Design of an Intelligent Cooking App for Young Office Workers Living Alone Based on Embodied Cognition Theory

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Abstract. Young office workers living alone often face the dilemma of “wanting to cook but dreading the hassle.” Existing cooking apps, however, remain at the level of recipe display and fail to address users’ embodied needs. Guided by embodied cognition theory, this study proposes a design concept for an intelligent cooking app based on three dimensions—bodily perception, action-based interaction, and contextual embedding—and develops the “Zhichu” app. The app offloads daily decision-making, converts abstract cooking information into perceptible signals, and integrates guidance into kitchen operations via sound and vibration. Usability and functional tests show positive outcomes in operational efficiency, satisfaction, and continued use intention, offering a reference for embodied design of intelligent cooking products.

Keywords: Embodied cognition; Intelligent cooking app; Young office workers living alone; Interaction design; User retention.

1. Introduction

With the continuous development of China's economy and society, urbanisation is accelerating, and thus the number of people living alone has been rising rapidly. According to the latest statistics in 2025, the number of single people in China has reached 297 million, making up 20.7% of the total population. The first problem for this group in terms of their daily diet is that they desire healthy and nutritious food but lack the time and energy for cooking after a long day of work. The two are in conflict, and thus this study was conducted. A typical dietary problem for young, single office workers living alone is their frequent use of takeout food. Among young consumers who order takeout often, more than half lack nutritional knowledge and are therefore unaware of how to eat healthily. Takeout is no longer just a way of eating for young people; it has become a serious problem of public health. Young people living alone also find that, although they wish to cook for themselves, they are unable to do so. On the one hand, the popular "one-person meal" economy shows that this group is willing to live well alone and seeks a high quality of life.

However, a survey of the current cooking apps shows some problems. The content mainly consists of static text and images of recipes, and no interactive guidance or assistance for cooking is provided. The modes of operation are monotonous and do not engage multiple senses of the user during cooking. Furthermore, the instructional function is not well integrated with the user experience; when following a recipe, users need to constantly look at their phones and the stove, making cooking inefficient and reducing the immersion and sense of achievement that cooking is supposed to provide.

Embodied cognition theory provides a motivating theoretical basis for rethinking the Design of intelligent cooking appliances. As a major change in cognitive science after behaviourism and information-processing theory, embodied cognition holds that cognition is not an abstract operation of processing information but is also grounded in sensorimotor experiences of the body. Cooking is an inherently embodied activity, and precise control of heat, accurate measurement of seasonings, and judgment of cooking time are all the result of prolonged coordination between bodily perception and motor experience.

Building on this analysis, the present study targets young office workers living alone and adopt embodied cognition theory as its design framework. It proposes a design concept for an intelligent cooking app aimed at this group and validates the concept through concrete design practice. The study

seeks to address the problems of existing cooking apps in content presentation, interaction patterns, and user experience, and to explore effective ways of lowering the barrier to cooking, making cooking more enjoyable, and forging a deep emotional bond between users and the act of cooking through embodied interaction design [1]. In doing so, it aims to provide theoretical reference and practical experience for the design innovation of intelligent cooking products, and to contribute design insight to improving the quality of the “one-person meal” lifestyle.

2. Analysis of Smart Home Products Themed on Cooking

Although smart home products themed on cooking enjoy broad market prospects, a systematic review and analysis of existing products reveals the following common problems

2.1. Young office workers are the core user group, yet product design has failed to adequately respond to their specific needs

Young office workers living alone commonly have the problems of "not knowing how to cook", "not knowing what to eat", and "frequent cooking failures". However, the functions of products have not been designed according to the specific circumstances of this group. Most cooking apps are still based on the logic of "provide as many recipes as possible"; instead of lowering the cognitive threshold for cooking, they exhaust users at the very first stage of "deciding what to eat". As a result, the group most in need of improved cooking abilities is precisely the group that existing products serve least effectively.

