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Design Thinking for Chinese Environmental (Art) Design Education: A Case Study within Design Day Marathon

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Abstract: This article investigates the paradigm shift in Chinese environmental (art) design education, moving from a focus on aesthetics and functionality to an emphasis on creativity, innovation, and interdisciplinarity. The reformed education aims to cultivate designers skilled in addressing "VUCA" as innovative changemakers. Design thinking, a human-centered, interdisciplinary, collaborative, and creative methodology, is explored through a pedagogical case study in Beijing Design Marathon. The conclusion highlights seven main capabilities for design-driven innovators: Professional Knowledge, Creativity, Interdisciplinarity, Management & Leadership, Adaptability, Collaborative Innovation, and Social Responsibility. This study offers valuable insights into applying design thinking in Chinese environmental design education and contributes experiential knowledge to the international spatial design education domain.

Keywords: Design thinking, Chinese environment (art) design education, Spatial design education, Design-driven innovator

1. Introduction

The design paradigm has evolved continuously, shifting from the 1950s' "style creation" to the 21st century's "design-driven innovation" (Lou, 2008). This evolution showcases five trends: transition from creation to strategy, tangible to intangible, specialized to interdisciplinary, creativity to innovation, and design to design thinking. Design's focus has reportedly moved from "objectives" to "thinking" (Krippendorff, 2005; Brown, 2008; Manzini, 2016), requiring a comprehensive knowledge integration, rendering design as a unique "way of thinking" and a driving "engine" for innovation (Lou, 2010).

In China, environmental (art) design (see figure 1), originally an interior decoration discipline, faces development challenges due to its complicated history and antiquated theories (Lou, 2018; Yang & Zhu, 2020). The field focuses on "space" (interior and exterior), tying closely with urban planning,

architectural, landscape, and furniture design (Song, 2020). However, decoration, aesthetics, and physical spaces focus is no longer adequate to address contemporary society and individual needs (Piotrowski, 2013). The modern design field demands interdisciplinarity, collaborative innovation, and social responsibility, capable of handling "VUCA" situations (Siniscalchi, 2021). Thus, design education, particularly China's environmental (art) design education, requires a transformative shift towards "design thinking."
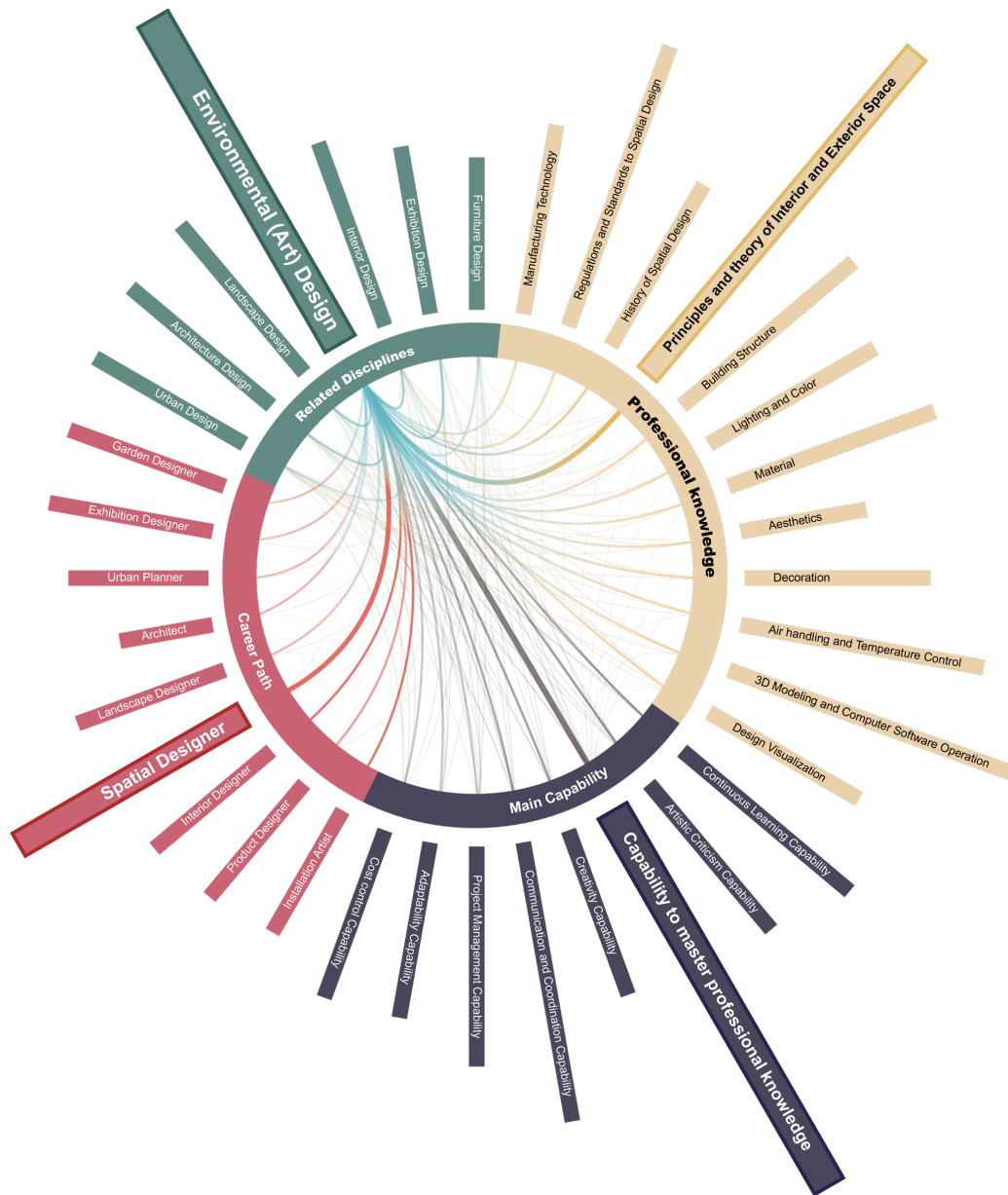

Figure 1. Original Environmental (Art) Design Discipline Information Blueprint (made by author). The green color indicates the related disciplines involved in environmental (art) design, while the yellow color signifies the required professional knowledge. The purple color represents the main capabilitys that environmental (art) designers must possess, and the red color indicates the future career paths in environmental (art) design. This chord diagram illustrates the relationships between various areas, and the depth of the line colors conveys the closeness or distance of these relationships. For instance, the theory of interior and exterior spaces is the most closely related professional knowledge in environmental (art) design, necessitating designers to possess the essential capability of professional knowledge. The primary career path for environmental (art) design is as spatial designers.

The recent pandemic has impeded international educational exchanges but sparked online teaching innovations. The Beijing Design Week's "Design Marathon" project aimed to explore innovative

interdisciplinary design education online. The project saw 12 participants from diverse international backgrounds partake in a 10-day workshop, centered around a 15-minute living circle concept. This experience underscored design thinking's capacity for creative problem-solving in environmental art design education.

2. Literature review

2.1 Design Thinking

Over the past 40 years, Western-originated "Design Thinking" has extensively permeated design theory, practice, management, and business, widely recognized as an innovation catalyst (Brenner et al., 2016; Mootee, 2013). Roberto Verganti (2009) developed it as a third form of innovation, integrating analytical reasoning with exploratory skills (Glen, 2014). Tim Brown of IDEO (2018) frames it as a human-centric innovation approach that marries people's needs, technology's possibilities, and business requirements, a view critiqued for its broadness and ambiguity (Xin, 2022; Corss, 2023).

