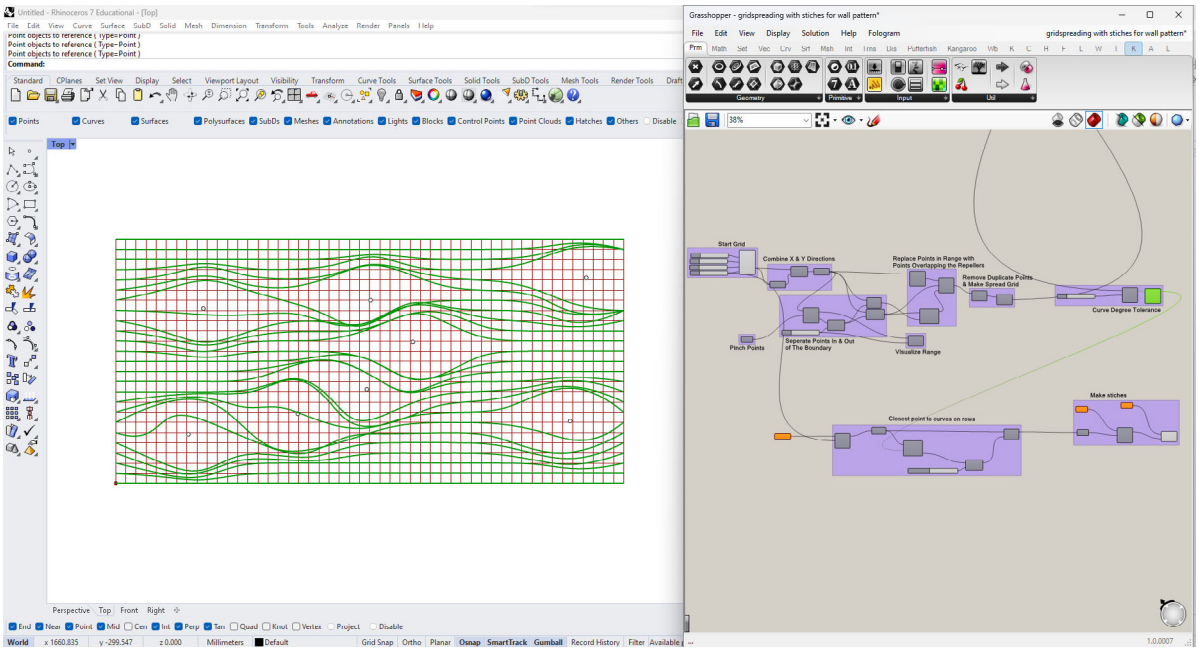

Figure 1. Grasshopper definition for grid spreading.

needle every eight rows, resulting in a gradual reduction of width. By the end of the 336 rows of knitting, only eight stitches remained on the knitting bed to form the top point of the triangle panel. This provided easy bind off at the end of production.

In order to facilitate production speed, the parametric pattern design was further adjusted. Rather than adhering to the computer-generated design, which dictated changes in stitches and floats with each row, the design was modified to repeat the pattern every eight rows to create elongated shifts. This adaptation aimed to simplify the fabrication process, considering the movement of the knitting machine carriage and the manual manipulation of active stitches using a transfer tool. See Figure 2.

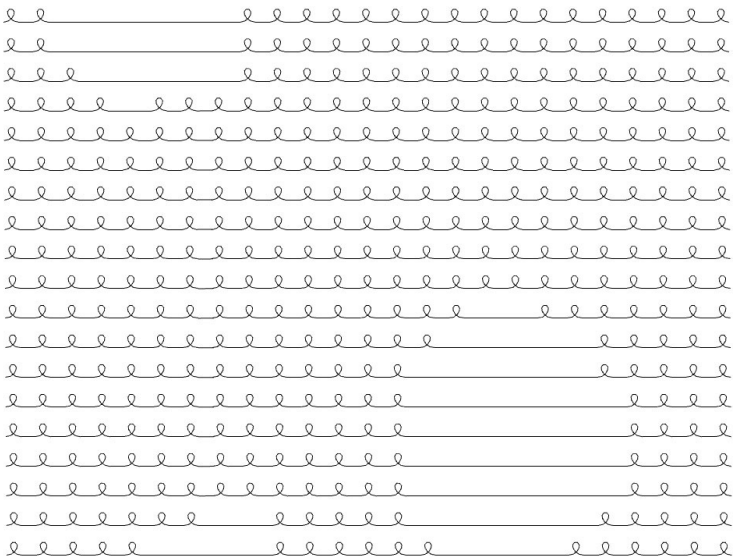

Figure 2. Sample of the final pattern design.

The final knitting process was performed manually, requiring several hours for each panel. Since this involved a human craftsperson following a printed pattern, mistakes and errors were inevitable, including counting errors, dropped stitches, or mistaken transfers. However, these imperfections were embraced as part of the craft, contributing to the uniqueness of each panel. As long as the craftsperson took the time to manually adjust the design to repair any errors and begin to make it match as much as possible to the original design patterns. This flow between the pattern to the knowledge and skill of the maker and freedom for adjustments was embraced as part of the process.

Final Design

In a total of twenty knitted panels were made for the folding wall, separated by the depth of the frame to allow for interaction and shifting of the pattern layers based on perspective and parallax. To highlight the different layers, two yarn colors, a blue and a pink wool mix of medium weight with 2 ply, were used for the front and back respectively.

The final dimensions of the knitted screen wall, measuring 2m (6.4ft) long by 1.8m (6ft) tall and 0.33m (13in) deep, proved to be successful in providing a visually engaging and lightweight architectural element. When collapsed, it was easily transportable and deployable. The lightweight nature of the knitted screen, allowed a single person to effortlessly carry and unfold it into an upright standing position, enhancing its practicality and versatility. See figure 3.

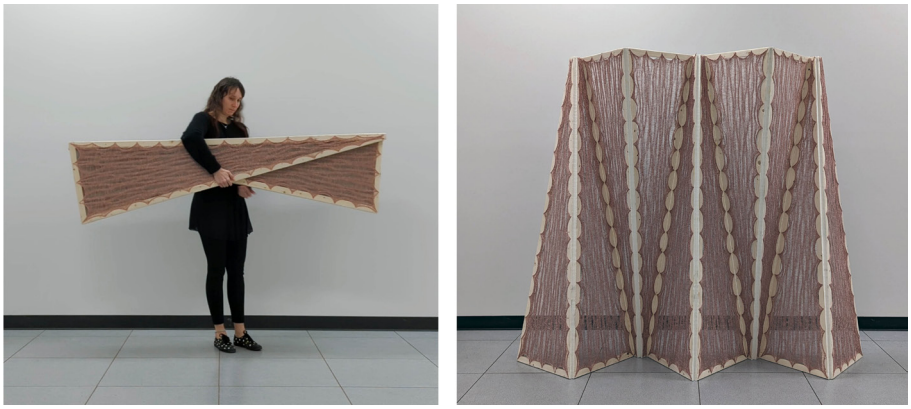

Figure 3. Final wall being transported and deployed.

The knit pattern particularly played the significant role in achieving the project's goals of screens and transparency. By leveraging the pattern design with Grasshopper in Rhino3D and applying parametric design principles, the pattern seamlessly transitioned solid and transparent areas, providing a play of light and shadow. The dynamic shifts in aperture and transparency created captivating patterns of light that added an artistic touch to the space.

The design of the knitted screen wall incorporated two layers of textile separated by the depth of the wood frame, which resulted in captivating visual effects of patterning and shadow play. As individuals move around the screen and light interacts with the layers, dynamic patterns emerge, resembling a moiré effect. The intentional difference in the density of the knit pattern between the two layers contributes to this captivating interplay of light and shadow. See Figure 4.