2.2. Cooking App Design Is Heavily Generalized, and Customized Products for Young Office Workers Living Alone Are Lacking

Most of the well-known cooking applications in China today have adopted a single Design pattern: they are presented as "digital recipe libraries", provide a large amount of recipe content in text-image or short-video form, and allow users to obtain this information by keyword search or category filtering. Although this model is convenient for data collection, it is fundamentally lacking; the product will still be an "information intermediary" and fail to truly help people cook.

2.3. User Retention Is Low and Personalization Is Insufficient

With the rapid development of artificial intelligence, many functions of digital products, such as personalized recommendation algorithms, user profiling and behaviour prediction, have been widely applied to provide a strong technical foundation for tailored feature adaptation. However, most existing smart home products are unable to collect cooking-related data and thus cannot be customized according to users' needs. Most of the products are still not very personalized; either only coarse-grained content filtering according to the tags selected by users is carried out, or no customization is provided and uniform content distribution is used instead. Therefore, "personalization" is often just a word without real substance and fails to realize the potential of AI technology.

3. Overview of Embodied Cognition Theory

Embodied cognition is one of the most influential theoretical turns in cognitive science since the 1980s. It thoroughly broke the shackles of the “mind-body dualism” of traditional cognitive science and established the core paradigm that cognitive processes are inseparable from bodily experience and environmental interaction. As a major theoretical breakthrough following behaviorist learning theory and information-processing learning theory, embodied cognition has become a research focus in cognitive science, psychology, education, human-computer interaction, and many other fields.

3.1. Core Tenets of Embodied Cognition Theory

Within the theoretical framework of embodied cognition, cognitive activity is understood as a dynamic system in which the body, action, and context are coupled together. To meet the needs of design practice, this study operationalizes the core tenets of embodied cognition into three interrelated dimensions—bodily perception, action-based interaction, and contextual embedding—each of which offers specific methodological guidance for interaction design.

3.1.1. Layer 1: Bodily Perception — The Starting Point and Foundation of Cognition

According to embodied cognition theory, the foundation of cognition is not abstract conceptual operations but rather the body's direct experience of the world. Our perception of the external world is formed by the activity of bodies acting on the world, and these activities shape the structure of our representations of it [2]. The first objective of this dimension is to offer a starting point for product design; based on the sense of perception of the user, convert abstract information into signals that can be felt by the body. The first problem that needs to be addressed in interaction design according to embodied cognition is how to make the information conveyed by a product "feelable" for the body rather than merely "comprehensible" by the mind.

3.1.2. Layer 2: Action-Based Interaction — The Behavior Corresponding to Cognition

Embodied cognition theory also holds that cognition is not only about passive reception but, significantly, involves active behaviour of the body. Cognition is linked to the body and the environment; therefore, cognition is both embodied and embedded [3]. Action is not only the result of cognition but also an essential part of the cognitive process. The first type of interaction design is that users are actively operating a device; therefore, the way to understand it is not by reading a manual, but by doing and experiencing it in practice. Thus, the Design should decompose the user's task goals into a series of embodied operation steps and facilitate learning and understanding by doing.

3.1.3. Layer 3: Contextual Embedding — The Environment in Which Cognition Occurs

According to embodied cognition theory, cognition is not independent of the body and is also closely linked to the environment and society [4]. Furthermore, it can be seen that context provides the space for cognition and is also a necessary condition for and an integral component of cognitive processes [5]. Expand the concept of Design Thinking beyond the "screen" to include "real-life scenarios"; that is, a product should improve the efficiency of interaction with the user interface and create a pleasant experience in a specific situation that aligns closely with the user's life.

