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Article

Integrating Speculative and Systemic Perspectives into Service Design Education in the Chinese Context

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Abstract

This study explores how to integrate Speculative and Systemic perspectives into Service Design teaching in the Chinese context to support future-oriented and systemic mindsets building for service design bachelor students. Through 1) a literature review to understand the current state of Speculative and Systemic approaches embedded in Service Design education; 2) three workshops as case studies to investigate Chinese students' service design mindset and process shift; 3) expert interviews with Chinese professors and researchers for discussion and reflection of above findings; this paper reflects two critical issues of Chinese Service Design education and discusses the potentials of Speculative and Systemic perspectives that can reinforce Service Design education.

Keywords

Service Design, Speculative Design, Systemic Design, Service Design Education

Introduction

Services have received increasing attention in recent years as one of the increasingly essential infrastructures of contemporary society. Designing sustainable, inclusive, resilient systems and services is a need for policymakers, organizations, and businesses, as well as delivering solutions closer to the people and citizens (Villari, 2022). Due to the increasing unpredictability under changing environments and complexity brought by system interconnections, designing services face the emerging challenges of future uncertainty and systemic complexity in parallel. Service design is increasingly considered one of the keys to tackling these emerging complex challenges (Sangiorgi, 2011; van der Bijl-Brouwer, 2017) because of its transformative role for organizations and society.

At the same time, higher education in Service Design has evolved along with it, and the number of programs has continued to grow (Becermen & Simeone, 2019, 2021). In Western countries, many design schools already acknowledge the importance of Speculative and Systemic thinking in developing future capabilities and have introduced the Speculative and Systemic approaches into their curriculums (Ibid.). However, by contrast, Chinese design schools are still at the preliminary stage of teaching critical future thinking design approaches such as Speculative Design, and the integrated teaching approach is still under-explored. Thus, this study explores how to integrate Speculative and Systemic perspectives into Service Design teaching in the Chinese context and investigates if and how these two design approaches can support future-oriented and complex mindsets for service design bachelor students, identifying limits and opportunities.

This paper conducted a literature review and expert interviews to understand the current state, gaps, and possible next opportunities of Speculative and Systemic approaches embedded in Service Design education. Then this paper explored and experimented with an entry point and effects for embedding Speculative and Systemic perspectives into the Service Design teaching approach and learning process by analyzing observational data, design outcomes, and reflection data from three parallel workshops. Further, through expert interviews, the study reflects on the integrated teaching approach and highlights the potentials of Systemic Design and Speculative Design that can

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reinforce Service Design education.

Service Design and Its Emerging Challenges

Nowadays, services and service systems in have moved beyond traditional business-oriented service challenges (Anderson & Ostrom, 2015), also beyond the design of improving a single product or service, towards the changing needs that people face in their daily lives (Mager et al., 2020). Service Design is considered a vital role in service innovation (Ostrom et al., 2010) and is seen as an intentional pathway to promote service system transformation and as a broader engine and catalyst for societal change (Koskela-Huotari et al., 2021; Patrício et al., 2018; Sangiorgi, 2011).

However, with the rapid development of the world, Service design is facing a further escalation of the complex, large-scale and uncertain challenges brought by the dynamic changes of the service system, the dynamic interaction of multi-actors and the challenges of interdependence between systems (Dorst, 2015; Manzini, 2011; Sangiorgi et al., 2017; Villari, 2022).

Therefore, Service Design needs to go further and think critically about challenges from a longer-term and systemic perspective. By designing services (systems) that are more sustainable, inclusive, and resilient to potential changes, to cope with the emerging complex and uncertain challenges, to open up new pathways for potential changes, and even avoid negative impacts and disruptions when some unpredictable problems arise (Jones et al., 2019), and play an active role in facilitating the radical service systems transformation (Koskela-Huotari et al., 2021; Prosser & Basra, 2018; Sangiorgi et al., 2017).

Speculative Design, Systemic Design and the Service Design overlaps

Since Service Design needs to be extended in dealing with uncertainty and complexity, we propose a hypothesis that Speculative Design and Systemic Design, which are considered with the capacities to critically consider future uncertainty and deal with systemic complexity (Auger, 2013; Jones, 2014; Mitrović, 2015), have the potential to be introduced into Service Design, thereby expanding its Speculative and systemic dimensions.

Speculative Design is considered a future-oriented, critical, and discursive practice that provokes new thoughts and reflections on a phenomenon, idea, or problem by imagining and designing possible future scenarios (Auger, 2013; Dunne & Raby, 2013; Mitrović, 2015). This long-term and critical design approach goes beyond the limits of "reasonable futures" and discuss the possibilities of "possible futures" to explore unforeseen opportunities and risks (Griffel, 2020).

On the other hand, Systemic Design is a design approach that integrates systems thinking and design, emphasizing that by constructing a holistic view of the system while considering actors within and outside the system (Sevaldson, 2019; Sevaldson & Jones, 2019). Systemic Design can help to build panoramic pictures (Jones, 2018), and also makes a richer contextual understanding for actors to a shared frame of reference for collective action (Ryan, 2014), enhancing relationships between different system actors and facilitating systemic change (Drew et al., 2021). Thus, Systemic Design has the potential to be further integrated into Service Design to enhance the systemic dimension of service design to deal with systemic complexity and systemic changes.

Furthermore, when constructing future scenarios, it does not only need to consider the micro or meso factors directly related to the service contexts but also macro factors that influence the service systems that shape the lives of actors (Griffel, 2020). Therefore, the two perspectives that need to be further integrated into Service Design are critical future thinking and systems thinking so that the dynamically changing factors in the service systems can be critically and systemically considered and help designers to think outside the box to reframe the challenges (Alstyne, 2010; Bishop & Hines, 2012).

The needs of Service Design techniques evolution

Another point to note is the role that Service Design techniques play in design education. In mainstream Service Design education, it remains a practice focused on creating new services to improve people's experiences, so many Service Design techniques are expanding its dimensions in enhancing service experiences through a human-cantered

approach (Polaine et al., 2013).

Besides, in Service Design, systems thinking has driven the generation of a range of methods and tools, such as service blueprint (Bitner et al., 2008), system map (Morelli, 2006), ecosystem map (Forlizzi, 2013), stakeholder map (Giordano et al., 2018), etc. Service designers can visually represent the relationships between users, service providers, and stakeholders through these techniques. However, the exploration of systems by these techniques is still limited in the dimension of visible stakeholders. Therefore, there is still potential for Service Design to expand its systemic dimension further by considering more system-related (even invisible) actors and resources so that the interconnectedness and interdependency can be better understood. In this case, possible techniques, such as Gigamapping (Sevaldson, 2011), or Social Ecosystem Map (Jones & Van Ael, 2022), can be introduced from Systemic Design to approach the re-design of a service or design a new service considering since the early stage of the process the possible impact pathways the solution as well as the design process will contribute to change a service system or to design a new system (van der Bijl-Brouwer & Malcolm, 2020).

In addition, although Service Design has techniques for service scenario building, these techniques mainly help to advance the understanding and the functional fulfilment of a service design brief by mapping the expected services (Kueh et al., 2022). These techniques lack sufficient opportunities to engage in critical discourse about the future (Pasman, 2016) while longer-term and even radical perspectives are needed to support the service systems transformation (Koskela-Huotari et al., 2021). In this context, Speculative approaches can be seen as complementary to the speculative dimension of Service Design (Gerber, 2018). In this perspective, possible techniques, such as trend mapping techniques (e.g., Future scan (Board of Innovation, n.d.), Future Scouting (Lutz, 2021)) and backcasting tool (The Service Futures Lab, n.d.), etc., can be considered for introduction to support the service discovery and ideation stages be more open-minded and engage critical discussion and feedback on the current issues of a service system (Griffel, 2020; Kueh et al., 2022).