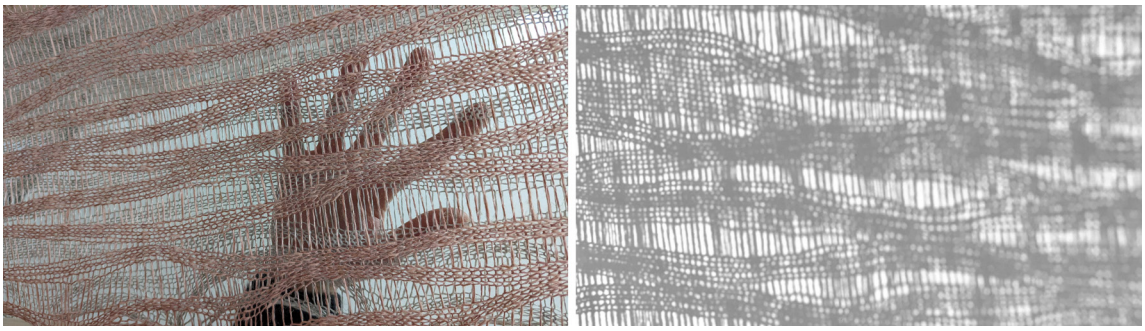

Figure 4. Final pattern details of shadows and texture.

The ability of the fluid design allowing more flexibility for the maker to manipulate the pattern or make adjustments on the fly during fabrication to achieve the desired result. This takes reflection on how you can design with digital tools but use those as a conceptual influence rather than as a fully resulted pattern to be followed to precise decisions.

Conclusion

By embracing both traditional craft and digital design methods, the project achieved a delicate flow between processes. The project uses the systematic approach of designing knitting patterns in a grid format, which lends itself well to computational design methodologies. This allows designers to create intricate and dynamic patterns with ease, bridging the gap between traditional craft and digital design.

The integration of digital design tools with handcrafted making highlights the value of human touch and craft in the creation of architectural elements. Richard Sennett's exploration of craft and making in "The Craftsman" emphasizes the importance of embracing errors and the maker's hand imprint on the final work (Sennett, 2009). This dynamic quality resonates with the concept of "architecture of error" as discussed by Francesca Hughes, embracing imperfections and unique outcomes in the fabrication process (Hughes, 2014).

The success of this project demonstrates how parametric design can offer architects and designers a powerful tool to push the boundaries of textile-based architectural elements. The seamless integration of computational design methodologies with traditional craft techniques expands the possibilities of architectural expression and spatial experience. As the project highlights the dynamic effects of screens and transparency, it sets the stage for further exploration and innovation in the intersection of textiles, architecture, and digital design. By embracing the unique capabilities of knitting patterns and their inherent connection to early computing history, architects can continue to push the boundaries of design and fabrication in the pursuit of novel and engaging spatial solutions.

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Design-driven multi-subject participation in community place- making: a case study of Yulin East Road Community in Chengdu

Duan Wu[1], Haoyue Lei[2], Francesca Valsecchi[3],Yuze Song[4], Zixin Ren[5]

[1]Tongji University Shanghai International College of Design & Innovation wuduan@tongji.edu.cn
[2]Tongji University Shanghai International College of Design & Innovation leihy@tongji.edu.cn
[3]Tongji University Shanghai International College of Design & Innovation francesca@tongji.edu.cn
[4]Tongji University Shanghai International College of Design & Innovation 2333806@tongji.edu.cn
[5]Tongji University Shanghai International College of Design & Innovation 2233746@tongjiedu.cn

Abstract

Many cities have changed the original governance framework to a more multi-subject participatory one. Therefore, the roles of designers and other subjects in community place- making changed. This case study of the Yulin East Road community in Chengdu, explores the multi-subjects participation framework in a design-driven community place-making, discussing the roles and approaches of each subject, and highlighting that of designers.

Keywords

Design Driven, multi-subject participation, community place-making.

Introduction

The national concept of "The cities are built by the people and are for the people" in 2019 re- emphasizes the role of all entities in building well-being. In such a context, many cities have changed the original governance framework to a more multi-subject participatory one (Li & XInag, 2022) as we are living in an era of "less stuff and more people" (Thackara, 2006, 4). Urban cultural practices are gradually expanding to grassroots, small-scale, multi-subject community spaces because of social context changes (Song, 2023). Meanwhile, communities are vital sources of urban innovation (Lou, 2018). Therefore, this research focuses on multi-subject participation in community place-making.

Originating in the 1960s, participatory theory has developed into one with ever-greater participation and ever-larger participants (Fuad-Luke, 200, 143). Nowadays, design has become a collaborative effort involving diverse stakeholders (Björgvinsson et al., 2012, 103). Individual designers or communities can not solve the systematic problem on the sole strength of design. We therefore questioned how the roles of designers and other subjects in community place- making changed, and have the participation framework changed too.

Research methods

This case study research uses 3 methods in the data collecting and analyzing phases.

1. Semi-Structured Interview in data collecting: to better understand the participating approaches and intentions, 4 interviews were conducted separately on July 6th and 7th, 2023, with 1 staff from the designer team, 1 artist and

community volunteer, 1 staff from the social organization, and 1 community planner with an average length of 2 hours by 2 researchers.

2. Participant Observation in data collecting: To better understand the behavior and interaction of the multi-subject participation in place-making, 2 researchers participated as tourists and residents conducting 2 observations on July 6th and 7th, 2023 separately with an average length of 4 hours by 2 researchers.

3. Flow-map analysis in data analysis: The participation framework includes elements of different roles, forces, and interdisciplinary interactions. Flow maps are used to describe this participation network system due to the features of graph-based, force-directed, and visualized readability.

Case Study: Participation subjects and frameworks in Yudong

Introduction to the site

The Yulin East Road Community (Yudong) in the Yulin sub-district, Wuhou District, Chengdu City in China is representative as it is one of the community governance pilots of Chengdu. Yudong is located in the old town area with convenient transportation and a relaxing local culture. This 0.45 km2 community has over 18,000 residents.

Thriving in the 1980s as the first modern neighborhood of the city, Yudong avoided urban expansion, maintaining a historical but less popular area. Officially established in 2001, Yudong finally started a community place-making in 2018. The local history brings a majority of aged built-up spaces and a society of aging and acquaintance in Yudong which are the contextual factors of multi-subject participation and community place-making.

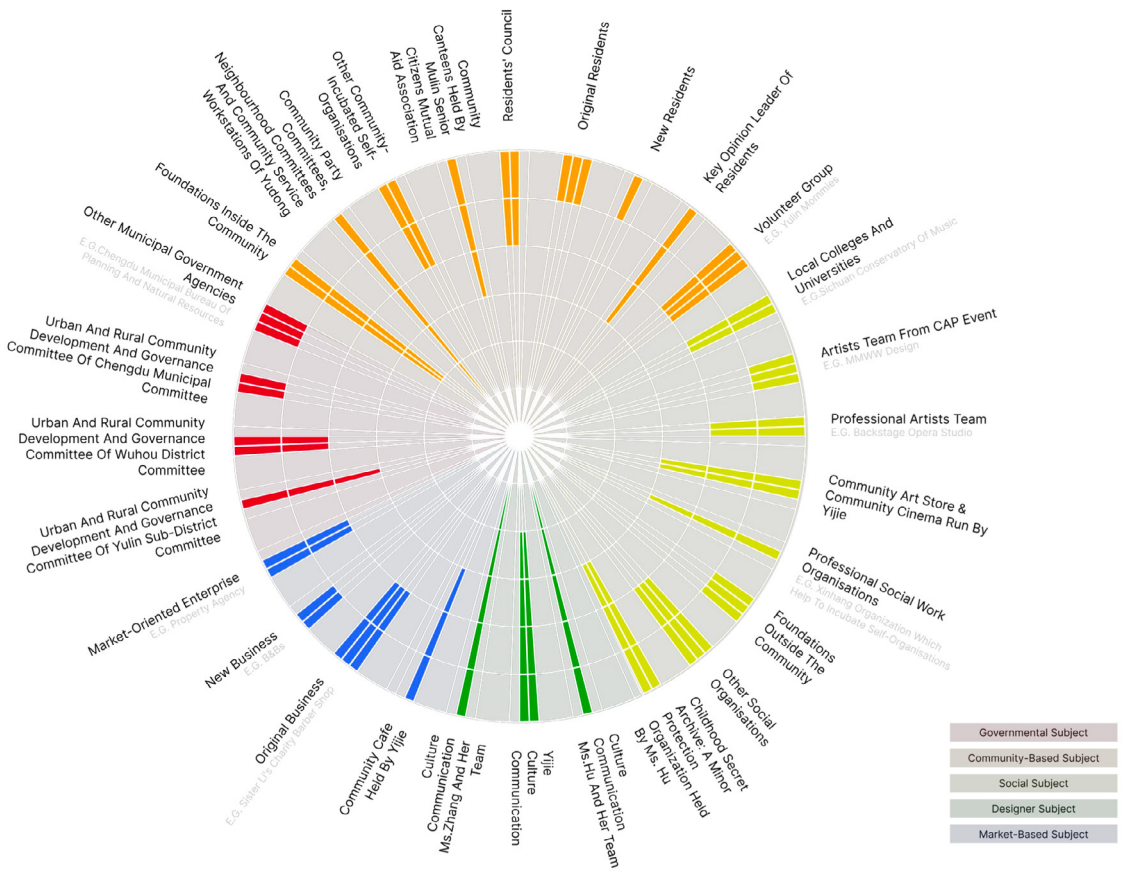

Figure 1. Roles, components and level of participation of subjects.