In short, the three dimensions of bodily perception, action-based interaction and contextual embedding are progressively connected from "body" to "action" to "environment" to present a whole-picture model of interaction design based on embodied cognition. Bodily perception addresses the problem of "what can be felt by the user?"; Action-based interaction answers "what can the user do with their hands?"; and Contextual embedding addresses "how can the product be applied in the user's life situation?". All three are necessary and work together to form the methodological system of embodied Design. (Fig 1)

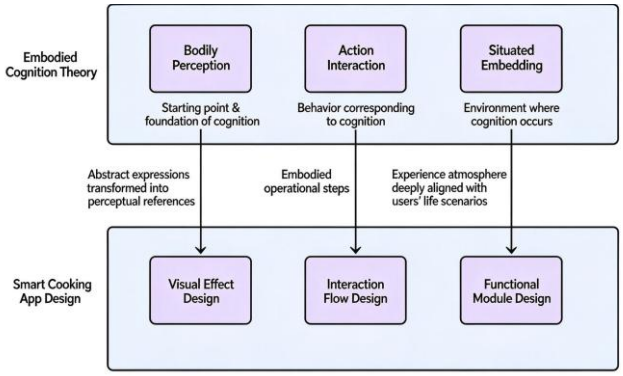


Fig 1. Embodied Cognition Theory.

3.2. Influence and Applications of Embodied Cognition Theory

TEmbodied cognition theory has long gone beyond the scope of cognitive science and spread to many places, such as human-computer interaction, product design, and artificial intelligence.

Embodied cognition theory provides an analysis system of "bodily perception-action-based interaction-contextual embedding" for the fields of human-computer interaction and product design [6]. Xu Jia and others have developed a model of the embodied interaction design process for concrete design research at the level of concrete design research methodology [7], translated embodied cognition theory into feasible design steps, and provided an explicit methodological path for design practice. The above studies have shown that building products in line with the principles of embodied cognition can result in more human-centred and user-friendly intelligent products.

4. Design Concept of an Intelligent Cooking App for Young Office Workers Living Alone Based on Embodied Cognition Theory

After in-depth analysis of the cooking problems faced by young office workers living alone and the functional deficiencies of existing products, this chapter proposes the design concept for "Zhichu", an intelligent cooking application based on the three-dimensional framework of "bodily perception-action-based interaction-contextual embedding" presented in embodied cognition theory.

4.1. Design Concept at the Bodily Perception Level: From Abstract Information to Perceptible Experience

The first layer of embodied cognition theory indicates that cognition begins with the body's direct perception of the world and that meaning derives from the body's sensorimotor experience. Traditional recipes abstract cooking knowledge into a system of symbols mediated by text and images. Building on this, the first design concept adopted in this study is to transform abstract cooking information into signals that the body can directly perceive, allowing users to “feel” rather than “decode” the cooking state through interface interaction.

4.2. Design Concept at the Action-Based Interaction Level: From Reading Recipes to Performing Operations

The second layer of embodied cognition theory reveals a key proposition: cognition arises not only from passive perception but, more importantly, from active bodily action. Users do not merely “watch” a product—they “use” it; cognition happens in the process of operating, not in the moment of reading. Building on this, the second design concept adopted in this study is to decompose the cooking process into a sequence of actionable tasks, allowing users to naturally achieve cognition and learning through hands-on execution. The core interaction of a product should be centered on “action” rather than “information” [9].

4.3. Design Concept at the Contextual Embedding Level: From Digital Tool to Situational Companionship

The third layer of embodied cognition theory understands cognition as a dynamic system in which the brain, body, and environment are coupled: context is not only the setting where cognition occurs but also an integral part of cognitive activity. For young office workers living alone, the cooking scenario is distinctive in three respects: physically, it is an enclosed kitchen; socially, it is a state of solitude; psychologically, it is a tension between post-work fatigue and the need for self-care. Building on this, the third design concept adopted in this study is to make the product an organic component of the cooking context rather than a digital tool detached from physical space.

