Designing for Mindful Food Consumption: Enhancing Consumer Engagement to Reduce Food Delivery Waste

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Perface

From studying industrial design during my undergraduate years to pursuing a master's degree in Design for Interaction, I have continuously explored various design domains that pique my interest. During my time in Delft, I had the opportunity to learn and understand what kind of designer I aspire to be in the future. This graduation project combines my passion for food design with my enthusiasm for interaction design, allowing me to apply the knowledge I gained during this period.

I want to express my gratitude to everyone who helped me during this project, especially my supervisor Rick and mentor Xueqing. Not only did you provide insightful feedback throughout the project, but you also patiently assisted me whenever I faced challenges.

I would also like to thank all the participants who contributed to this project through interviews, co-creation sessions, brainstorming sessions, prototype testing, and evaluation testing. Special thanks to Zailun, Shuyue, Zihan, Xiaonan, and Yunzhao for your valuable feedback along the way. Lastly, I am grateful to my parents and family for your long-term support, which allowed me to successfully navigate my graduate studies.

Through this report, I hope to provide you with a deeper understanding of the graduation design project I have worked on during this period. Along the way, I have learned a great deal about food waste in the food delivery system and consumer behavior, and I have also gained insights into myself.

I hope you enjoy the reading.

Best regards, Feb 2024

Shiyue Jiang .

Executive Summary

In China, the takeaway industry has been steadily rising, gradually maturing, and evolving into a large-scale dining market. Urban white-collar consumers constitute the primary user base for food delivery and are the target user group for this project. However, food delivery waste has yet to be adequately addressed. During the theme exploration and research phases, through methods such as interviews and co-creation, it was found that subjectively, there is a weak awareness of reducing food waste, unclear criteria for judging the freshness of leftovers, and a lack of facilities for storage and reheating. However, the most significant objective obstacles include portion sizes exceeding appetite, and the taste not meeting consumer expectations.

This corresponds to an opportunity to bridge the information gap between consumers' expectations and the actual portion sizes and tastes of dishes. Combining with the SICAS consumer behavior model, which aims to increase the conversion rate of consumers' willingness to reduce food delivery waste into actual behavior. The goal of this project is to assist consumers in feeling confident, inspired, and encouraged about how to order takeout that suits their food intake and tastes, thereby reducing food waste. Through brainstorming sessions and prototype testing during the ideation phase, the final design was iterated in both intuitive and conscious directions.

The final design is a new takeout ordering app that primarily integrates an AI assistant - Order Pal, and visual information prompts to help consumers of different personas order takeout with appropriate portion sizes and flavors in various scenarios. Through Order Pal learning users' ordering preferences, recommending suitable portion sizes and flavors, the app assists consumers in quickly and conveniently placing takeout orders while feeling guided and inspired. Additional details in visual information continually prompt and reinforce consumers' understanding of portion sizes and flavors. With long-term reminders and encouragement from Order Pal, consumers gain a better understanding of their food preferences and intake, enabling them to find meals that suit them, reduce food waste, and cultivate a more mindful food consumption.

Glossary

FDS:

Food delivery service

FDW:

Food delivery waste

Big city in china:

First-tier cities and new first-tier cities.

First tier cities:

Developed cities with geographic resources and competitive advantages. There are 4 in total: Shanghai, Beijing, Shenzhen, Guangzhou.

New first-tier cities:

The top 15 cities according to the city's commercial charm, ranking in 2022: Chengdu, Chongqing, Hangzhou, Xi'an, Wuhan, Suzhou, Zhengzhou, Nanjing, Tianjin, Changsha, Dongguan, Ningbo, Foshan, Hefei, Qingdao.

Starting price:

The price that meet the minimum purchase amount required to start shipping.

Full-reduction discount:

After reaching a certain amount, there will be corresponding discounts.

Red pocket:

After purchasing a platform member, 6 red envelope coupons of 5 yuan will be issued every month. Using this red envelope will give discounts greater than or equal to 5 yuan according to different merchants.

Everyday coupons:

When users open the app, the platform will automatically issue full-reduction discount coupons for specific merchants or specific products, and usually the amount required to achieve that discount is relatively high.

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Introduction

In this chapter, I will present the background and overview of the project. This encompasses the reasons for embarking on this project, as well as the project's context, objectives, design methodology, and the structure of the report.

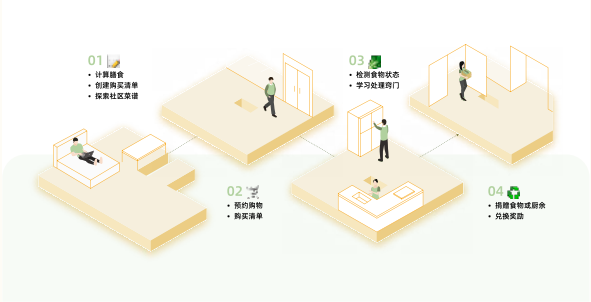
01 Introduction

1.1 The Necessity of Initiating the Project

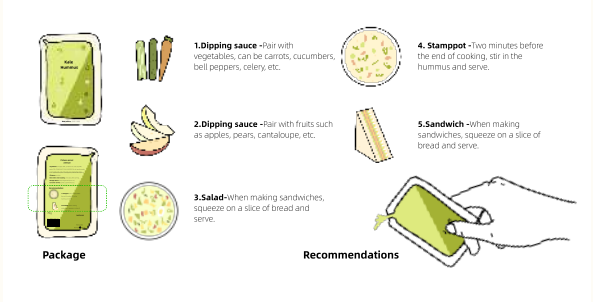
1.1.1 Why did I choose to undertake this project?

Based on my longstanding interest in topics related to food and food culture, prior to commencing my studies at TUD, I undertook a personal conceptual project focused on developing a service system aimed at reducing food waste generated by consumers during supermarket shopping. During my study time at TUD, I also chose to enroll in the elective course "ID5295 Food & Eating Design," which is instructed by my project supervisor, Rick Schifferstein.

Throughout the process of working on my personal project and participating in the "Food & Eating Design" course, my enthusiasm for this field has grown significantly. Through in-depth research and design exploration, I've developed a deeper interest in the subject matter. I aspire to have more opportunities to engage in food-related design in the future. My graduation project, along with the unwavering support from my supervisor and mentor, has provided me with an exceptional chance to explore further within this realm.



Personal project-supermarket food waste



Food & Eating Design course-package redesign

1.1.2 What makes this project worth pursuing?

In addition to my personal enthusiasm for the food domain, another reason that makes this project worthwhile is the chosen food system within China, particularly the food delivery system, which is experiencing rapid growth and expansion, holding immense potential. In comparison to more traditional dining forms like eating at home or dining out at restaurants, food delivery represents a relatively newer and more expansive avenue for development.

- **Economical and Social Impact:**

The development of the food delivery service industry is closely intertwined with two crucial economic trends: the internet economy and the individual economy.

As the internet rapidly expanded in China since the year 2000, the country's internet user base reached a staggering 1.067 billion in 2022, achieving a penetration rate of 75.6%[1]. Concurrently, the rapid growth of e-commerce has triggered novel shifts in food consumption patterns. Beyond conventional offline supermarket shopping, restaurant dining, and home-cooked meals, online supermarket shopping services and food delivery services have become increasingly prevalent. These services cater to a larger audience, providing greater convenience and speed in acquiring food, especially for the fast-paced urban dwellers of modern China.

Figure1: Impact of Food Delivery Service

Moreover, as the single-person community grows, the proportion of single individuals is steadily rising. Alongside declining birth rates, the natural population growth rate has dropped to below 1‰ for the first time since 1961[2]. This trend has spurred the rapid growth of the "individual economy" or what is commonly referred to as the "one-person economy." The food delivery industry has benefited from this phenomenon, with 45.7% of single individuals adopting food delivery as their dining consumption habit[3].

So from an economic point of view, with the development of the internet and the individual economy in China, apart from traditional cooking at home and dining out at restaurants, food delivery has emerged as a prominent dining choice for urban singles and white-collar professionals. Consequently, the food delivery industry has become a significant component of the culinary landscape. With the increasing number of users, there is also a greater potential for development and optimization in addressing the food waste generated from this practice.

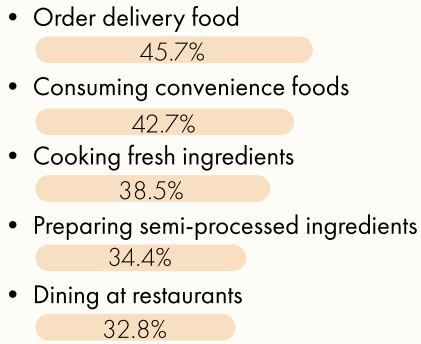


Figure2: 2021 China Single Population Dietary Habit Survey

- **Environmental Impact:**

Food waste has consistently been a focal point of global sustainable development concerns. Among the 17 Sustainable Development Goals (SDGs) set forth by the United Nations, Goals 12 "Responsible Consumption and Production" and 13 "Climate Action" are closely linked to the issue of food waste[4]. In the year 2019 alone, the world wasted a total of 931 million tonnes of food, with an average per capita waste of 121 kg annually[5]. This phenomenon not only signifies the squandering of natural resources but also contributes to pollutant emissions that impact climate change. The consequences of climate change, such as warming temperatures, threaten the security of essential resources such as freshwater, food, and energy, creating an unsustainable cycle.

"Chinese households discard 21 million tonnes of food annually, equivalent to 54 million tonnes of CO2e carbon emissions, 24 billion cubic meters of water resources, and 23 million hectares of land use."[7] Household food waste is of enormous magnitude. Therefore, from an environmental perspective, the issue of food waste is becoming increasingly urgent, particularly with the expanding phenomenon of food waste generated from food delivery services.

While the issue of food delivery waste (FDW) demands immediate attention, there is currently a lack of substantial research in this area. Most studies related to food waste continue to focus on conventional dining settings, such as food waste generated within households or in supermarkets and restaurants. As a result, there remains a notable scarcity of research dedicated to understanding the environmental impact of food waste specifically originating from food delivery services (FDS). The realm of FDW offers considerable unexplored territory, warranting further in-depth research and study.

1.2 Current environment and measures in China

1.2.1 Overview of current FDW

- **FDW Phenomenon:**

With the rapid development of the internet and e-commerce, food delivery services (FDS) are assisting consumers in China's modern fast-paced urban life to conveniently access food. In large cities like Wuhan, with a population exceeding 9 million, the per capita waste value attributed to FDS surpasses the food waste generated in restaurants and households. Among white-collar workers, the level of food waste is nearly twice the national average, over three times that of restaurants, and more than six times that of home dining when purchasing food online. This illustrates that food waste in the context of food delivery has become a significant aspect of the broader food waste discourse and can be considered an emerging trend within the issue of food waste[4]."

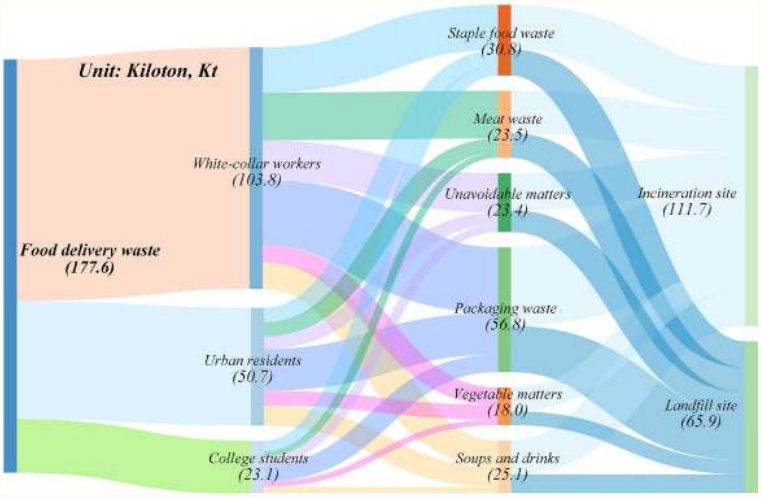


Figure 3: FDW generation by consumer group, by waste type, and by destination in Wuhan in 2019. Figure is taken by [4].

- **Hypothetical Factors Contributing to the FDW Phenomenon:**

Based on my investigation into the user process of food delivery platforms, I speculate that a portion of the rapid increase in food waste from takeaway can be attributed to the platforms' promotional policies, specifically "discounts upon reaching a certain spending threshold" and "minimum order value" policies. The former refers to offering discounts once the total order amount reaches a specified threshold, while the latter requires consumers to order a minimum amount of items to qualify for delivery. Both of these foundational policies incentivize consumers to order more food than they may actually consume, potentially resulting in wastage.

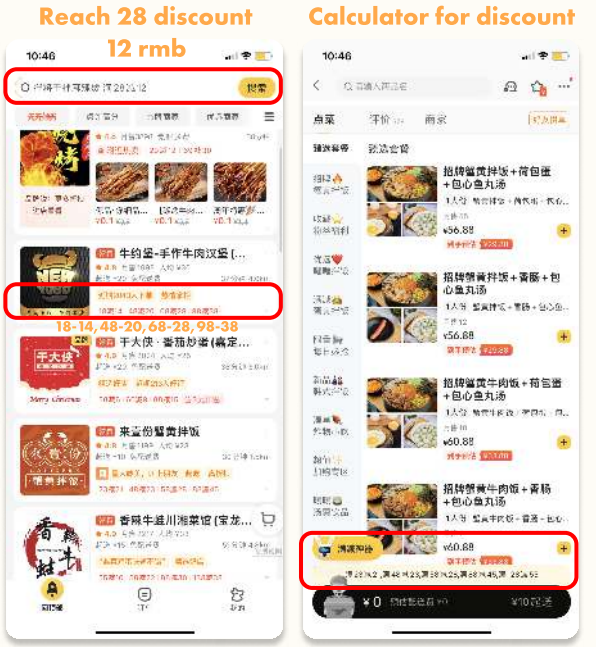


Figure 4: "Discounts upon reaching a certain spending threshold" policy

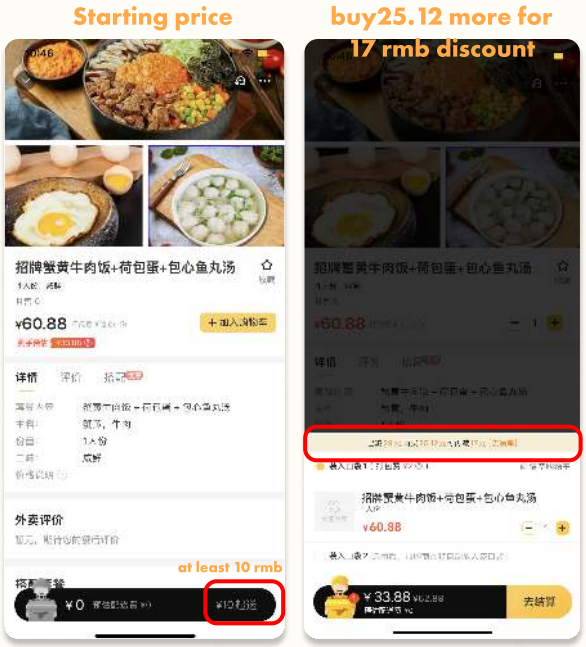


Figure 5: "Minimum order value" policy

1.2.2 Measures

Addressing food waste requires concerted efforts from multiple stakeholders. Currently, measures to combat food waste are being pursued by various entities, including government bodies, platforms, and NGOs. Despite these existing efforts, many of them either remain on paper and have not been fully implemented, or they focus primarily on tackling packaging waste or food waste within households, rather than specifically addressing the food waste generated by food delivery services (FDS). As a result, further actions are needed to effectively reduce food waste in the context of FDS, specifically targeting food delivery waste (FDW).

- **Government:**

As a developing nation, China is also committed to achieving the SDGs. The Chinese government introduced the Anti-Food Waste Law of the People's Republic of China in April 2021, which emphasizes that FDS should prominently display information encouraging moderate ordering. This includes providing details about food portion sizes, specifications, and recommended serving sizes for consumers[6].

Figure 6: Anti-food waste law poster

- **Platforms:**

China's two largest food delivery platforms, Meituan and Ele.me, have introduced their respective environmental initiatives, the "Qingshan Plan" (Green Mountain Plan) and the "Blue Planet Plan." These initiatives involve offering reusable bags or contributing to reforestation in exchange for reducing the use of disposable utensils. However, their main focus is on reducing packaging waste rather than addressing food waste.

- **NGOs:**

Several initiatives are also underway. The Green Food Bank initiative, for instance, redistributes soon-to-be-wasted food to those in need. The WeChat public account "GoZeroWaste" educates readers through blog posts about reducing daily waste production. The WeChat mini-program "PreciousPlasticSH" provides information about nearby sustainable businesses and regularly hosts related events.

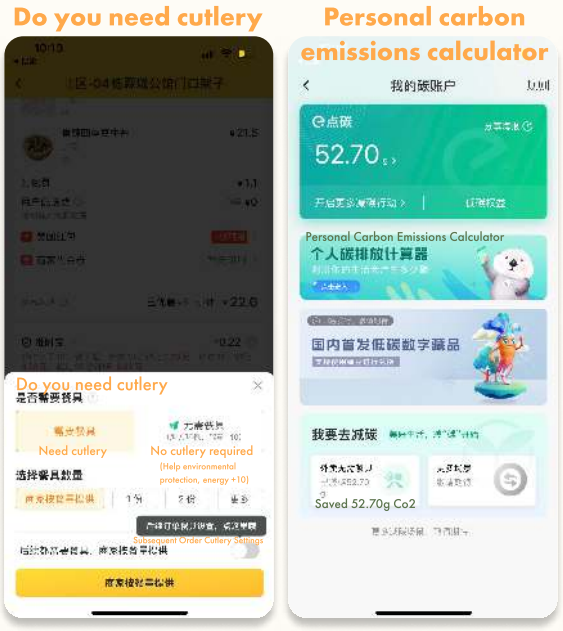


Figure 7: Meituan and Ele.me's eco-friendly plans for disposable tableware

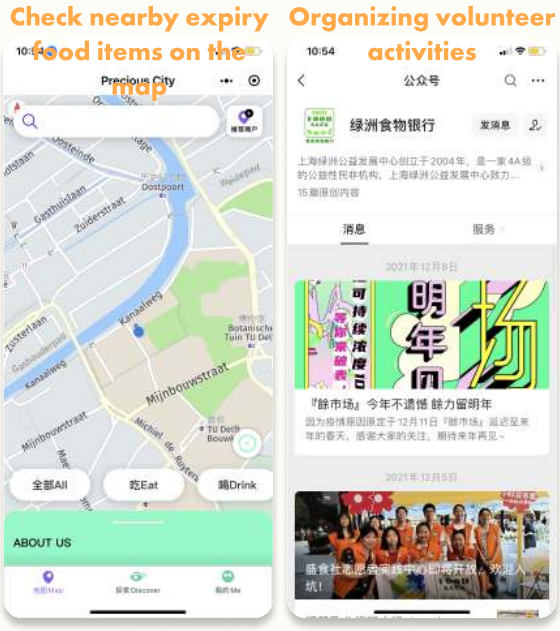


Figure 8: Activities by other initiatives to address food waste

1.3 Project Overview

1.3.1 Project aim

In this thesis project, the primary scope of research revolves around understanding the key obstacles that have prevented the effective resolution of Food Delivery Waste (FDW), with the aim of identifying corresponding potential opportunities. It's important to note that beyond changing consumer behavior, collaboration from other stakeholders is essential. Furthermore, exploring methods that can help alter consumer behavior and mitigate FDW within Food Delivery Services (FDS) is crucial.

To delve into this topic more comprehensively, the project will address the following three research questions and their associated sub-questions to better comprehend and address the issue:

Research Question 1: Understanding Obstacles and Opportunities
What are the main barriers and potential opportunities for consumers to reduce avoidable delivery waste?

- What are the main barriers causing FDW within FDS?
- What potential opportunities exist to address these barriers?

Research Question 2: Stakeholder Collaboration
What knowledge does each stakeholder need to make informed decisions?

- Besides consumers, what other stakeholders need to be involved in solving the FDW issue?
- How can their involvement be encouraged through systematic product-service design?

Research Question 3: Behavior Change Methods
What method is more likely to change consumer behavior?

- What behavioral factors contribute to FDW within FDS?
- What methods can effectively encourage consumers to reduce FDW in the context of FDS?