Subjects in participatory place-making

Yudong values the variety of participants in place-making as it sets the action strategies in four dimensions: community management, professional planning, resident democracy, and market management while design plays a supporting and synergistic role in between.

Accordingly, we divided the participants into 5 sectors, namely governmental, community- based, social, market-based, and designer subject (Figure 1).

Roles and participating approaches of subjects

Governmental subject

The participating approach of the governmental subject in Yudong has been influenced by innovations in the organizational framework of the Municipal Government in 2017 when the Urban and Rural Community Development and Governance Committee of the Chengdu Municipal Party Committee (CDGC) was established (Figure 2).

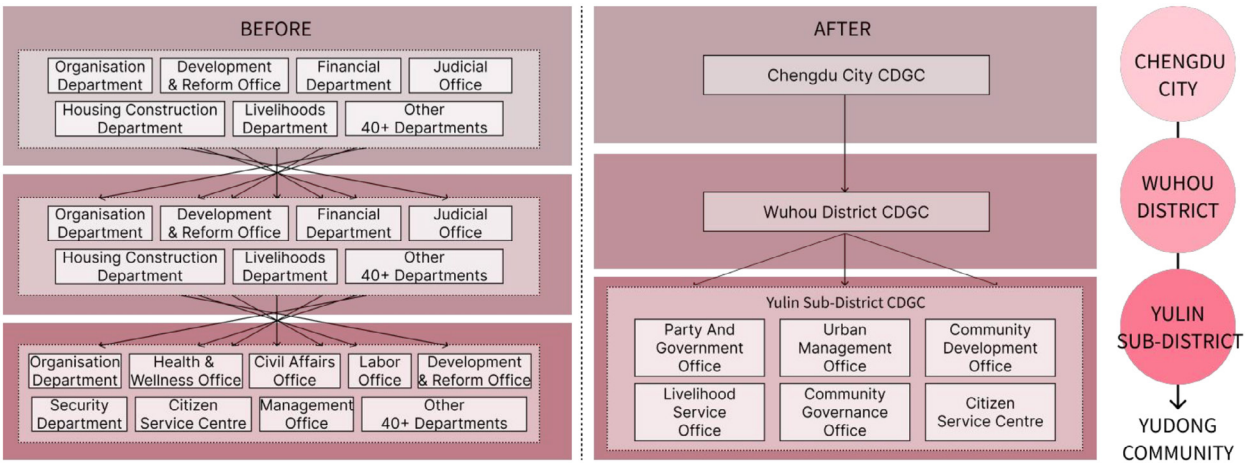

Figure 2. The change of orgianizational framework.

The more linear and targeted governmental framework improves the efficiency, professionality, and participation level of the subject which can be proved by the positiveness and the high mention frequency during all interviews with non-governmental subjects.

Community-based subject

The community-based subjects in Yudong include community managers, self-organization, social foundations, and residents which take up the largest portion of participants with 50 volunteer teams, and over 160 members of residents' councils. Three of them are analyzed in detail below.

The community managers

The framework of community manager, namely "two committees and one station", includes a communist party committee, a neighborhood committee, and a community workstation with 7 staff overall. This subject values professional capacity cultivation as they traveled to Germany and Japan to learn about related theories with experts before the start of place-making which provides an active and trustful foundation for the later participant.

The community funds and self-organizations

Yudong set up an internal community fund, the Community Microfund, which enables Yudong to incubate self-organizations and empower more participants. Subjects can apply as a start-up project for grants, and a review committee comprising all 5 subjects, including 50 residents, social organizations, enterprises, expert teams, community managers, etc. reviews the approval of various projects and the allocation of the funds (Figure 3).

This slice is representative of the overall Yudong framework, as all 5 subjects form a community of interest with a clear monitoring system. The outcome of this framework is significant as 36 active self-organizations have been formed. According to an on-site publication, Yudong plans to use a fund of ¥235,000 this year to support the participation of market-based or social subjects, e.g. in the construction of the community open source governance web 3.0 digital platform by one market-based enterprise.

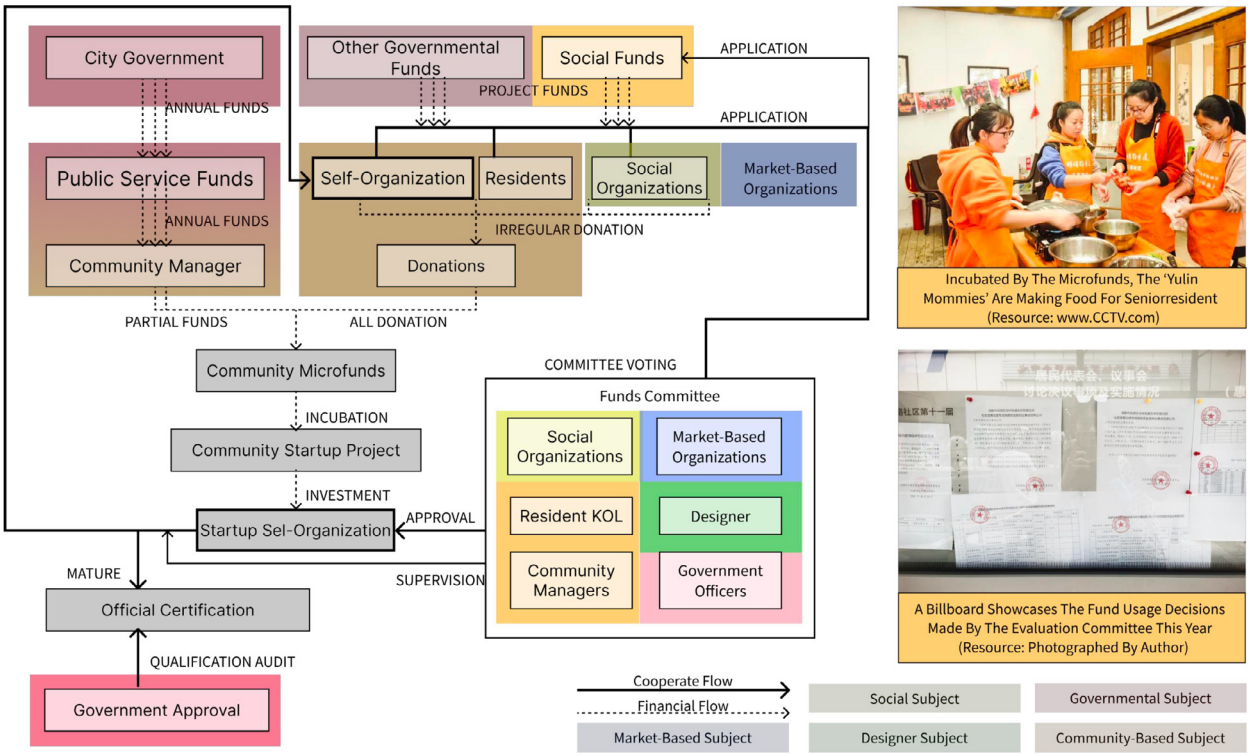

Figure 3. Framework of Yudong Microfunds incubating self-organisations.

The residents

Retired workers and teenagers account for an important proportion of residents in Yudong. Due to the historical context of this district, most of these residents are former colleagues, forming a typical society of acquaintance. Therefore, resident opinion leaders have a great influence on the participation of community members. During the interview, a staff of the designer team stated that the core of place-making in Yudong is the value of people. As she introduced, community workers spend a lot of time on one person (an opinion leader) to understand the needs and make those opinion leaders understand, recognize, and even be involved in the place-making process. In this way, the participation of resident entities is expected to grow in the long term.