5. Design Practice of an Intelligent Cooking App for Young Office Workers Living Alone Based on Embodied Cognition Theory

Building on the design concept above, this study developed an intelligent cooking app for young office workers living alone — “Zhichu” (Intelligence Kitchen).

5.1. Product Information Architecture and Functional Module Design

The information architecture of the "Zhichu" app is based on the user's operating path, and it aims to complete the entire process from "opening the app" to "started cooking" in a small number of steps with simple navigation. The four functional modules of the product are displayed in a bottom navigation bar. (Fig 2)

The Home Module is called "Your Kitchen Plan" and is the starting point of the application. At the top of the home page is a personalised greeting and a short list of recommended items for the day to make users feel special and cared for. The absolute visual centre of the page is the "Today's Effort-Saving Set"; based on the user's set taste preferences, the real-time inventory of ingredients in the refrigerator and the user's health goals, the system will intelligently generate a suitable cooking plan for that day, which is displayed prominently as a card showing the recipe name, estimated cooking time, calorie information, and main ingredients. Below the card are the two main action buttons: "Swap" and "Start Cooking", for plan replacement and process start, respectively. At the bottom of the home page are thumbnail lists of popular recipes for users to browse independently when they are interested in learning how to cook. The aim of the design for the entire home page is to eliminate the daily choice problem of "what to eat today", which bothers users and increases their cognitive load; thus, it hopes to transform the starting point of cooking from "hesitation" into "confirmation".

The AI Matching Module is for recipe browsing and exploration. Instead of building a large database of data like traditional apps, this module uses "lightweight exploration" based on a user's past cooking records and taste tags to recommend a small number of highly relevant recipes and thus avoid the problem of information overload. Recipes are displayed in a waterfall chart, and for each recipe card, information about the level of difficulty and necessary ingredients is provided to help users decide whether to use it now.

The Cooking Module is used to drive the embodied design of the app. After the user selects a recipe and starts cooking, the window will switch to full-screen "cooking guidance mode", display steps one by one as cards, show operation instructions, a timer and progress information in each card. A circular progress ring is added at the top of the display to show the cooking progress of food; users can thus intuitively know how much longer the food will take to cook by observing the current position of the ring without having to read text or calculate mentally. After finishing a step, the user taps the "Done" button, and then the system will automatically switch to the next step along with a sound and vibration. The Design Goal of this module is to enable users to "focus on the stove rather than the phone" and provide full-featured cooking guidance with minimal screen operation; the user's hands should be occupied holding the spatula, adding seasonings, and stirring food, not constantly swiping the phone screen.

The Personal Centre module is for managing user information and the achievement system. Users can set their food habits, health goals and ingredient lists in the fridge, and also view cooking statistics such as the number of days they have cooked, achievements earned, skill development curves, etc. Achievement badges are displayed on the wall, and their unlocked/locked status can be shown to help users track their progress and keep the motivation to participate. The design of this module is in line with the idea of "continuous companionship" mentioned in Chapter 4; every time a user cooks, that experience will be recorded and saved to show them their development over time through repeated use.