The attempt to define design thinking has spawned various interpretations, leading to the adage, "a thousand scholars have a thousand design thinking perspectives". The highly-cited "Design Thinking: Past, Present and Possible Futures" argues the futility of seeking a unified definition, suggesting more value lies in understanding its practical and pedagogical roles (Sköldberg et al., 2013). The evolution of design thinking, from the 1960s' "design methods movement" to today's term "design thinking", is seen not as a linear replacement of concepts, but an amalgamation process, characterized by 3 key transformations (figure 2).
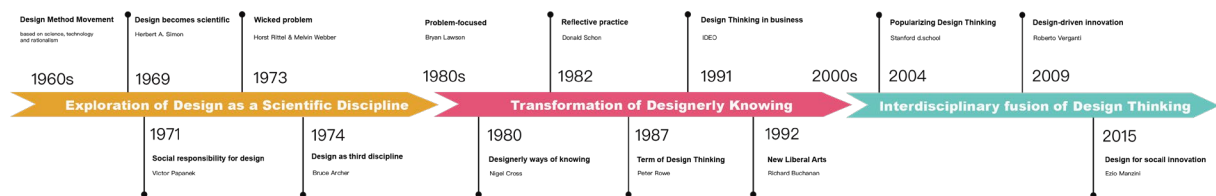

Figure 2. Timeline of design thinking evolution (made by author).

- The first transformation (1960-1980) focused on "design as a scientific discipline," with scholars applying scientific paradigms to the design process in an attempt to develop design into a discipline grounded in scientific principles. This period is often considered the beginning of design thinking research (Johansson, et al, 2013).

- The second transformation (1980-1990) centered on a shift in "design cognition (Kimbell, 2011)." The scientific paradigm-driven research was criticized, as theoretical results failed to gain recognition and application in practice, creating a gap between research and practice. Nigel Cross (2006) and others, based on previous research, compared designers and scientists in terms of cognition, thinking, and action, proposing the concept of "designerly ways of knowing" and its underlying theory. During this time, "design thinking" was first used as an academic term in architecture and urban planning, while Donald Schon introduced "reflective practice" as a critique of the "technical rationality" represented by Herbert Simon.

- The third transformation (2000-present) emphasizes the "integration of design thinking with other disciplines (Schallmo, et al, 2018)." Design-driven consultancies like IDEO and Frog have emerged as industry leaders, and the rise of service design as a new design field has led to the development of novel tools and processes for co-creation and participatory design. This shift towards collaborative design and multidisciplinary teams focuses on open and internalized creative processes and ways of thinking, making them more transparent and accessible to all.

Design thinking is often modeled in stages, such as Stanford University's five-stage model: empathy, define, ideate, prototype, test (Dam, et al, 2019), or the British Design Council's Double Diamond (Council, B. D., 2005). However, the practical application of these models faces challenges due to their universal nature and the inherent non-linear, flexible characteristics of design processes (Dam and Siang, 2017). While accessible to a broad range of professionals, these generic models can lack specificity, limiting their effectiveness in specialized domains like spatial design. To address this, it's necessary to adapt these models to specific design domains, maintaining core design thinking principles but with more targeted applications. Thus, a tailored model for environmental (art) design, based on the five stages of design thinking, will be introduced in section 5 to enhance its effectiveness in this specific discipline.

However, Design thinking's role in spatial design education is a relatively untapped field with scarce literature and research. In his 2018 doctoral research, Pham Tu Ngoc argued that conventional models fail to capture the intricate interior design process, leading him to establish a design thinking-based educational methodology recognized for its human-centric, cross-disciplinary, problem-solving, and exploratory traits. In 2019, Annalinda De Rosa identified fresh challenges in spatial design due to global shifts, promoting a "space + service" cross-disciplinary strategy. This strategy affirms Muratovski's 2016 claim that modern design extends beyond physical entities to designing systems, strategies, and experiences. Moreover, in recent years, Tongji University's DESIS group has fused spatial design with social innovation theories by Ezio Manzini (2015), implementing several community micro-renewal projects in Shanghai, including "NICE 2035" and "Open Your Space". They've also contributed to the creation of several FabLabs in the Tongji neighborhood, collaborating with institutions like the MIT MEDIA LAB, Aalto LAB from Finland, and Aston Martin LAB.

2.2 Design Thinking in Education

Design has expanded beyond aesthetics to a comprehensive management approach, employing distinct processes and "thinking" methods (Dell'Era et al., 2020). Globally, institutions have harnessed design thinking in education through innovative collaborations, such as the RCA Global Innovation Design project, Hasso Plattner Institute of Design, Alta Scuola Politecnica project, and the Sino-Finnish Centre project. These initiatives aim to foster designers equipped with interdisciplinary understanding to address complex real-world problems.

These educational models view design thinking as effective for knowledge integration, addressing human needs and sustainability objectives (Lou et al., 2015). They encourage interdisciplinary collaboration for comprehensive problem understanding and innovative solution generation. Some have incorporated entrepreneurship, enabling students to apply design skills practically and innovate value to meet market demands.

Meyer and Norman (2020) argue for a fundamental shift in 21st-century design education, responding to rapid change, new technologies, environmental issues, and evolving social concerns. In line with this, Friedman (2019) proposed equipping designers to tackle four groups of 11 complex challenges, aligning with the UN's 2030 Sustainable Development Goals (table 1).

Table 1. 11 Challenges Faced by 21st Century Designers (edited by author).

Fours Groups	Eleven Challenges	Key Information
	(proposed by Ken Friedman and later supplemented by Michael W. Meyer and Don Norman)	(extracted by author)
Performance Challenges (Challenges related to what designers must do, rather than a challenge to their skill sets.)	1. Design acts on the physical world and on the linked world of intangibles.	physical world, intangible world
	2. Design addresses human needs and desires (sometimes focusing upon specific things—be they tangible or intangible—sometimes focusing on abstract things such as experinces, purposes, and goals).	human needs, desires
	3. Design generates the tangible and intangible built environment as well as the social environment. (Design is a discipline of making. It makes the physical, as in the built environment, and devices, machines, and tools; and the intangible, as in services and procedures.)	tangible, intangible, built environment, social environment
Systemic Challenges (Challenges related to addressing the entire system, not just a single part.)	4. We live in a world marked by ambiguous boundaries between artifacts, structures, systems, and processes.	ambiguous boundaries
	5. We work in a world of large-scale social, economic, and industrial frames.	large-scale
	6. We design for a complex environment of ever-shifting needs, requirements, and constraints.	complex environment, ever-shifting needs, requirements, constraints
	7. We design for a world in which intangible content often exceeds the value of physical substance.	intangible content, physical substance
Contextual Challenges (Challenges related to dealing with complex systems that are strongly affected by their environment, local culture, and political concerns.)	8. The projects, products, and services we design often cross the boundaries of organizations, stakeholder, producer, and user groups.	cross the boundaries, organizations, stakeholder, producer, user groups
	9. These projects, products, and services must meet the expectations of many organizations, stakeholders, producers, and users.	meet the expectations, organizations, stakeholders, producers, users
	10. These projects, products, and services must meet demands at every level of production, distribution, reception, and control.	every level, production, distribution, reception, control
Global Challenges (Challenges related to dealing with complex sociotechnical systems.)	11. We must address the major societal issues facing the world, including the sustainable development goals specified by the United Nations, which seek to "address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice" with the goal of achieving "each goal and target by 2030.	major societal issues, poverty, inequality, climate, environmental degradation, prosperity, peace, justice

The author has synthesized the discussion of the 11 challenges into several key points: Design plays a crucial role in both tangible and intangible domains, focusing on human needs and creating physical and non-physical environments. Within the broader social, economic, and industrial contexts, design must respond to constantly changing demands and constraints, emphasizing intangible values. Spanning organizational boundaries and stakeholder interests, design must meet diverse needs while addressing global challenges such as the United Nations' 2030 Sustainable Development Goals.