As stated in the project objective, the target user group for this project will focus on white-collar professionals in first-tier and super-first-tier cities. This decision is based on the current research highlighting that the primary demographics consuming food delivery services consist of white-collar workers, urban residents, and college students, with white-collar workers being the predominant group[4].

The types of Food Delivery Waste (FDW) can be broadly categorized into three groups. The first category comprises avoidable waste, such as staple foods like rice and noodles, vegetables, meats, soups, and beverages. The second category includes unavoidable waste, like bones, fruit pits, and eggshells. The third category consists of packaging waste, encompassing bags, boxes, and utensils used for packaging.

This project is specifically aimed at reducing avoidable food waste within the context of food delivery, rather than addressing unavoidable waste or packaging waste. The rationale for this focus is rooted in the background research, which revealed that certain measures have already been implemented to address packaging waste. In contrast, avoidable waste offers greater potential for design and optimization within the scope of this project.

Moreover, this project aims to explore how to facilitate a transformation in the attitudes and behaviors of consumers within this demographic, with the goal of reducing Food Delivery Waste (FDW). Additionally, the project seeks to collaborate with other stakeholders to achieve this objective.

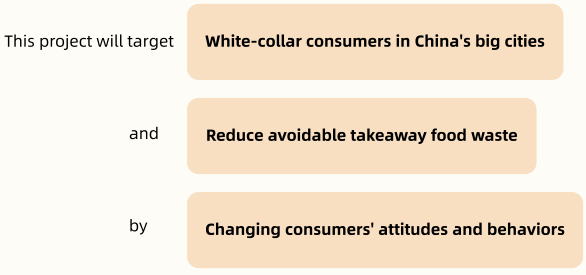


Figure 9: Project objective

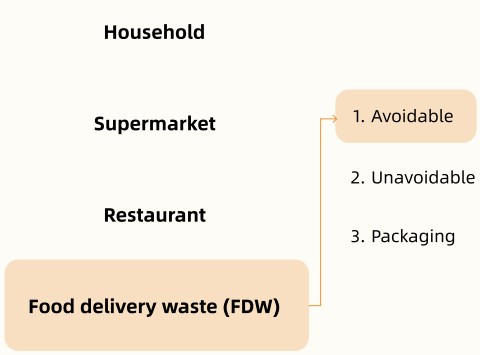


Figure 10: FDW types

1.3.2 Approach

In this project, the overall process follows the Double Diamond design process model, which consists of two major phases: Research and Design. The research phase is divided into two stages: 1. Discover and 2. Define. The design phase is further divided into: 3. Design and 4. Deliver.

- **1. Discover**

In this initial phase, my primary focus was to delve into relevant subject matter, gaining a comprehensive understanding of the dynamics surrounding Food Delivery Services (FDS), Food Delivery Waste (FDW), and the specific consumer landscape within the unique backdrop of China. Moreover, I took note of the contrasting elements between this context and that of Western developed nations. During this phase, I also solidified the project's foundational objectives and identified potential design methodologies that could be utilized as a basis for advancing the subsequent stages of the project.

- **2. Define**

During this phase, I undertook further qualitative research involving two rounds of consumer engagement to establish a more precise scope for the project. This included defining the primary research questions, user groups, stakeholders, and other relevant parameters. Drawing insights from research conducted across three crucial domains: Food Delivery Services (FDS), Food Delivery Waste (FDW), and consumer behavior, I pinpointed the key barriers preventing the reduction of FDW and identified potential opportunities and strategies. Based on these essential insights, I restructured the design challenge into a more specific form and developed corresponding design criteria. These criteria provide the standards against which the final design can be validated.

- **3. Design**

The primary objective of this phase is to explore a range of diverse design directions and solutions that effectively address the identified design challenge. Drawing upon the crucial insights and strategies acquired earlier, and integrating insights from co-creation and consumer feedback, I engaged in a comprehensive process of ideation. Guided by the established criteria, I carefully selected and developed two distinct conceptual directions. Subsequently, I proceeded to create prototypes for these concepts and subjected them to a thorough evaluation process. Through iterative cycles of assessment and refinement, I honed and polished the prototypes, gradually evolving them into a refined and well-rounded final design solution.

- **4. Deliver**

During this phase, the primary goal is to present the ultimate design logic and outcomes, which may include components such as service blueprint, ideal scenario, as well as the UI of the app or packaging. This phase aims to illustrate the comprehensive picture of the final design's structure and effects. Additionally, I will summarize the final outcomes and engage in reflection to assess any limitations encountered during the process. Constructive suggestions for further improvement or refinement will also be outlined in this phase.

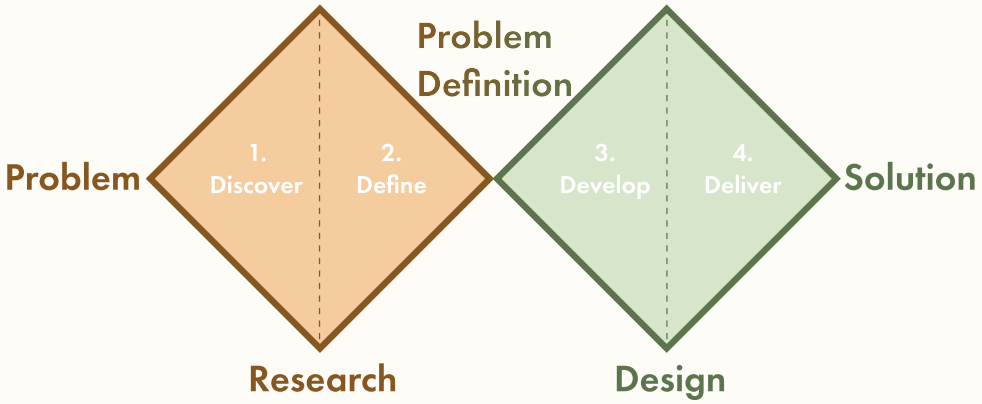


Figure 11: Double diamond-design process model

1.3.3 Project process

Exploration

Introduction
Giving the overview, it's motivation, background, as well as the project objectives, design methodology, and the structure of the report.

Theme exploration
Exploring FDS development trends, project scope addressing FDW, and possible approaches and behavior change models.

Research
Gaining insights into objective and subjective barriers and opportunities through two rounds of interviews.

Design

Reframe
Reframing new design goal, interactive vision and testable criteria.

Ideation
Brainstorming ideas and determining design direction through co-creation and brainstorm sessions, and testing the low-fidelity prototypes.

Final design
Based on prototype test reflection, combining the two concept directions and iterating to the final design.

Evaluation
Evaluating whether the final design achieves the design goals based on vision and criteria, and analyzing limitations and recommendations.

Theme exploration
-FDS, Food waste, Consumer behavior

This chapter primarily discusses the characteristics of China's food delivery service system. Based on the current methods of handling food waste and the characteristics of food consumption in the context of food delivery, the project scope has been defined. Additionally, drawing upon assumptions about consumer behavior towards food waste in the literature review, this sets the stage for further research into the impact of consumer behavior on food waste in the context of food delivery.

02
Theme exploration

2.1 Trends in the Chinese Food Delivery System (FDS)

2.1.1 Past

- **How Did It Develop?**

As mentioned earlier, the growth of Food Delivery Services (FDS) in China is closely intertwined with the development of e-commerce. FDS falls under the category of Online-to-Offline (O2O) commerce, which involves using online platforms to drive or complement offline business activities. With the widespread adoption of mobile electronic devices, more people can make purchases through apps on their smartphones. Starting from 2013, the O2O sector has witnessed rapid expansion. In its initial 1.0 phase, it focused on online booking for offline consumption. The 2.0 phase emphasized service-oriented e-commerce, integrating O2O into users' daily lives, and introducing various at-home services such as fresh food delivery and ride-hailing services like Didi Chuxing, similar to Uber. Notably, home food delivery is a prime example benefiting from this O2O evolution. Currently, in the 3.0 phase, the trend is moving towards vertical segmentation, concentrating on specific areas. For instance, apps like "Delicious, No Need to Wait" focus on queuing online for restaurant orders. These services are developed to address specific pain points and cater to users' needs within a certain domain [8].

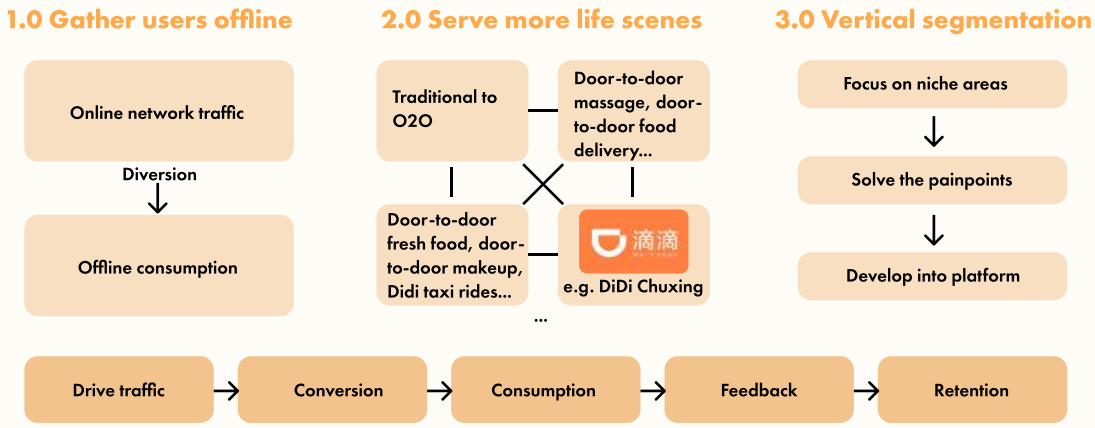


Figure 12: The development history of takeaway services

2.1.2 Current

- **China's rapid & substantial development in the global e-commerce market**

With the continuous development of O2O, coupled with the increasing disposable income in developing countries, especially in China where internet and electronic payment are widely adopted, the e-commerce sales reached US$1.935 trillion in 2019, tripling the expenditures in the United States (US$586.92 billion)[9]. This accounted for 54.7% of the global e-commerce market. Furthermore, after the impact of the Covid-19 pandemic in 2019, FDS gained even more prominence, as it allowed more consumers to experience the convenience, speed, and affordability of obtaining pre-prepared meals without leaving their homes. In 2019, the FDS consumer base in China reached approximately 460 million people, with an industry scale of around 653.6 billion RMB, approximately 84.768 billion euros (EUR), and about 101.388 billion US dollars (USD) [10, 11].

- **Meituan and Ele.me as the pillars of China's extensive FDS orders**

Currently, Meituan and Ele.me are the two largest food delivery service platforms in China, collectively handling around 50 million FDS orders per day. Meituan Waimai alone recorded an average of 23.9 million daily orders and a total of 8.7 billion orders in 2019[10]. China sees approximately 50 million FDS orders daily, a number that continues to rise. These staggering figures underscore the considerable consumer spending power within China's FDS sector. Additionally, the impact of the COVID-19 pandemic further accelerated consumer adoption of FDS habits, as dining in restaurants experienced an overall decline in 2020. FDS is projected to reach 20% of China's entire dining industry[12].

Figure 13: Two largest FDS platform in China

- **Current State of China's Food Delivery System - Government, Platforms, Merchants, Consumers**

As depicted in the diagram, the primary stakeholders within the current food delivery system in China include food delivery platforms, consumers, platform merchants, as well as the government and delivery personnel. Beyond the basic material and monetary flows generated by commercial transactions, there exists an invisible information flow that may significantly impact consumers' attitudes toward food delivery waste (FDW). This includes factors such as government policies, platform promotional messages, and merchant food packaging, all of which contribute to shaping consumer behavior and perceptions of FDW.

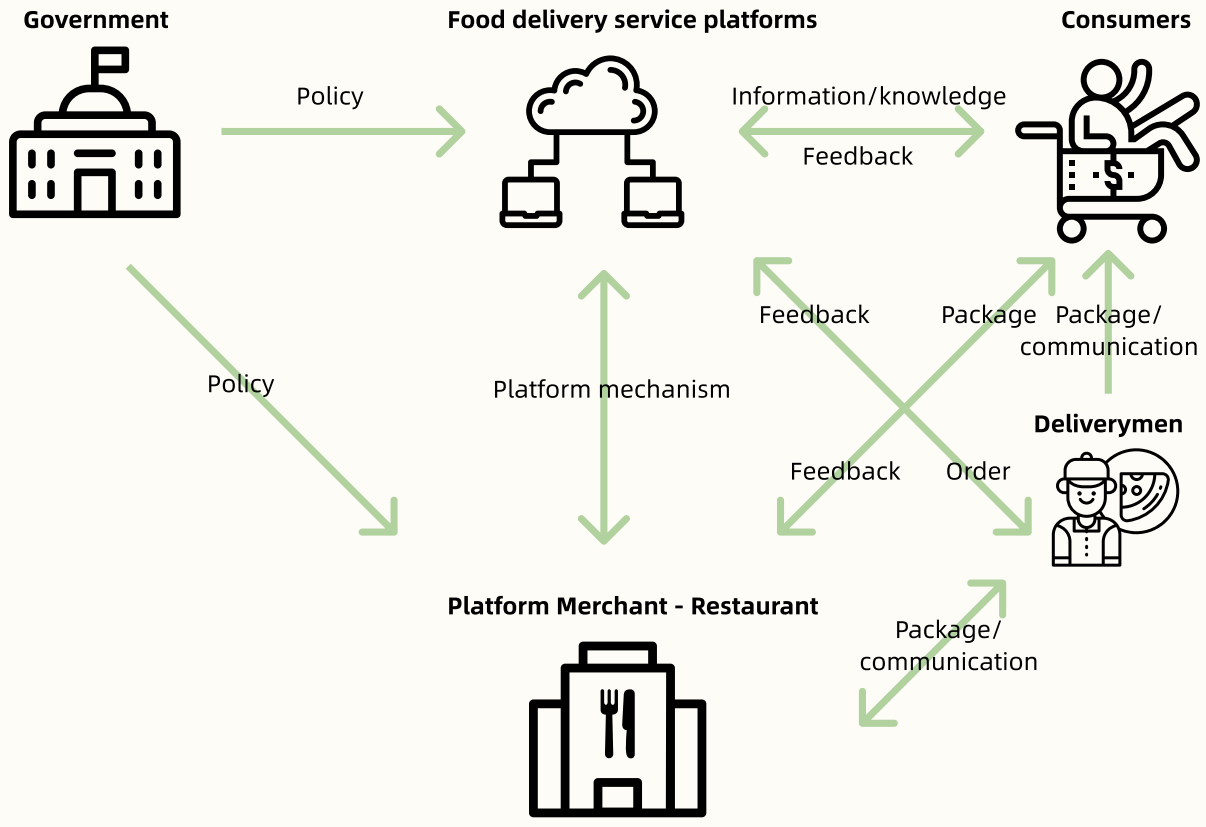


Figure 14: Stakeholders map

- The government functions both as a source and a cornerstone in the food delivery system, conveying relevant policy changes to platforms, merchants, and users. This primarily takes place through the information flow. In 2021, the enactment of the "People's Republic of China Anti-Food Waste Law" imposed regulations on food service operators and platforms, requiring them to provide consumers with information about food portion sizes, specifications, or recommended serving sizes. The law also encourages individuals to make reasonable food choices based on their personal health conditions, dietary habits, and meal needs [6].

- Platforms, serving as intermediaries and messengers, play a crucial role by connecting consumers, restaurant merchants, delivery personnel, and the government. On one hand, platforms provide services to both merchants and users, establishing the mechanism for food delivery. On the other hand, platforms adjust their mechanisms based on feedback from the government, users, merchants, and delivery personnel.

- Merchants need to comply with the platform's mechanisms to provide consumers with food information and packaging, including meals and utensils. Delivery personnel, although directly connecting with consumers, have a relatively limited connection flow, typically involving the delivery of meals to consumers.

- Consumers primarily engage in ordering and providing feedback. Their role is mainly reflected in evaluating the quality of delivery and restaurant services.

2.1.3 Future

The current development speed of China's FDS does not match the speed of its sustainable development (economic, social, and environmental impact), more and more young people are beginning to choose takeout as a food consumption option, far surpassing eating out and cooking at home. [9, 13], However, both the job satisfaction of delivery workers and the increased carbon footprint caused by the large amount of plastic and food waste generated by consumers urgently need to be improved and solved.

In the future, China's food delivery industry will need to focus on how to enhance its sustainability.
In addition to some relevant measures currently in place to reduce plastic waste, the FDW that this project focuses on is also a very important part of it. In the face of an increasing number of consumers, it is crucial to balance the collaborative solutions of various stakeholders, so that governments, platforms, merchants, and consumers can jointly actively research, try, and implement measures that can reduce or prevent avoidable FDW.

2.2 Approaches to Reduce Food Delivery Waste (FDW)

2.2.1 Food Waste Handling Methods in Food Delivery v.s Household Settings

Before traditional household food waste was generated, there were still many opportunities for leftovers not to be wasted, such as storing them in the refrigerator for the next meal, or processing them again into a new dish.

But because most of its audience are white-collar workers and students, when ordering too much food results in leftovers, they do not have sufficient conditions to store and reheat the leftovers, and it is more likely that the leftover after the meal will enter the trash can and become FDW[9]. Therefore, compared with the disposal methods of household kitchen waste, the disposal methods of takeaway leftovers are more limited, which increases the possibility of meals becoming FDW.

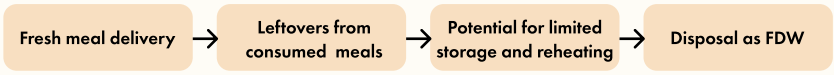


Figure 15: The transition process from takeaway food to FDW

2.2.2 Preventing Waste vs. Managing Garbage

Referring to the food recovery hierarchy of the US EPA, there are still many ways to reduce the generation of FDW in the process from fresh meals to final food waste, such as the most recommended source reduction, to feeding hungry people and animals. So incineration, landfilling, anaerobic Digestion for power generation (ADP), and mixing with municipal solid waste (MSW) are not as good as preventing the original takeaway food leftovers from occurring in the first place.

Figure 16: U.S EPA-food recovery hierarchy

2.3 Assumptions Regarding Consumer Behavior and Attitudes Towards Food Delivery Waste (FDW)

2.3.1 Possible Reasons for Consumer Generation of FDW

In addition to some objective factors that produce FDW mentioned in 1.2.1, through a literature review of current food waste (see appendix 1.2), some assumptions about food waste due to consumer psychology or attitudes were also discovered.

Due to online ordering, consumers **have a weaker perception of food and a lower sense of effort required**, making weak psychological ownership of take-out food possible as one of the reasons for waste [14]. It is also found that most consumers **have weak environmental awareness** and rarely consider how FDW is produced and its impact on the environment [9]. In addition to personal factors, **family norms and social norms** also have an impact on consumers' attitudes and actions.

2.3.2 Possible Measures to Reduce Food Delivery Waste (FDW)

Through literature review, there are some solutions in other food waste scenarios that can be used as measures to reduce takeaway food waste. They mainly include **social reflection, expectation management, information promotion, and behavioral change models**. These four assumptions can intervene in consumer attitudes and even Behavior.

2.3.3 Consumer Behavior Change Model

Changing consumer consumption behavior is a complex task, and various models have been proposed to address this challenge, such as Prochaska's Transtheoretical Model of Behavior Change. However, to tailor the approach to the specific context of this project – China's food delivery service system – the SICAS model has been chosen as the methodological framework. The SICAS model was introduced in the 2011 China Social Marketing Blue Book by DCCI Internet Data Center, a leading authority in internet monitoring research in China. This model is designed to align with the current stage of China's e-commerce development, particularly in the era of 2.0 mobile internet and complete digitalization. It represents an innovative evolution from traditional models like AIDMA and AISAS, and it is uniquely suited to understanding and influencing consumer behavior in this digital landscape.