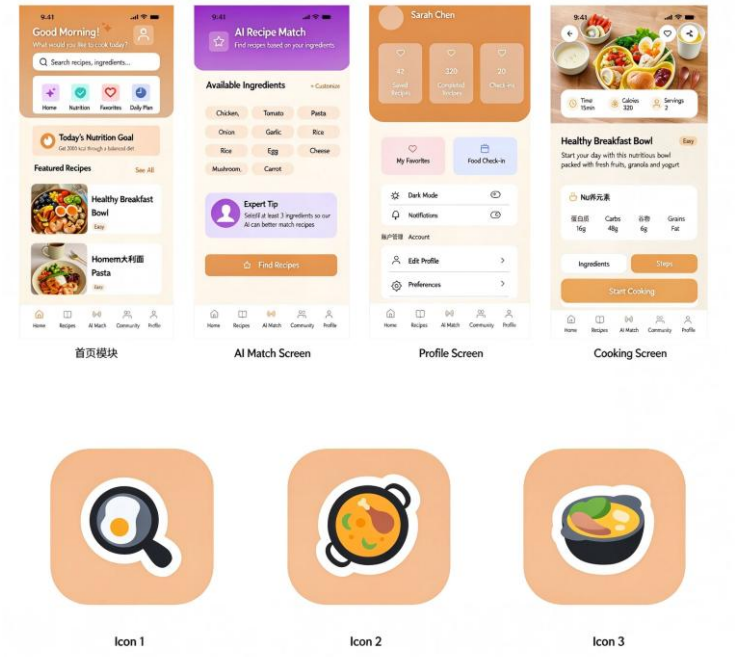


Fig 2. Information Architecture and Functional Module Design

5.2. Core Interaction Flow Design

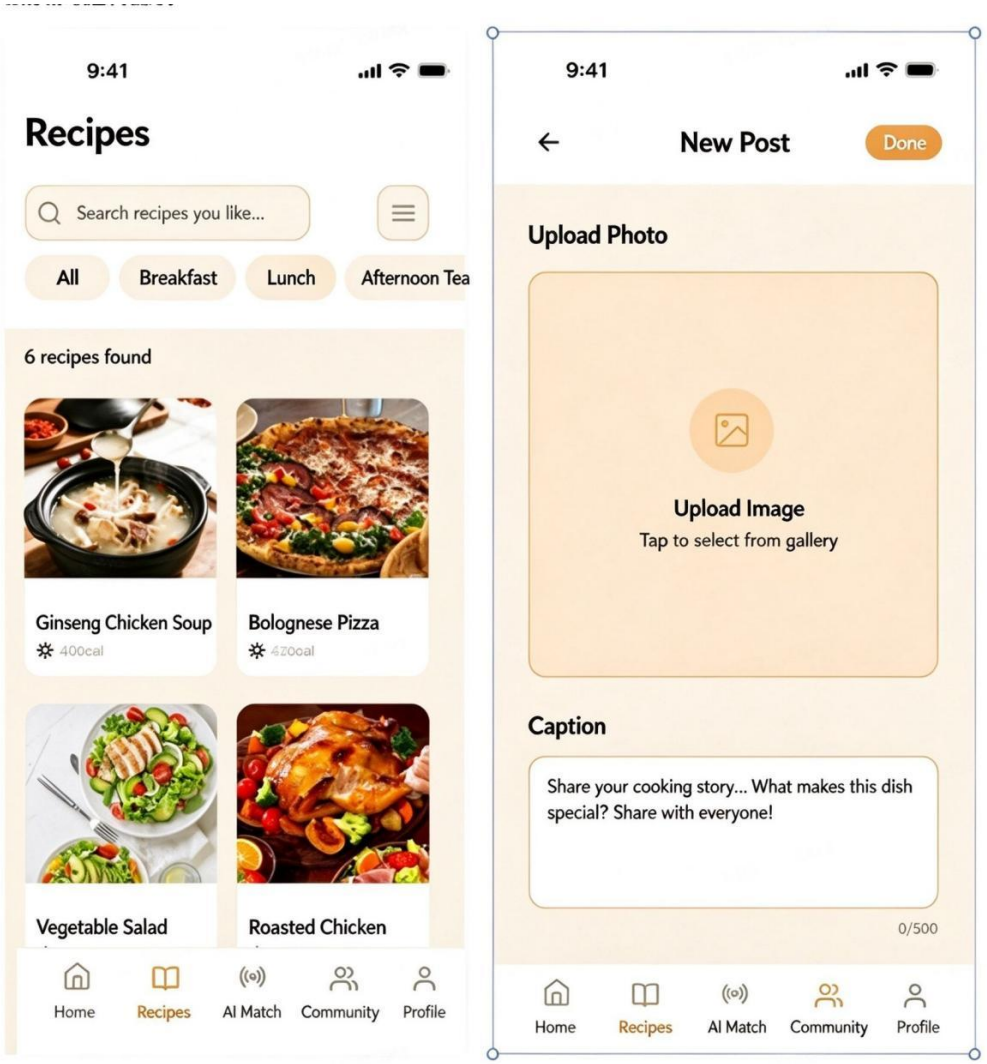
The main interaction flow of the “Zhichu” app is to achieve the design goal of "a seamless experience from selection to completion", and it consists of four stages, each corresponding to the actual implementation of a design concept in Chapter 4: (Fig 3)