While residents participate in the design process, design is also empowering them. A vivid example is what design

has done in protecting rights and enhancing the participation of vulnerable residents, such as the disabled, children, women, etc.

Childhood Secret Archive Is Devoted In Minor Protection Issue In An Artistic Way (resource: photographed by author)

Barrier Free Facilities Of Outdoor Public Space (Resource: Photographed By Author)

Barrier Free Facilities Of Community Cafe (Resource: Photographed By Author)

Figure 4. Barrier-free design in Yudong.

Taking the participation of the disabled as an example, in 2018, the community managers and Wuhou District Disabled Persons' Federation commissioned the designers to renovate an abandoned car shed in the community and create an accessible community cafe in Yudong. All the public open spaces in the community were improved and equipped with barrier-free facilities afterward (Figure 4). In this way, design empowers these vulnerable community members and enables them to have more possibilities to participate in place-making.

Social subject and market-based subject

The social subjects in the Yudong are diverse, including non-profit social organizations, social foundations, social enterprises, etc., aimed at promoting public welfare. Noteworthy is that there are 7 professional artists or researcher teams who actively participate in place-making. Designers also have a close interaction with them. For example, these events, e.g. Yulin Opera Festival, were designated by the community planner in a community calendar, with different events happening every quarter.

The market-based subjects in Yudong are relatively small in business, less profitable, and more dependent on other subjects, especially with designers, e.g. the architects renovated Ms Lee's local hairdresser's shop to provide a better consumer experience.

Designer subject: take Yiiie as example

The designer subjects in Yudong include community planners and multidisciplinary design teams. Compared to that of community-based subjects, the population of designer subjects is relatively small, but the level of participation is the deepest.

Among them the Chengdu Yiiie Co.,Ltd (Yiiie), a local multi-disciplinary creative institution mainly focusing on architectural design, is one of the earliest designer participants of Yudong's place-making.

As a design team, Yiiie serves as a core participant and an empowering agent in place-making. These 5 years witnessed Yiiie consistently participating as a design force in the entire process of place-making, reshaping the core public space of Yudong through architectural design, community planning, etc. What is more, it serves as a coordinator for a multi-subject participation platform with its series project, named Community Art Project

(CAP, later changed into CACP) in 2019 (Figure 5). This project, initiated and operated by Yiiie and sponsored by governmental foundations, used leftover community public space as a medium, creating a tangible platform for subjects to quickly reach consensus and cooperate. Different themes of each year allow the ever-increasing participants such as designers, artists, scholars, and residents to conduct a rapid and active collaboration in a short period.

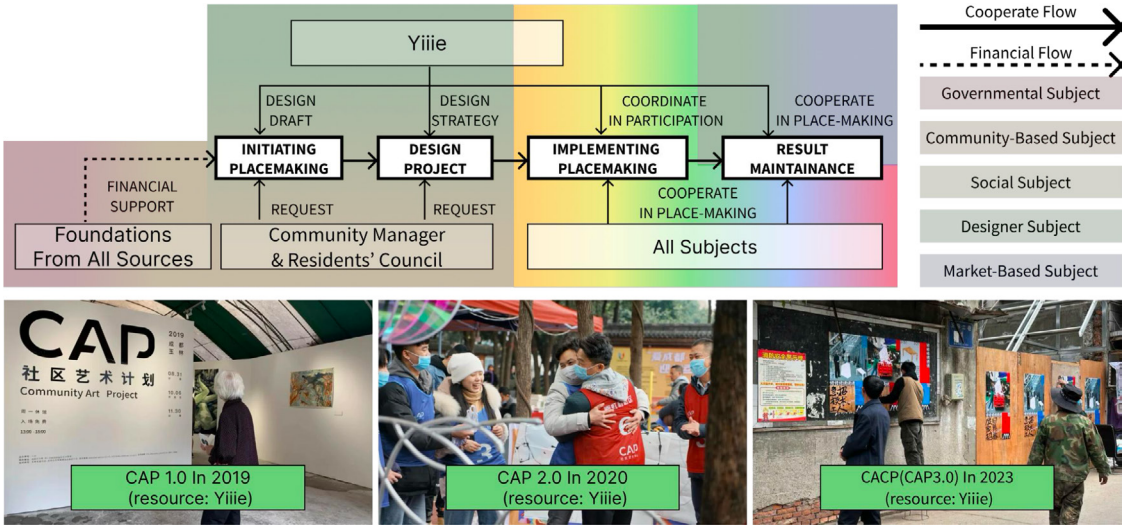

Figure 5. A design driven multi-subject participatory community platform framework of Yiiie.

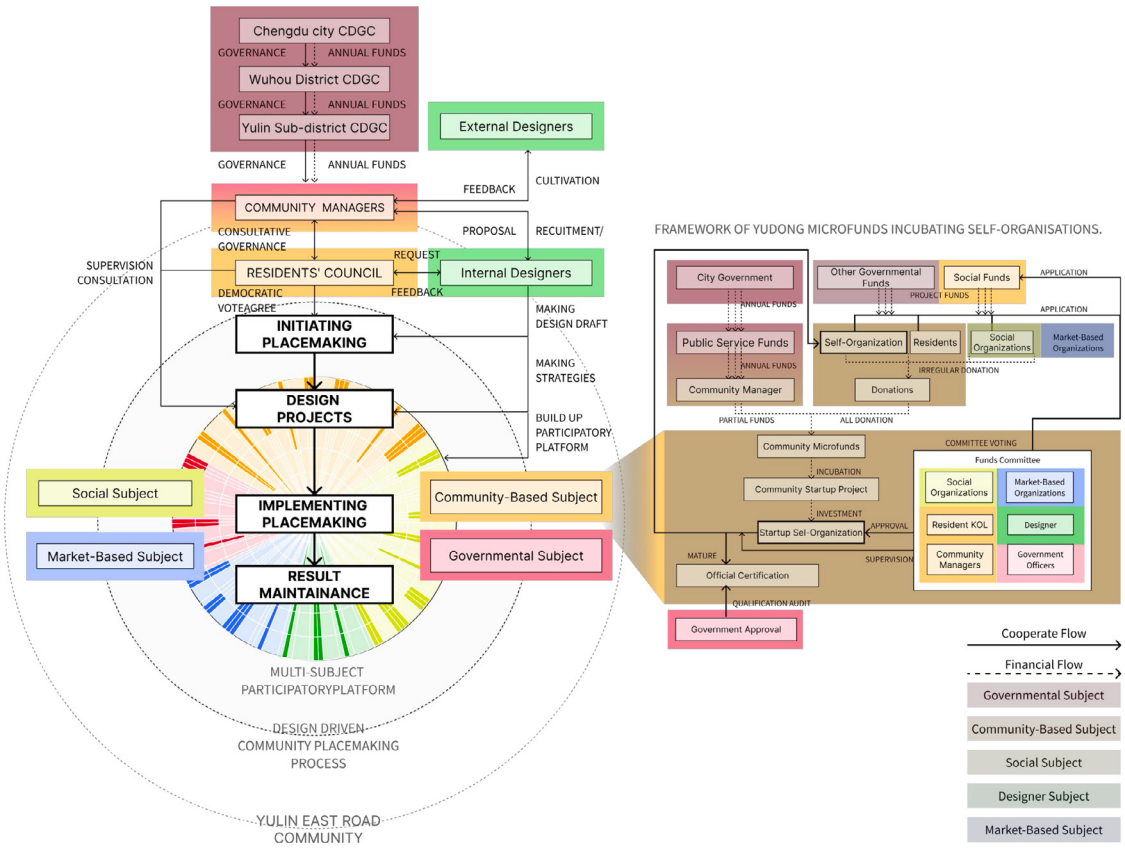

Figure 6. The overall participatory framework model in Yudong's place-making.

Conclusion

The above paragraphs discuss the roles and framework features of all 5 subjects who participated in the community place-making of Yudong.

A flow map is used to summarize the overall framework of the multi-subject participation in Yudong place-making, which demonstrates relatively equal and multidisciplinary participation in the place-making process among all subjects(Figure 6). The Microfunds incubating system in this framework is highlighted.