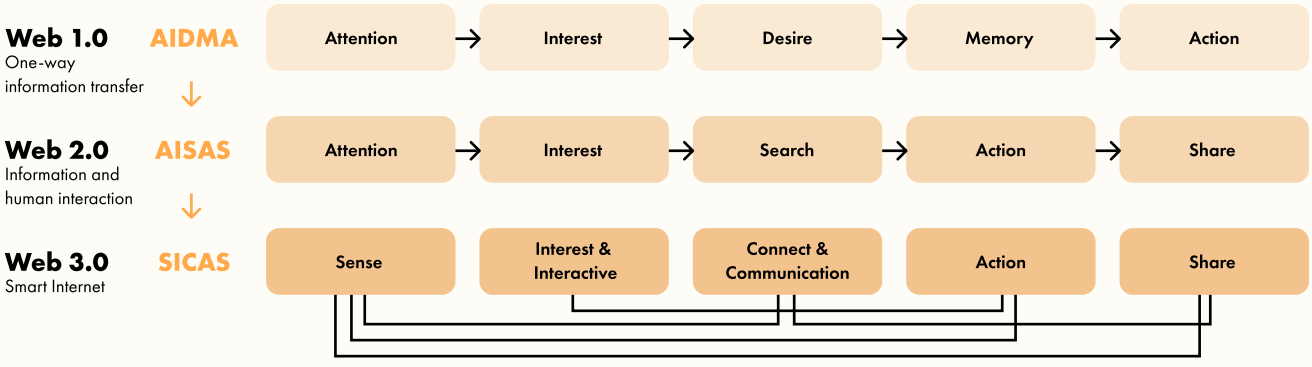


Figure 17: Behavior change model development

- SICAS:

The SICAS model combines the strengths of the AIDMA and AISAS models, offering a comprehensive depiction of consumer behavior from brand perception to experience sharing in the digital era. It highlights the importance of interaction, experience, connection, and sharing, aiding businesses in better understanding and guiding consumer behavior to stand out in a competitive market.

- Sense: Businesses and users mutually perceive each other, encompassing both the enterprise's understanding of users and users' awareness and trust in the brand. Appropriate brand promotion strategies contribute to being perceptible to users when opportunities arise.
- Interest & Interactive: Interaction's key lies in content, manner, and relationship. Through effective interaction, enterprises establish psychological coupling, emotional resonance, and interest alignment with consumers, thereby enhancing their interest and attention.
- Connect & Communicate: Trust and dependence gradually form through ongoing communication between businesses and consumers. Employing multi-channel, frequent, and diversified communication methods, enterprises actively reach out to customers and promptly provide feedback on customer interactions.
- Action: Purchase actions are no longer limited to traditional offline stores but frequently occur on online platforms. Thus, leveraging the advantages of online platforms for key metric analysis and evaluation, and optimizing marketing strategies, becomes a crucial task.
- Share: Purchase and sharing are not the culmination of the consumer journey but rather the beginning of a cycle. A positive consumption experience aids in customer retention, while effective sharing contributes to attracting new customers. Interaction and guidance form word-of-mouth marketing, elevating a business's influence.

The SICAS model reflects the dynamics of consumer behavior in the digital landscape and offers a strategic framework for businesses to effectively engage consumers throughout their journey, from awareness to sharing experiences.

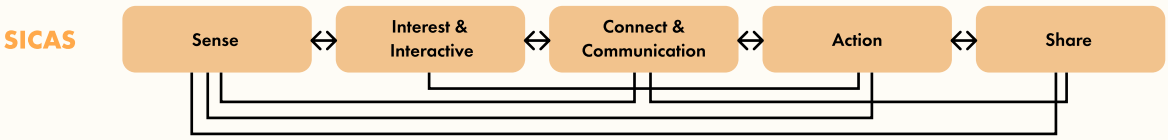


Figure 18: SICAS model

Conclusion:

Through this exploration phase, a deeper understanding of China's food delivery service (FDS) in the global e-commerce market has been gained. Unique characteristics such as a larger FDS consumption share, affordability, and convenience distinguish China's FDS from that of other developed countries. This makes China's food delivery waste (FDW) particularly noteworthy and worthy of distinct research, especially when compared to countries like the Netherlands. The stakeholders involved in FDS include the government, platforms, merchants, and consumers. Additionally, the differences between FDW and household kitchen waste suggest that preventing FDW generation is more suited for FDS, aligning well with the project's scope.

The potential reasons for consumers generating FDW include weak perception of food, limited environmental awareness, and broader societal influences. Corresponding measures could involve societal introspection, expectation management, information dissemination, and behavior change interventions. Notably, the SICAS model for changing consumer behavior aligns perfectly with addressing Research Question 3 and will be employed in later stages to validate these assumptions.

Research

In this chapter, the research questions derived from the previous exploration were established, and through interviews with 15 participants, a deeper understanding of the project's target users, stakeholders, and variations in consumer behavior with regards to food delivery across different types and scenarios were delineated. Factors influencing current wasteful behaviors, both objective and subjective reasons, as well as the primary obstacles, were identified. Lastly, based on an analysis of consumer decision-making processes, strategies were proposed to encourage consumers to reduce Food Delivery Waste (FDW).

03

Research

3.1 Research questions

3.1 Research questions

In the preceding section 1.3.1, the project aim has already provided a concise overview of the three most crucial research questions for this project. Building upon the preliminary exploration and understanding, I have outlined more detailed and specific research questions.

RQ 1: Understanding Obstacles and Opportunities
What are the main barriers and potential opportunities for consumers to reduce avoidable food delivery waste?

- What are the main barriers causing FDW within FDS?
- What potential opportunities exist to address these barriers?
- What is the context in which the problem occurs?
- Why does food delivery waste happen?
- When does takeaway waste happen?
- Who are my main user groups?
- What are the factors that influence consumers' decision to choose takeout?
- What is the attitude of takeaway consumers towards FDW?

RQ 2: Stakeholder Collaboration
What knowledge does each stakeholder need to make informed decisions?

- Besides consumers, what other stakeholders need to be involved in solving the FDW issue?
- How can their involvement be encouraged through systematic product-service design?

RQ 3: Behavior Change Methods
What method is more likely to change consumer behavior?

- What behavioral factors contribute to FDW within FDS?
- What methods can effectively encourage consumers to reduce FDW in the context of FDS?
- What other assumptions about opportunities are there based on the literature review?
- How to make consumers more interested in food waste?
- How to change the inherent habits/behavior patterns of consumers?
- What are the criteria to measure if it works?

3.2 User Interview -FDS & FDW

3.2.1 User interview setup

- **Purpose:**

The purpose of this interview is to understand the user journey and important stages of FDS and the main obstacles that currently fail to reduce FDW and possible opportunities.

- **Participants:**

The interviewees were composed of 15 white-collar workers working in first-tier or super-first-tier cities in China, and were young consumers aged between 20 and 40. Specific information about each participant and takeout habits can be found in appendix 2.1.

- **Process:**

First, the purpose of this project was introduced, and then the participants' daily ordering habits were understood. Simulate ordering through think-out-loud to understand the user journey, the main stages and the obstacles to reducing FDW. A more detailed transcript of the interview structure can be found in the appendix 2.2, and an analysis of the interviews for each interviewee can be found in the appendix 2.3.

3.2.2 Overall insights

RQ - What are the common dining choices for users?

Among white-collar workers in big cities, if some companies have canteens, they will choose to eat in canteens because it is more convenient. Secondly, most people mention take-out meals. Some of the remaining common options are cooking for themselves, eating at restaurants, convenience stores, etc.

Key insight:

White-collar workers who have company canteens give priority to canteens, and **takeout is the most common choice**. The main reason is that they don't know how to cook, don't have time to cook, or don't want to cook.

RQ- Do users involve others when placing orders?

To explore whether consumers typically order food individually or in groups, the interviews revealed that due to the fact that the price of a single meal is usually sufficient for meeting the delivery minimum, and each individual has their own preferences, most people opt to order food for themselves. They perceive limited benefits from ordering together with others, or they believe that the inconvenience of group ordering outweighs the advantages. As a result, group orders typically occur only during occasions such as company gatherings, afternoon tea, or for items like breakfast, bubble tea, or snacks, where the order might not meet the delivery minimum on an individual basis.

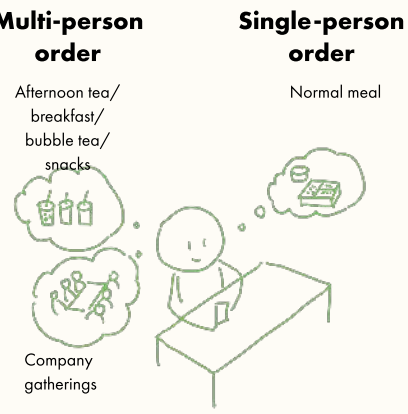


Figure 19: Single-person order habit

Key insight:

While there are scenarios in which consumers order food at the workplace, various reasons contribute to the majority of individuals preferring to order meals individually. As a result, whether at home or in the office, **consumers typically opt for single-person orders when using food delivery services.**

RQ: What factors in the platform app influence consumers' decision-making when ordering food?

Analysis of the interviews revealed that consumers primarily prioritize factors such as the reputation of the merchant, hygiene standards, user reviews, taste of the food, pricing, and delivery speed when placing orders. Figure 20 shows more specific elements of these standards in the app.

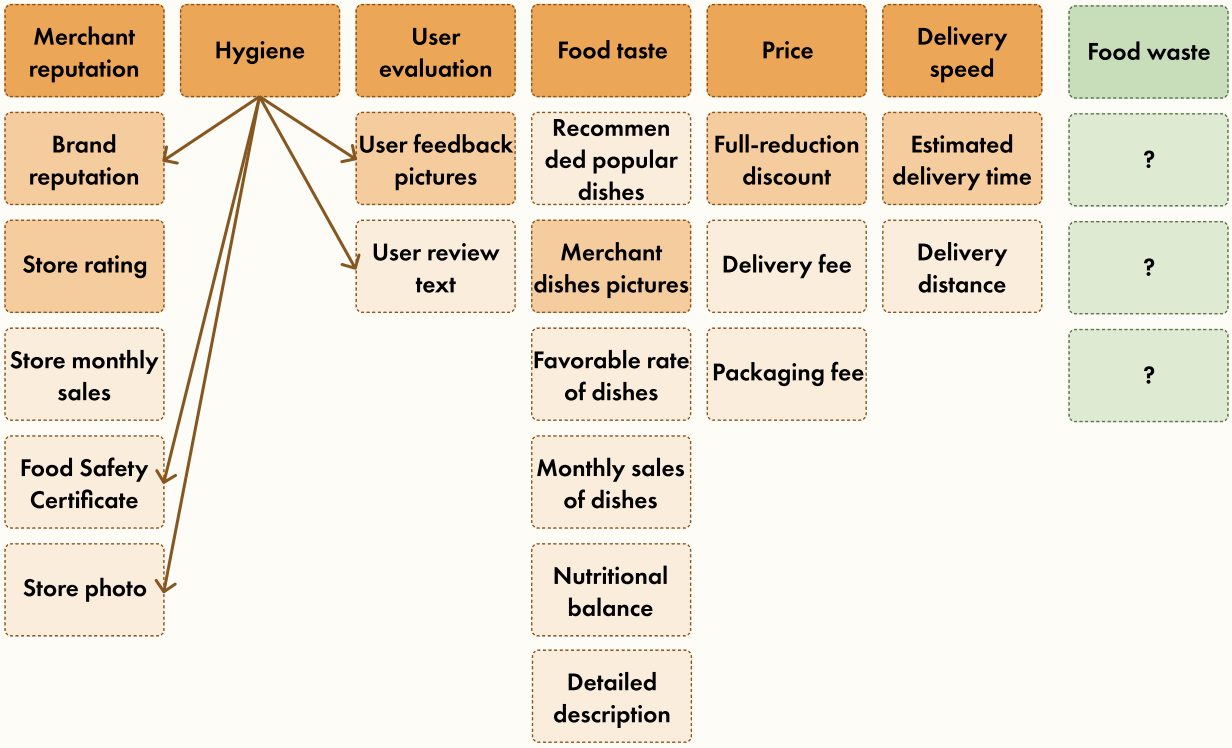


Figure 20: Influencing factors in app

Key insight:

Through the analysis of factors that may influence consumer ordering choices on the app, it was found that **users are most concerned about the availability of detailed information (both textual and visual) provided by the merchants and substantial user feedback**. This information serves as a reference for consumers to accurately assess whether the offerings meet their requirements and expectations. **Currently, factors related to food waste have not been integrated into consumers' considerations.**

RQ: What is the current attitude of consumers towards Food-Related Domestic Waste (FDW)? Through which channels do users gain information on food-related topics? What types of food/ environmental topics interest them?

According to Maslow's hierarchy of needs theory, most consumers only order takeout to satisfy the most basic physiological needs, while reducing FDW is a more advanced esteem need that only a few users with personal interests will take the initiative to learn. **The current attitudes of consumers towards FDW can be mainly divided into two categories: 1. Almost no awareness or concern about FDW; 2. Understand the importance of reducing FDW but know very little about how to do it.**

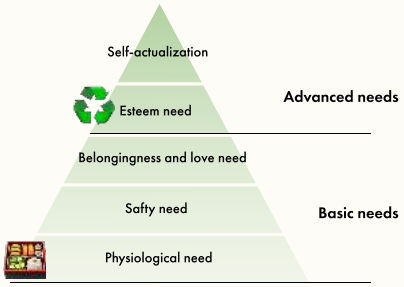


Figure21: Maslow's Hierarchy of Needs

Group 1: unconcerned

Group 2: understand but limited knowledge

Figure22: Quotations from interviewees

Key insight:

In conclusion, the primary challenges and opportunities lie in **raising awareness among consumers who are currently unaware of FDW** and **bridging the gap between consumers who understand FDW's significance but lack actionable knowledge**. The platform's policies and promotional efforts play a role in influencing consumers' understanding of FDW.

3.2.3 Persona

RQ - Do consumers have different types of consumption demand?

In order to understand the various demands of consumers when ordering meals and to cater to their different needs more effectively during the design phase, based on the ranking of consumption demands and influencing factors from the 15 participants, consumers can be primarily categorized into four major types: hungry eaters, health seekers, taste seekers, and everyday diners.

- **Hungry Eaters prioritize convenience and speed when ordering food.** They typically don't want to spend too much time on the ordering process and usually allocate only 5-10 minutes for placing an order. They order food 5-6 times a week, which means approximately once a day on workdays and occasionally on weekends. They pay particular attention to the delivery time and distance to quickly satisfy their meal needs.

- **Health Seekers pursue balanced nutrition and high-quality food.** They often order food 3-4 times a week due to a preference for avoiding cooking. They value food diversity, such as a mix of both meat and vegetables, trust in well-known brands for quality assurance, and user feedback.

- **Taste Seekers prioritize the taste of the food and order delivery primarily to enjoy a variety of flavors.** They order food 2-4 times a week and care most about the delivered cuisine aligning with their cravings and preferences.

- **Everyday Diners order food as part of their daily routine**, consuming it for two meals each day, totaling 12-14 times a week. For them, affordability is key. They prioritize factors like discounts from merchants, platform vouchers, and price reductions when making their orders.

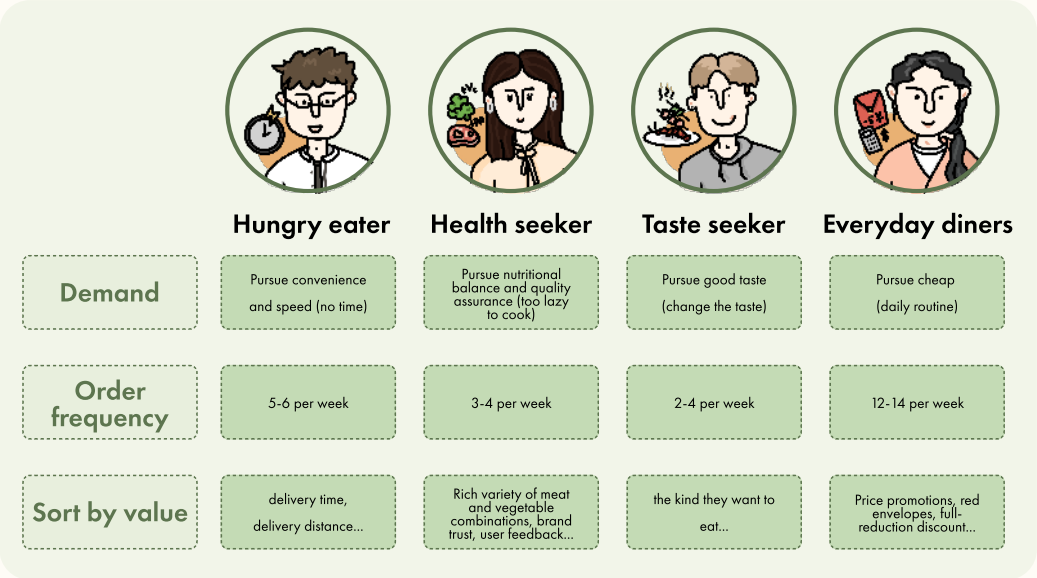


Figure23: Demand based personas

Key insight:

Consumers can be categorized into **four major persona: Hungry Eaters, Health Seekers, Taste Seekers, and Everyday Diners.** This classification can aid in designing personas with more targeted elements for generating behavioral change intent during the design phase. It also helps in validating whether the different needs of various consumer types can be effectively met.

3.2.4 App flowchart & User journey stages

RQ: What is user journey guided by the platform? What are the stages in which consumers generate FDW when using FDS? Are there differences among different persona?

In order to understand the essential stages and steps of consumers' use of FDS, and to identify intervention points for altering consumer attitudes and behaviors in different stages and for different personas' user journey stages, the operational flow of the platform app can be outlined as follows: searching/consuming category classification/recommended restaurants, selecting a restaurant, choosing dishes, verifying selected items, checking order price and discounts, completing the order, confirming receipt, providing order feedback.

Key insight:

The main stages of consumer interaction with FDS can be divided into five phases: Pre-order, Order, Wait, Eat and After. Different personas have certain differences in user journey stages. As can be seen in figure 24, **the main difference is reflected in the different content they search for in the pre-order stage due to different needs.** A more specific user journey map for each persona can be found in appendix 3.

Figue24: App flowchart

3.2.5 Objective Barriers

RQ: What are the objective barriers for consumers to reduce food delivery waste due to the platform or the restaurants?

- The most frequently mentioned barrier is **excessive portion sizes**, mainly observed in the abundance of staple foods like rice and noodles. It's possible that r**estaurants provide larger portions** by default, limiting consumers' choices. Moreover, consumers might request smaller portions in their order notes, but due to restaurant busyness or concerns about customer satisfaction, they receive larger portions anyway, leading to FDW. Another factor contributing to excessive portions is consumers' response to discounts and promotions. **Consumers tend to order larger quantities of food beyond their regular consumption patterns.** Additionally, the issue of excessive portion sizes might arise from consumers' desire to achieve a balanced and nutritious diet, leading them to order more food items than they can consume.

- The second point, feeling that **the food doesn't match their taste or is not delicious**, could be due to it **not meeting their expectations**. It might also be because there are **parts of the meal combo that they don't enjoy**. For instance, in the displayed images, users might think the dish looks appetizing or assume it's sweet, but in reality, it turns out to be salty. Alternatively, in some stir-fried dishes or combos, there are always one or two items that they don't like. Consumers might not be aware of this when placing the order, which eventually leads to food wastage.

- The third point of concern about food safety encompasses various aspects. On one hand, some consumers believe that reheating food in plastic containers may release harmful substances into the food, making it unhealthy to consume. On the other hand, due to seasonal changes, consumers worry that the food might spoil faster than expected. For instance, fresh-squeezed fruit juices in the summer might deteriorate quickly, or winter foods might become cold and result in oil floating on the surface. Additionally, consumers are also wary of the origins of certain off-brand beverages offered by restaurants or the lack of proper safety measures for soups. This hesitation to consume these items prevents them from giving them to others and ultimately leads to disposal.