Service Design Education

Programs in higher education in Service Design are also evolving step by step with the development of the design discipline, according to the economic, societal and environmental challenges. Universities and other higher education institutions worldwide have included Service Design courses and programs at the undergraduate and graduate levels as part of their educational portfolios, aiming to develop professionals with Service Design thinking and capabilities (Ferruzca et al., 2016). However, the multidisciplinary nature of Service Design has led to diverse program designs involving Service Design. Thus, not only design-oriented programs exist, but a rather diverse landscape: there are different types of degrees (e.g., MDes, MAs, MFAs, MBAs, and MScs) distributed across different faculties and departments (e.g., design, management, business, IT, engineering, etc.) (Becermen & Simeone, 2019, 2021; Ferruzca et al., 2016). Since the focus of this paper is on design education, the Service Design education we explore later is design-oriented higher education programs.

Service Design Education in Western countries

Based on comparative studies of Service Design higher education program curricula by Service Design researchers and educators (Becermen & Simeone, 2019, 2021; Ferruzca et al., 2016), as well as two databases - Service Design Network (https://www.service- design-network.org/organisations) and the Politecnico di Milano's Service Design Landscape (https://www.servicedesignmap.polimi.it/) - for data on educational institutions with Service Design programs, the data analysis from higher educational institutions that offer courses/programs/related contents in Service Design shows that there are already many design schools that provide design-oriented programs in Service Design at the master's level (Becermen & Simeone, 2019, 2021). In contrast, at the bachelor's level, some lectures or courses include a Service Design component, but there are still fewer programs with a service design focus.

As for the Service Design Master's programs, Becermen & Simeone (2019) state that a common feature of most programs is that they combine "hands-on" projects with lectures/seminars and that the learning process is accompanied by collaboration with external organizations and companies. This teaching process aims to expose students to the thinking and the complete process of Service Design and thus become proficient in Service Design methods and tools. In addition, in these design-oriented Service Design programs, the concepts of "Social

Innovation," "Sustainability," "Critical/Speculative," Future," and "Systems/Systems Thinking" have also been increasingly involved in recent years (Becermen & Simeone, 2019, 2021; Lin & Villari, 2022), by offering courses and studios such as Social Innovation, Sustainable Design, Design Future, Systemic Design, and Product Service Systems Design, etc. Higher educational institutions in Western countries are gradually introducing new perspectives emerging in Service Design research to expand Service Design education in order to create professional profiles of service designers that are able to deal with complex issues and be more strategic and leadership (Sangiorgi et al., 2022).

Service Design Education in China

In the China Higher Education of Service Design Survey Report (Service Design Network Beijing Chapter, 2022), we can obtain data on the higher educational institutions that offer Service Design courses in China. From the report, we can see that although the development of Service Design education in China started late, it is developing rapidly. In a review of the literature in Chinese, we found that research on Service Design education mainly focuses on the establishment of curriculum/programs and practical teaching frameworks for Service Design under the Industrial Design program (e.g., Chen, 2012; Fan & Huang, 2016; Gao, 2017; Liang & Zhao, 2018; Wu & Su, 2019; Yan, 2017).

After analysing the Survey Report with the literature in Chinese, we found that different from the situation in Western institutions, in China, Service Design courses are more often set up under the Industrial Design program at the undergraduate level, which is almost twice that of graduate courses. The reason for this phenomenon is related to the classification of the disciplines of design education in China. The mainstream design education system in China still regards Industrial Design and Product Design as the primary design majors, and these majors embed other design disciplines, such as Service Design and Interaction Design, in their curriculum.

To be specific, it means that most Chinese universities and design schools do not offer separate Service Design programs at the undergraduate and graduate levels but instead consider Service Design as a "direction" and integrate relevant courses under the Industrial Design or Product Design programs. At the undergraduate level, most of the learning processes can be divided into three stages: the first year is devoted to the development of essential competencies, the second year to the development of design applied competencies, and the third to fourth years to the development of innovative and practical design capabilities (Liang & Zhao, 2018). Generally, Service Design courses are offered in the third stage (but the course title is not necessarily directly named Service Design). Meanwhile, under the Industrial Design program, there are "directional" courses such as Interaction Design, Product Design, Automotive Design, visual communication, and so on. Students can choose courses according to their developmental directions.

In addition, a characteristic of graduate programs in Chinese higher education is that the teaching system is in many cases a tutorial system (except for some joint programs with foreign institutions). This means that even though there are Service Design related graduate courses, the depth of the knowledge is hard as specific and in-depth as the specialized Service Design programs in Western institutions mentioned above. Therefore, one of the challenges of Service Design education in China is the problem of fragmentation and lack of depth learning of Service Design knowledge (Yan, 2017).

Furthermore, in the Survey Report (Service Design Network Beijing Chapter, 2022), which lists 147 existing Service Design courses in China, we can see the emergence of concepts such as "Product System/Product Service System," "Sustainability," and "Social Innovation," but key concepts such as "Critical/Speculative," Future," and "Systems/Systems Thinking" are still rarely mentioned.

The comparison of the course concepts shows that the direction of Service Design education in China is the same as that in the Western context, i.e., both aim to cultivate students to become more plural and interdisciplinary design professionals. The difference, however, is that Service Design education in China is not sufficiently independent, and it is slower to integrate other emerging disciplines and approaches. This means that Service Design education in the Chinese context has not been able to evolve timely when faced with new challenges and demands.

The emergence of this problem depends on the maturity level of Service Design and the breadth of the intersectional research in Speculative Design and Systemic Design. Since these three design approaches originated in Western contexts, the development of Service Design education is indeed influenced by the level of its

development and acceptance in the local society at large. Secondly, although Speculative Design and Systemic Design have been studied in China, they are not included in the Industrial Design program, which leads to less intersection with Service Design in general and less integration in education. However, we can see that Service Design shows a rapid development trend in China, so we can be optimistic about its educational evolution. For this reason, the study should first understand what direction evolution should take.

Materials and Methodology

With the aim of understanding the current situation and existing issues of Service Design education in the Chinese context and proposing possibilities for further evolution, the research has been structured into three main activities. Firstly, by reviewing the literature to identify the criticalities and needs of the evolution in Service Design education, especially in the Chinese context. Secondly, workshops were conducted to explore and test the embedding of Speculative and Systemic approaches as experiments for possible approach integration. The third activity is expert interviews, through interviews with eight academic design professionals with the aim of understanding the current criticalities and development possibilities of Service Design education in the Chinese context.

The detailed research process is as follows:

1. Through literature review, this research firstly reviewed the literature on Service Design and its education, Speculative Design, and Systemic Design in both Chinese and English, aiming to understand the current situation of Service Design and the embedding of Speculative Design and/or Systemic Design in Service Design, both at the theoretical and design education levels.
2. This paper reports on the design and delivery of three six-week parallel workshops that employ thinking, methods, and tools from Speculative Design and Systemic Design into Service Design to facilitate the exploration of future autonomous public transportation as a comparative case study. The workshops were conducted with Chinese senior design students to equip them with Speculative and Systemic thinking to understand the complex service systems and explore and reflect on alternative futures. This paper also analyses the students' learning diaries throughout the workshop and questionnaires after the workshops to investigate students' critical reflections on their service design mindset and process shift.
3. Expert interviews with four Chinese professors and four researchers are conducted to investigate their current or previous (Service Design) teaching approach in the Chinese context. Then reflect on the differences between the integrated teaching approach of embedding Speculative and Systemic perspectives into the Service Design with their current or previous teaching approach and discuss the opportunities the integrated teaching approach can bring.