In this framework, governmental subjects, i.e. CDGC, play an active and targeted role in top- down decision-making and urban resource allocation, while community-based and social subjects have the largest population of participants, making it possible for bottom-up democratic decision-making and the diversity of participants in place-making to happen. Market-based subjects provide economic and professional support to the community, while Yudong nourishes them in return. Among them, we consider design as a driving force of this framework as designers play the roles of core participants, empower agencies, and platform coordinators.

In conclusion, this is the era of "less stuff and more people" when multi-subject innovative participatory frameworks in community place-making are needed. The research of Yudong provides a framework reference to help "participants to shape up the overall concept" in the place-making process. (Thackara, 2006, 4; Wu et al., 2019)

Acknowledgments

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The Integration of Artificial Intelligence and Design

Lei Yu

Lei Yu yulei
821008@163.com

Abstract

design, examining the influence of AI on creative thinking, innovative design, and design education. By analyzing existing research and applications, this paper emphasizes the revolutionary impact of AI on the traditional design field, guiding the transformation from manual to intelligent design.

Keywords

Artificial Intelligence, Design, Creative Thinking, Innovative Design, Design Education

Introduction

valuable outputs is not new [1-2]. However, due to the reliance of modern AI and big data technologies on online data resources, it's only recently that AI tools have begun to surge on a large scale. AI tools are renowned for their capability to efficiently and directly generate high-quality multimedia content [3], challenging longstanding paradigms in various creative disciplines, including art and design. As a result, an increasing number of scholars are re- evaluating and rethinking established design concepts and educational philosophies. They are delving deep into the impacts and challenges that big data and AI bring to the design education system [4-7]. How to guide students in facing the challenges posed by the advancement of AI technologies, seize opportunities, and leverage AI to enhance efficiency and creativity has become a pressing issue in contemporary design education.

1 Literature Review

1.1 Design and Analogical Thinking

Design emphasizes the use of imagery and visual tools to solve problems. In 2005, the British Design Association introduced the double diamond model of design, which includes four stages: Discover, Define, Develop, and Deliver[8]. The Discover phase mainly focuses on exploring the value of the topic and identifying problems in the current field. The Define phase organizes and integrates the content from the Discover phase. The Develop phase diverges to consider various potential solutions to the problem, and the Deliver phase integrates and implements these solutions[9]. Analogical thinking is one of the three main reasoning methods in human logical thinking. By comparing the similarities between things, it generalizes knowledge to another subject. This method is widely used in scientific research[10-11]. Through analogical thinking, humans can create innovative solutions in new fields, leading to new business opportunities. Additionally, analogical thinking can help people better understand complex problems and provide viable solutions[12]. It also fosters interdisciplinary collaboration and knowledge sharing, promoting the advancement of knowledge[13]. Past research indicates that an individual's analogical processing mainly involves three core processes: abstracting the problem into a single schema, seeking the analogical domain, and applying the discovered analogy to generate solutions[14]. In the field of

design innovation, analogical thinking is considered a fundamental cognitive tool[15], with the identification and application of analogies serving as innovative methods. This aids designers in drawing inspiration when creating new products and services[16]. As a valuable cognitive tool, it helps students solve problems, invent new solutions, and promote knowledge sharing and interdisciplinary collaboration[17-18]. With the rapid development of the internet in modern society, a vast number of invention patents, scientific papers, legal cases, web pages, and videos are emerging online. The explosive growth of online data provides new opportunities and possibilities for identifying analogies. How to mine analogies in a rapidly growing information space, especially deep similarities between multiple fields, remains a challenge in modern design innovation. Moreover, humans' sensitivity to superficial similarities often means they focus on surface details, making it hard to retrieve or apply distant similarities[19]. Due to these human limitations, effectively leveraging online data in the information age is a significant concern in contemporary design education.

1.2 Innovation and Artificial Intelligence

The concept of innovative capability best expresses human potential. Renowned American creativity and innovation psychologist, Sawyer, views innovative capability as "part of being human"[20]. In most existing studies, emotional intelligence, artistry, aesthetic level, and innovative ability are defined as primary human cognitive characteristics, with innovative capability widely recognized as a unique human trait[21-23]. With the rapid advancement of AI, after analyzing existing art pieces, AI has produced outputs indistinguishable from human-made outputs[24-26], blurring the lines between AI and artists[27]. This presents a formidable challenge for today's innovative designers. Regarding AI, Patrick Winston of MIT defined it in his 1992 textbook "Artificial Intelligence"[28] as "the study of computation that makes perception, reasoning, and action possible." This suggests AI employs algorithms, models, and other computational methods to mimic some human intelligence behaviors, including receiving external information, reasoning, and deriving certain outputs. It's a tool inspired by the human brain and empowered by mathematics and computational methods to achieve various intelligent behaviors[29]. However, computers can't autonomously generate programs for any arbitrary need; they must be designed and coded by humans since they lack creativity. Computers' increasing prowess stems from humans creating more and more programs for them to run, but they can't expand their functionalities on their own. Sawyer argues, "Despite AI computer programs holding world champion titles in chess, processing vast amounts of data, and recognizing patterns invisible to the human eye, they still cannot master everyday creativity." They lack the kind of creativity inherently associated with humans[30] and require physical development to produce outputs[28]. Thus, computer creativity and intelligence are mechanical and rigid; they follow human-issued instructions to complete specific tasks. While they are fast and accurate, they lack the abilities of creation and abstraction[31]. The outputs of data-centric computers fundamentally differ from the intentions and expectations humans have during creative tasks[32]. Nevertheless, the value of AI is undeniable. With continual scientific and technological progress, AI will achieve unparalleled accuracy, usability, and accessibility, inevitably being globally embraced and utilized. Most people will enhance their creativity with AI support. Therefore, how to effectively leverage AI to augment human creativity is a pressing issue in modern design education.

2 Research Hypothesis

Due to the significant limitations of analogical innovation in the traditional human brain, in our teaching practice, we deconstruct the traditional analogy process and allocate it to different information processing units. This approach aims to overcome the limitations of current analogical thinking and maximize the potential of artificial intelligence. This leads to our research hypothesis: By breaking down the analogical processing capability into

multiple steps and distributing them amongst different individuals and AI, design innovation outcomes can be enhanced more effectively.

During the course planning phase, the curriculum is based on the four design stages of the double diamond model. We designed an approach combining analogical thinking with distributed focus groups, utilizing both artificial intelligence and machine learning to identify and address real-world design issues. In the Discover phase, machine learning is employed for big data analysis to detect user needs. During the Define phase, focus groups abstract user requirements to identify deeper issues. In the Develop phase, artificial intelligence language models are trained to search and retrieve analogy suggestions, offering students innovative paths to potential solutions from other fields. In the Deliver phase, focus groups are once again employed to collate and summarize

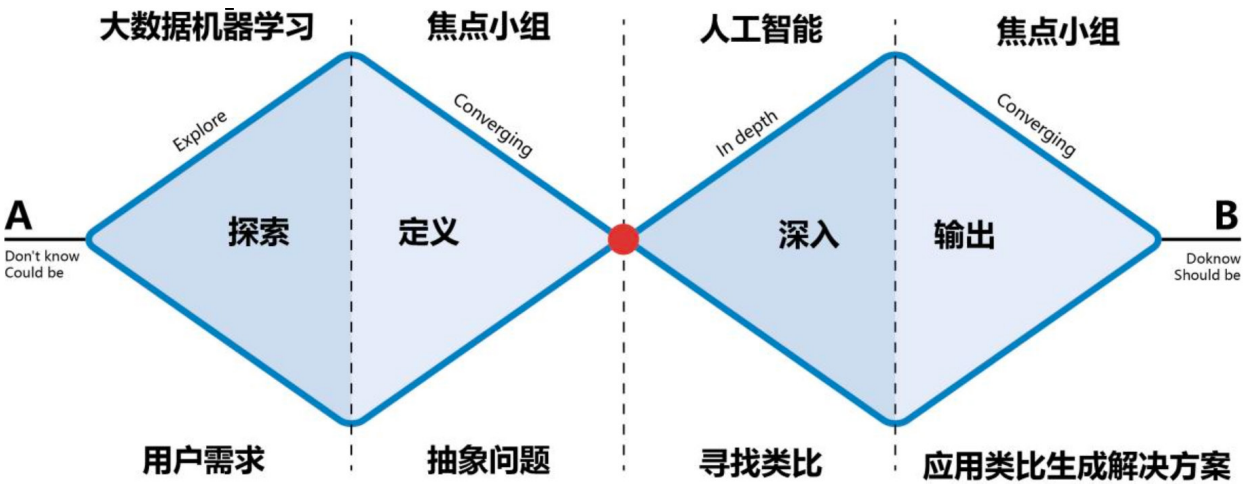

Figure 1. A theoretical framework for design education in which analogical thinking is integrated into artificial intelligence

The subjects of this study were 40 students of the 2021 Industrial Design Design Thinking and Methodology course at the School of Art and Design, Yanshan University. Overall, the students had a high level of design literacy. The experiment was conducted in a discussion classroom in the Department of Industrial Design to ensure flexible use of the classroom space for group discussion activities and manipulation of teaching aids. Students are divided into two groups, one for issue groups and the other for non-issue groups, with the issue groups designing products based on their chosen targets and the non-issue groups acting as a support group for the issue groups to expand their analogous thinking and not directly involved in product design. In practice, the different issue groups actually exist as non-issue groups for the other groups. The researcher also made it clear in advance of the course that it would be used as a teaching practice research course and informed the post-interviews to ensure that students were informed and volunteered.