In order to address these 11 challenges, the author has identified seven primary capabilities that designers of the new era should possess. These include (figure 3): Professional Knowledge, Creativity,

Interdisciplinarity, Management and Leadership, Adaptability, Collaborative Innovation, and Social Responsibility. The following paragraph provide a detailed analysis of these seven capabilities.
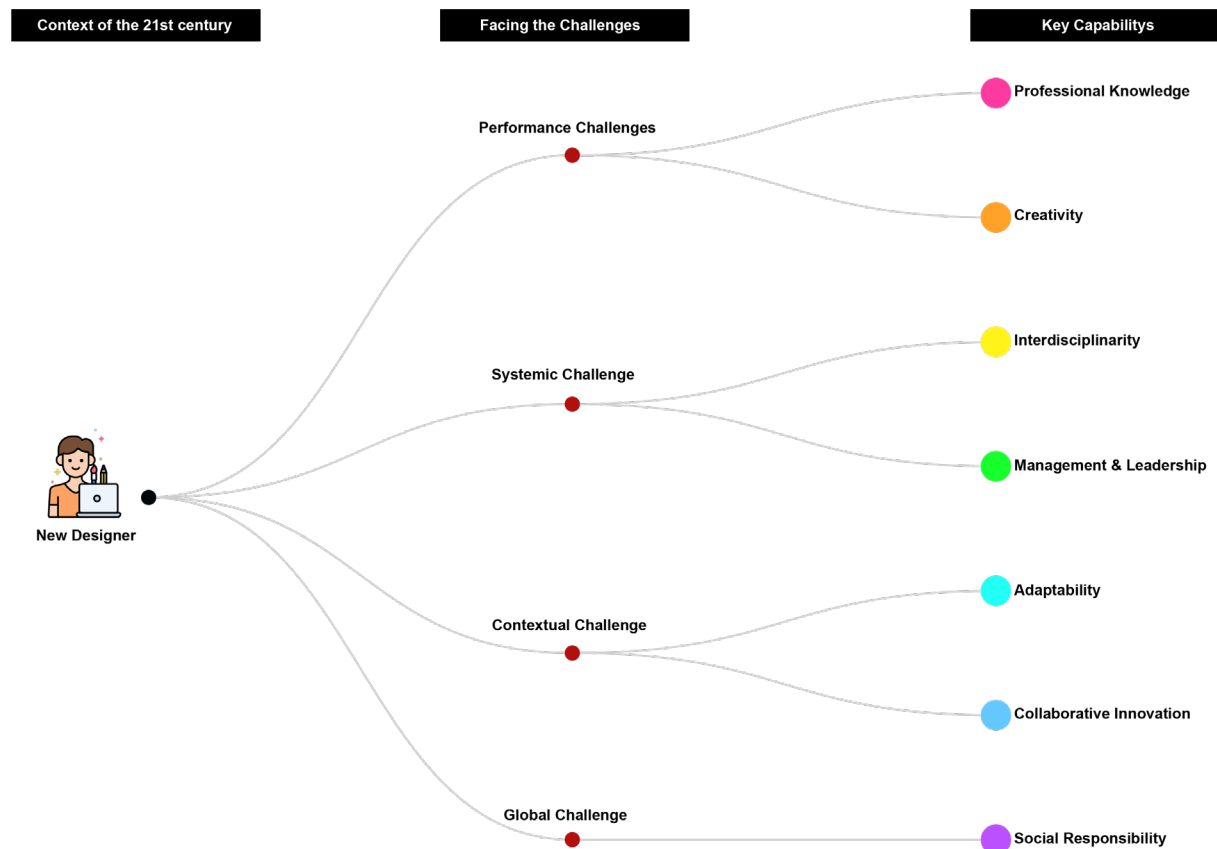

Figure 3. Seven Capabilities that New Designers Need to Master in the 21st Century (made by author).

- **Professional Knowledge** (Responding to Performance Challenges)
  Professional knowledge encapsulates the domain-specific knowledge and skills designers require in various specialized fields such as spatial, fashion, service, interaction, and product design. These fields each have unique characteristics and distinct knowledge systems, offering the theoretical foundation for problem-solving and excellence in design.

- **Creativity** (Responding to Performance Challenges)
  Creativity, fundamental to the design process, enables designers to generate unique and innovative ideas and convert them into viable designs. Through unique perspectives, challenging conventional approaches, and thorough client communication, designers stimulate creativity, producing innovative and high-quality work.

- **Interdisciplinarity** (Responding to Systemic Challenges)
  Design systems encompass disciplines like anthropology, psychology, engineering, and art. An interdisciplinary approach, therefore, becomes essential, integrating knowledge from various domains for more comprehensive, holistic solutions.

- **Management & Leadership** (Responding to Systemic Challenges)
  Effective design management includes project, team, budget, time, and resource management. Designers also require strong organizational coordination, decision-making, and communication skills for smooth project progression and objective attainment. These skills ensure project success and sustainable growth at both commercial and organizational levels.

- **Adaptability** (Responding to Contextual Challenges)
  Adaptability is a designer's capability to adjust to different cultural, environmental, and political contexts impacting design. It encompasses understanding target users' culture and behavior, familiarity with local legal environments, and coping with change and uncertainty.

- **Collaborative Innovation** (Responding to Contextual Challenges)
  Collaborative innovation requires designers to work with various stakeholders within specific contexts to address complex multi-organizational issues. This implies abilities to collaborate, communicate, work as a team, resolve conflicts, and understand and respect diverse social and cultural nuances.

- **Social Responsibility** (Responding to Global Challenges)
  In the face of global challenges, social responsibility in design means designers must consider the societal and environmental impact of their work. Designers should contemplate how their designs can address social and environmental issues, driving social change and sustainable development.

3. Methodology

This research reviews design thinking literature and proposes a novel environmental (art) design concept, reflecting the transformation of core concerns and design objects. It identifies the benefits of design thinking in education and proposes seven essential skills for new era designers to meet 21st-century challenges. A seven-dimensional radar tool is developed to assess design education projects.

The study then utilizes an online workshop in the Beijing Design Week's Design Day Marathon as a pilot case for environmental (art) design education, involving students from varied disciplines and academic levels. The online collaborative sharing model adopted promoted cross-cultural interactions, networking, and enabled students to develop culturally inclusive solutions.

Classroom observations documented the instructional process, allowing reflection on pedagogical strengths and limitations, critical for improving teaching quality (Montgomery, 2013). Feedback from workshop attendees and experts was collected via questionnaires and semi-structured interviews to draw conclusions. The study focuses on two primary research questions:

- How can design thinking be integrated as an innovative approach within Chinese environmental (art) design education?
- What are the key advantages of employing this approach?