Workshops

Participants

Three workshops involved a total of twenty-eight students from the Industrial Design program in their fourth year of undergraduate study. Five researchers from Service Design, Interaction Design, and Automotive Design facilitated three workshops. Before participating in the workshops, students had studied design "directions" of the Industrial Design program, including Product Design (96.4%), Interaction Design (85.7%), Visual Communication (60.7%), Service Design (35.7%), and Automotive Design (21.4%). Twenty-eight students were divided into six groups, which ensured that each group had at least two students who learned about Service Design and its techniques in advance.

Workshop process, methods and tools

According to the Design processes, methods and tools of Service Design (Design Council, 2019; Stickdorn et al., 2018; Stickdorn & Schneider, 2012), Speculative Design (Dunne & Raby, 2013; Mitrović, 2015; Montgomery & Woebken, 2016; Voros, 2003), and Systemic Design (Design Council, 2021; Sevaldson, 2009, 2011; Van Ael & Jones, 2021), we extracted one of the most important parts of Speculative Design on "building alternative future

scenarios," and one of the essential parts of Systemic Design on "understanding the system holistically." The extracted two parts (methods and tools involved) were embedded in the Service Design process. And since it was the first time the students encountered these emerging design methods and tools, the workshops set up more than three iterative sessions during the design process to avoid the students' inability to follow the design process or the misunderstanding.

In summary, three parallel workshops lasted six weeks, and the process was divided into four major stages: 1) systemic exploration, 2) critical future envision (divided into short-term future and long-term future), 3) iterative design loops, and finally, 4) critical reflection (see Fig. 1). The detailed steps are as follow Table 1.

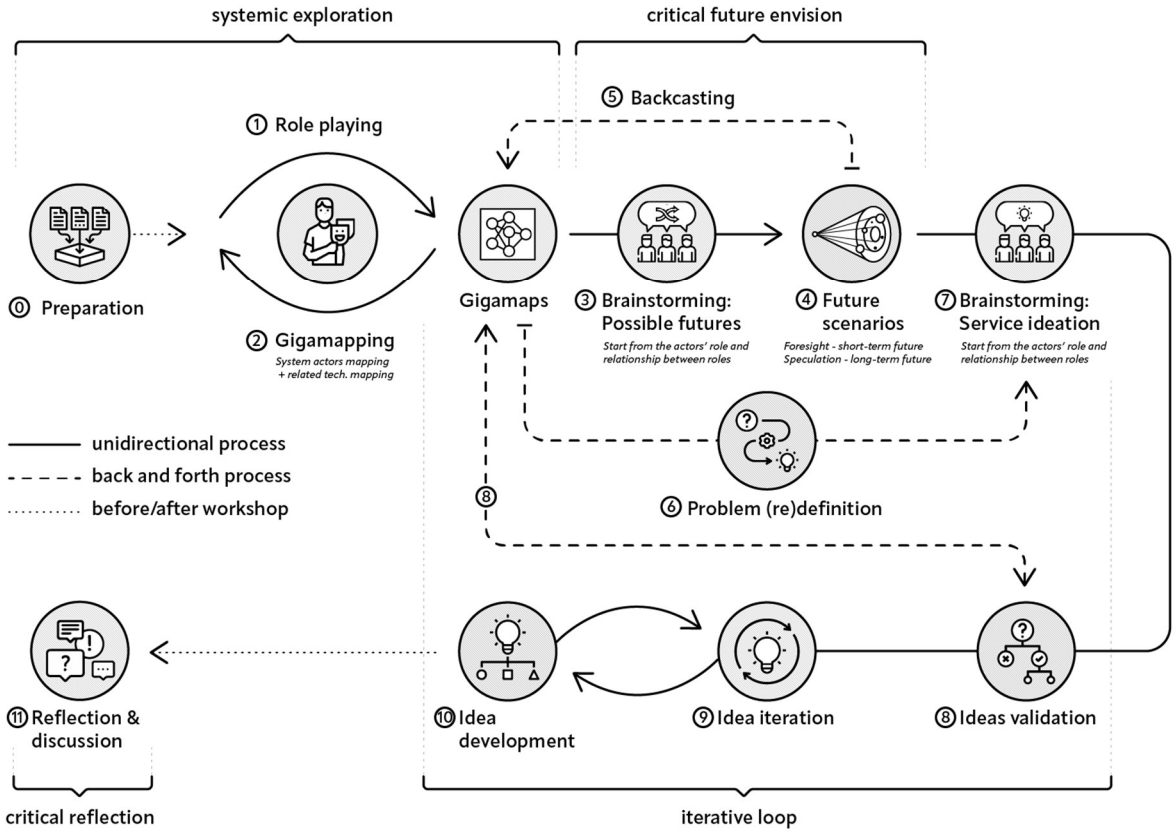

Fig. 1: The design process of the workshops

Table 1: The detailed processes of the workshops

Preparation	Before the workshops start, students are informed about the topics of the workshops and the roles of the actors in the system under the different topics, so that they can have an advanced exploration and understanding of the issues and the roles they are going to play. On the opening day, the researchers (author 1 and 3) gave information related to Speculative Design, Systemic Design, public transportation, and autonomous vehicles, including key concepts, methods and tools, technology and design trends, and relevant case studies.
Step 1	Students put on the hat of different roles and role-play with other members of the same group on their group's topic.
Step 2	While conducting the role play, gigamapping of the roles, relationships between roles, and related technologies was conducted on the Miro.
Step 3	Based on the gigamaps, the students brainstormed on the future directions of different topics and the overall future worldview construction.

Step 4	The students gradually composed future scenarios under different directions. Each of the three workshops had two groups, A and B. Group A envisioned the short-term future (within five years), and Group B envisioned the long-term future (fifty years from now).
Step 5	Backcasting on the created future scenarios, combining gigamaps to analyze what key systemic factors make up the future scenarios they created.
Step 6	The students redefined the design issues/challenges that may arise in the future scenarios.
Step 7	Based on the previous systemic exploration, reflection on future scenarios, and problem re-definition, students brainstormed service concepts. In this stage, students were asked to consider the roles they played and the relationships between roles and other system actors.
Step 8	After the first round of concept brainstorming, by visualizing several selected service concepts, the students shared their design directions and service concepts with the rest of the groups, the professor in charge of the course, and the researchers. Then through two rounds of voting and feedback sessions, the students selected three concepts for further validation. The three concepts were then returned to gigamaps to validate that their proposed service concepts could be reasonably embedded and have a (positive) impact on the system. After the validation phase, the students decided on the central service concept.
Step 9	The students went through two to three rounds of iterations of the central service concept based on the validation and feedback sessions.
Step 10	The students developed services based on the previous iterations and feedback. This step occurred iteratively with the previous steps.
Step 11	At the end of the workshop, researchers brought the students from the three workshops together, shared the future scenarios and services of six groups, and asked the students to have a reflection and discussion.

Questionnaires

At the end of the workshops, the students were asked to fill out questionnaires. The questionnaires focused on whether and what impact they had on their design mindset, design processes, and behaviours as a result of embedding Speculative Design and Systemic Design into the Service Design process; and their reflections on the future design of autonomous public transportation.