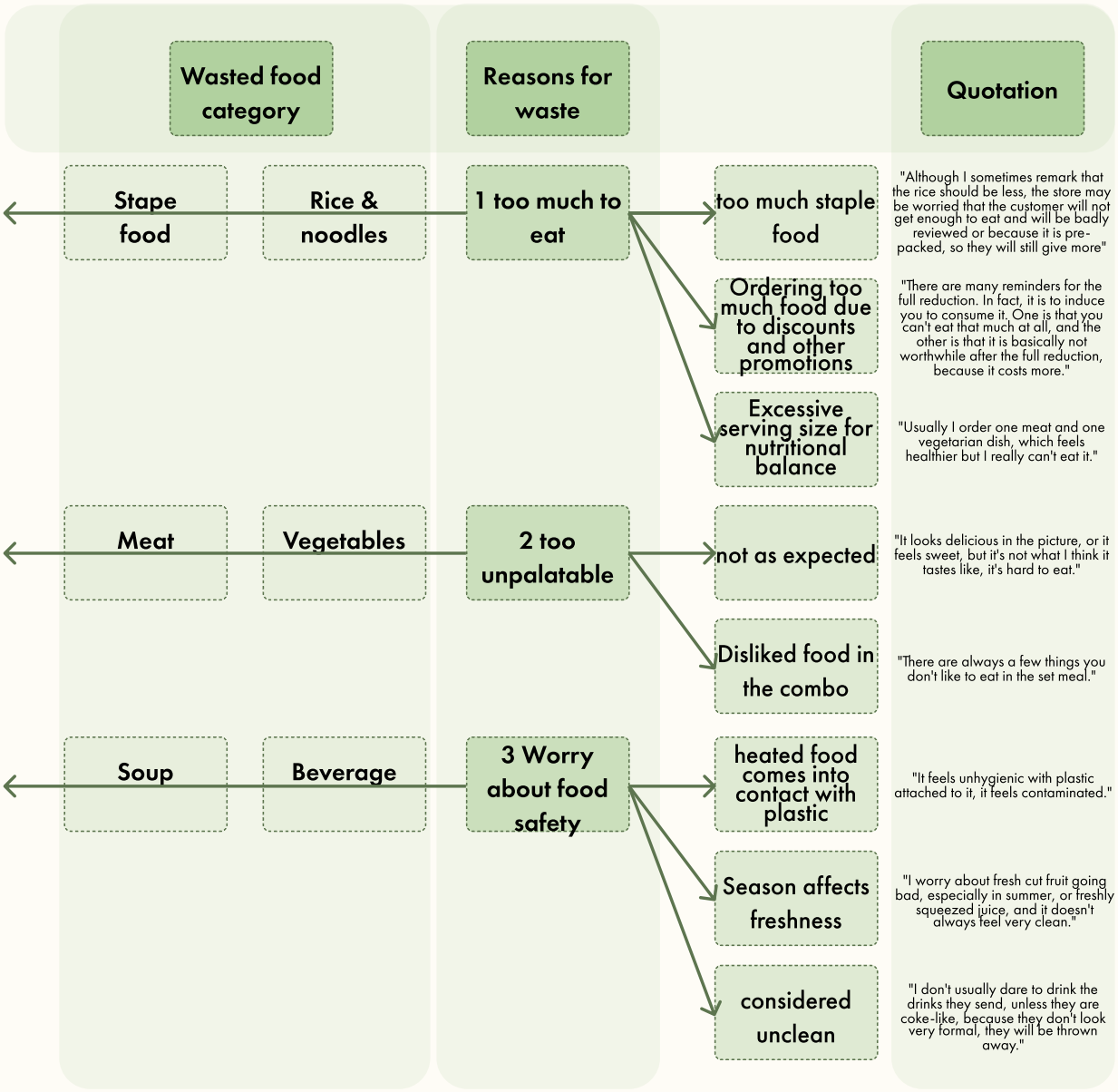


Figure25: Objective barriers

Key insight:

In conclusion, based on the above analysis, **the main objective obstacles for consumers when ordering through the platform are: 1. Oversized portions, 2. Mismatched taste preferences, and 3. Concerns about food safety.**

3.2.6 Objective Opportunities

RQ - What are the potential opportunities corresponding to these objective obstacles?

These opportunities are: **1. Portion prediction, 2. Flavor Prediction, and 3. Hygiene Assurance.** Derived from the objective obstacles with the main factors influencing consumers in the app mentioned in section 3.2.2, we can find that:

- Corresponding to the Portion Prediction opportunity, it is primarily manifested through businesses providing clearer and more accurate depictions of portion sizes in dish images. Additionally, offering more detailed descriptions of portion sizes, along with suggestions to encourage consumers to pay attention to portion control while balancing meat and vegetables, and advising on portion sizes when taking advantage of discounts or price reductions.

- Corresponding to the Flavor Prediction opportunity, it involves providing more detailed descriptions of dish flavors, including the degrees of sourness, sweetness, bitterness, spiciness, saltiness, and umami. This can be complemented by incorporating a greater amount of user-generated images and textual feedback related to flavors.

- As for the Hygiene Assurance opportunity, it encompasses user feedback regarding the hygiene conditions of establishments. It also includes offering specific food safety tips tailored to different seasons, providing instructions for safely heating plastic packaging, and describing the safety measures of the brand in relation to complimentary beverages.

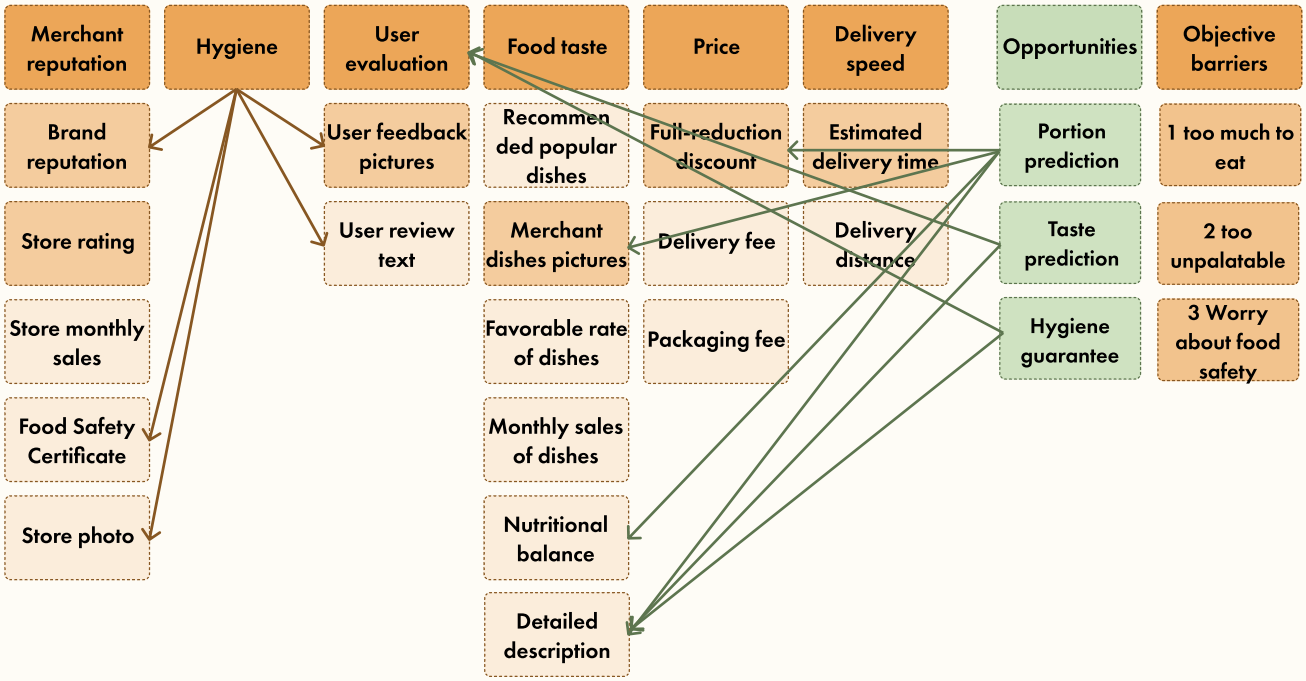


Figure26: Objective opportunities

Key insight:

During the design phase, the insights gathered from these three points – **1. Portion Prediction, 2. Taste Prediction, and 3. Hygiene Assurance – can be leveraged to develop targeted strategies to address the specific design challenges**. Additionally, by extrapolating ideas from elements within the app that influence consumers, it's possible to generate innovative solutions aimed at mitigating objective barriers.

3.3 Co-creation Interview-Consumer behavior

3.3.1 Co-creation interview setup

- **Purpose:**

The purpose of this co-creation is two-fold. One is to answer questions that have not yet been answered in the user interview: the subjective barriers of FDW caused by consumer attitudes and behaviors and consumers' behavior after producing leftover; the second is to brainstorm possible solutions with consumers.

- **Participants:**

There were 4 participants this time, mainly from the participants who gave proactive feedback in the previous interviews. They also fit 4 different personas and two different attitudes towards FDW. Three of them are consumers, so that we can understand as much as possible about consumer psychology, and one is a designer, who can promote brainstorm's diverse ideas.

- **Process:**

Prior to conducting the co-creation session, a week before the one-to-many interviews and collaborative activities, a preliminary assignment was distributed. This assignment aimed to encourage participants to reflect on their usual post-ordering behaviors, particularly their attitudes and specific actions towards leftovers. This preparation helped familiarize consumers with the topic and encouraged introspection, ultimately leading to more insightful contributions during the session (see Appendix 4.1 for details).

The interview component of the co-creation session began by prompting participants to recall their typical consumption habits and wasteful behaviors. Subsequently, participants were asked to identify which persona(s) from the ones outlined in section 3.2.3 they most closely aligned with. Following this, they engaged in a more detailed reflection on their attitudes towards FDW and identified barriers to reducing FDW, using predetermined questions related to FDW.

For the brainstorming aspect of co-creation, participants were presented with ideation questions based on the opportunities arising from the objective obstacles I identified in section 3.2.6. These questions aimed to guide participants in generating targeted ideas and suggestions (for a more comprehensive co-creation process, refer to Appendix 4.2).

Figure27: Co-creation analysis process

3.3.2 Overall insights

The six primary insights from this co-creation session are as follows:

1. **Current approaches to leftover management by consumers.**
2. **Attitudes towards FDW and their stage in the consumer behavior change model.**
3. Factors Influencing consumer behavior.
4. Motivations for ordering takeout.
5. **Subjective barriers and opportunities for reducing FDW.**
6. **Suggestions for reducing FDW.**

Insights 3 and 4 appear to align with findings from section 3.2.2; therefore, a repetitive summary is not provided in this stage.

Subsequent sections will provide more detailed analysis for the remaining insights. Supporting data such as specific codes for each insight cluster can be viewed in appendix 4.3.

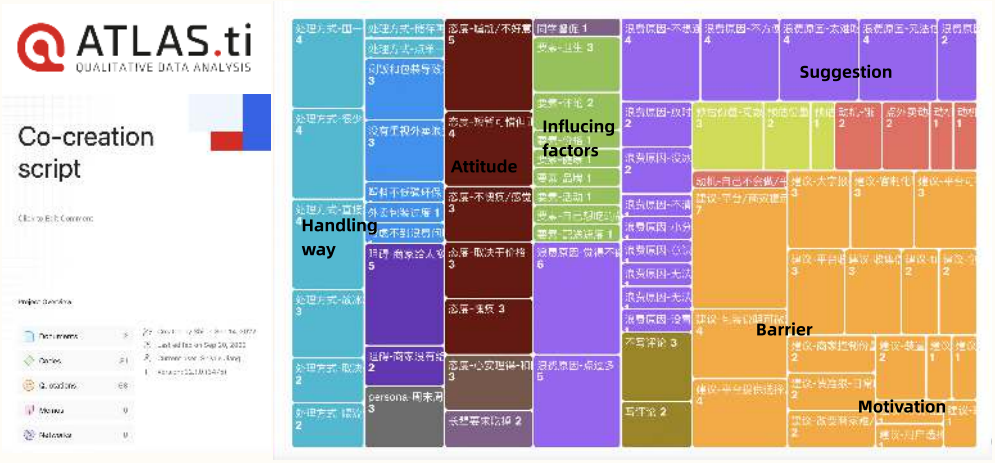


Figure28: 6 main insight cluster of co-creation

3.3.3 Current Consumer Approaches to Dealing with Leftovers

RQ - How do consumers currently handle leftovers?

At present, the main methods of disposal are as follows: **throw away directly, throw away after being stored for a period of time if not eaten, put in the refrigerator but can only be thrown away after forgetting, feed to stray cats and dogs, and eat after storage.**

In interviews, most people mentioned that they threw away the food directly because the remaining portion was too small or not enough to eat in the next meal.

It is not uncommon for food to be thrown away after storage. There are many reasons for this, such as feeling stale after being stored for a long time, not wanting to eat the same food, or not having the conditions or willingness to reheat a little leftover, etc.

Feeding to stray cats and dogs and storing them for later consumption are not very common cases.

Because white-collar workers are usually busy at work, a little leftover is not enough for the next meal, so they do not spend a lot of time thinking about how to use the next meal, and end up ordering new takeout, as a result, the remaining leftover was discarded for various reasons.

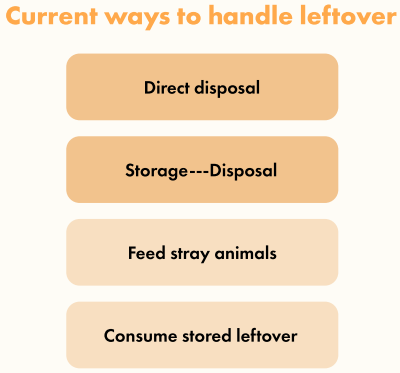


Figure29 : handling leftover ways

Key insight:

Currently, while some consumers may feel a sense of waste, **practical constraints often lead to the ultimate disposal of leftovers, either directly or after a period of storage**. The practice of retaining and subsequently consuming leftovers is relatively infrequent.

3.3.4 Scenarios - Corresponding to Personas

RQ - Do consumers exhibit consistent or varying behaviors in different scenarios? Is the consumer persona consistent throughout?

Key insight:

Participants were asked to identify with a persona. Interestingly, **consumer personas are not static**; they may shift based on different scenarios, resulting in corresponding shifts in their FDW attitudes and behaviors.

Deviating from the initial assumption of scenarios based solely on workplace and home settings, the analysis led to the identification of two pivotal scenarios: **workday scenarios and off-day scenarios.** On workdays, consumers are often engrossed in their work and have limited time and mental bandwidth for contemplating their meals, resulting in decreased attention towards FDW. Conversely, during weekends or days off, consumers tend to be more relaxed and have more leisure time to engage with food delivery services.

These two usage scenarios align well with their respective personas. On workdays, consumers are more inclined to adopt the "Hungry Eaters" and "Everyday Diners" personas, seeking quick lunch or dinner options. On weekends, the personas "Health Seekers" and "Taste Seekers" become more fitting, as consumers dedicate more time to selecting meals that reward their week's efforts and are more likely to provide feedback on their dining experiences due to having the time and mood for it.

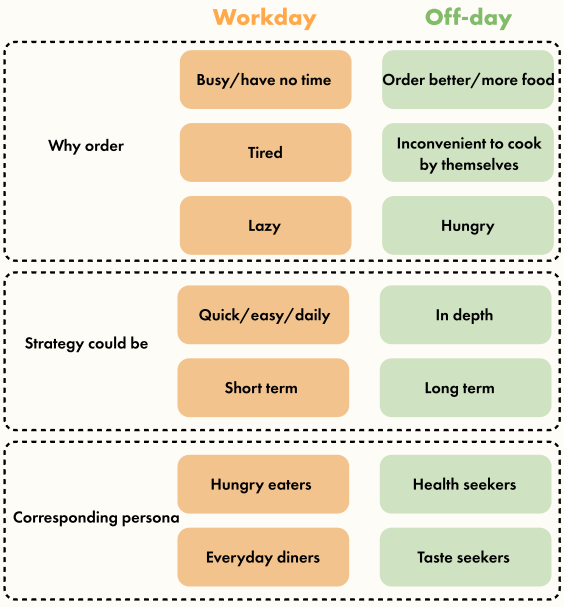


Figure30: 2 main scenarios

3.3.5 Attitude-quotes (SICAS)

RQ - In which stage of SICAS is the current consumer attitude towards FDW?

Key insight:

To systematically comprehend the stage at which consumers currently stand in terms of changing their consumption behavior, the SICAS model of consumer behavior change can be applied. Considering the insights from these two interviews, consumers can be classified into two stages:

- **Stage 1 - Sense:** This stage corresponds to individuals who are indifferent towards FDW and lack environmental awareness. They require a basic increase in awareness and consciousness about the importance of FDW reduction.

- **Stage 2 - Interest to Connect to Action:** This stage pertains to individuals who possess a foundational awareness of the significance of reducing FDW but lack concrete strategies for implementation. Efforts should focus on boosting their willingness to translate their awareness into actual behavioral change.

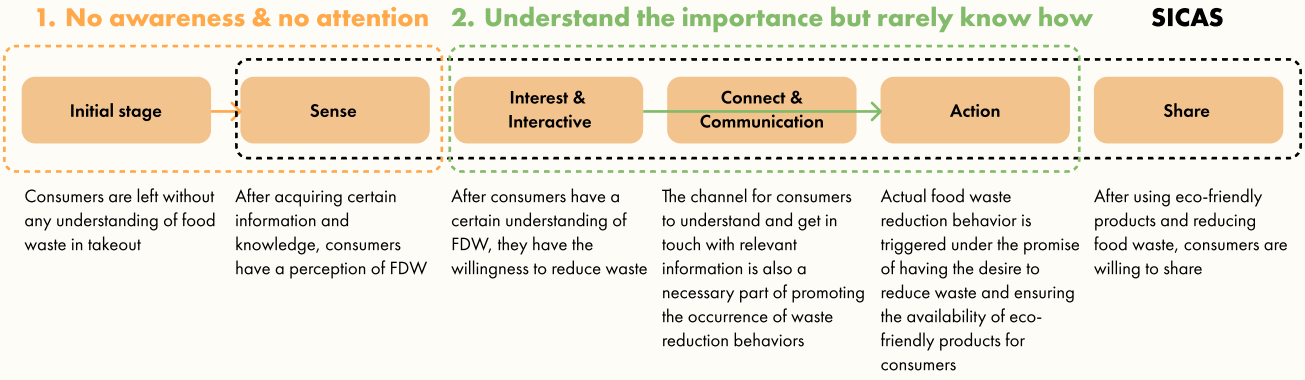


Figure31: Consumer attitude stage

3.3.6 Subjective Barriers

RQ - What are the subjectively perceived barriers caused by consumer attitudes or behaviors?

Key insight:

From the graph, it is evident that **the primary reasons include perceiving leftovers as not fresh or unhealthy, inconvenience/laziness to reheat and store, ordering too much food, reluctance to eat repetitive dishes in succession, taste mismatch, and inability to estimate portion size**. In the graph, the green sections represent the previously discussed objective barriers, while the orange segments signify new reasons related to FDW due to consumers' personal factors discovered in this round of interviews. Subjective barriers can be categorized into three main groups: **1. Weak awareness of FDW due to favorable living conditions 2. Ambiguous understanding of leftover freshness 3. Leftover portions too small to be worth reheating or not deemed worthy of the effort.**

- The first point refers to the fact that China no longer faces the widespread shortage of food as it did decades ago. Especially for urban white-collar workers who grew up in metropolitan areas, they haven't experienced food scarcity like previous generations. As a result, they may lack the same reverence for food and sense of food scarcity crisis as before. Therefore, young people living modern lives in urban areas generally **have a weaker awareness of food waste (FDW).**

- The second point was the most frequently mentioned barrier during this round of interviews. Many individuals believe that consuming leftover food for an extended period is detrimental to their health. They view sacrificing their health for a small amount of leftover food as unnecessary. Moreover, **everyone has a subjective interpretation of the freshness of food**, lacking a clear understanding of how long specific types of food can be stored before they become inedible. This subjective interpretation can lead to potentially edible leftovers being prematurely discarded as FDW.

- The third point is the second most frequently mentioned barrier, with a focus on white-collar workers who might lack the necessary resources due to their living conditions. Some individuals may not have refrigerators or microwaves for storing and reheating leftovers. Additionally, some might find it **inconvenient to go through the effort for a small amount of leftover food**. Respondents also mentioned that since leftovers are typically small in portion, they don't know how to store them properly, and the amount might not be sufficient for another meal.