4. New Environmental (Art) Design

The Chinese environmental (art) design discipline has a history spanning over 70 years, evolving from its initial stages of interior decoration and interior design to the more comprehensive field of environmental design today (figure 4). It is worth noting that due to the ambiguity in Chinese academic and design communities concerning the concepts of art and design, the latter is often considered a subsidiary of the former. To distinguish it from engineering design, some scholars prefer using the adjective "art" before the term "design," leading to frequent confusion between "environmental design" and "environmental art design." The author regards design as a discipline independent of art, with "environmental design" being the appropriate academic term. Nonetheless, in light of the confusion surrounding terminology within the Chinese academic community, this article employs the term "environmental (art) design" to represent the discipline for better communication and exchange. Putting aside the issue of nomenclature, an in-depth examination of the practice, research, curriculum, and employment aspects of environmental (art) design reveals a closer resemblance to the English term "spatial design" (Song, 2020). However, due to the lagging theoretical framework, ambiguous definitions, and indistinct design objectives in Chinese design, the discipline has faced various challenges (Lou, 2019) that have hindered its development.
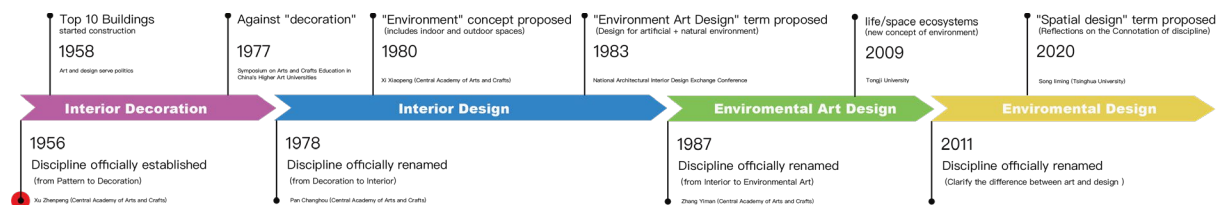

Figure 4. Timeline of Environmental (Art) Design Discipline in China (made by author).

Reconsidering the academic terminology of the discipline from a Chinese context and cultural perspective, we can derive new insights into environmental (art) design. The main subject of the term is "environment." In Chinese, the term "environment" (环境) can be broken down into two components: "环" (huan), meaning surrounding or around, and "境" (jing), signifying boundary, atmosphere, or conditions. By reinterpreting Chinese characters, we can view environmental (art) design as a field that studies "designing for the human-centered surroundings, atmosphere, and conditions." The design objects here include both physical and non-physical, tangible, and intangible elements.

Furthermore, the traditional Chinese philosophy of Tai ji offers an interpretation of the world's ontology (Slote, 2021). Tai ji embodies the balance and interaction between Yin and Yang, representing a middle path that emphasizes harmony and balance in the development and transformation of things. The relationship between Yin and Yang is interdependent and mutually transformative. This transformation process is continuous; when Yin reaches its limit, it transforms into Yang, and when Yang reaches its limit, it transforms into Yin.

Viewing the world through the lens of Tai ji (figure 5), the black Yin symbolizes the intangible, non-physical, invisible, and untouchable, while the white Yang represents the opposite: tangible, physical, visible, and touchable. In accordance with the Yin-Yang philosophy, black and white are evenly distributed, intertwined, and balanced. There is white within black and black within white, expressing the idea that Yin and Yang are not absolutely separate but rather

mutually inclusive and interconnected. This concept aligns with the challenges faced by contemporary design, where graphics, products, services, and strategies are interpenetrating and inclusive, rather than being isolated from one another.

In the "Book of Changes (易经)", the worldview of Yin Yang suggests a pluralistic, rather than dualistic perspective of the world. It argues that occurrences in the world do not adhere to absolute binaries. There is no absolute right or wrong in an event, no definitive goodness or badness in a person's character, and no unequivocal correctness or error in a design. Furthermore, biological hierarchies are not absolute, signifying a parity in the relationship between humans and nature. These rudimentary tenets of Chinese philosophy can find applications within the lens of design studies, thus providing a holistic perspective on design concepts.
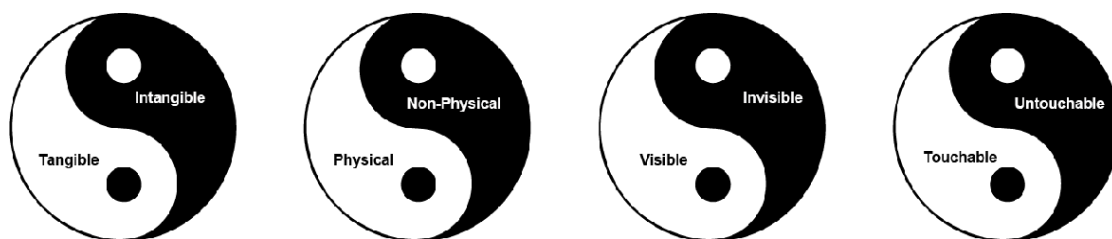

Figure 5. Attributes Corresponding to Tai ji's Yin and Yang (made by author).

Design scholar Richard Buchanan (2001) introduced the well-known Four Orders of Design to reflect the contemporary design issues we face today, consisting of symbols, physical objects, activities, and systems. In the chart with two axes, the four quadrants seem to be arranged in an ascending hierarchy. However, in reality, the design objects are not hierarchically ranked or arranged in an incremental relationship; rather, they are interdependent and inclusive. The author proposes to integrate these four quadrants within the Tai ji framework and generate a new model to address emerging design challenges (figure 6).

This new model, based on the Tai ji concept, embraces the interconnectedness and balance of the Four Orders of Design. Instead of viewing them as separate and hierarchical entities, the revised model presents them as interwoven and mutually inclusive aspects of design, acknowledging the complex nature of contemporary design issues. By adopting this Tai ji-inspired perspective, designers can better understand the intricate relationships between symbols, physical objects, activities, and systems, ultimately leading to more holistic and effective design solutions.

In essence, the fusion of Buchanan's Four Orders of Design with the Tai ji concept offers a fresh and insightful approach to comprehending and addressing today's design challenges. By recognizing the interdependence and inclusiveness of the four design quadrants, we can develop a more integrated and comprehensive understanding of design, ultimately enabling us to tackle complex design problems in a more informed and innovative manner.
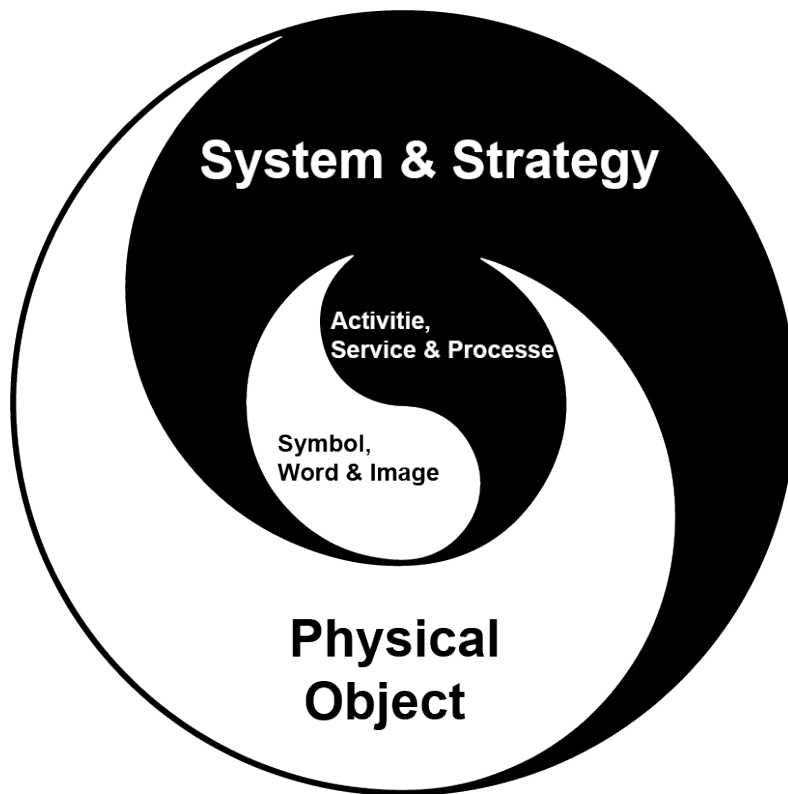
Figure 6. New model of the design problem and objects (developed from Buchanan's four orders of design model, completed by the author).
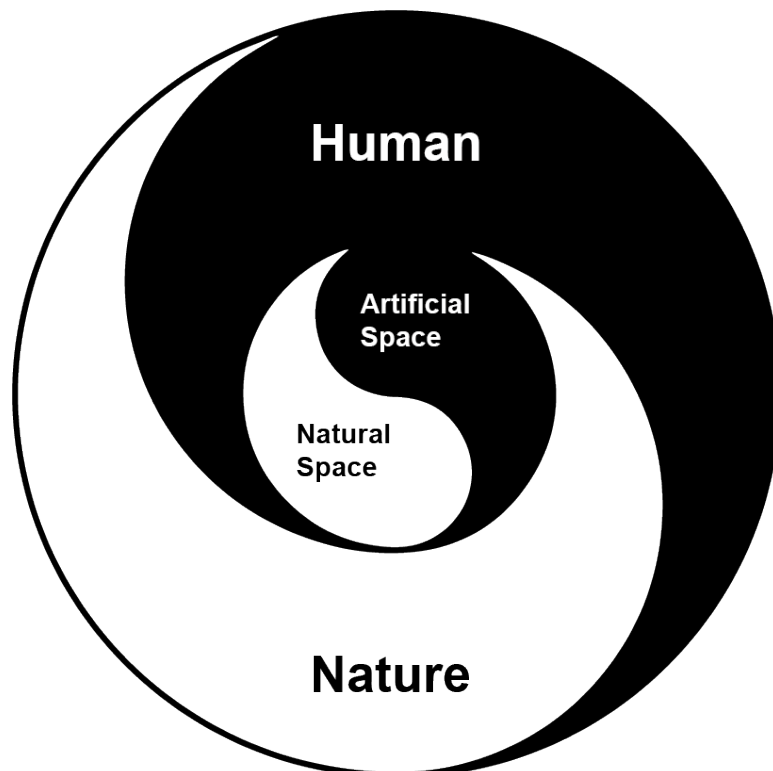