Learning diary

Students were asked to keep a weekly learning diary during the workshops. The learning diary is about their weekly experiences and reflections on the use of embedded design methods and tools. They also reported their thoughts and reflections on what changes in their design mindsets and behaviours occurred at what point in time to clarify when the shift occurred.

Group interviews

The researchers (author 1 and author 3) conducted group interviews with each group at the nodes of step 4 and step 8 of the workshops. The main objectives of the group interviews were 1) to understand whether the students were able to understand the meaning and effectiveness of using the methods and tools of Speculative and Systemic approaches during the workshop, 2) to understand whether the students' process of applying the embedded Speculative and Systemic methods and tools influenced on them and 3) to confirm whether their design concepts were generated based on the understanding of the system and exploration of future scenarios.

Data analysis

For data analysis, the students' learning diaries and interviews record were loaded into MAXQDA, a software that can organize and code data from various sources, for inductive thematic analysis (Braun & Clarke, 2006). Author 1 organized these inductive codes into themes, and the thematic codes were reviewed, evaluated, and iterated by all co-authors for the further coding process. The codes included students' experiences with the use of Speculative and Systemic methods and tools, the advantages of applying the Speculative and Systemic approaches, the problems students encountered in their design processes, and reflections on their shifts in design mindsets and behaviours.

Comparative case studies

This section presents the process and results of the service concepts in the workshops as a comparative case study. The three parallel workshops have the same process but different topics. The topics were the design for the interior, exterior, and station of the Automated Shuttle Bus (ASB). In the first phase of the systemic exploration, all students used the same approach to systemically explore the service systems and system actors in different scenarios. All three parallel workshops were divided into groups A and B in the second phase. The future time span of group A was within 5 years, i.e., the foresight of the short-term futures. The future scenario of group B was mainly set in 50 years, which was the speculation of the long-term futures.

Given that the current Service Design is still mainly designing for short-term futures, the workshops look at the impact of the critical future-thinking approach on students' design mindsets by comparing the services designed for short-term and long-term future scenarios, and whether they can reflect on long-term future scenarios and services to think critically about the current design challenges.

The last part of this section is the students' reflective session of the workshops.

Systemic exploration

By role-playing while gigamapping, students mapped out the relationships of system actors under the topics and the relevant technology and trends (see Fig. 2). Through role-playing, students could think outside the designer mindset; different group members then presented the needs of different actors through visualization and worked together to build relationships between the different actors. Through this process of exploration, systemic thinking and methods help design students to consider the problem more holistically and simulate the process of building relational thinking and awareness among actors.

Students stated that (in Chinese, translated by author 1):

> "Gigamap provides us with a way to tell the story of a complex system. When the design topic is complex, with a lot of information and multiple layers that are difficult to sort out, gigamap also provides a rational way to help us move forward step by step and find the leverage points."

> "I used to prefer to play a highly subjective designer in the design process. But during this workshop, I benefit a lot from the role-play activity. Throughout the role-play activity, our group not only considered the micro needs of different actors but also realized a macro level of relationships between our roles."

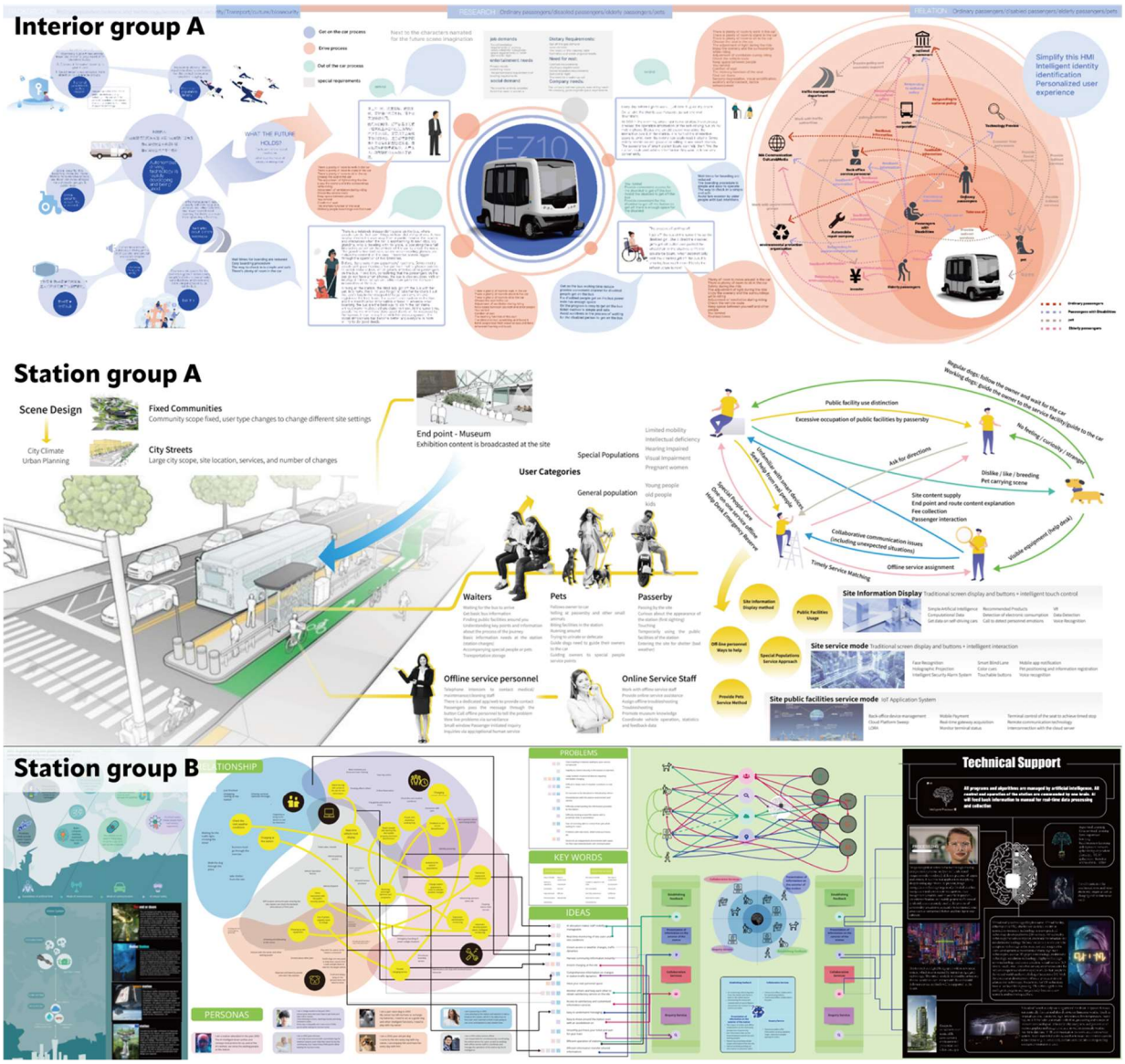

Fig. 2: Examples of the gigamaps of the workshops

Critical future envisions (see Fig. 3)

1. **Foresight (short-term future)**

A groups, in all three workshops, constructed short-term future scenarios based on the current situation for the next 5 years.

Interior A: In 2030, the ASB will become the mainstream mode of future public transportation. Therefore, there will be many self-service in-vehicle services that need to be designed.

Exterior A: Based on the current social development trends, in 2030, many cities in China will have counter-urbanization. People live farther away from the central work area, and multiple travel modes will frequently switch during commuting.

Station A: With the development of technology, in 2030, everything will pursue immersive experiences; and recovering from the Covid situation, city travel is a growth spurt. Therefore, the bus station will be thematic and immersive as one of the city's attractions.