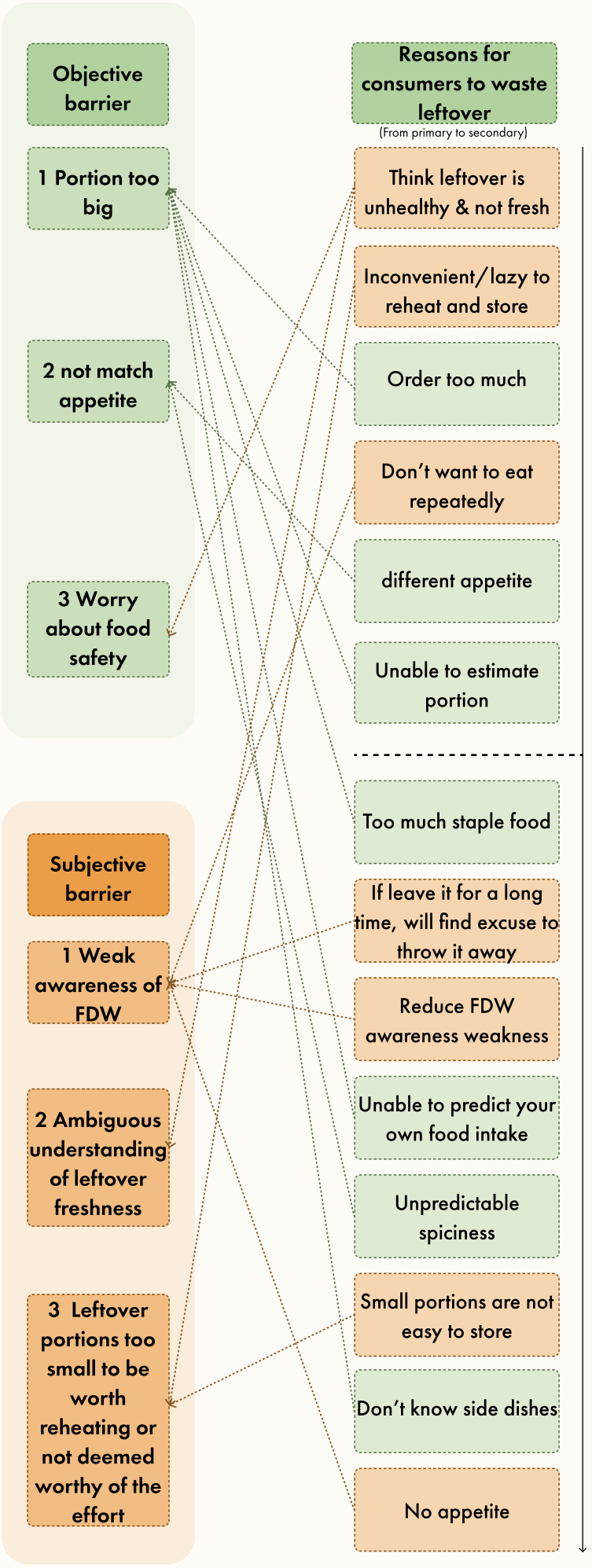


Figure32: Subjective & objective barriers

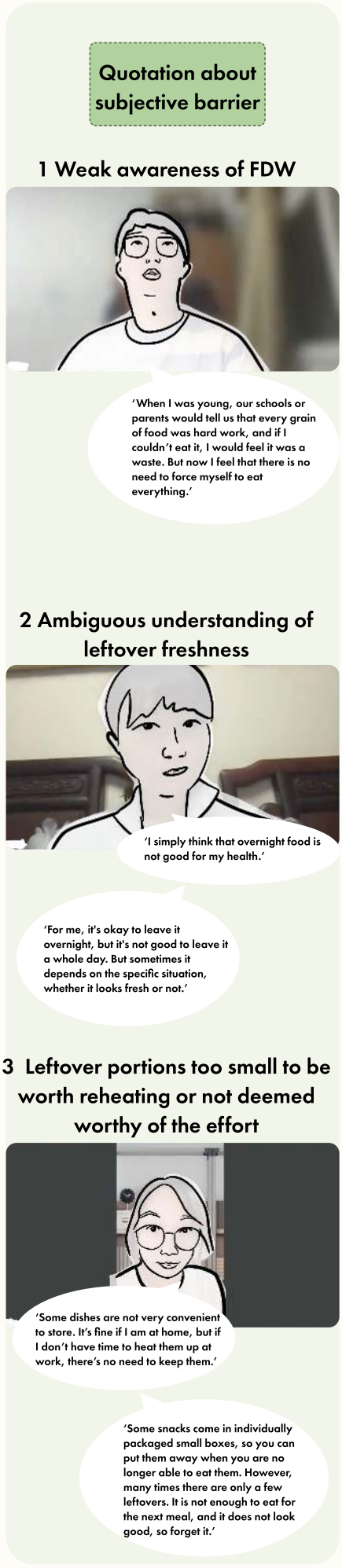


Figure33: Quotations about subjective barriers

3.3.7 Opportunities

RQ - What are the potential opportunities corresponding to these subjective barriers?

Key insight:

The identified opportunities for addressing subjective barriers include: 1.**Enhancing awareness** among individuals with favorable living conditions about the significance of reducing FDW. 2.Improving the understanding of **freshness standards** for leftover food. 3.Providing insights into **how to store and utilize** small portions of leftover food effectively.

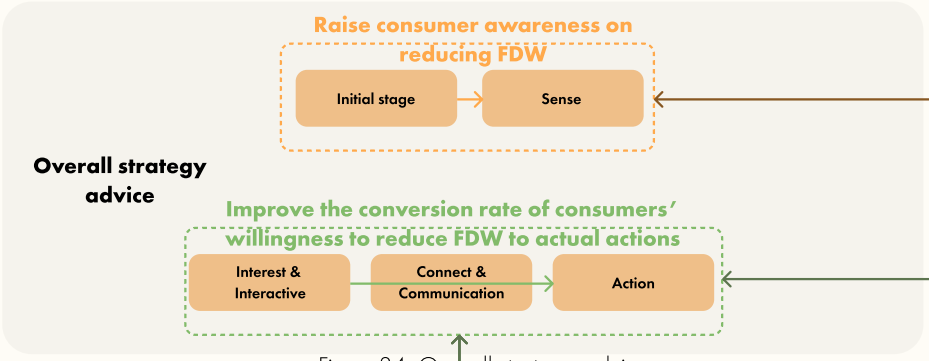


Figure34: Overall strategy advice

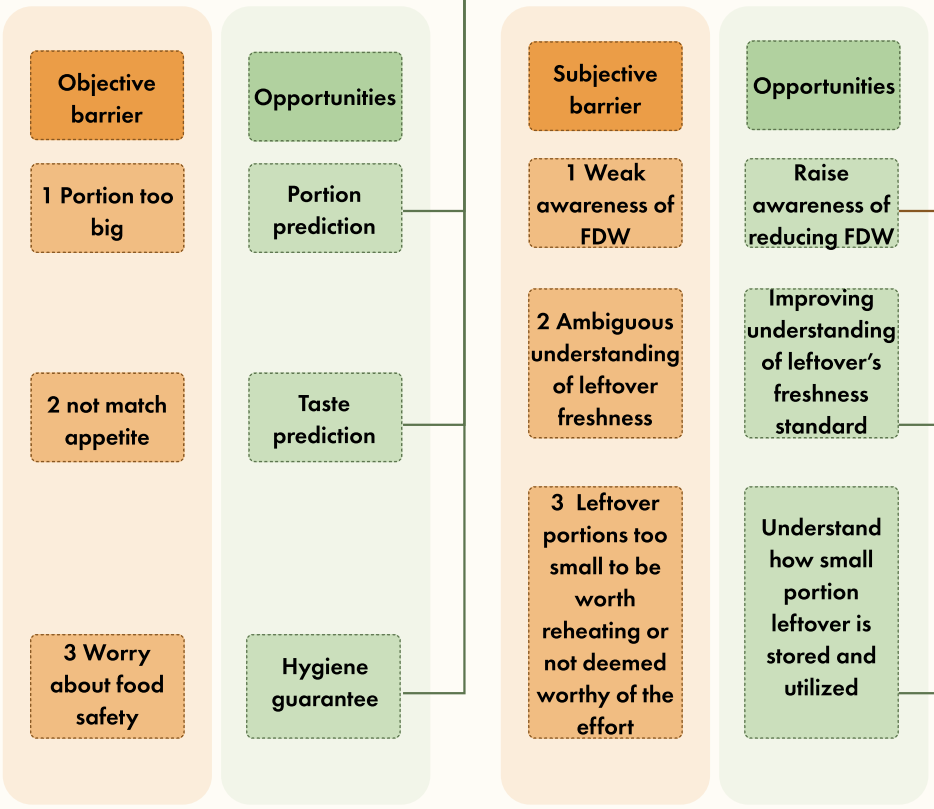


Figure35: Opportunities-objective barrier

Figure36: Opportunities-subjective barrier

Conclusion:

In this defining research phase, three primary research questions were elaborated upon to uncover detailed insights. Through two rounds of qualitative interviews, numerous interesting and critical key insights were gained, providing valuable input for advancing into the subsequent development phase. These insights include the identification of two stages in consumers' attitudes and behaviors towards FDW: "sense" and "interest to action"; the consideration of two scenarios: workday and off-day; the categorization of four personas: hungry eaters, health seekers, taste seekers, and everyday diners; and the recognition of five user journey stages: pre-order, order, wait, eat, and after.

Furthermore, a comprehensive analysis was conducted to identify objective barriers hindering consumers' ability to reduce FDW, such as excessive portion sizes, mismatched tastes, and food safety concerns. Additionally, subjective barriers were acknowledged, including an awareness gap due to favorable living conditions, unclear understanding of leftover freshness, and reluctance to store or reheat small portions of leftovers. These insights serve as a crucial foundation for addressing pain points and developing strategies in the upcoming design phase.

Reframe

In this chapter, I have restructured the design challenges based on the initial problem statement and the research analysis in the domains of Food Delivery Services (FDS), Food Delivery Waste (FDW), and Consumer Behavior. These insights have allowed me to define a fresh set of design challenges and establish design criteria that will facilitate the evaluation of the final design.

04
Reframe

4.1 Reframe the design challenge scope

The initial design challenge of this project was broader in scope, targeting **white-collar consumers in China's big cities to reduce avoidable takeaway food waste by changing consumers' attitude and behaviors**.

After an early research on the current subjective and objective obstacles, it can be seen that the objective obstacles are mainly too large portions and unpalatable, and the corresponding strategic opportunities are predictions of taste and portion; while the subjective obstacles are a vague understanding of the freshness of leftovers and a lack of knowledge and conditions for storing and utilizing small portions of leftovers. The corresponding opportunity is to improve consumers' understanding of freshness standards and understand how to store and utilize small portions of leftovers. Combining the two strategies of SICAS, we can improve consumers' awareness of reducing FDW and improve the conversion rate of consumers' willingness to reduce FDW into actual behaviors.

Based on the above strategic analysis of subjective and objective obstacles, it can be seen that the design goals can also be divided into two main parts:

- **Goal 1: In the pre-order and order stages, help consumers set more accurate expectations for portion and taste.**

- **Goal 2: In the eat and after stages, help consumers understand the freshness standard more clearly, and provide conditions for storage and reuse of leftover.**

These form a relatively complete design strategy, but the scale is still too broad for a graduation project, and it is unrealistic to solve all the problems. Therefore, based on its desirability, feasibility, and viability, I selected the first goal that I thought would be most achievable and effective within two to three years as the main design goal scope.

Design goal

I would like **China's urban white-collar consumers** can feel confident, inspired and encouraged about how to order takeout that **suits their food intake and tastes**, so that they can reduce food waste.

In terms of **desirability**, according to the food recovery hierarchy, it can be seen that the way to solve the leftover that has occurred in the later period is relatively limited, the actual operability is also weak, and it is not recommended; in contrast, before the leftover has not yet occurred, there are more operational possibilities to prevent food waste that may occur later, and it is more likely to reduce more FDW.

In terms of **feasibility**, whether it is portion size, taste information, or conveying awareness of food waste prevention, compared to leftovers managed by consumers themselves, the platform has greater controllability and operability, and it is also conducive to setting goals and achieving goals from top to bottom, from the government to the platform to merchants and consumers.

From a **viability** perspective, based on China's current environment regarding food waste processing technology and the progress of policies such as anti-food waste laws, there are some food safety risks in giving specific leftover suggestions to consumers. The current government and platforms lack strong motivation to do it. Helping consumers understand portion size and taste more clearly is more in line with the current government and platform policy goals of reducing carbon emissions and combating food waste.

4.2 Interaction vision and Criteria

In order to more specifically envision the interactive vision I want to achieve, the following metaphor is written; and the three criteria (confident, inspired, and encouraged) are specifically defined. Through the two important measurement standards of vision and criteria, it is easier and more effective to quickly verify whether the new design achieves the design goal and its degree of completion during the ideation and evaluation stages of the design phase.

Interaction vision

It's like participating in a **planting/potting workshop** initiated by an experienced horticulturist with clear instructions, **making participants feel confident, inspired and encouraged.**

- Before the workshop begins, the horticulturist provides clear instructional materials, allowing plant enthusiasts to feel confident and in control as they prepare to learn the upcoming content.

- During the workshop, horticulturists will share practical suggestions, techniques, tools, etc., so that participants can feel inspired and referenced for their own planting experiences.

- After the workshop, the horticulturist continues to offer assistance, such as answering questions, so that participants feel encouraged to continue exploring and learning how to plant and care for plants.

Criteria

Confident

- Consumers feel fully informed about their food intake.
- Consumers feel fully understand the portion size provided by the merchant/platform.
- Consumers feel in control of the specific flavor and ingredients of dishes.
- Consumers feel that merchants/ platforms are responsive to special requirements for dishes.
- Consumers feel they have ample choice.

Inspired

- Consumers feel informed about the portion size they should order.
- Consumers feel guided when indecisive.
- Consumers feel more aware of their ordering habits.
- Consumers feel inspired that their actions can reduce food waste.

Encouraged

- Consumers feel encouraged to choose portion sizes that best suit their appetites.
- Consumers feel encouraged to choose restaurants and dishes that suit their tastes.
- Consumers will feel conscious about reducing FDW when ordering food in the future.

Figure 37: Testable criteria

Conclusion:

This chapter identifies more specific **design goal: I would like China's urban white-collar consumers to feel confident, inspired and encouraged about how to order takeout that suits their food intake and tastes, so that they can reduce food waste.**

It also proposes **an interaction vision that makes consumers feel confident, inspired, and encouraged, just like participating in a potting workshop, as well as related testable criteria.**

Ideation

Based on the strategies and new design goals derived from the previous analysis, this chapter conducted two brainstorm sessions to divergently explore the design solutions and determined two different concept directions, and then analyzed its advantages and disadvantages through prototype testing to guide iteration to the final design.

05
Ideation

5.1 Ideation process

The entire idea process consists of divergence starting from the research stage and convergence of ideas. First, consumers put forward some design suggestions in the co-creation session of the research phase; based on these suggestions, a self-brainstorm was conducted and a lot of ideas were produced. Afterwards, a more targeted brainstorm session was conducted, and two concept directions were determined; low-fidelity prototypes in both directions were tested and analyzed, and the final design plan was iterated.

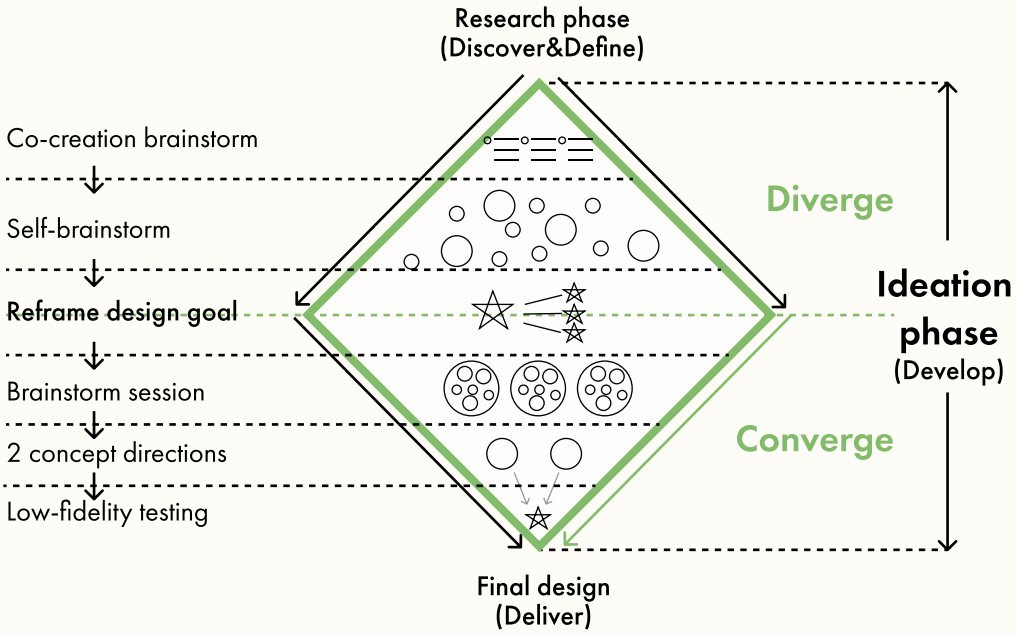


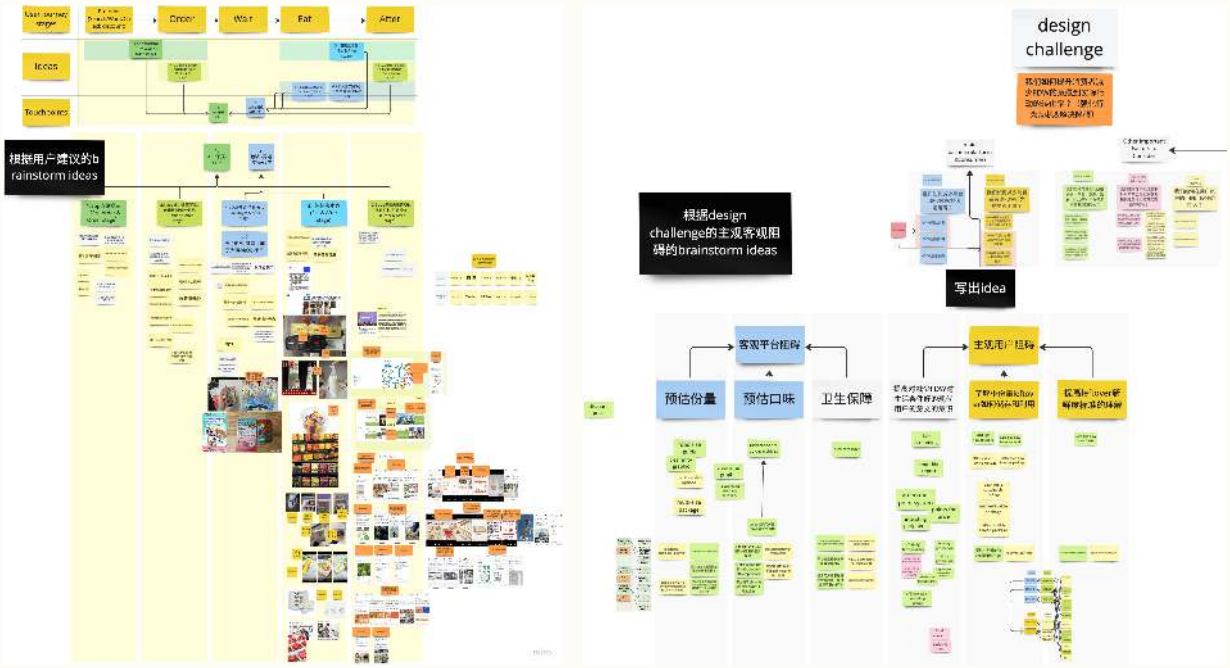
Figure38: Ideation process

5.2 Brainstorm ideas

5.2.1 Co-creation brainstorm & Self-brainstorm

In the co-creation session during the research phase, in addition to discussing subjective obstacles, a brainstorm was also conducted, and consumers put forward some suggestions that they thought were feasible. Through code and cluster, the most frequently mentioned suggestions include: the platform/merchant prompts that the portion size is too large; the platform provides selection/feedback points; provides microwavable/independently sealed packaging, etc. More detailed suggestions can be found in appendix 4.4.

Based on these suggestions, opportunity strategies, and design goals, and combined with important insights such as stakeholders, personas, scenarios, etc., multiple rounds of self-brainstorming and few case studies were conducted. (See appendix 5.1 for details)



5.2.2 Brainstorm session

After the self-brainstorm after the co-creation session, due to the reframe of the new design goal, as well as the interaction vision and criteria, some self-brainstorm was performed (see appendix 5.2). However, due to too many rounds of self-brainstorm, it resulted in Ideas starting to stay in my own box, so a new brainstorm session was conducted.

- **Purpose:**

This brainstorm session has two main purposes. One is to discuss more divergent ideas from the perspective of consumers and designers in order to break the original limitations. The second is to summarize and select conceptual directions with more room for development from the ideas produced in the session and the previous self-brainstorm ideas.