Figure 7. A new perspective on the environment (made by author).

Building on the previous discussions, the author proposes a new concept map for environmental (art) design. The primary focus of this new environmental (art) design is centered around the interactions between humans and their surroundings, encompassing both artificial and natural spaces. The design objects addressed in this new perspective on the "environment" involve those presented in (Figure 7). In this new perspective, the designer's role is to create spaces that promote harmony between humans and their environment, enhancing the quality of life and fostering positive experiences. Moreover, the new environmental (art) design model acknowledges the importance of interdisciplinary collaboration and research, bringing together experts from diverse fields. This interdisciplinary approach ensures that environmental (art) design addresses not only the aesthetic and functional aspects of space but also the social, cultural, and ecological dimensions.

In summary, the proposed new concept map offers a comprehensive and integrative perspective on the complex relationship between humans and their surroundings. By focusing on the interplay between people and their environment, this model promotes a more holistic and interdisciplinary approach to design, ultimately leading to the creation of spaces that enhance human well-being and foster a harmonious coexistence between humans and their environment.

5. Case Study Details

Building on earlier models addressing design issues and new environmental (art) design concepts, a comprehensive concept and process model (Figure 8) is proposed. This diagram, featuring a circular structure, serves as a visual guide for designers in handling contemporary environmental (art) design challenges across four orders of design. It outlines three primary stages in the outermost ring: understanding, exploring, and implementing, providing a high-level journey from problem identification to solution execution. The colored inner ring offers a more detailed design process, based on Stanford's five-stage model with an added "implement" phase, yielding six steps: empathize, define, ideate, prototype, test, and implement. These steps ensure a systematic, comprehensive approach to problem-solving.

The effectiveness and applicability of this design process are evaluated and refined through its implementation in the context of the current workshop. By examining the outcomes and insights gained from the workshop, the design process can be further fine-tuned, thereby providing a more robust and logical framework for designers to navigate the complexities of contemporary environmental (art) design challenges. Below are the details of the workshop.
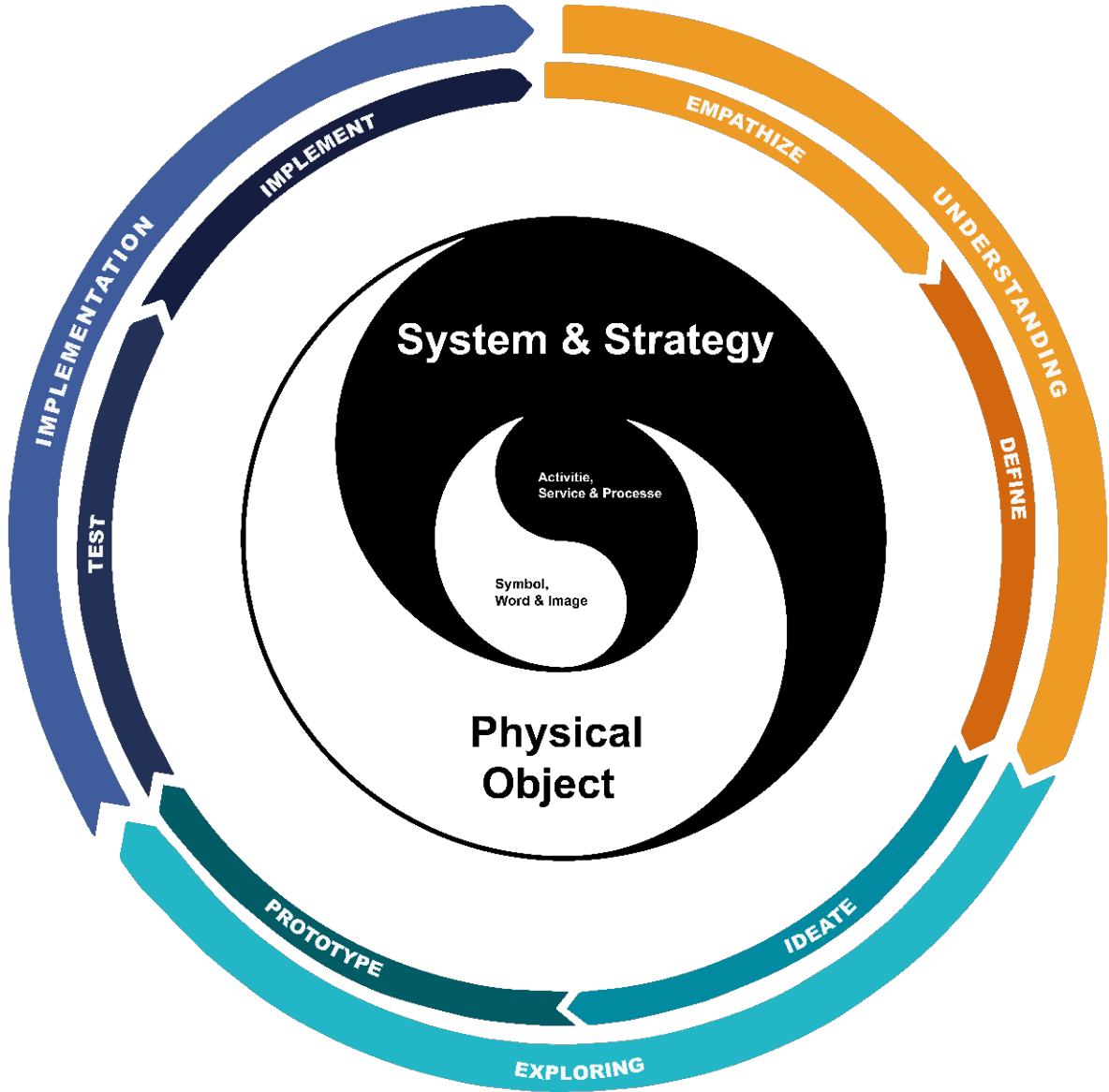
Figure 8. Comprehensive environmental (art) design concept and process model. (referring to Stanford's five-stage model, completed by the author).