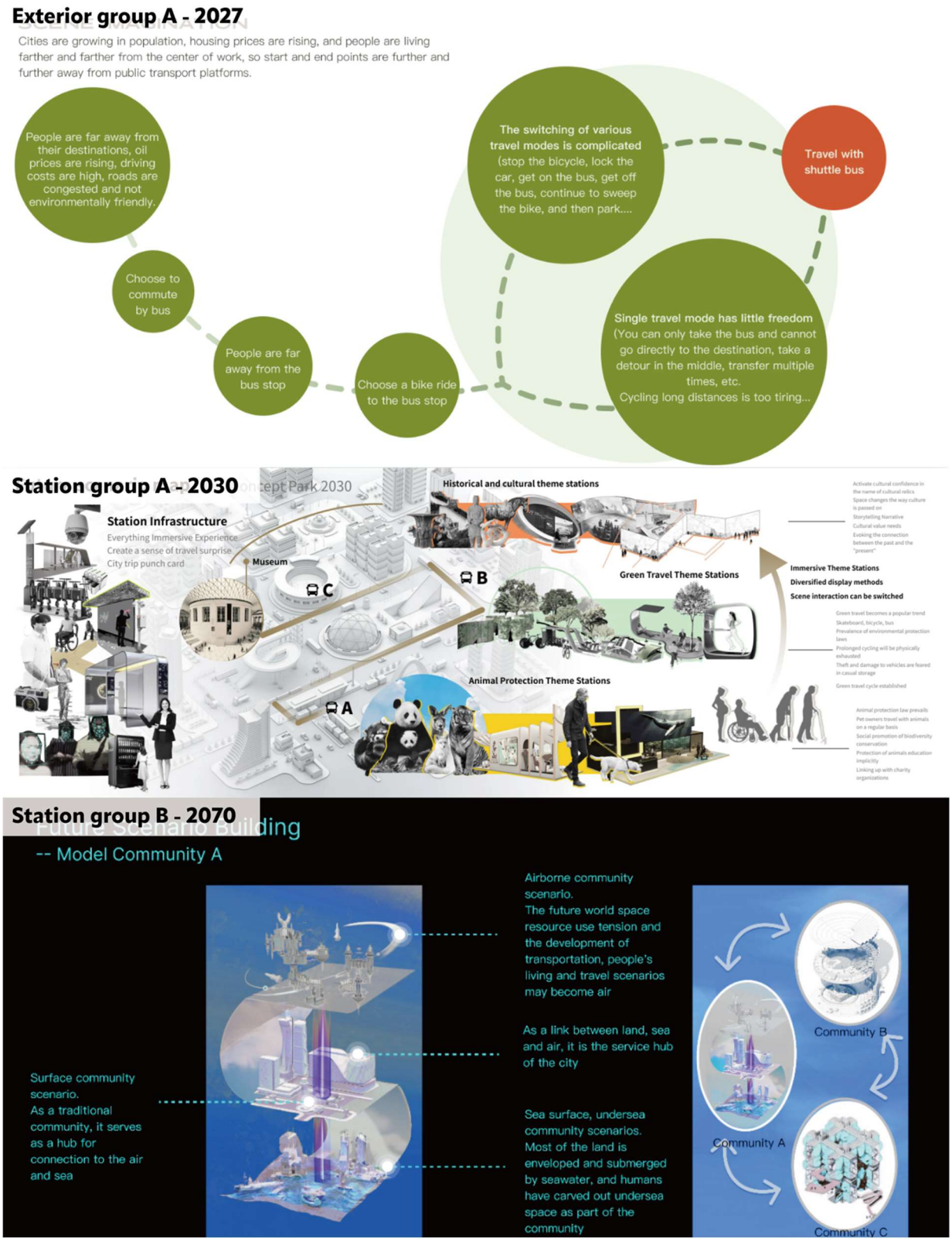

Fig. 3: Examples of the alternative future scenarios

2. Speculation (long-term future)

For the long-term futures, the three groups B coincidentally envisioned a basic worldview in which cities are re-zoned as a result of rising sea levels and reduced human habitation due to climate change, which has also led to changes in the mode of public transportation within cities.

Interior B: By 2070, ASB is already quite intelligent and will adjust the interior according to the external environment by providing different intelligent services.

Exterior B: Autonomous public transportation is not limited to driving on land, and the bus is highly intelligent. Therefore, the mode of public transportation has also produced a huge change.

Station B: Due to the shrinkage of the living area on land, human beings have to build new communities in the air and above the sea. Therefore, a transit station will emerge to connect the three living communities.

After this phase, students stated that (in Chinese, translated by author 1):

> "The alternative future scenarios helped to break my previous design mindset of directly imaging needs and designing directly, but instead, through speculative design thinking, I was able to find better details related to actors and explore design directions from unthinkable perspectives by building stories and backgrounds."
>
> "The biggest change is that I have learned to reframe the problem in the design process constantly. This way of thinking about problems iteratively has profoundly influenced my understanding of the problems when analyzing research data. And I am no longer limited by the current environment when envisioning new concepts because many unexpected things will happen in the future, and I have learned to take a long-term view when facing problems."

Iterative loop

Based on the future scenarios constructed in the previous session, each group thought out and conducted at least three iterative design sessions.

Interior group A focuses on the conception and service improvement of self-service for ASB. For example, face recognition, self-help lost and found service, self-adjustable interactive display on each seat for route inquiry, seat adjustment, etc.

On the other hand, **exterior group A** considered the frequent switching of multiple travel modes. It developed the service for scenarios where bicycles will connect to and travel with ASB.

Station group A has designed an immersive thematic bus station. The station not only serves as a route for passengers but also takes on the functions of humanities education and sightseeing.

From the three A groups' design proposals (see Fig. 4), we can see that their starting points are based on current issues, and the design concepts are based on current trends, including technological and cultural trends. Many innovation points are based on technology that has been developed but not yet popularized or has been trended but not yet widely implemented.

Fig. 4: Design proposals of Groups A

The focus of the B groups' scenarios was different from that of the A groups. The students understand that the speculative approach does not aim to come up with a feasible solution but to come up with new thoughts and reflections. Therefore, all three B groups' proposals (see Fig. 5) were designed to reflect on the impact of environmental changes on public mobility.

The design proposal of the **interior group B** is that the highly intelligent ASB will judge the condition of the external environment and thus provide different modes of services to the users inside the vehicle, such as entertainment mode, risk avoidance mode, etc.

Exterior group B builds the concept of ASB will flying in the air. It includes the way of making reservations for daily travel and bringing other vehicles on the bus in the mixed travel mode.

Station group B designed the transit station that connects the three types of communities, including how passengers can interact in the transit station and the various services that the transit station provides.