- **Participants:**

This session found three participants who are both takeaway consumers in big cities and designers. The purpose is to not only think about the problem from the perspective of consumers, but also help diversify more effective ideas from the perspective of designers.

- **Process:**

First, the warm-up topic was started through persona, and then the goals and important research insights of the project were introduced. Then the main design goals were raised through How might we (HMW) questions to help consumers brainstorm their ideas. Then we discussed the written ideas with each other, gathered similar ideas into a group, named them, and finally voted for the direction that we think has the most room for development and the most limitations, and discussed the reasons for its advantages and disadvantages. (See appendix 6.1 for details.)

Key insights:

Based on the final classification from the cluster, 5 of the 20 ideas were selected that were considered to have more room for development. They are:

1. **Ai assistant** - Use AI assistant to recommend more accurate portion sizes and tastes suitable for users
2. **Personal profile** - Create a personalized profile by filling in a questionnaire about portion size and taste so that the APP can accurately recommend meals.
3. **Health related** - Recommend more suitable meals to users by setting health-related goals, such as calories and nutritional content
4. **Labeled evaluation** - By labeling important information, such as portion size and taste, users can quickly understand the meals that suit them.
5. **Visualized description** - Help consumers quickly understand the portion size and taste of food through visual patterns, colors, etc.

After the session, these concepts were scored according to the design goal and criteria and expanded with more detailed ideas, which can be seen in appendix 6.2.

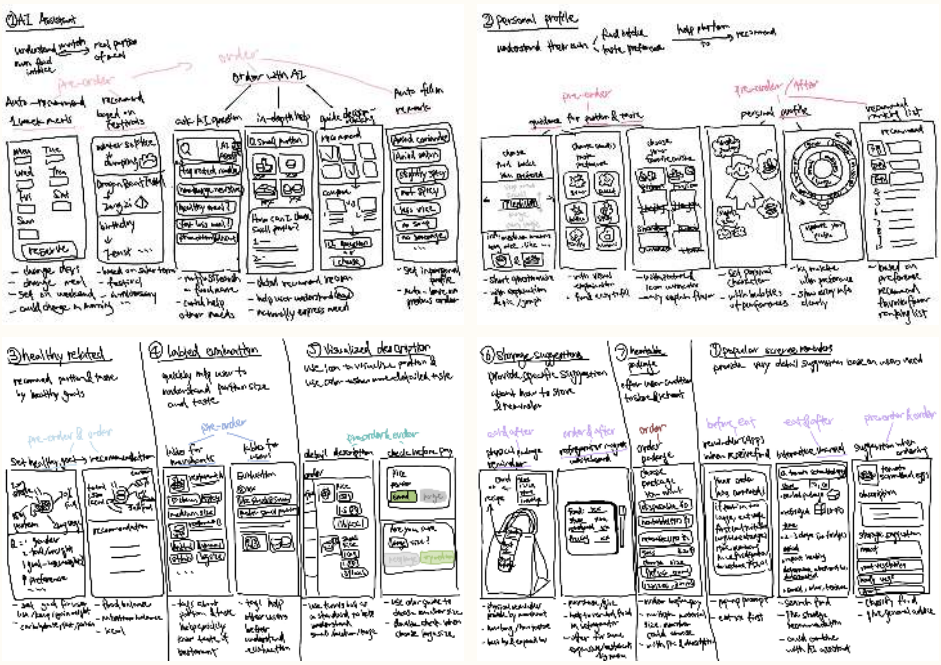


Figure39: Sketches about concepts

5.3 Two Concept Directions

Based on the five important ideas generated after the brainstorm session, ideas with similar functions were screened and combined into two final conceptual directions. The main design logic is to help consumers find meals that suit their food intake and taste, so as to prevent waste caused by ordering inappropriate dishes.

- The first direction is Intuitive, which is mainly composed of Labeled evaluation and Visualized description, helping consumers quickly and intuitively judge whether the meal meets the consumer's portion and taste through tags and visualization. Its user journey is very close to the flow of existing food delivery apps, but the form of information provided is different..

- The second direction is Conscious, which is mainly composed of Ai assistant and Personal profile to help consumers better understand their ordering needs and more consciously choose meals that suit their portions and tastes. Its user journey shortens the process of selecting meals, leaving room for more understanding of their own needs and raising awareness of FDW reduction.

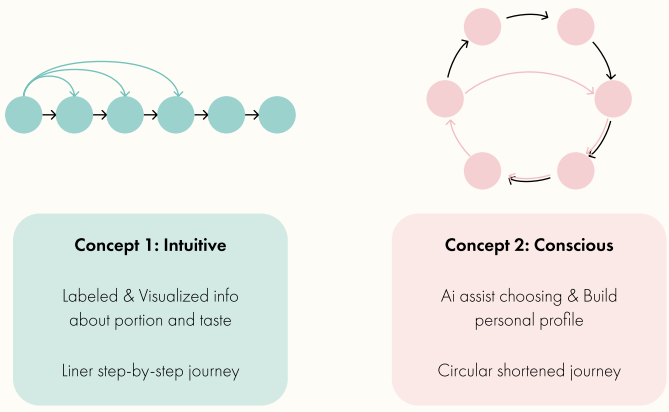


Figure40: Visualization of 2 concept directions

5.3.1 Concept direction 1: Intuitive

The first concept is intuitive, and the following are its main design points:

- The home page has **designed a search portal for different persona groups**. Different from basic search, it automatically sets default filtering conditions based on the ordering needs of different persona, and can quickly recommend suitable restaurants and dishes.
- In the list of restaurants and dishes, **colored boxes of pictures, icons and labels are used to help identify the taste, cuisine/type, portion size** and other important information related to reducing waste in the restaurant/dish.
- On the dish details page, **the taste of the dish is more specifically displayed through icons of sour, sweet, bitter, spicy, salty and umami; the portions of the dish are more intuitively displayed through labels and pictures similar to tennis balls**.
- In the dish evaluation, **the color, icons and labels of the avatar frame are used to display the user's usual taste preferences and food intake**, helping other users to more easily guess their portion size and taste.
- In the specification page, **add more options and detailed descriptions to remind users to choose appropriate flavors and portions, as well as taboos.**

In view of some important design points, many variations have been made. For a more detailed and complete low-fidelity model, please see appendix 7.1.

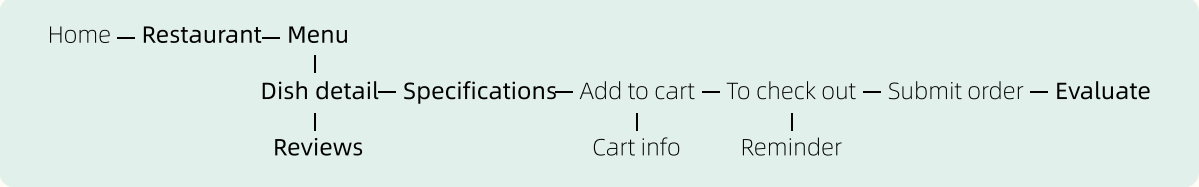
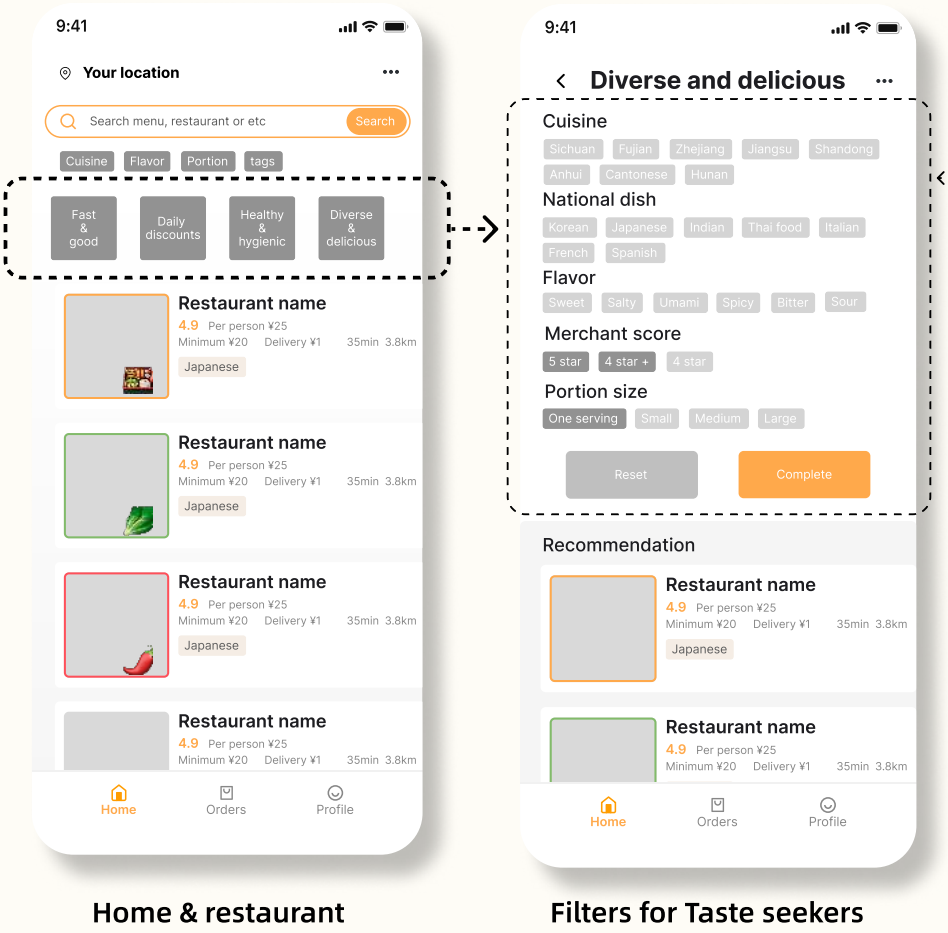


Figure41: Concept 1 app flowchart

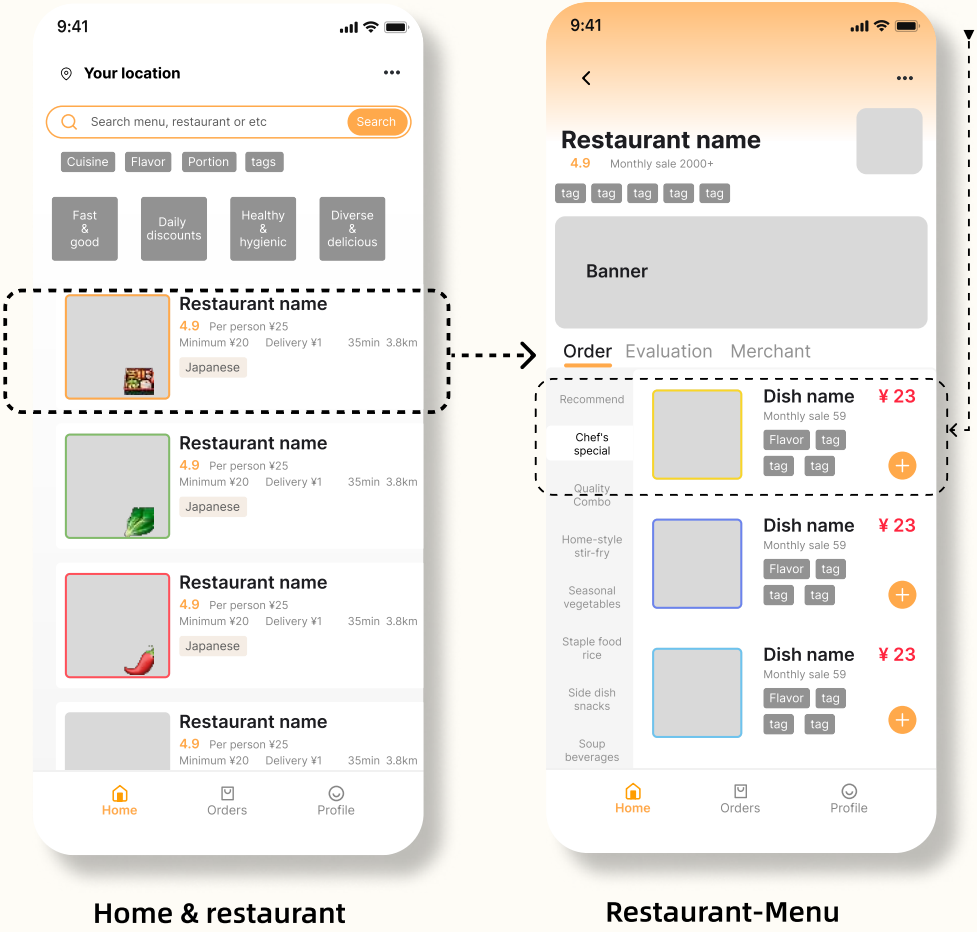


- Only show this type of personas' needs
- Auto-select possible tags as default
- can also choose other tags

- Design for 4 different personas
- Each persona have their priority needs
- these 4 filters help users quickly find the meal fits their needs, so that decrease the possibility producing leftover & FDW due to unsuitable portion & taste

Home & restaurant

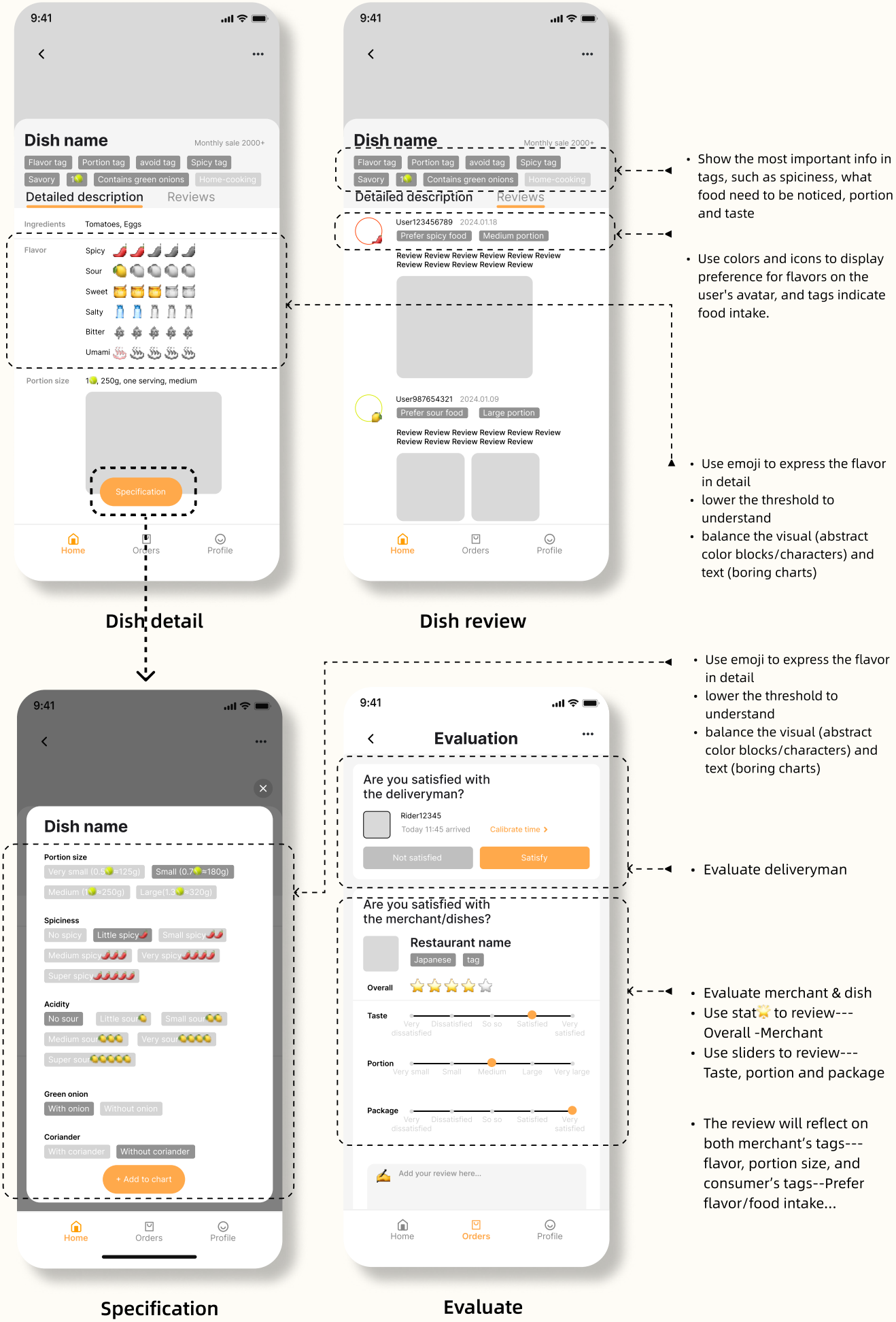
Filters for Taste seekers



- Use different colored borders and small icons to distinguish the restaurant's taste
- Tags on the right show more info about portion and taste

Home & restaurant

Restaurant-Menu


9:41
Dish name
Monthly sale 2000+
Flavor tag
Portion tag
avoid tag
Spicy tag
Savory
Contains green onions
Home-cooking
Detailed description
Reviews
Ingredients
Tomatoes, Eggs
Flavor
Spicy
Sour
Sweet
Salty
Bitter
Umami
Portion size
1, 250g, one serving, medium
Specification
Home
Orders
Profile
Dish detail
User123456789 2024.01.18
Prefer spicy food
Medium portion
Review Review Review Review Review Review Review Review Review Review Review Review
User987654321 2024.01.09
Prefer sour food
Large portion
Review Review Review Review Review Review Review Review Review Review Review Review
Dish review
Show the most important info in tags, such as spiciness, what food need to be noticed, portion and taste
Use colors and icons to display preference for flavors on the user's avatar, and tags indicate food intake.
Use emoji to express the flavor in detail
lower the threshold to understand
balance the visual (abstract color blocks/characters) and text (boring charts)
Dish name
Portion size
Very small (0.5≈125g)
Small (0.7≈180g)
Medium (1≈250g)
Large(1.3≈320g)
Spiciness
No spicy
Little spicy
Small spicy
Medium spicy
Very spicy
Super spicy
Acidity
No sour
Little sour
Small sour
Medium sour
Very sour
Super sour
Green onion
With onion
Without onion
Coriander
With coriander
Without coriander
+ Add to chart
Specification
Evaluation
Are you satisfied with the deliveryman?
Rider12345
Today 11:45 arrived
Calibrate time
Not satisfied
Satisfy
Are you satisfied with the merchant/dishes?
Restaurant name
Japanese
tag
Overall
Taste
Very dissatisfied
Dissatisfied
So so
Satisfied
Very satisfied
Portion
Very small
Small
Medium
Large
Very large
Package
Add your review here...
Evaluate
Use emoji to express the flavor in detail
lower the threshold to understand
balance the visual (abstract color blocks/characters) and text (boring charts)
Evaluate deliveryman
Evaluate merchant & dish
Use stat to review---Overall -Merchant
Use sliders to review---Taste, portion and package
The review will reflect on both merchant's tags---flavor, portion size, and consumer's tags--Prefer flavor/food intake...

5.3.2 Concept direction 2: Conscious

The second concept is Conscious, the following are its main design points:

- A **conspicuous AI assistant entrance** is designed on the homepage to prompt users to use AI to search for their needs (taste, portion, price, speed, etc.)
- In the question interface, **set basic questions related to reducing food waste such as taste and portion size** to guide consumers to become aware of their choices and links to reduce food waste.
- On the recommendation page, in addition to the basic recommendation results, the user will also **be prompted for the reasons why AI chooses to recommend, and the correlation** between appropriate portion size and taste and reducing food waste.
- On the personal profile page, **record personal preferences such as food intake and taste**. The more times you use the AI assistant, the more relevant future recommendation results will be to the user's needs; **users will be reminded of their past choices' contribution to reducing FDW**.

For a more detailed and complete low-fidelity model, please see appendix 7.2.