Table 2. Workshop Information (made by author).

Name	**15-minute Living Circle**
Time	**10 days**
Participants	**15 undergraduate, master's, and doctoral students from various universities**
Location	**Online**
Objective	This workshop encouraged each participant to explore and address the shortcomings of their respective 15-minute living circles, centered around their habitual living environments. This approach deviates from the traditional urban-centric paradigm, emphasizing a personalized design process with each individual as the focal point. The design scope extends beyond the mere physical spatial arrangement to encompass a comprehensive system based on the four orders of design, underlining a systemic, ecological, and sustainable perspective.

Instructional strategies	Lectures; Desk critique; Field experience; Co-design session; Peer review; Exhibition (Online)
Design process	**Phase 1: Understanding**

Phase 1: Understanding

Step1: Empathize

Students engage in an in-depth investigation of people, context, and location based on a specific theme. They employ various research tools such as literature reviews, observations, interviews, and field studies.

Step2: Define

By synthesizing and summarizing the collected information, students define the design problem, which involves four dimensions of the four orders. Various analytical tools are used to articulate the research questions, including inductive reasoning, persona development, and SWOT analysis.

Phase 2: Explore

Step3: Ideate

Students utilize design methodologies to generate early-stage concepts addressing the research questions. They examine relevant exemplary cases and extract valuable insights. Additionally, stakeholders and experts are invited to discuss the issues and exchange opinions collaboratively. Tools used in this stage include case studies, brainstorming sessions, and co-design activities.

Step4: Prototype

Rapid prototyping is carried out based on the experiences and key information derived from the previous steps. Tools employed for this purpose include 3D modeling, sandbox modeling, and visual representation techniques.

Phase 3: Implementation

Step5: Test

The prototypes are shared and tested with stakeholders. As the workshop's primary focus is on stakeholder participation, it becomes easier for them to identify relevant parties. Techniques used for this purpose include questionnaires, radar models, and interviews.

Step6: Implement

Upon receiving feedback from experts and stakeholders, participants refine and improve their prototypes. During Beijing Design Week, the prototypes are shared with other attendees to gather further suggestions. Due to the pandemic, the project cannot be fully implemented in reality, which is a limitation of this workshop.

In this section, the author showcases the student project "15-minute Living Circle: Waste Management and Transformation in Fangjia Hutong" as an illustration of the teaching

outcomes accomplished. The students tackled the challenging issue of waste management by designing an integrated ecological system prototype that encompassed various aspects of waste disposal and recycling. The proposed system addressed multiple dimensions, including waste disposal routes (symbols) (Figure 9), smart trash bins (physical objects) (Figure 10), transformation of Hutong turning points (physical spaces) (Figure 11), a smart waste disposal app (services) (Figure 12), and waste disposal promotional activities (activites) (Figure 13). This comprehensive and sustainable design solution (system) not only combined multiple online and offline tools but also fostered community engagement by allowing local residents to co-create and cultivate a new harmonious environment. Consequently, the overall quality of life and social cohesion in the community were expected to improve.
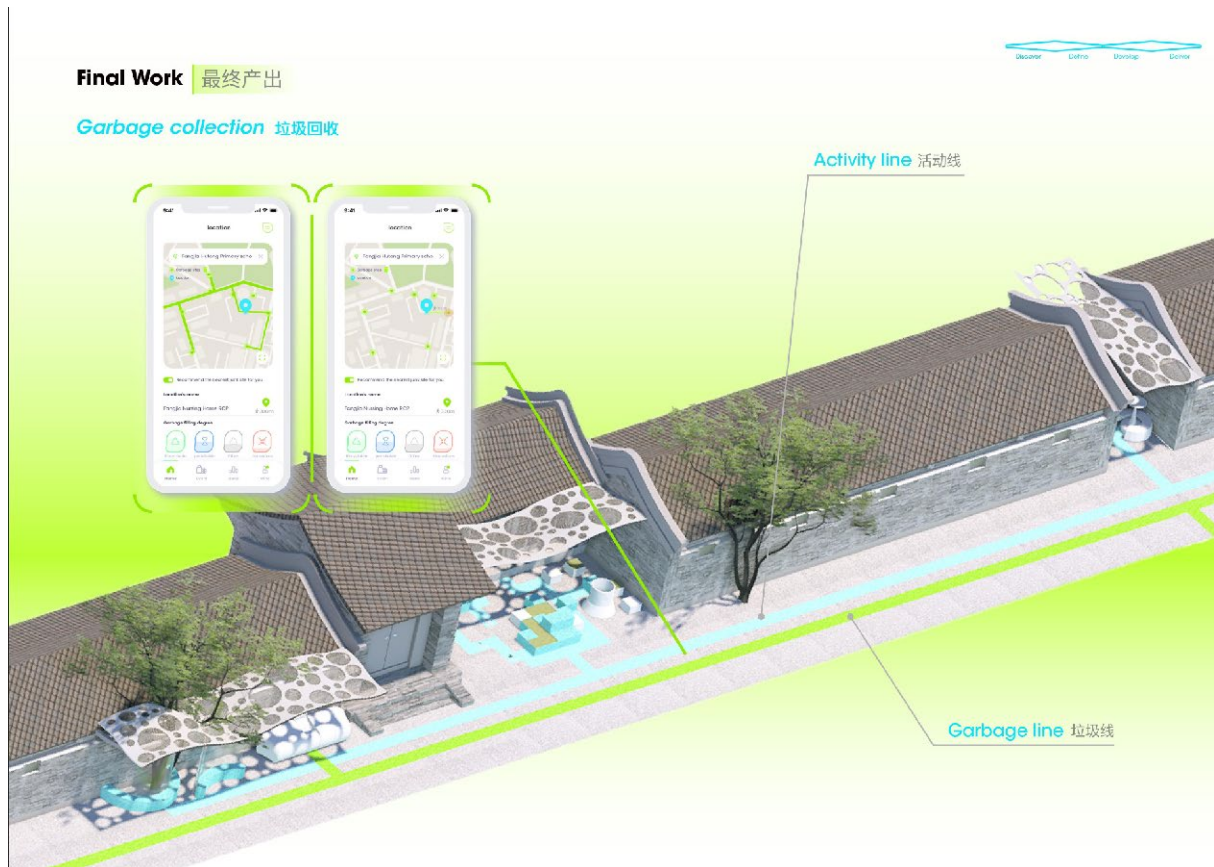

Figure 9. Design of Waste Treatment Routes in Fangjia Hutong. (made by workshop participants).

Figure 10. Design of smart trash bins in Fangjia Hutong. (made by workshop participants).