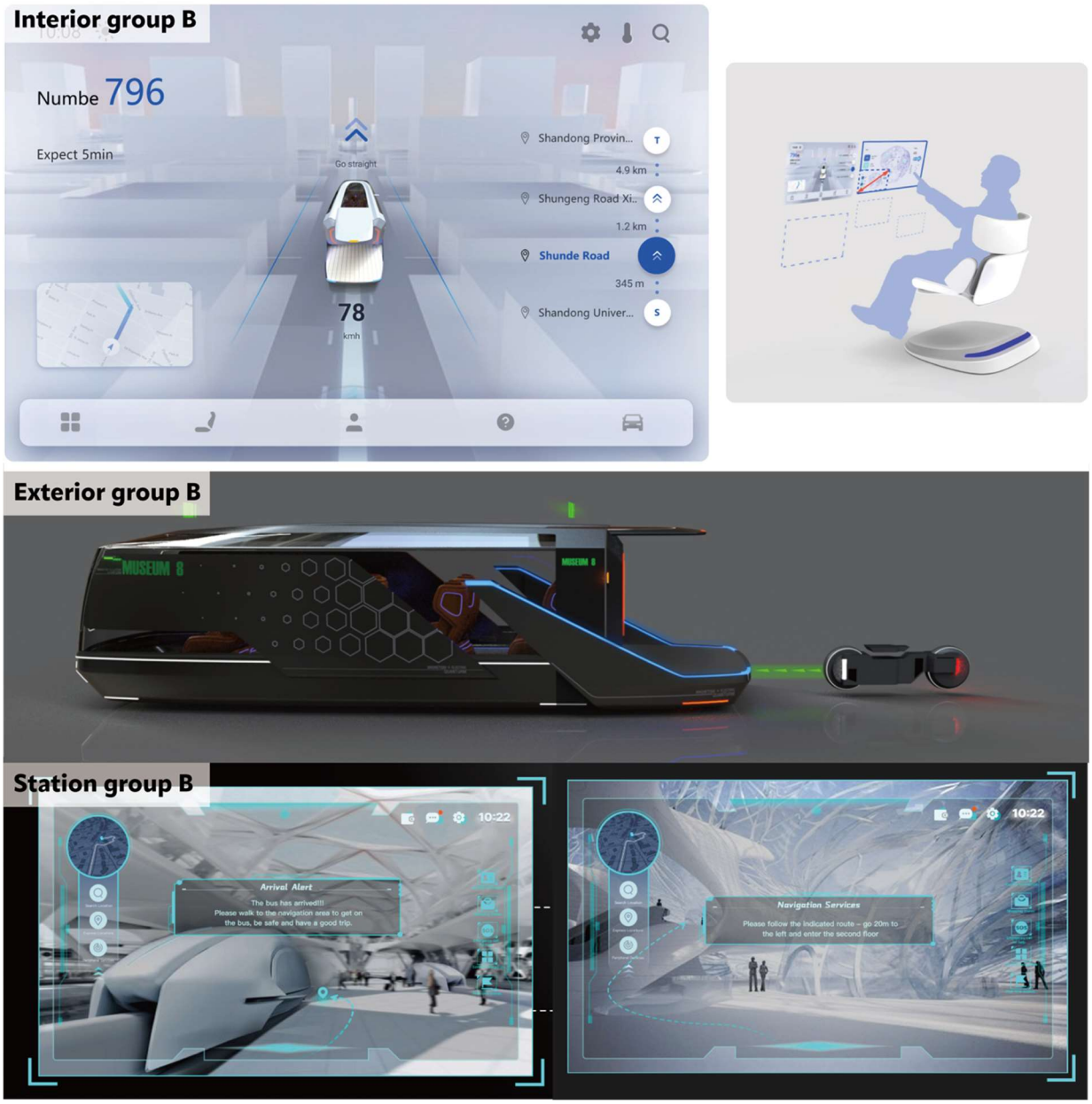

Fig. 5: Design proposals of Groups B

Students' feedback and reflection

Although some students expressed difficulties in understanding or using design methods and tools during the two phases of the process, all of the final questionnaires received positive feedback from students on critical future thinking and systemic thinking. Most of the feedback was that they learned how to think in a systemic, multi-

perspective, holistic, and reflective way, away from the linear thinking of the so-called "product design mindset". 89.3% of the students positively felt that the Speculative and systemic approaches could be part of their Service Design process in the future, to expand their understanding of service systems and develop innovative design ideas. The most effective design methods and tools they identified were "future scenario building" (64.3%), gigamap (57.1%), service concept brainstorming (53.6%), and backcasting (50%). The different reflections of the different groups are shown in the Table 2.

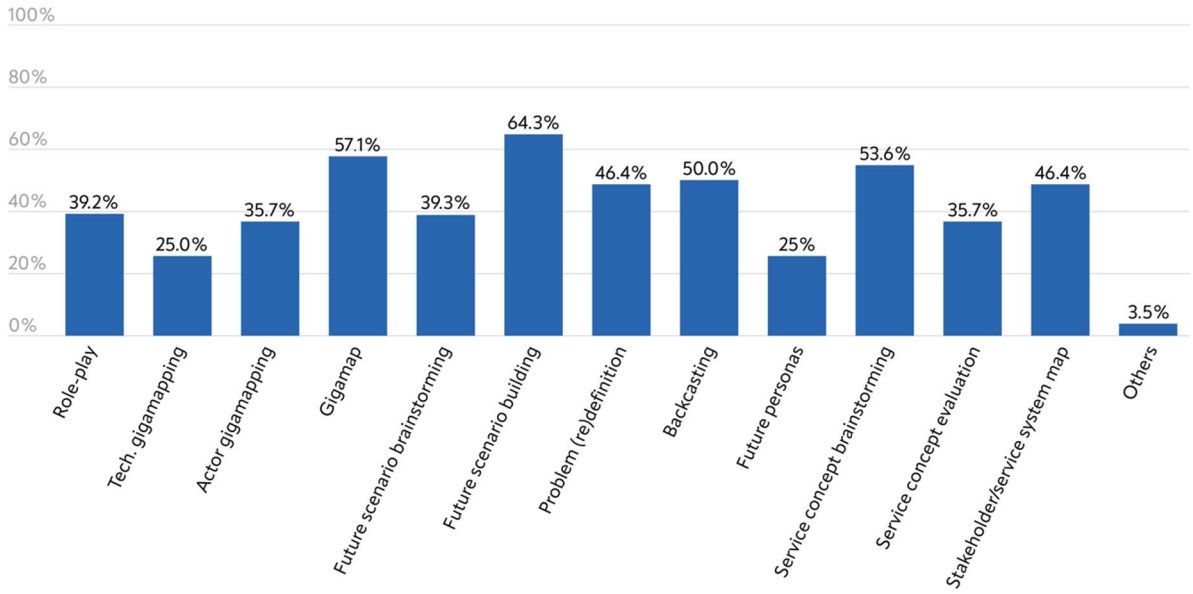

Fig. 6: Questionnaire result: The most effective design methods and tools

Table 2: Summary of each groups' learning diary during the workshops

	Group A	Group B
Interior	This group started the workshop with a mindset of "backstepping questions with answers." Although the workshop process started with systemic exploration, their problem redefinition and concept generation were limited by their "backstepping" mindset. The process was slowly put on track only after changing this mindset in the later stages, and the content from the first phase was used.	This group recognized the importance of imagination from the beginning and hasn't dismissed some so-called "impossible" situations. The speculative and systemic design methods and tools helped them to expand, organize, tighten and iterate on their service proposals. The overall process was smooth.
Exterior	This group could keep up with the systemic exploration at the beginning but did not apply what was explored to the later development stages. This led to a "fall in love with one idea" situation during brainstorming and concept development. The problem was discovered in time during the validation session, and after several iterations, the final proposal was improved.	This group was confused about what value these methods and tools could bring and was limited to a results-oriented mindset in the beginning. During the validation and iterations of the sessions, they were pushed to expand their design mindset, especially in dealing with envisioning dimensions. After several iterations of the idea, the group's results became more systemic and futuristic.
Station	This group made good use of visualization to advance systemic exploration. And the speculative and systemic thinking is also well integrated throughout their design process. The exploration phase widely opened their mindset, and in the development stage, their focus is backcasted to a small point to make the proposal practical and feasible.	This group was the one that followed the process best. They understood and applied the methods and tools well at each stage, and their proposal showcases a strong connection between the exploration and development phases. This group indicated that the speculative and systemic approaches had a positive impact not only on this workshop project but also on other projects they were working on at the same time. They reflected on the problems of their previous design process and learned to take a systemic and long-term view.