Stage 1: Plan Generation - Corresponds to the concept of "decision offloading". After opening the app, the user will be immediately shown the recommended "Today's Effort-Saving Set" on the home page. The system will generate a plan based on data in three dimensions: first, the user's pre-set taste preferences and health goals (e.g., calorie control, muscle gain, light meals); second, the real-time inventory of ingredients in the user's refrigerator (manually entered by the user or synchronized from a smart refrigerator); and third, the available recipes in the recipe database. Under the three conditions above, intelligent matching can be used to recommend a suitable plan for the user and prevent food waste.

Stage 2: Ingredient preparation - in line with the concept of "lowering the threshold for ingredient preparation", the system automatically generates an ingredient list based on the recommended recipe and, according to the refrigerator's inventory status, automatically labels each item as "in stock" or "to buy". After completing the purchase, the user can enter the guided preparation session. The preparation steps for the application are shown in a sequence of visual task cards, and each card shows a particular operation along with detailed instructions and diagrams. The Design turns the traditional way of preparation, which has relied on accumulated experience, into a step-by-step executable sequence of operations under guidance to help users complete their preparation work.

Stage 3: Cooking guidance - corresponding to the concepts of "action-based interaction" and "perceptualized presentation", after tapping "Start Cooking", the user enters the embodied guidance interface. Split the steps in the recipe and set up a separate timer for each in the system. A circular progress ring is shown in the upper part of the interface to indicate the current cooking status, when it will be finished, and how much longer it will take; after completing one step, a tap is needed to confirm, otherwise, the system will automatically proceed to the next stage. At a particular time, the system will sound an alarm and vibrate to inform the user that cooking has begun and will be completed before the timer runs out. After all the above steps are completed, a congratulatory animation and a completion prompt will be displayed in the system for the user.

Stage 4: Outcome recording—corresponding to the concept of “sustained companionship.” Users can photograph and upload their cooking outcomes, and the system automatically records the cooking session and updates the user's cooking data and achievement progress. Users can also post pictures to share with the community, interact with other users, and receive likes and comments from their friends. Every time someone cooks, it's recorded; by repeatedly using this feature, users can feel that they are improving over time and are thus motivated to keep cooking.



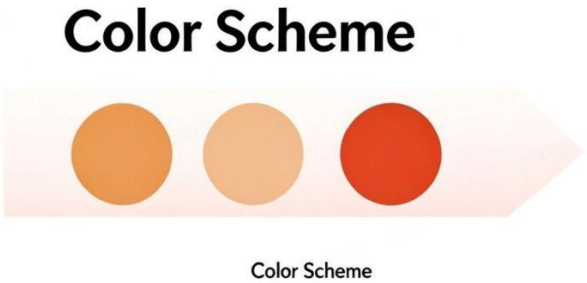


Fig 3. Core Interaction Flow and Color Scheme Design.

5.3. Visual Effect Design

Based on the aesthetic demands and living habits of young, single office workers, the visual Design of the "Zhichu" app is centered on "simplicity, warmth and efficiency"; at the same time, it aims to present the brand idea of "cooking is a small, relaxing pleasure" through visuals.