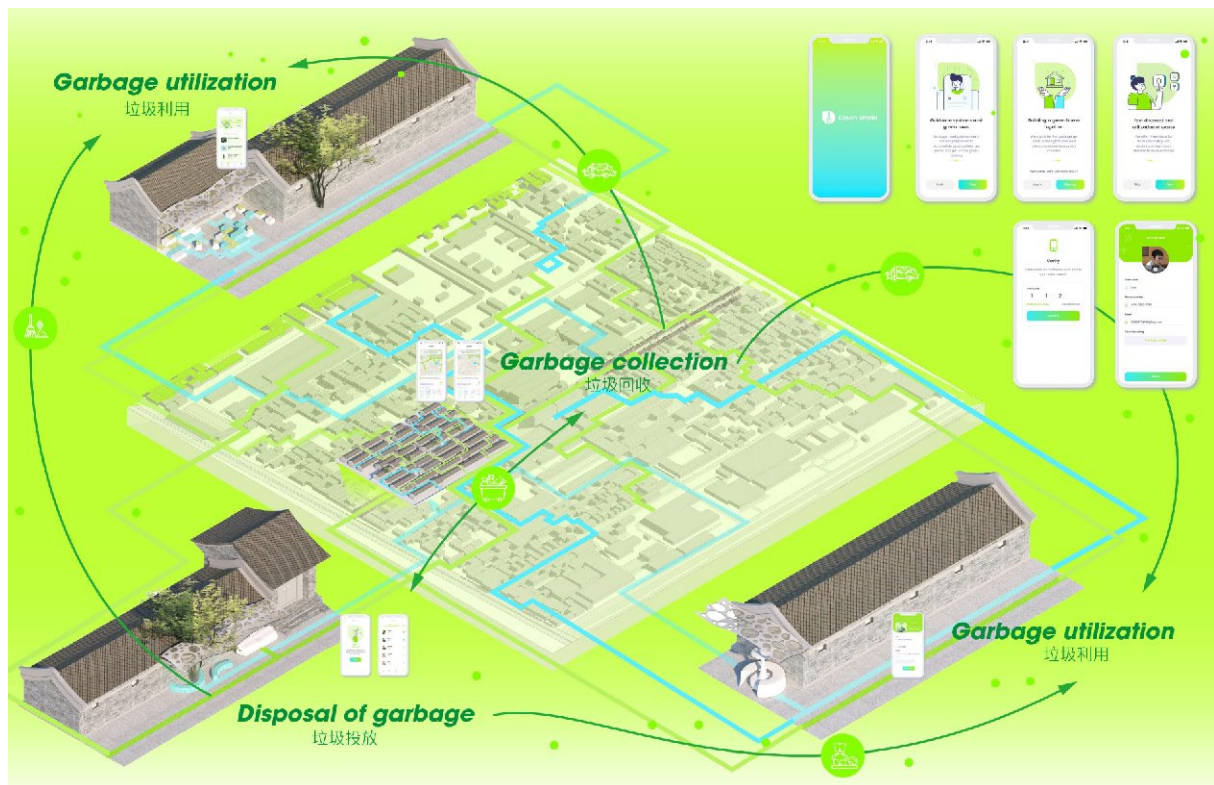*Figure 11. Design of Hutong turning points in Fangjia Hutong. (made by workshop participants).*

Figure 12. Design of smart waste disposal app in Fangjia Hutong. (made by workshop participants).

Figure 13. Design of waste disposal promotional activities in Fangjia Hutong. (made by workshop participants).

In the initial phase, students used a systematic approach with various tools to identify and analyze complex issues in Fangjia Hutong. They formulated a design vision centered on transforming turning points and creating a sustainable waste management system. To understand user experience, they employed empathy maps, user personas, and stakeholder

maps, combining insights from strategic, service, experience, and architectural design to prototype.

Emphasizing a research-driven approach (Keinonen & Koskinen, 2007), the students leveraged academic rigor, logical reasoning, and interdisciplinary perspectives to devise a solution that addressed waste management challenges while enhancing community life quality.

In the workshop's final stage, a questionnaire was distributed to over 30 global experts for project evaluation based on 7 capabilities (Professional Knowledge, Creativity, Interdisciplinarity, Management & Leadership, Adaptability, Collaborative Innovation, and Social Responsibility). The average scores were visualized in a radar chart (figure 14) to represent the designers' capabilities in addressing the corresponding challenges.
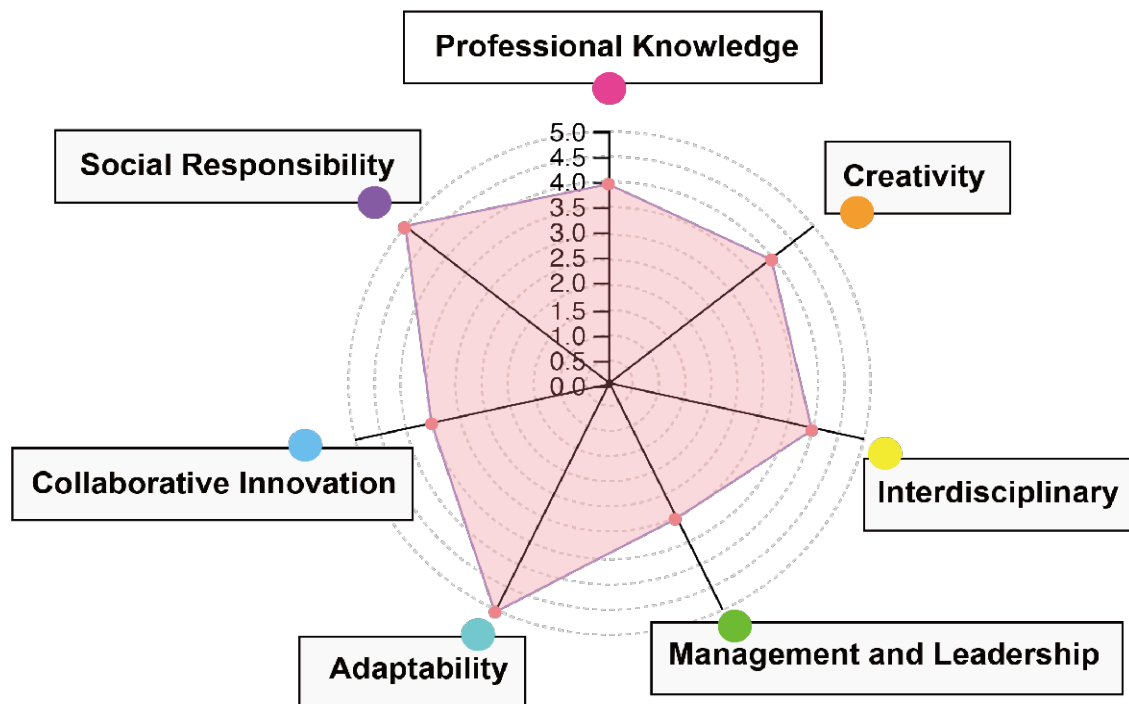

Figure 14. 7-capability assessment radar chart. (made by author).

For the Fangjia Hutong project, the following scores were obtained for each dimension: 4 points for Professional Knowledge, 4 points for Creativity, 4 points for Interdisciplinarity, 3 points for Management and Leadership, 5 points for Adaptability, 4 points for Collaborative Innovation, and 5 points for Social Responsibility. Upon conducting an in-depth analysis of these scores, we have drawn the following conclusions:

- Experts generally believe that the project performs well in terms of professional knowledge, creativity, and interdisciplinarity, with each capability receiving a score of 4. This indicates that the designers possess a high level of ability in these areas and can effectively apply their knowledge and skills to solve practical problems.

- The score for management and leadership is slightly lower, at 3. This suggests that there is room for improvement in the project's organization and leadership aspects, which might be due to the weaknesses of working online during the pandemic. To enhance this capability,

designers can strengthen both online and offline teamwork, clarify objectives and division of labor, and learn and apply effective management techniques.

- Adaptability and social responsibility received high scores of 5. This demonstrates that the designers have a strong ability to respond to changes and pay attention to social responsibility. They can flexibly adjust their strategies to adapt to the constantly changing environment and consider the impact of the project on society and the environment.

- The score for collaborative innovation is 4, indicating that the designers have a certain level of strength in collaborating with other stakeholders for innovation. This contributes to the realization of cross-disciplinary and cross-industry innovative collaboration, providing a more diversified perspective and solutions to address problems.