Expert Interviews

Through expert interviews with four professors in Service Design, Product-Service System Design and Speculative Design, and four researchers dealing with Service Design and design for autonomous vehicle, we explore in this section the current or previous state of Service Design education in the Chinese context, including what teaching methods are used in the relevant courses, what kinds of design methods and tools that students learn in the relevant courses, and so on. In addition, we also discussed the current situation of the embedding of Speculative Design and Systemic Design in Chinese design education. Finally, we asked the four professors two open questions about what new possibilities and opportunities the Speculative and Systemic approaches can bring to Service Design from an educator's perspective; and their reflections on the development of Service Design education in China.

In the following quotes, P1 refers to the professors who observed the whole process of these three workshops, and P2-4 refers to three design professors from different universities. The four professors work on one of the areas of Speculative Design (Design Futures) or Systemic Design in addition to Service Design. R1-4 refers to the four design researchers who studied Service Design at Chinese universities during their undergraduate or graduate studies and are now working as PhD fellows. Among them, R1 and R2 co-facilitated (only supported the content about the autonomous vehicle but did not influence the design process) these three workshops.

Criticalities with the current or previous (Service Design) teaching approach in the Chinese context

Based on expert interviews, this paper summarizes the two critical problems faced by current or previous service design education in China:

1. Students are limited by a linear, reductive, result-oriented mindset - "product design thinking."

In the interviews, both professors and researchers mentioned a linear mindset called "product design thinking." Under the influence of this inertial mindset, even though design students learn Service Design, their thinking logic

is still limited by the more linear, designer-oriented, and result-oriented design mindset they learned before. This leads to a neglect of the service design process, which may further lead to "taken-for-granted" design outputs that may not solve the design challenges or even have a negative impact - which cannot be known in the absence of validation and reflection sessions.

> P1: "The students were mainly exposed to Product Design, Interaction Design, or Visual Communication separately before and did not take a systemic perspective on design issues and concepts. This leads to a tendency to weaken the early research and understanding stages when they are exposed to new design challenges and enter the stage of proposing the final solutions too early."

> P3: "... Another problem is that there is a certain lag of reflection and iterations in the course process. Students spend too much time developing a perfect concept at once, leading to the lack of iterations before the course ends."

> R1: "When I was studying Service Design as a postgraduate student in China, I felt that the 'final service solution' was often the core focus of the course and the criterion for grading. So we focus more on creating a very fancy solution. However, when I studied further for a master's degree in a European design school, I realized that the Service Design process might be the focus. Because the output of service design is not a one-time thing but will go through multiple iterations and have progressive impacts. In this case, the process is the basis for determining the service outcomes."

2. The Service Design course is introduced later part of the curriculum, resulting in students not having solid skills in Service Design. Furthermore, Speculative and Systemic approaches were either not considered for introduction or were introduced too late into the Service Design course, which also might lead to difficulties for students to be skilled in relevant thinking, methods, and tools well at a later stage of the educational journey.

The existing curriculums mainly take Service Design to serve as one of the directions under the major of Industrial Design. As a result, the Service Design courses' cycle is usually short and offered to students almost at the later stage of their undergraduate education. In this case, students may not have a deep understanding of Service Design and even have to figure out the methods and tools themselves. But this also leads to a "tool-oriented" problem. Some students think they are doing service design if they use specific methods or tools, which leads to superficial and ineffective design behaviour.

> P4: "Our service design course scheduled in the second semester of the junior year introduces the systemic design approach. In the course, as a teacher, my most important task is to correct the students' inertial 'product design thinking.' However, I think it is late to introduce the concept of systems thinking until junior year. I would suggest that courses including service design thinking and systems thinking should be placed early in undergraduate education, at least at the same time as product design courses."

In addition, although the systemic approach has been introduced and developed over time, it is considered to be introduced late to the educational journey, causing educators to spend much time trying to guide students' design mindset shifts even in the later stages of undergraduate education. Moreover, some schools still view Speculative Design as art creation or exhibition outcome rather than consider building students' critical and future thinking through the Speculative approach. Even though some schools have courses related to Speculative Design and Systemic design, the design mindset, process, methods and tools are not well integrated with Service Design in teaching; sometimes, the approach differences make students feel conflicted in the learning process.

> P1: "One of the problems is that students have not been exposed to these emerging design methods before, so the intense input of knowledge in the workshop led to a lack of deep understanding of future and systems thinking. Coupled with the influence of the previous inherent linear design mindset, some conflicting and opposing issues may arise, thus affecting the effectiveness of applying the emerging methods and tools and the quality of the final service concepts."

> R4: "Some students think that if they use certain service design tools, such as user journey map, service blueprint, etc., they are doing service design. Students don't understand why they need to have these maps, and they use methods and tools just because they think most service design projects are using them."
>
> P4: "I think the cultivation of critical thinking is also lacking. As I know, the courses that offer Speculative or Critical Design are not general in the overall design education in China. And these courses are basically not connected critical thinking with Service Design, but instead, in another route that focuses more on expressive output, which the design outcomes more like an art exhibition."

The potentials of the Speculative and Systemic approaches that can reinforce Service Design education

Although current Service Design education in the Chinese context does not integrate both the Speculative and Systemic approaches at the same time, in separate courses and this study's workshops, based on the experiences of interviewed experts, this paper summarized the following potentials for the Speculative and Systemic approaches to support Service Design education.

One of the most mentioned potentials of Speculative Design is that it can help students understand and think outside of their biased perspectives. Visual and experiential methods and tools of the Speculative approach help students open up their imagination to explore possibilities that seem "unrealistic" from the present. This exploration and even further problematization and reflection are the processes of exploring uncertainty. To think and reflect on the uncertainty in the service systems is a critical thinking process about unforeseen opportunities or risks/challenges. Speculative Design can not only help translate uncertainty but also facilitate the development of critical thinking for design students.

> P1: "Two of the most immediate advantages of this workshop were that it allowed students to regain focus on the early research and understanding stages, and that the role-play allowed students to think outside the confines of the 'designer' and 'student' roles. "
>
> P2: "Speculative Design helps our students, with or without a design background, think outside the box by creating alternative future scenarios and using speculative prototypes."

In addition, Systemic design provides students with an approach to understanding and managing the complexity and interconnectedness of the service systems. Actually, in the traditional processes, students did not subjectively ignore the complexity but sometimes did not have the proper methods and tools to navigate complex problems. Therefore, introducing a designerly way of systemic approach can help them expand their understanding of systems and explore the complexity and interconnectedness of systems, and students' systems thinking can be actively mobilized as well.

> R3(as tutor in the course): "We introduced the Systems Oriented Design approach into the Product Service System Design course two years ago. Its methods and tools like gigamaps and ZIP analysis allow students to visualize, sort out and present the system's complexity and evaluate the leverage point to inform the later design process."

In addition, as workshop facilitators, the researchers also expressed that they think educators and facilitators need a mindset shift to better support their students' critical future thinking and systems thinking cultivation.

> R2: "I have facilitated Service Design workshops based on the double-diamond model and have not been exposed to this future-oriented design approach before. Therefore, the construction of alternative future scenarios and backtracking from scenarios are emerging methods not only for the students but also for me. As I facilitated the processes, I also felt a definite shift in the design mindset."