3 Teaching Practice

3.1 Big data machine learning to discover user needs stage

The objectives of this stage are: to enable students to effectively use the python language to data crawl the user evaluation information of the products involved in the web platform, and to use the LDA (Latent Dirichlet Allocation) algorithm to construct a topic model and to form preliminary information on the structural representation of product requirements, the difficulty at this stage is the students' mastery of the python language. Thanks to the rapid development of artificial intelligence, students have effectively solved the problem

of data crawling and processing integration through the form of semantic question and answer with the help of artificial intelligence chat bots, and improved the efficiency of design exploration.

In the actual teaching process, after the issue group students teamed up according to their selected target products, they used the proposed design theme works as keywords and used the python program to obtain the top ten user reviews of the target products in the Jingdong shopping platform for similar products. Duplicate reviews with the same id and reviews with a total word count no greater than 2 were removed and valid review statements were obtained. After cleaning the review vocabulary, a bag-of-words model was constructed and LDA topic analysis was performed. By adjusting the parameters, five topics as well as core vocabulary were obtained as shown in the figure. This uses machine learning methods to efficiently extract the possible demand points of users and ensure the diversity of demand extraction, which provides a scientific basis for the extraction of abstract questions on the nature of demand by users at a later stage.

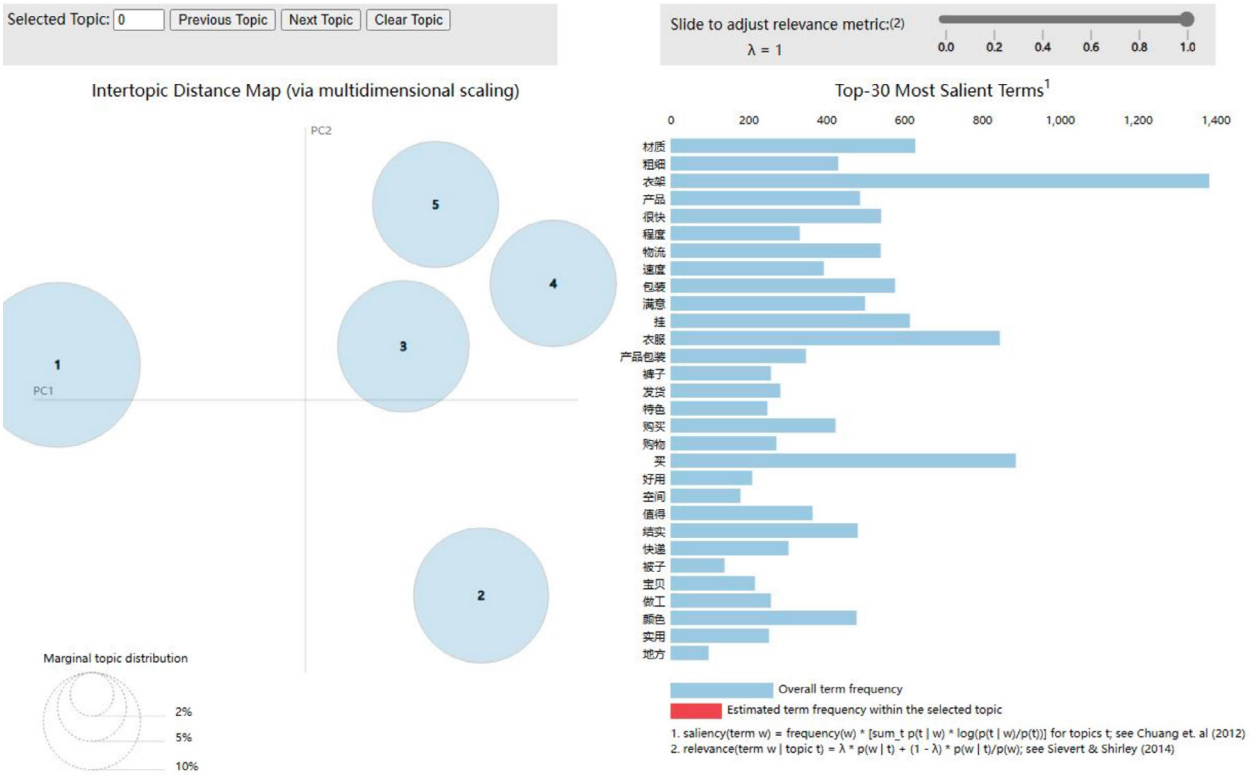

Figure 2. Results of LDA model runs

3.2 Focus group classification abstraction definition design problem stage

The aim of this stage is to guide the students in defining abstractions based on the information obtained from the machine. The abstracted problem should reflect the essence and be far removed from the product domain, but reflect enough relevant expertise to motivate students to come up with useful and non-obvious solutions. The challenge at this stage is to construct and reconstruct the problem, which requires students to abstract the problem while leaving as much room as possible for the solution to be implemented.

In practice, issue group students are required to develop ideas for the proposed design theme. The main task is to

analyse high-frequency words from user reviews crawled on the web and to understand the meaning behind the words, which are then abstracted and abstracted into a series of concrete problems. In the guided teaching phase, the course therefore reproduces a number of specific products so that students understand the specific problem schema and mechanism of their design, for example such as the Dyson bladeless fan, whose main problem is the uncomfortable noise and safety hazards that can arise from traditional fans, and whose mechanism is to separate the blades and the blower and then synthesise them, resulting in the design of a bladeless fan. In the students' concrete practice, they are mainly guided through the inductive method of grouping the key problems into different categories, and then allowed to brainstorm as many possible problems as possible, combining the card method with this to form the final abstract problem, which through training, students can gradually abstract to a high quality. For example, when considering the design of a coat rack, students first understand the user's needs through high frequency words and abstract the surface part of the problem, then focus on the user's core needs and break them down into multiple constraint patterns.