In summary, the Fangjia Hutong project demonstrates a high level of capability across multiple dimensions, although there is still a need for improvement in management and leadership. By enhancing this area, the project is expected to achieve better overall performance and provide more effective solutions to complex design challenges.

6. Discussion and conclusion

In response to the 11 challenges raised by Ken Friedman, this research proposes an approach to address these issues by highlighting the need for contemporary designers to master seven key capabilities. Traditional design education has proven to be insufficient in imparting these competencies, necessitating a transformation in design education. Drawing from Chinese Tai Ji philosophy, the author introduces a novel design problem, environmental (art) design concept, and process model in the context of Chinese environmental (art) education, aiming to improve and update design education. The conclusion asserts that the future of Chinese environmental (art) design requires the mastery of these seven capabilities, with the content, objectives, professional knowledge, and occupations of environmental (art) design education undergoing changes (figure 15).

Addressing the two research questions posed in this study, design thinking is a human-centered, collaborative, multidisciplinary, creative problem-solving, and iterative experimental methodology applied to Chinese environmental (art) design education. Its advantages include:

- Emphasizing human-centered design: Educators can guide students to identify design directions by researching user needs and experiences, incorporating this approach throughout the design process. Additionally, the evaluation of design proposals should focus on whether they genuinely satisfy user needs, reinforcing the human-centered design philosophy.

- Encouraging interdisciplinary collaboration: Design thinking advocates cross-disciplinary cooperation, and instructors can motivate students to collaborate with peers from different fields, fostering idea exchange and creativity.

- Promoting rapid prototyping: Educators can lead students to employ rapid prototyping in the design process, refining design proposals through iterative creation and testing of multiple prototypes.

- Focusing on sustainability and social responsibility: Instructors can teach students to consider sustainability and social responsibility throughout the design process, encouraging them to factor in social value and environmental impact to enhance the practicality and societal value of their designs.

- Cultivating teamwork: Educators can encourage students to actively participate in teamwork during the design process, advocating for an inclusive and open work culture, and embracing diverse opinions and perspectives during the creative process.

In addition, the new medel exhibited lower scores in terms of Management & Leadership in the workshop. This analysis can be attributed to several factors. Firstly, the duration of the workshop, being only 10 days, proved insufficient for the students to fully establish themselves as an effective team. Secondly, traditional teaching methods predominantly position the instructor as the central authority, with students assuming more passive roles as followers. Consequently, this dynamic fosters a tendency towards compliance among the students. Thirdly, due to the limitations of online teaching, when confronted with complex social research problems, numerous unforeseeable contingencies often arise that cannot be adequately addressed.

In conclusion, the author contends that future design education should transcend a narrow focus on professional knowledge and reject the confinement of environmental (art) design to the training of spatial designers alone. Instead, education should strive for a novel approach rooted in the liberal arts, reminiscent of the teachings of Confucius, who proposed the "six arts": rites, music, archery, charioting, calligraphy, and mathematics, over 2,600 years ago. Such an approach will cultivate future designers who embody innovative leadership and possess the capacity to drive design-led innovation.

This viewpoint aligns with the perspective put forth by Giulia Calabretta (2016), whereby design professionals engaged in innovation are no longer mere executors of new product and/or service design briefs. Rather, they are increasingly involved in shaping these briefs and contributing to the strategic decisions that inform them.
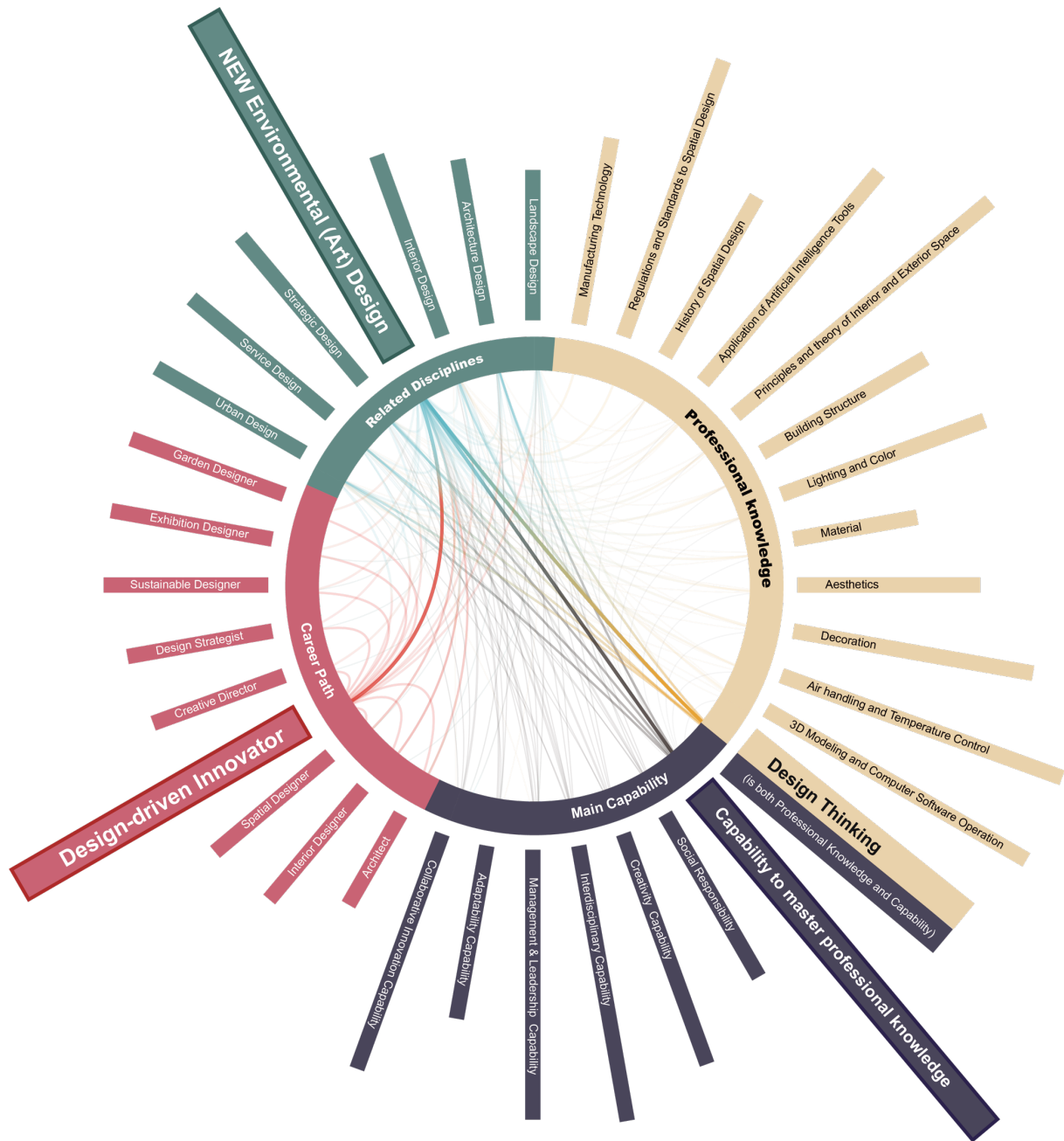
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Figure 15. New Environmental (Art) Design Discipline Information Blueprint (made by author). In the future, the scope of disciplines associated with environmental (art) design will extend beyond the realm of spatial design to encompass fields such as strategic design and service design, which place emphasis on "non-physical" aspects. Consequently, the role of future designers will not be limited to acquiring a solid foundation in professional knowledge. Instead, "design thinking" will emerge as a new form of professional knowledge and an essential capability for them. These designers will no longer base their career choices solely on professional skills; they will also position themselves as "design-driven innovators" capable of tackling uncertain challenges.

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