Discussion

Reflection on the potential directions of service design Chinese education evolution

Based on the literature review, data analysis of workshops, and expert interviews, we can understand that Service Design education in the Chinese contest at this stage is still not developed into an independent program. And the service design education that students receive at the undergraduate level is still based on the linear design thinking process. For example, Service Design undergraduate education at Tongji University (Gao, 2017) shows that:

> "We see Service Design as a mindset about finding problems, simplifying them, and redesigning them around the real needs of users, intending to provide effective, practical, efficient, and desirable services." (in Chinese, translated by author 1)

However, design scholar Loewe (2019) criticizes this reductive, linear design thinking, which is deployed as a universal tool that promises to engage in a faster, more efficient, and ultimately more successful design process to handle complex problems. However, this linear and reductive process may fail to solve the issues and even have unforeseen and adverse impacts. He further critiques that design thinking also leads to an increasing void in critical thinking in design education, resulting in emerging designers being ill-equipped to understand and address increasingly complex and uncertain challenges.

Therefore, to better deal with the future uncertainty and complexity of service systems, service design education should evolve into a "non-linear" direction to help design students shift their mindsets, break through the limits of linearity and learn to use the "non-linear approach." (“Non-Linear Approaches to Service Design,” 2021)

In addition, the embedding of multiple directional courses in the Industrial Design major has resulted in a lack of continuous and effective iterative reinforcement of students' design mindset and design capabilities, which makes it easy to think about design issues and design goals from a one-sided and superficial perspective (Liang & Zhao, 2018). This is one of the critical problems of Service Design education in China, it has impact on the student mindset and approach to the project, focusing on a more reductive and result-oriented design rather than questioning the process and the solution to a more ‘problem setting’, systemic and strategic perspective.

Chinese design educators have also reflected on this phenomenon that a single or separate piece of training cannot achieve the construction of a comprehensive design mindset and design capabilities. Improving design mindset and capabilities requires iterative and continuous reinforcement exercises and repeated simulations during the educational process (Gao, 2017; Liang & Zhao, 2018).

Reflection on the potential directions of service design Chinese education evolution

One of the critical problems that Chinese service design education faces today is that students’ design mindset and behaviour are limited by a linear, designer-oriented, result-oriented thinking approach, and they lack the continuous cultivation of long-term, systems and critical thinking. Designing complex systems, such as service systems, envisioning sustainable transitions, supporting digital transformations are one of the main challenges in (re)designing new services. It is about not only designing smooth journeys and experiences, but also about imagining new relationships between actors, long-term changes in organizations, behavioural change in people, and so on. Future service designers need to be able to face with this complexity, and need to design ‘enabling platforms’ (Manzini et al., 2001) rather than fixed solutions. This fits with the need to introduce Speculative and Systemic approaches to reinforce Service Design education.

In the previous sections, we mentioned opportunities that systems thinking can bring. In the workshops, we tested and acknowledged role-playing and gigamap as a systems lens that can support students to become aware of and take a closer look at the systemic complexity and explore the complex relationships between system factors by empathizing multi-stakeholder perspectives visually, thus reducing blind spots from the linear mindset. In addition, gigamap can serve as the foundation for insight into the possible impact of an emerging event or design outcomes as a connected, holistic, contextual approach to validation and evaluation.

On the other hand, critical thinking has many definitions. From an educational perspective, critical thinking is defined as “a type of thinking pattern that requires people to be reflective and pay attention to decision-making

which guides their beliefs and actions. Critical thinking allows people to deduct with more logic, to process sophisticated information and look at various sides of an issue so they can produce more solid conclusions." (*Teaching Thinking Skills*, 1987; Rothwell, 1988)

In the workshop, we further tested the opportunity that the Speculative approach with critical future thinking can bring. By constructing alternative future scenarios, which can serve as a trigger for reflection, can provoke design students to reflect on if there are biased views they may hold in their embedded social, economic, or political beliefs, thus enabling them to switch perspectives actively and consider whether their ideology limits their design mindset (Søndergaard & Hansen, 2017). In other words, the Speculative approach uses future scenarios as a medium to engage design students to better think critically about a topic, an issue, or even their own mindsets and biases.

Through the workshop, we found that Chinese students do lack the trigger that will drive them to change their design mindset and behaviour. Students can gradually understand Speculative thinking and apply the relevant methods and tools in practice. After this process, they can reflect on themselves and express their willingness to change. However, in this case, our workshop, also as a short-term training or provocation, has the limitation of testing continuous cultivation.

Limitations and possible directions for future research

This study conducted a design experiment in the form of parallel workshops on Speculative and Systemic approaches embedded in Service Design. The limitations of this experiment are that the overall duration is short, and the methods introduced have space for further development and integration. The primary Speculative approach introduced in this workshop is the construction of alternative future scenarios, and the Systemic approach is the construction of a holistic view of the service systems. However, there are still many methods and tools that can be explored further, and many of them have similarities with existing methods and tools in Service Design, which need to align into one language for better integration. Another operating limitation of the workshops is that not all the students are familiar with Service Design techniques due to the restriction of recruiting participants in the same context. So future research needs to further narrow down this bias, for example, to compare before and after embedding Speculative and Systemic Perspectives in Service Design with participating students who are already familiar with Service Design and its general techniques.

Another potential limitation that needs to be acknowledged is in expert interviews. As emerging disciplines in the Chinese context, few experts work in both Systemic/Speculative Design and Service Design compared to the Western contexts. So this research acknowledges that the interviews might have a certain bias.

Therefore, the studies and reflections on how to explicit integrate systemic and future-oriented perspective in service design are still ongoing (Jonescu et al., 2023; Vink, 2021; Vink et al., 2021). Future research needs to explore more comprehensively the integration of such approaches from a theoretical and practical view, that also means to align the language of similar methods and tools; or to reflect on and adjust conflicting methods and tools to avoid misunderstandings in integrated use.

Conclusion

Based on the literature review and expert interviews on Service Design education in the Chinese context, this paper summarized two main issues: 1) compared with Service Design education in the Western context, Service Design education in China is at a preliminary stage of development, and the mainstream teaching approach of design schools and the students' design mindset face the problem of lacking "non-linear" mindsets and approaches, such as the Speculative and systemic approaches. 2) The Chinese Service Design education system lacks iterative and continuous training and reinforcement of comprehensive design mindsets and capabilities.

Through the design workshop experiments, this study tried to embed the Speculative and Systemic approaches into the Service Design process and obtained positive results. Based on the reflections on the process and results of the design workshops and the expert interviews, this paper proposes that Speculative and Systemic approaches can reinforce Service Design education in the following:

- **Service Design mindset:** Speculative and Systemic approaches help students think outside the linear mindset and biased perspectives through visual, experiential means to build a more systemic, speculative,

and iterative service design mindset. This mindset can better handle the escalating challenges of complexity and uncertainty that service design faces during its evolution.

- **Service Design capabilities:** Speculative Design facilitates an integrated capability building of critical and future thinking for reflecting on the present by providing a way to imagine long-term alternative future scenarios.
  Systemic Design supports the cultivation of the capacity to manage the complexity of service systems by providing an approach that helps to understand and deal with system complexity and system interconnectedness.
- **Methods and tools:** In the experiments of this study, methods and tools for future scenario construction in Speculative Design and for visualizing system complexity in Systemic Design, as the most common methods and tools, are considered adequate for integrating into Service Design. However, we also emphasize that the introduced methods and tools are only preliminary and need further development and integration.

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