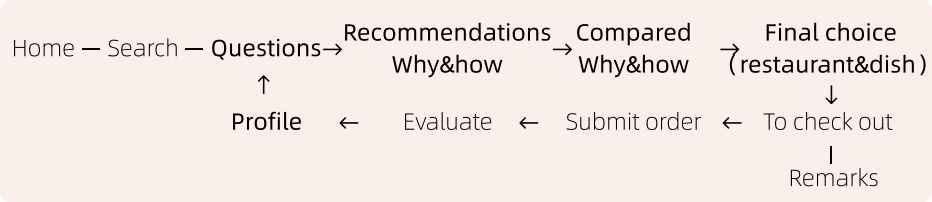
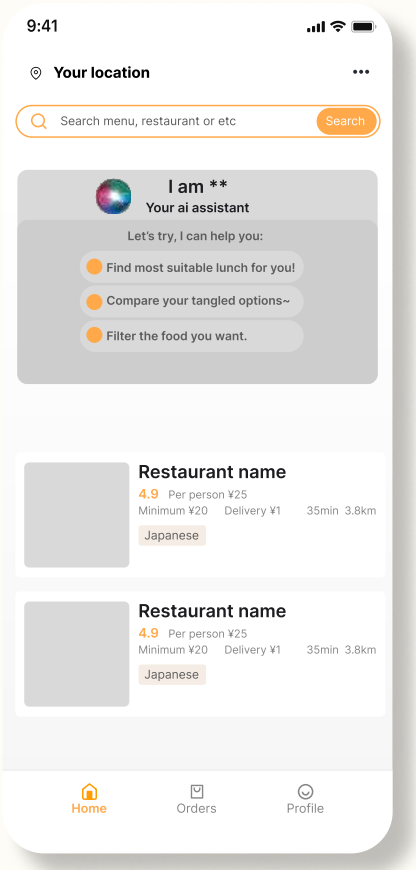
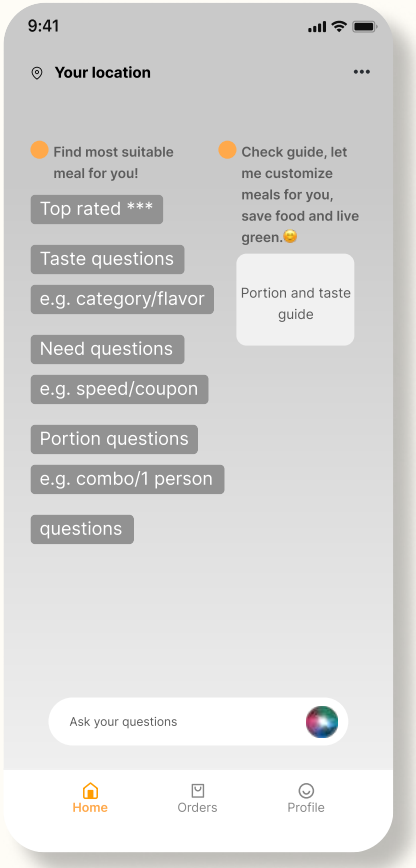


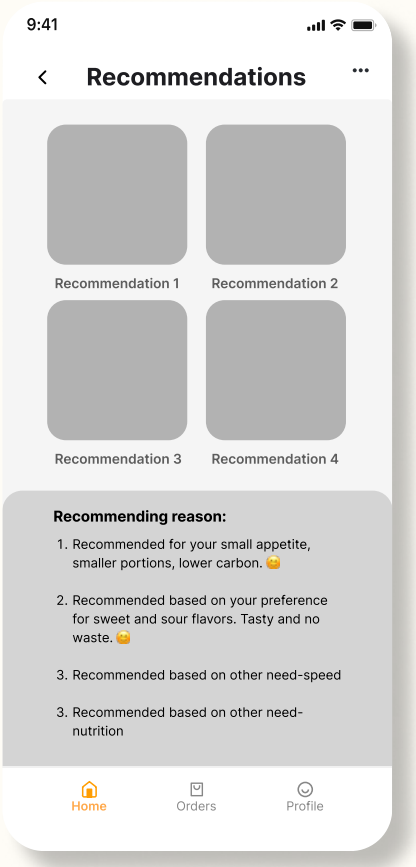
Figure42: Concept 2 app flowchart



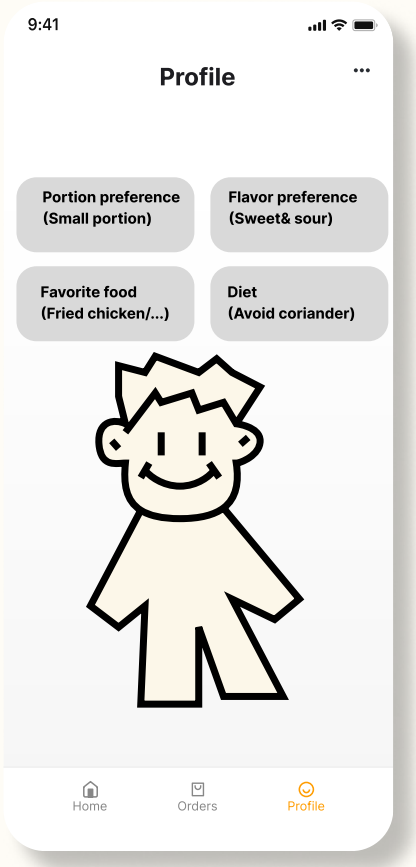
Home & AI search



AI search



Recommendations



Profile

5.4 Low- fidelity prototype test

5.4.1 Low-fidelity prototype test setup

- **Purpose:**

Through low-fidelity prototypes, test whether the design can achieve the design goals - by ordering meals that suit users portion size and taste, thereby reducing the generation of FDW; discover design points that can be optimized. And compare two different design concept directions, and summarize the advantages and disadvantages of each direction to achieve the selection or combination of the final concept.

- **Participants:**

There were five people in this test, mainly composed of the target user group. It also ensures that the participants cover different personas as much as possible. Two of them were also designers. This ensures more room for discussion of design ideas.

- **Process:**

Two prototypes of different concept directions were first prepared. Based on the background of four different personas in two different scenarios, stories and character settings (see appendix 7.3) are used to help participants imagine and lead into specific ordering scenes . Then show the main design points in the low-fidelity prototype. Some design points may show different versions to compare which version can achieve the goal better and provide participants with more ideas.

During the test process, think-out-loud is used to allow participants to express their opinions on the design in a timely manner. After each concept direction test, fill in a short questionnaire (see appendix 7.3) consisting of testable criteria to understand the direction to understand the degree of completion of the design goals in this direction. Finally, by analyzing the feedback provided by participants during the test process, specific optimization suggestions can be obtained, and the criterion scores of the two concepts can be compared, and iterative suggestions on how to finally select or combine the two concepts can be obtained.

5.4.2 Analysis of iteration recommendations

According to the feedback from a short questionnaire about the criteria, it can be seen that both design directions have essentially achieved the design goals. Concept 1 - Intuitive lacks encouragement, while Concept 2 - Conscious provides users with more confidence. In figure 43, the most effective design points and improvement points in achieving design goals in these two concept directions are listed.

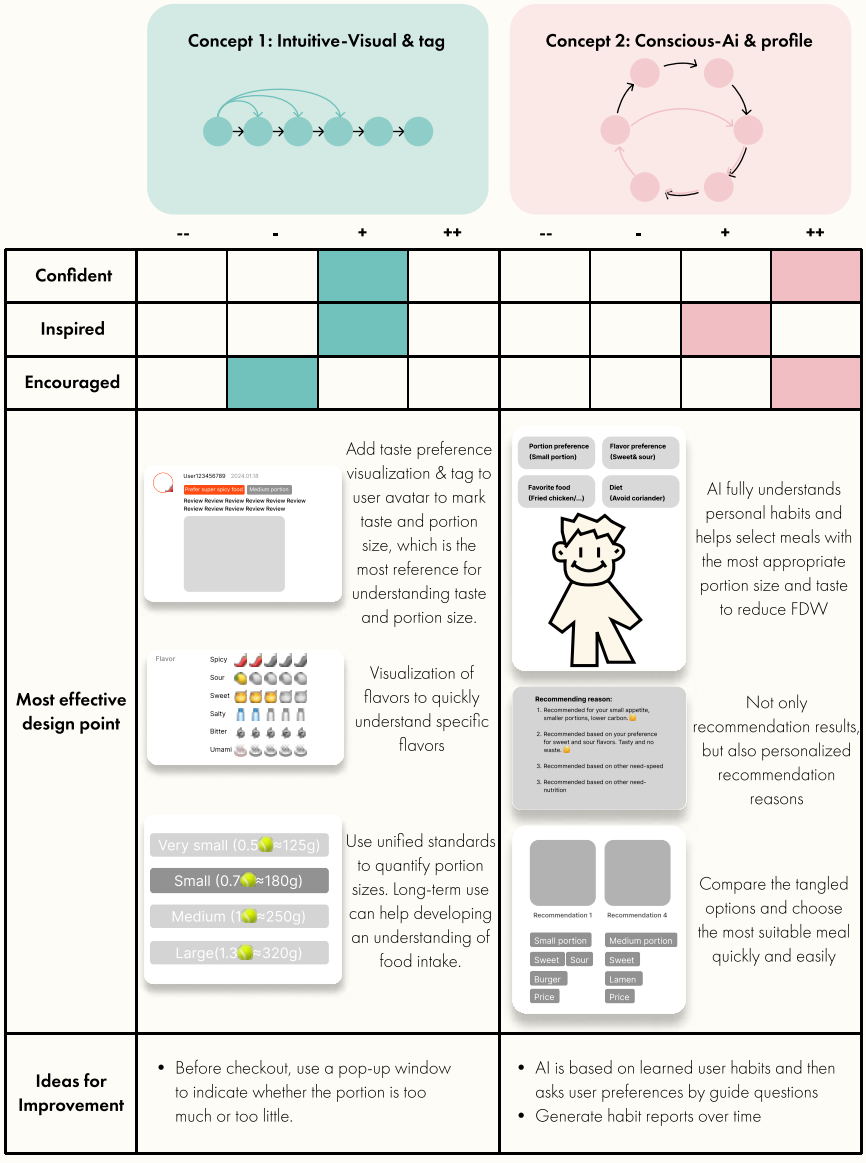


Figure43: Analysis of comparing 2 concept directions

Key insights:

Interestingly, even though the name of Concept 2 is "Conscious," originally designed to raise awareness of reducing food waste through conveying information via an AI assistant, **testing revealed that the AI assistant actually helps users skip the process of understanding their relationship with food waste. Instead, it directly achieves the design goal of ordering suitable meals to reduce waste.** The reason behind this is that users trust the AI's learning ability and recommendations, and they prefer not to invest significant effort in understanding and learning when ordering takeout. Thus, they believe AI is a convenient and reliable choice.

On the other hand, **Concept 1 - Intuitive can indeed help users quickly understand flavors intuitively.** However, there is a learning curve to understand the measurement standards for portion sizes. Nonetheless, it gradually raises users' awareness of reducing food waste in the long term.

Concept 1-Intuitive

Pros:

- Visual taste charts can quickly help consumers understand flavors, providing more specific and accurate information.
- Adding user avatar frames and labels helps users more accurately comprehend the portion sizes and flavors through user reviews.

Cons:

- There is a somewhat high learning curve for portion size prompts, which may be challenging for some users to understand.
- There is not enough direct encouragement for users to choose appropriate portion sizes to reduce waste.

- Concept 2-Conscious

Pros:

- Consumers currently have a high acceptance of AI, and curiosity drives them to try it out.
- The AI assistant can quickly and simply help consumers select suitable meals, achieving the goal of waste reduction.
- Through learning users' ordering habits from historical orders and feedback, AI builds profiles to help users better understand their dietary habits and contributions to waste reduction. This encourages users to make more informed choices in their next consumption.
- Providing specific reasons for recommendations alongside the results gives users a personalized experience and increases their trust in the recommendations.

Cons:

- The AI assistant helps consumers skip the understanding of their relationship with reducing food waste, leaving room for improvement in awareness.

Finally, Concept 2 was chosen as the prototype of the final design. According to the suggestions, the effective design points in the first concept will also integrated into the final design if needed.

Conclusion:

This chapter, after several rounds of brainstorming, has generated two concepts: Intuitive and Conscious. Through prototype testing and analysis, it was found that Concept 1 provides more accurate details in displaying portion sizes and flavors. On the other hand, Concept 2, leveraging an AI assistant, helps consumers quickly select meals with suitable portion sizes and flavors, thereby achieving the design goal of reducing food waste. **Consequently, the final design will primarily iterate on the Concept 2 framework, incorporating effective design elements from Concept 1 as supplementary information.**

Final design

Based on the combined and iterated design points of the two conceptual directions from the previous prototype testing, This chapter presents the final design. The evaluation testing has been analyzed to identify the limitations and provide design recommendations.

06

Final design

6.1 Final Design

6.1.1 Final Design

The final design is a new takeout ordering app that primarily integrates an AI assistant - Order Pal, and visual information prompts to help consumers of different personas order takeout with appropriate portion sizes and flavors in various scenarios. Through Order Pal learning users' ordering preferences, recommending suitable portion sizes and flavors, the app assists consumers in quickly and conveniently placing takeout orders while feeling guided and inspired. Additional details in visual information continually prompt and reinforce consumers' understanding of portion sizes and flavors. With long-term reminders and encouragement from Order Pal, consumers gain a better understanding of their food preferences and intake, enabling them to find meals that suit them, reduce food waste, and cultivate a more mindful food consumption.

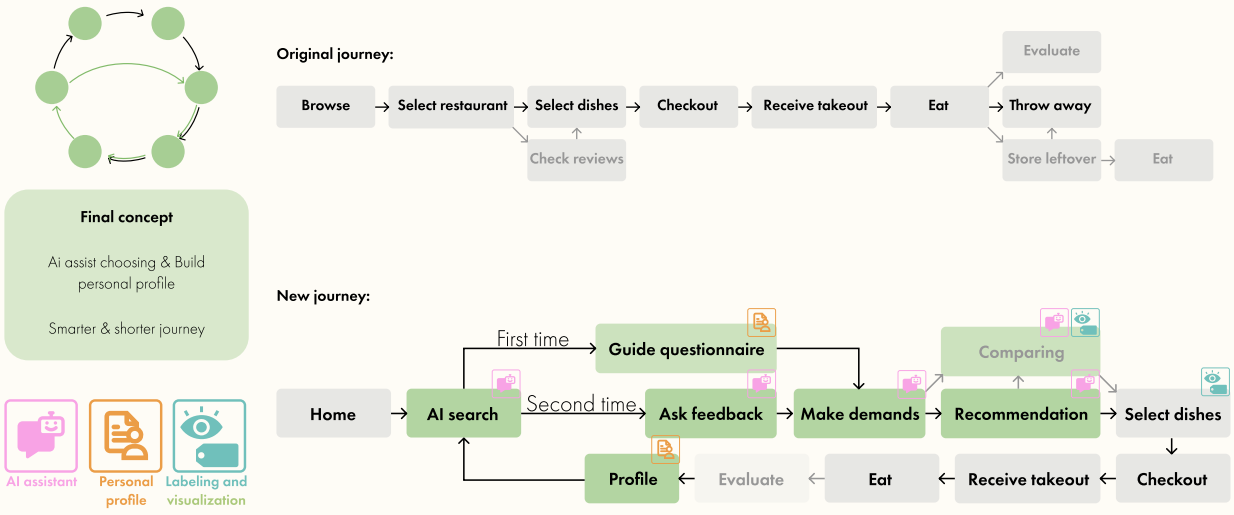


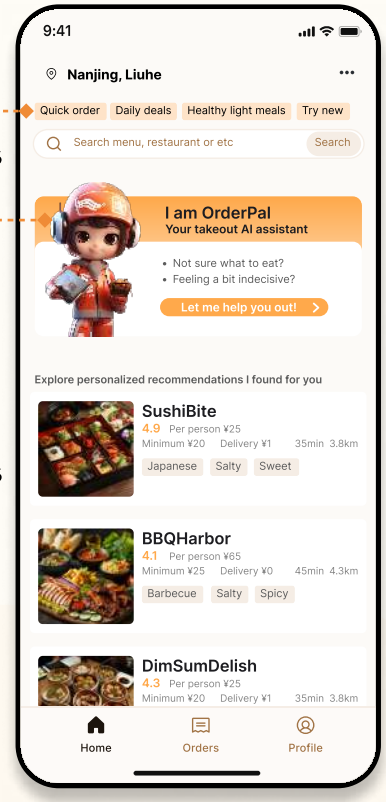
Figure44: Final design user journey map

Quick entry to 4 types of personas

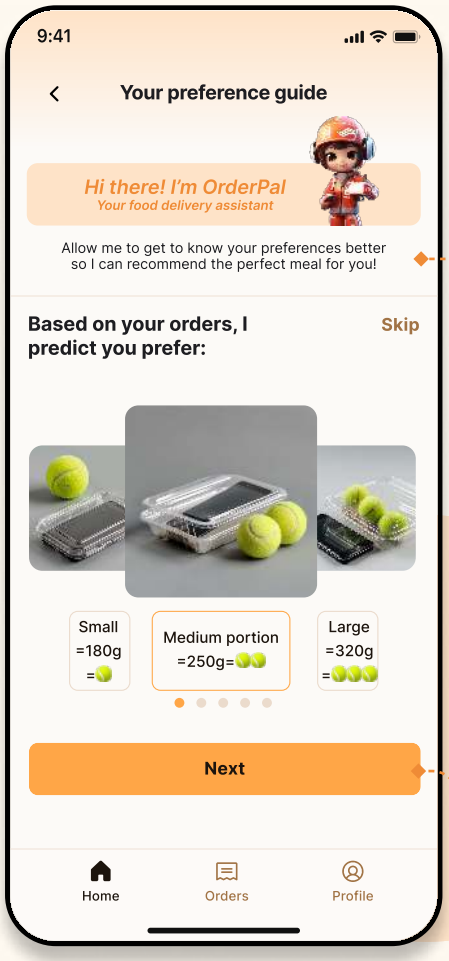
Quickly recommend meals that meet users' needs

Introducing OrderPal

Eye-catching entrance attracts users

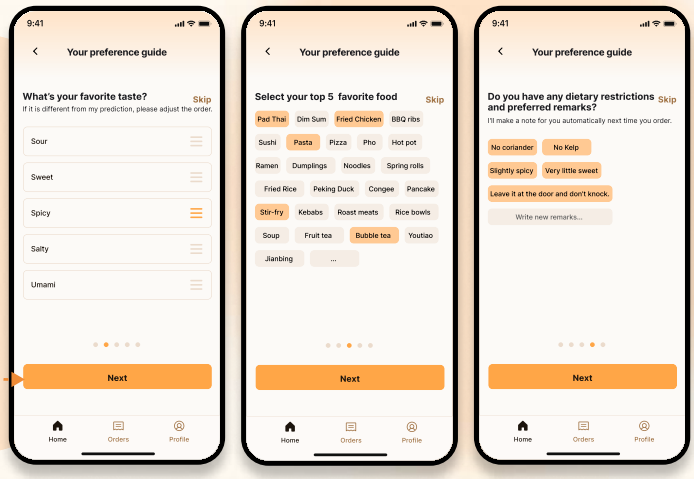


Home



Preference guide

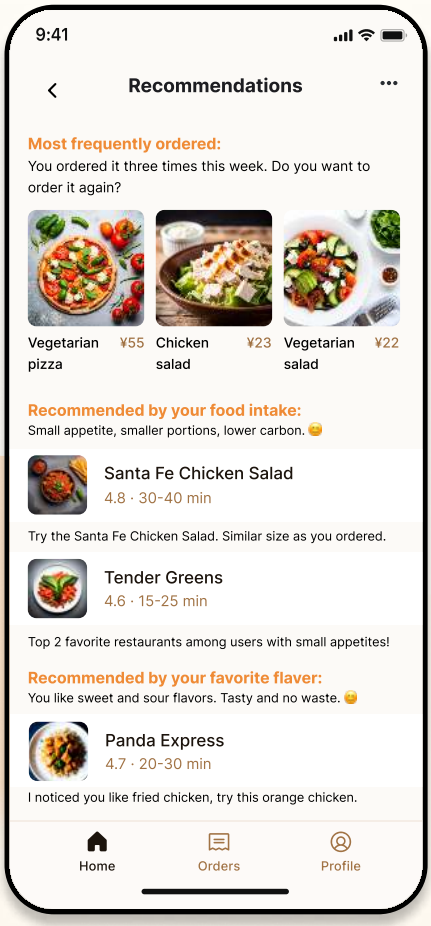
Ask users if the predicted portion size, flavor preferences, favorite types of food, dietary restrictions, and ordering needs are accurate.