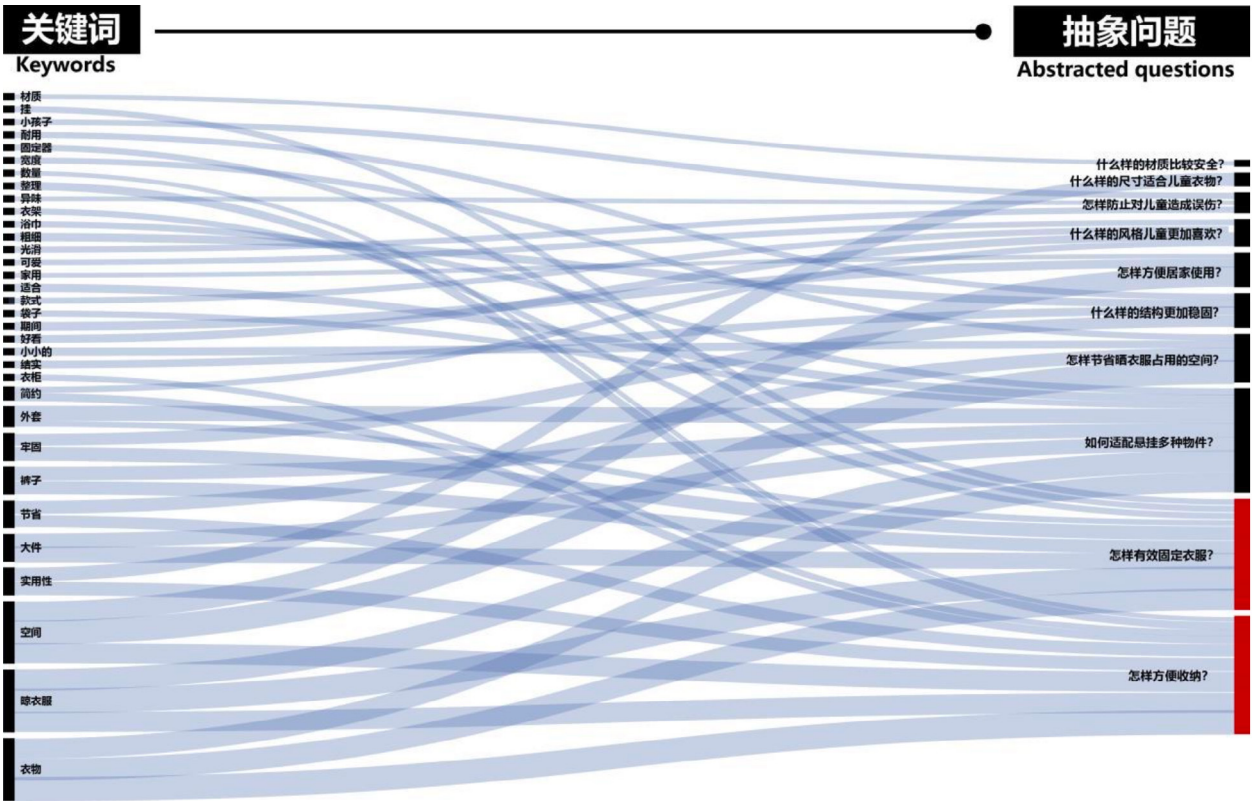

Figure 3. Classified abstraction defining the design problem

3.3 Artificial intelligence to construct analogous data stages

The goal of teaching at this stage is to guide the non-topic group students to use artificial intelligence to search through these areas for inspiration that might be applicable to solving the original problem. The benefit of this approach is that the non-issue person does not have the professional constraints of the intended product and searches for answers through the wealth of ideas, solutions and skills recorded on the web only in relation to the abstract problem provided by the issue group, such an approach makes it easier for the non-issue group to use AI to search for analogies that closely match in one dimension but are far apart in another, for items that are distant clustering to provide different similarity solutions.

During the teaching process, the main task of the non-topical group was to use artificial intelligence to find as many solutions to the problem as possible and to put together a workable solution mechanism. For example, when considering the design of an infusion device for children, the non-topics group students gave more than 10 different solutions to different problems through artificial intelligence, based on the abstract problems abstracted by the topics group: reducing child rejection, automatic infusion control, etc. At this stage the artificial intelligence processed is millions or even billions of data at a speed unmatched by humans, there is a lot of noisy data, which therefore needs to be checked, selected and adjusted manually to exclude the impurities produced by AI. For this reason, the non-topical group has adapted the solutions given by the AI search and has given example diagrams of each of the five possible solutions to the problem, with illustrations.

Figure 4. Artificial intelligence to construct analogous data

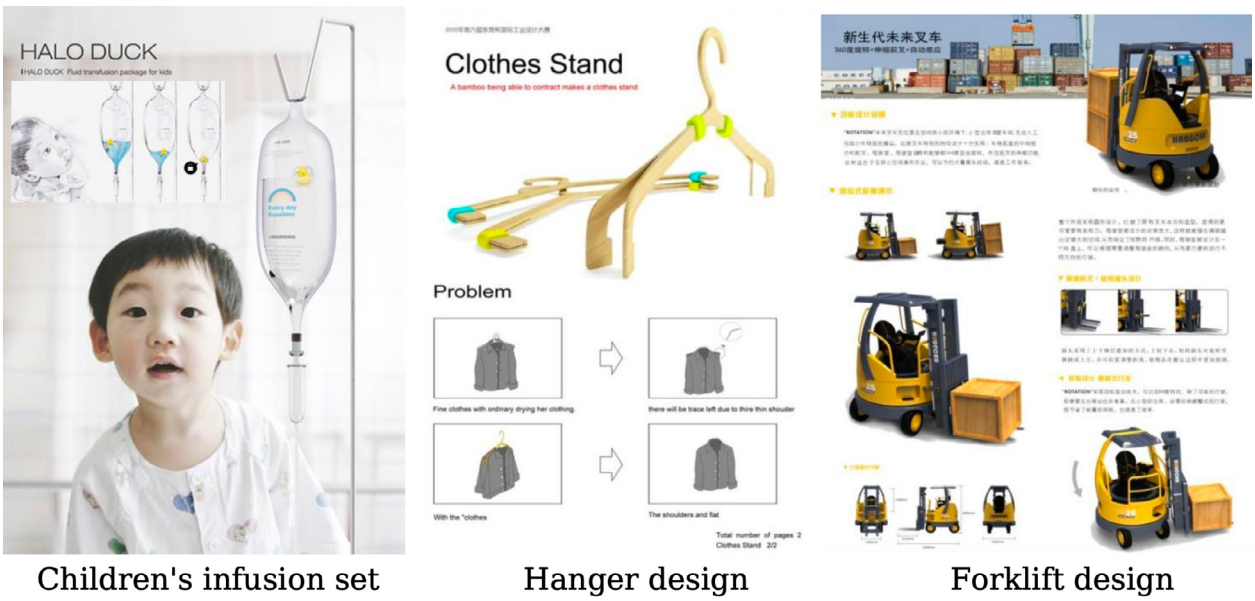

Figure 5. Figure 5 Part of the design coursework

3.4 Focus group output analogy solution phase

The main objective at this stage of the teaching is for the topic group to sort through the information and develop a final innovative analogical solution based on the information provided by the students in the non-topic group. During the teaching process, students addressed two main aspects of the problem, firstly by reviewing candidate inspirations retrieved by the AI and secondly by applying them to the problem at hand and integrating multiple potentially conflicting inspirations. For example, in the design of a forklift truck, in response to the problem of how to move the object in a small space, the issue team took the rotating dining table solution given by the non-issue team and modified the product by using a 360 degree rotation. By taking the open-ended problem-solving solutions put together by the non-topical group through artificial intelligence and turning them into a better solution, students are often able to find inspiration for innovation from other disciplines or fields, an approach that can effectively transcend the boundaries of students' current information and lead to innovation. Some of the design coursework is shown in Figure 5.

4 Exploring Teaching Outcomes

The aim of this course is to develop the skills and tools for students to acquire innovative knowledge and to enhance their effectiveness to engage in innovative activities[33]. Efficacy is defined by Bandura as an individual's ability to assess his or her performance in a given task. Efficacy is defined by Bandura as the individual's ability to assess his or her ability to perform a given task, and perceived efficacy is positively correlated with innovation[34][35]. The perception of efficacy is positively correlated with innovation. Therefore, this study explores the outcomes of the programme by understanding students' assessment of efficacy in the learning process. Questionnaires and focus group interviews were used to find out the efficacy of students participating in the programme and to understand the outcomes of the programme.

To assess students' agreement with learning efficacy, a five-point Likert scale was used and the learning efficacy research literature was consulted[36][37]. A four-component learning effectiveness scale was designed to include four dimensions: competence enhancement, goal attainment, self-directed learning and confidence in application. The competency enhancement scale includes questions on knowledge gained, methods and tools, teamwork and ability to implement the topic; the goal attainment scale includes questions on topic attainment and knowledge learning; the self-directed learning scale includes questions on knowledge acquisition and implementation of the topic; and the application confidence scale includes questions on application of learning and entrepreneurial application. The Learning Effectiveness Scale was administered to students at all four stages of the course, and an online questionnaire was administered through Yanshan University's Teaching Quality Assessment System. We asked students how much they agreed with the questions in order to understand their feelings about various aspects of learning effectiveness. In the end, we received 40 valid questionnaires.

The focus group interviews were conducted in groups of students in the discussion rooms of the school and were recorded to ensure the accuracy of the data collected. The interviews consisted of a questionnaire on learning effectiveness and were conducted through discussions among group members to understand the effectiveness of students' learning at each stage of the process. During the focus group interviews, the content of the course and the results of each group topic were provided to help the participating students review their learning journey in order to obtain reliable interview data.