Warm orange is paired with off-white in the colour system: Warm orange can stimulate appetite, give people a sense of vitality and warmth, and off-white is very clean and comfortable. Together, they form a warm yet modern brand image. Light grey will be used for the main text and icons to increase reading comfort. The entire Colour system is not too bright; thus, it will be less fatiguing for the eyes of users during extended use.

In line with the concept of "minimising information noise", there are no superfluous ornaments or other distracting visual devices in the display area. At the centre of the home page is "Today's Effort-Saving Set", and the recommended plan is displayed in a large card that contains essential information about the recipe, such as its main image, name, time and calories, and has a clear information hierarchy. The bottom navigation bar has four items: "Home", "Discover", "Cook", and "Me", and the icons are in a line and simple, which is suitable for mobile touch operation.

For the launch icon and brand identity, the launch icon of "Zhichu" uses an abstract chef's hat and spatula as graphic elements, has clean and smooth lines, and the combination of warm orange and white is highly recognizable in app stores. Mock-ups of the app running on real mobile phones are provided to show how it works and to enhance users' sense of authenticity.

5.4. Technical Implementation of Embodied Interaction

The technical architecture of the front-end and back-end of the "Zhichu" app are separated. The front-end is built with a cross-platform mobile application development framework, and the back-end service uses a layered structure of business-logic layer and data-access layer to handle basic business functions, such as user login and management, recipe data management, personalized recommendation algorithms, and cooking record saving. Auditory Feedback for each operation by the user in the app will also be provided; for instance, there will be a soft tap sound upon pressing a button, a confirmation tone after completing a step, and a reminder sound when the timer runs out—all managed by the native audio API of the mobile platform and designed to deliver information gently and discreetly. During cooking guidance, the system uses a TTS engine to provide voice announcements at key nodes, and users can obtain the next operation instructions without looking at the screen. Use of the auditory channel frees up visual attention from the screen and directs it towards the stove; thus, users can focus on the condition of the ingredients and cooking activities. For Haptic feedback, the application can utilise the vibration function of the mobile phone and call the native vibration API to produce various vibration patterns with different intensities and rhythms. After a user completes a cooking step, the device will issue a brief vibration to indicate successful operation; as the timer nears its end, both the frequency and strength of the vibration will gradually increase to signal time-out; upon completion of all cooking steps, a sequence of regular vibrations will be emitted to give the user a sense of finishing. [8]

6. Conclusion

Targeting young office workers living alone and guided by embodied cognition theory, this study proposed and developed an intelligent cooking app, “Zhichu.” Starting from the core contradiction of the solo-living group — “wanting to cook but dreading the hassle”—the study systematically reviewed existing cooking apps and revealed their prevalent problems: homogeneous content, heavily generalized design, and low user retention. The findings show that current product design fails to adequately address the specific needs of young office workers living alone in terms of cooking time, energy, skill, and psychological motivation; this gap constitutes the core problem addressed by the present study.

At the theoretical level, this study systematically explained the historical origins and core tenets of embodied cognition theory and introduced the three-layer framework of “bodily perception-action-based interaction-contextual embedding” from cognitive science into the field of interaction design, providing clear methodological guidance for the design of intelligent cooking products. On this basis, the study proposed the three-layer design concept of the “Zhichu” app—transforming abstract

cooking information into signals perceivable by the body, decomposing the cooking process into an operable task sequence, and making the product an organic component of the cooking context—thereby achieving the transformation from theory to concept. In design practice, the three-layer design concept was implemented one by one as concrete design decisions: the “Today's Effort-Saving Set” function offloaded the cognitive burden of “what to eat today” at the decision level; the circular progress ring transformed abstract cooking duration into an intuitive spatial graphic; step cards decomposed the cooking process into a sequentially advancing execution sequence; and sound and vibration feedback integrated guidance information into the physical rhythm of kitchen operations.

The research outcomes of this study provide theoretical reference and practical experience for the design innovation of intelligent cooking products and also contribute design insight to promoting a healthy lifestyle for young people in the era of “solo dining.”

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