AI prediction

AI customized recommendation

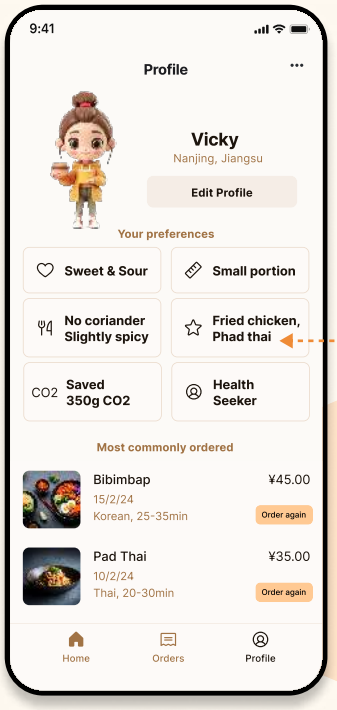
Recommend dishes or restaurants based on user needs and attach reasons



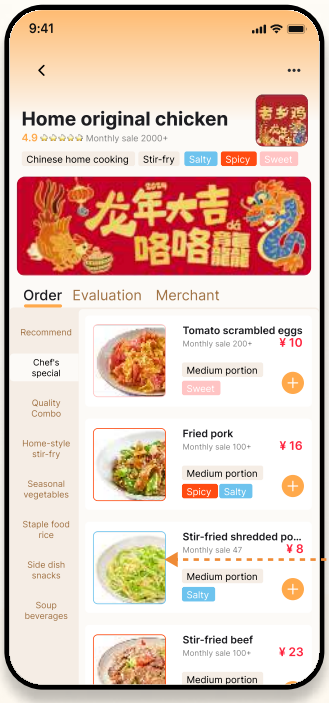
Recommendation

Personal profile & Report

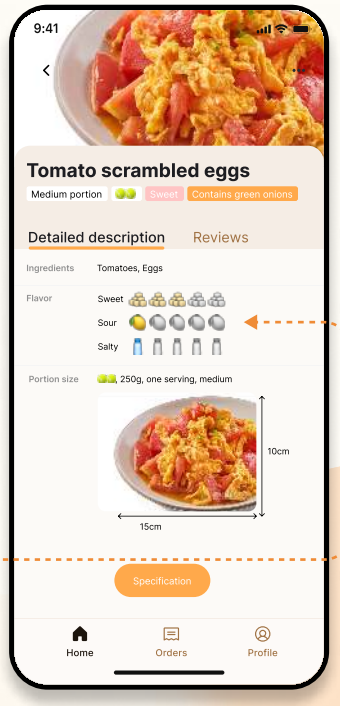
Help users understand their consumption habits- favorite taste, food type, portion size, dietary restrictions, saved co2 and demand, as well as frequently ordered dishes and restaurants



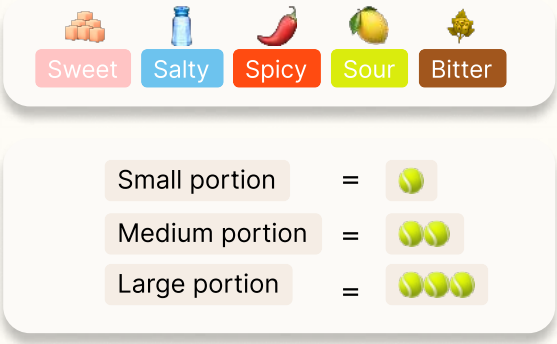
Profile



Restaurant menu

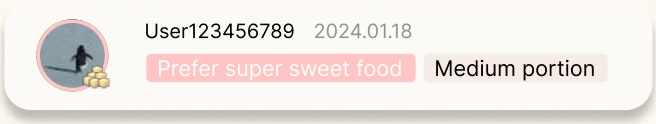


Dish details



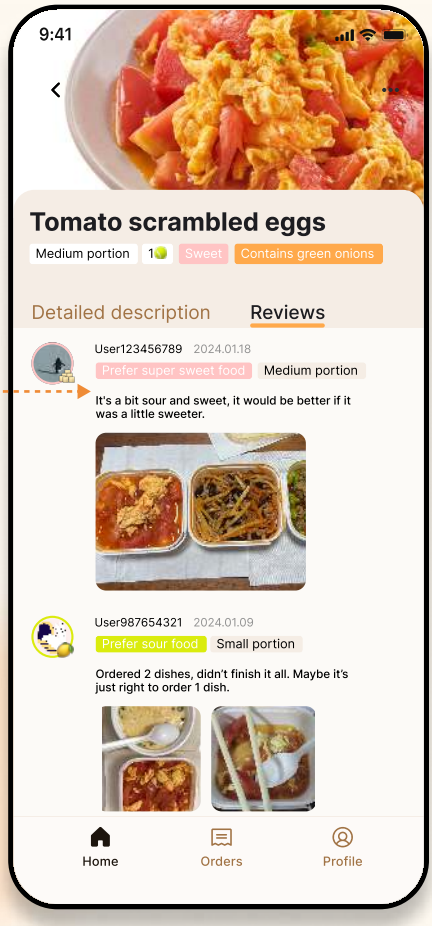
Visualized and labeled information (portion & taste)

Indicate flavors through colored boxes, labels and charts, and portion sizes through serving sizes and uniform standards.



User avatars & feedback label

User avatars and labels display the user's preferred flavors and portions, and supporting images help other users understand their accuracy.



Dish reviews

6.1.2 Technology

The foundation of the final design relies on dependable AI algorithms, particularly leveraging advanced AI technologies such as OpenAI's ChatGPT and Alibaba Cloud's Tongyi Qianwen. These representative large-scale AI models excel in information filtering and conversational capabilities.

In September 2023, one of China's largest online shopping platforms, Taobao, launched a beta version of an AI assistant called 'Wenwen' (means ask ask). It marked the first generative AI application targeting consumers in the e-commerce sector. Wenwen's function revolves around providing better recommendations through user queries, gradually replacing traditional search functionalities. **This demonstrates the gradual maturity of large-scale AI models, indicating a future trend that will see wider applications in various consumer-facing apps, including food delivery platforms.** The maturity of such technology also signifies support for functionalities in the final design, such as food recommendations, predicting user ordering habits, and generating user profiles and reports.

Figure45: Taobao Wenwen

6.1.3 Storyboard

With the assistance of OrderPal, the final design can be more targeted in helping different scenarios and personas. Right from the beginning of using OrderPal, consumers can explicitly state their most important needs, **allowing OrderPal to more effectively assist hungry eaters, everyday dinners, taste seekers, and health seekers, catering to their specific requirements.**

During busy weekdays, OrderPal can provide short and quick recommendations, suggesting the most frequently ordered dishes and restaurant options. This helps consumers make swift and error-free selections of meals with suitable portion sizes and flavors. **On the leisurely weekends** when consumers have more time, OrderPal's detailed recommendation reasons and personal profiles can assist users in understanding their food intake and taste preferences better.

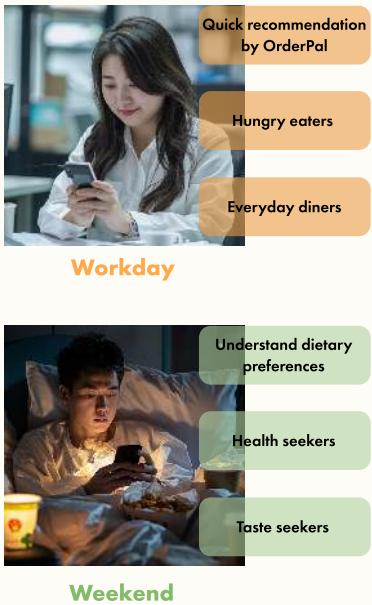


Figure46: Storyboard of workdays and weekend

6.1.4 Information architecture

In order to make the entire information architecture more complete, figure 47 shows the logic and important design points of the entire platform system.

During the initial use, OrderPal learns and predicts consumers' past ordering habits based on historical records. It then refines these predictions through guidance, recommending and assisting users in comparing options to ultimately select meals with portion sizes and flavors most suitable for the user. Users who prefer not to rely on AI recommendations or those wanting to understand meals more independently can utilize visual charts and labels to comprehend portion sizes and flavors.

User feedback after meals will further aid OrderPal in continuously learning consumers' habits, generating individual user profiles. This helps in understanding users' dietary habits, fostering sustainable consumption practices to reduce food delivery waste. After the second use, consumers no longer need to fill out guides. OrderPal autonomously learns and updates consumer profiles through self-learning or by asking questions.

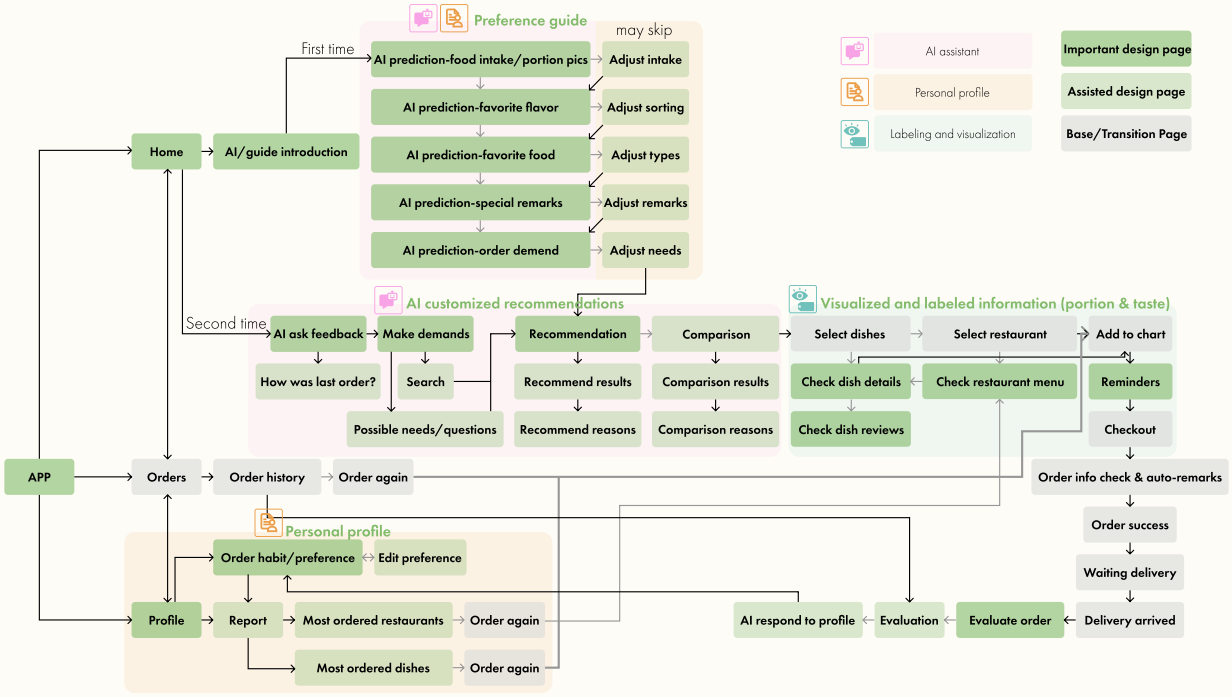


Figure47: Final design flowchart

6.2 Evaluation

6.2.1 Evaluation test setup

- **Purpose:**

Using the high-fidelity model, the evaluation aimed to validate whether the final design achieved its objectives: ensuring that China's urban white-collar consumers can feel confident, inspired, and encouraged about how to order takeout that suits their food intake and tastes. Additionally, the evaluation sought to identify limitations in the final design and provide recommendations for future improvements.

- **Participants:**

The evaluation testing involved four individuals, all belonging to the target user group—urban white-collar consumers. Efforts were made to ensure that the participants represented diverse personas, including health seekers, taste seekers, everyday diners, and hungry eaters.

- **Process:**

First, a high-fidelity model of the final concept was prepared. Through task-driven testing, before commencing the tests, participants were provided with personas and specific scenarios tailored to their roles as story backgrounds to immerse them in the context. Subsequently, consumers were encouraged to express their thoughts out loud while using the model, and their feedback was gathered through questioning to assess the completeness of design points and overall user experience.

Finally, participants filled out a questionnaire consisting of design criteria to understand the completeness of the final design across various aspects. The feedback provided by participants during the testing process, including points of curiosity, strengths, confusion, drawbacks, and improvement suggestions, was then analyzed using Insight-Driven Analysis (IDA) to derive the ultimate design recommendations.

6.2.2 Key insights

Design goal , criteria, vision

By analyzing the completeness of the final design against the design criteria, it is observed that, **overall, the final design performs well in the aspects of confidence and encouragement.**

This is primarily manifested in providing consumers with ample recommended options, guiding them, and encouraging the selection of suitable meals. **The only drawback lies in the somewhat ambiguous understanding of portion sizes**. While there is a lack of inspiration, particularly in the limited connection and enhancement of consumer awareness regarding food waste, **the design goal (to help consumers choose more suitable meals and reduce food waste) has been well achieved. The user experience has also largely fulfilled the interaction vision**, participating in a potting workshop with clear instructions.

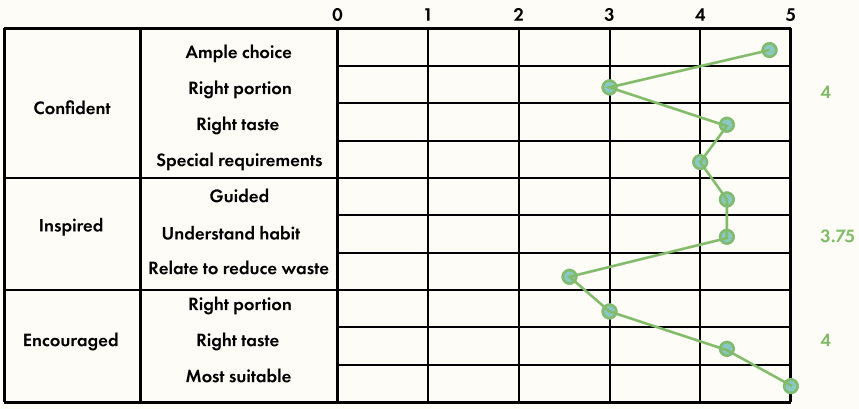


Figure48: Final design criteria scores

Effective design points - quotes

- "The **novel AI image** is very eye-catching and attracted me to click and explore."
- "The **AI predicts** my preferences well, saving me time from filling out guides, and also makes me trust it's smart ."

- "The **recommendation page** left a strong impression on me because it recommended several sections, such as dishes I frequently order, dishes recommended based on different needs, and personalized recommendations with reasons. It makes me feel confident that the suggested dishes suit me."
- "I like that it **directly recommends dishes** to me instead of restaurants because I prefer a straightforward approach when ordering, and it makes me feel simplicity in the process."
- "I often check the dishes I've ordered before, so having the **most frequently ordered dishes** directly accessible in my profile is very convenient for me."
- "The **user feedback icons** are very useful to me, providing reference value, as I almost always check reviews to assess portion sizes."
- "The **color indicators for taste** are very clear."

Suggested improvements

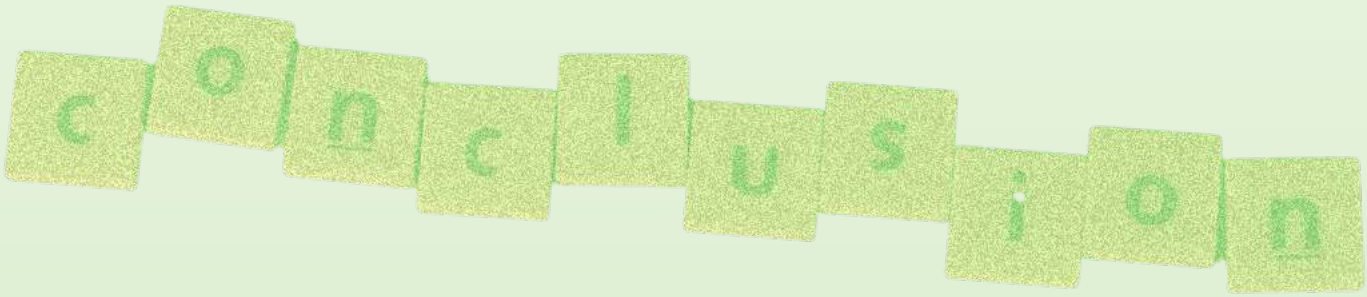
- The entry points for four personas are too small and not prominent enough; could be placed at the beginning when AI asks questions to clearly understand user needs.
- Add more visuals in the preference guide, such as icons and images, to make it more engaging.
- Include more images and references to illustrate food portion sizes, or establish a unified standard to explain the differences between small, medium, and large.
- Reduce text on the recommendation page or present content gradually to enhance readability.
- Provide friendly prompts when users order large portion food and positive feedback when ordering small portion food, helping users understand the correlation with food waste.
- Add more information related to food waste in profiles to enhance consumer awareness.

Conclusion:

Following the suggestions from prototype testing and the combination and iteration of the two design directions, the final app design has been completed. The primary focus of the final design is the **OrderPal AI assistant, providing users with personalized recommendations supplemented by visual information** to help them find meals that best suit their preferences of portion sizes and tastes, ultimately aiming to reduce food waste. **In the final evaluation, the design performed well in achieving the goal of reducing food waste but still has room for improvement in raising consumer awareness.**

Conclusion and recommendation

This chapter summarizes the significant processes and insights of the entire project, along with the current limitations of the project and personal reflections on the project.



07

Conclusion and recommendation

7.1 Conclusion

In the exploration phase, driven by an interest in the field of food design, I identified the topic of reducing food waste in Chinese white-collar takeaways as the project background. Through a literature review, I explored the current measures taken by stakeholders in China, potential reasons leading to waste, trends in food delivery services, methods of handling food delivery waste, and assumptions about the reasons behind consumer attitudes.

In the research phase, the primary goal was to address three research questions: the main obstacles and opportunities, knowledge of stakeholders, and methods to change consumer behavior. Through two rounds of qualitative interviews, I identified the primary objective and subjective obstacles, 2 types of consumers' attitudes toward and behaviors in food delivery waste corresponding to stages in the SICAS consumer behavior change model. Additionally, I analyzed four crucial stages of the user journey, four personas, and two scenarios. Based on these insights, potential opportunity strategies were formulated.

Before the design phase, I reframed the design goals to be more specific: "I would like China's urban white-collar consumers to feel confident, inspired, and encouraged about how to order takeout that suits their food intake and tastes, so that they can reduce food waste." Additionally, design criteria and an interaction vision were established for evaluating and validating the final design.

In the design phase, multiple rounds of brainstorming and co-creation sessions were conducted, leading to two concept directions: intuitive and conscious. After testing with low-fidelity prototypes, feedback and directions for iteration were obtained. The final app design, centered around an AI assistant with visual information as a supplement, emerged through these iterations. The evaluation testing with a high-fidelity prototype revealed that the final design performed well in helping consumers feel confident and encouraged to choose suitable meals. However, there was a lack of elements to make users feel inspired, especially regarding portion descriptions and connecting consumer behaviors to reducing food waste.

7.2 Limitations

In both the research and evaluation testing stages, the participants were primarily young individuals due to the project being undertaken by a student. This age concentration may limit the generalizability of the findings to a broader demographic of urban white-collar workers. Additionally, the number of participants was relatively small, and while their insights were directional, they may not fully represent the entire user population. Furthermore, despite acknowledging the importance of government and platform stakeholders, limited opportunities for engagement with them resulted in their exclusion from the design process. Given the project's context in China, the final design is tailored to the cultural and usage habits of Chinese consumers. Consequently, in different cultural contexts, consumers may react differently, and the effectiveness of the final design may vary.

7.3 Reflection

In this project, I attempted for the first time to organize interviews and testing sessions with multiple participants on my own. Finding and reaching out to suitable interviewees was a significant challenge for me, as social skills have never been my forte. This difficulty contributed to some delays in the project, but I'm glad to say that I eventually overcame this challenge and successfully completed the project. The final design in this project involved both app design and the application of AI, allowing me to explore and experiment with emerging interaction prototyping tools and AI tools such as ProtoPie and Midjourney.

I believe that time management and mindset adjustment were the most important lessons I learned in this project. Experiencing an entire project on my own for the first time, I realized the importance of seeking help when facing obstacles and confusion. Whether it was my supervisor, Rick, or mentor, Xueqing, both provided me with patient academic and emotional support. I would like to express my gratitude to them once again. When dealing with procrastination, it's crucial not to let the negative emotions of stress overwhelm you. By breaking down significant goals into countless smaller tasks, one can progress step by step towards completion.

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