The results of the questionnaire on learning effectiveness were presented using a quantitative approach,

presenting students' self-assessment results across the four stages of the learning and implementation themes. The verbatim transcripts of the interviews are analysed and summarised for content. The results of the quantitative and qualitative analysis are used to interpret the assessment and feedback of the participating students on the effectiveness of their learning in this course.

The results of the Student Learning Effectiveness Questionnaire are shown in Table 1. The Cronbach's alpha scale was used to check the reliability of the four constructs, with Cronbach's alpha values of 0.891, 0.933, 0.934 and 0.951 respectively, all of which are greater than 0.7, indicating that the results of this study have good reliability. The mean value of students' learning effectiveness in this course was 4.36, and overall, the majority of students considered the learning effectiveness of this course to be high. In terms of the four dimensions of competence enhancement, goal attainment, self-directed learning and confidence in application, students agreed with the highest level of competence enhancement (4.43) and the lowest self-rating for confidence in application (4.293). Across the three learning stages of the course, students' self-ratings of learning effectiveness were highest at output (4.41) and lowest at depth (4.35). The qualitative data collected through the focus group interviews were used to analyse and interpret the students' learning effectiveness.

Learning Phase / Learning self-efficacy		Explore User requirements		Definition Abstract questions		In-depth Finding analogies		Output Applying analogies to generate solutions		Total
		Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)
Capabilities Upgrading	Knowledge	4.45 (0.597)	4.413 (0.455)	4.50 (0.506)	4.488 (0.435)	4.615 (0.679)	4.375 (0.575)	4.50 (0.591)	4.463 (0.495)	4.434 (0.430)
	Methods/ tools	4.45 (0.677)		4.60 (0.496)		4.564 (0.736)		4.35 (0.597)		
	Teamwork	4.50 (0.599)		4.40 (0.591)		4.667 (0.672)		4.35 (0.597)		
	Implementation capacity	4.25 (0.707)		4.45 (0.597)		4.564 (0.776)		4.25 (0.504)		
Objectives Reach	Themes achieved	4.30 (0.648)	4.375 (0.575)	4.40 (0.672)	4.375 (0.696)	4.615 (0.853)	4.375 (0.805)	4.30 (0.648)	4.300 (0.648)	4.344 (0.606)
	Knowledge learning	4.45 (0.677)		4.35(0921)		4.590 (0.802)		4.35 (0.723)		
Autonomy Study	Knowledge	4.45 (0.677)	4.375 (0.597)	4.45 (0.597)	4.375 (0.677)	4.667 (0.662)	4.375 (0.666)	4.35 (0.744)	4.425 (0.605)	4.375 (0.534)
	Executive Topics	4.30 (0.648)		4.30 (0.791)		4.538 (0.723)		4.30 (0.597)		
Applications Confidence	Apply what you have learned	4.35 (0.802)	4.300 (0.668)	4.05 (0.876)	4.175 (0.805)	4.615 (0.776)	4.325 (0.773)	4.25 (0.583)	4.375 (0.714)	4.293 (0.633)
	Start-up applications	4.25 (0.707)		4.30 (0.791)		4.436 (0.810)		4.40 (0.677)		
Total		4.375 (0.480)		4.380 (0.549)		4.345 (0.596)		4.41 (0.546)		4.362 (0.524)

Table 1. Descriptive statistical analysis of learning effectiveness

5 Exploration of research findings

This pedagogical practice is based on the Double Diamond model of design thinking, which expands the prospects for unexpected discovery in a distributed manner through a series of manual focus group discussion processes and artificial intelligence systems. These processes overcame the previous challenges of analogical innovation. Through post-questionnaire and interview content analysis, the study concluded that there are a number of important benefits to incorporating distributed analogies through artificial intelligence, summarised in three advantages:

5.1 Effective ways to break out of the mindset

In traditional analogical innovation, one can often only find analogies with high surface similarity, but not those with deep structural similarity. To address this problem, many researchers have proposed various approaches to help designers build more abstract representations of problems, such as generating multiple abstract representations or using functional ontologies to represent the relational structure of a problem[38]. However, using web- based big data and artificial intelligence techniques, it is possible to bring together thousands of people worldwide to work on complex cognitive tasks. Through student questionnaires and interviews, it can be seen that this teaching practice method can help people to find inspiration in distant areas while avoiding stereotypical thinking. However, in the early stages of teaching practice, there was some risk that the method might fail, for example, because students might not be able to ask abstract questions explicitly or, even after giving some key cues through the non-topic groups, they still did not recognise the deep structural relationships contained in this information and therefore missed some important information. To address such problems, the group added to the teaching content at a later stage of teaching practice, focusing on exploring the abstraction model of questions and the way distributed focus groups fit together, as well as the value of distributed processes and abstraction models among group members, and training students to become proficient in tools such as induction and card methods as a way of taking data summarised by machines, transforming it into different categories, and then carrying out focus abstraction in order to generate high quality abstract questions that can be used to find inspiration from different fields.

5.2 Forming effective ways to expand thinking

Analogies are an effective way to find new ideas, but finding useful analogies in large-scale data sets can be a challenge. To address this challenge, this teaching practice uses two complementary approaches to solve it: a population-based approach and an artificial intelligence-based approach. The AI-based approach uses artificial intelligence to examine large datasets and suggest possible analogies. Machines can process large amounts of text, images, video, patents, research papers and other data sources to discover potential analogies and help students find useful inspiration faster. By assigning steps to different people and machines, different innovation paths are explored. The benefit of this approach is that machines can process large amounts of data quickly and accurately and find useful analogies quickly, but machines cannot understand the deep knowledge and context of the domain in the same way that humans can, and thus a human and machine collaborative approach is used throughout the teaching process in order for students to find analogies in different domains to gain an abstraction capability that machines do not have, and the strategy is able to provide machine learning system with useful analogical problems and a useful complement to student innovation that can help students search for more distant and fruitful areas of expertise.

Through interviews, students generally found these AI-provided analogies to be a valuable, unexplored source

of new ideas, and the approach offered more possibilities with increased creative efficacy than standard self-directed learning. This suggests that this collaborative human-AI strategy may hold promise for helping students more quickly to extract useful information from a range of different real-world datasets.

5.3 Effective means of responding to complex issues

By breaking down tasks and opening the door to more possibilities for more types of innovative work, the involvement of artificial intelligence will bring complementary benefits to this process. While people's ability to derive and apply deep relational patterns from unstructured real-world data is unparalleled, they are limited in their ability to search widely for vast repositories of potential analogues.

The interviews revealed that the teaching strategy can effectively address multiple constraints in product innovation and find solutions to design problems through effective abstraction. In the students' design process, there are often multiple conflicting factors to consider, such as safety and flexibility. To address these challenges, through the group process of human-machine interaction, students first decompose the problem into multiple constraint patterns and find corresponding solution models for each constraint pattern. These models are then integrated into a solution that addresses each constraint. Through this approach, students can solve open-ended design problems of unknown form and translate them into problem statements with clearly defined constraints. Students can then integrate these constraints by finding inspiration from different fields and create solutions that are more practically useful and original in their thinking. This approach offers a viable approach to complex design problems and can help students to explore problem-solving possibilities in a more focused way, avoiding over-reliance on traditional sources of inspiration, such as copying or modifying existing designs. It can also help students to better understand and manipulate design constraints, further improving the practical feasibility and innovation of their designs.

6 Conclusion

Although the application of existing AI systems in the design field is still relatively limited, as technology continues to develop and data resources increase, we believe that design methods based on AI and human collaboration will become increasingly common and practical in the future. To better accommodate the future of design teaching, in this teaching practice the course breaks down a person's analogous processing power into decentralised steps and assigns them to different individuals or artificial intelligences. This approach allows for the use of the respective strengths of the person and the AI to form a complementary set while improving their weaknesses in order to increase the number of potential analogies found. It also allows the brain work done by each individual in the focus group to be captured effectively so that the rest of the group can make use of it. So analogies are not just a person's expertise in the traditional sense, by collaborating to exploit the complementary strengths of people and machines, important social problems can be better solved. However, this approach also brings new challenges, such as how to coordinate the efforts of different people and how to determine the best configuration of human and machine processing, which are issues that need to be explored in depth in future teaching.

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