

# *Light Alzheimer's Hand Exercise Product Design*

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**Abstract:** Society needs to pay more attention to the MCI group, and theoretical research from product design to production practice is also poor. The difficulty of assistive cognitive impairment products in the market could be better for people with cognitive impairment. There still needs to be a gap in hand movement products for older people. Due to the complexity of cognitive impairment rehabilitation, cognitive impairment has irreversible characteristics in current mental training and treatment processes. Cognitive training in the early morning can slow down the deterioration of the condition and delay phenomena such as memory decline. Therefore, the final product output of this article combines theoretical research on cognitive training needs to investigate existing hand movement products for older adults with mild cognitive impairment; based on the user characteristics of older people, a balanced analysis of the theoretical, market, and user factors conducted to design and study a hand movement product. This product uses pressing to stimulate the relevant acupoints of the hand, combined with repeated voice prompts and other methods, to help older people with MCI prevent and slow down memory decline and, to some extent, to prevent and delay the occurrence and development of mild cognitive impairment.

**Keywords:** MCI, hand exercise product, elderly

## 1. Introduction

### 1.1. Research Background

With the continuous improvement of people's living standards, the aging of the population is an important trend of social development, among which the prevalence of mild cognitive impairment, senile dementia, and other diseases continues to increase [1]. Search on the Internet for "cognitive impairment elderly products," "anti-dementia products," and different keywords; the search results are primarily kong ming lock, a kind of traditional puzzle product; the publicity title is basically to play "a product" can prevent dementia. However, according to all types of papers, Lu Ban lock and other products are too complex for the cognitively impaired elderly [2].

In the CNT, "mild cognitive impairment + product" and "mild cognitive impairment + design" were searched, and the results were the intervention and treatment methods of mild cognitive disorder or the design literature of the elder [3]. In China, the MCI group has not caused widespread social attention. The theoretical research of product design to production practice is abysmal, and the products to prevent and delay cognitive impairment stay in rehabilitation centers and research institutes.

## **1.2. Study Purpose and Significance**

### **1.2.1. Purpose of Research**

At present, for the harm of cognitive impairment and high incidence without a correct understanding, manufacturers and designers lack relevant research through this attempt from the hand exercise of mild cognitive impairment elderly group targeted product design and improve the present situation of mild cognitive impairment of the elderly product design. Design a product design that helps prevent and mitigate memory impairment in older adults with mild cognitive impairment.

### **1.2.2. Research Significance**

Since no specific drug for mild cognitive impairment can slow its development or reverse the disease, most are non-pharmacological interventions. By designing products, patients at this stage can conduct some straightforward training content to some extent, which can carry out relevant cognitive training at home and adopt the most popular and accepted multimodal training for elderly users to improve the existing training equipment, products, and training methods.

The current methods for improving cognitive training based on mental activity provide different entry points from a professional perspective to alleviate mild cognitive impairment. Therefore, the following is an overview of the areas involved in mental training.

## **2. Product and Behavior Analysis**

### **2.1. Current Status of Cognitive Training Design**

The entry point of cognitive training can generally start from the sensory system, attention, subject emotion, own behavior, and interactivity [4]. Sensory stimulation has three main parts: vision, hearing, and touch [5]. Visually, it is necessary to give patients sufficient time to receive and respond to visual information, but the whole training time is not too long to prevent visual fatigue, and the dynamic elements must cooperate with the visual motion speed of the elder, which also reduces the recognition ability of the elder; in hearing, the product needs to avoid the stimulation of high-frequency sound, and the repetition can take when necessary; the soft comfort of the material should guarantee [6].

When grasping patients' attention, the entire product can present patients with familiar, engaging, and simple content in a gamified form. In using the product, attention should pay to the difficulty control of the product to prevent the frustration caused by patients due to the excessive difficulty. The feedback on using the product should be able to timely improve the enthusiasm of patients, including music assistance to improve the patient's mood [7].

### **2.2. Hand Exercise Product Research**

Hand exercise products are divided into four categories: simple hand exercise equipment, advanced technology of electronic products, mechanical training devices for sports activities, and household hand exercise products.

Table 1: Main categories of hand exercise products.

Simple hand exercise equipment	Natural stone ball	Principle: through long-time contact, the human body can absorb some trace elements to play the effect of health care. Typical raw materials: marble, agate, jade, and so on. Disadvantages: No falling may not be suitable for beginners; sweating in summer and freezing hands in winter.
	Wooden ball	Common raw materials: pear wood, mahogany, acid branch wood. Features: bring in health care effect; can absorb sweat and then volatilize to achieve warm in winter and cool in summer. Disadvantages include the need to use walnut oil maintenance to prevent dry weather and cracking.
Advanced technology of electronic products	rehabilitation medicine equipment	Principle: Let patients wear gloves and often practice some movements, mainly some hand movements often used in my life (machine movement drives the patient's hand movement). Primary function: to restore the hand function of the patients.
Home-use hand exercise products	Grip ball	Main materials: silica gel, rubber, oak, etc. Function: Exercise the hand strength to stimulate the hand acupoints. Disadvantages: Exercise hand strength to stimulate hand acupoints mostly cannot give users exercise feedback.
	hand-muscle developer	
	Rubber massage ring	

From Table 1, it can see that the primary function of hand exercise products is to play preventive healthcare. People can achieve restorative care through exercise, massage, and acupoint stimulation [8].

For the design opportunity points for such products, one is a sense of affinity and reduced resistance, even with the adoption of advanced technology. But we must not let users lack a sense of closeness to it, making the product more like toys for older people. Instead of the training of the apparatus, reduce the resistance of users; Second, the use of a diversified environment, when using hand exercise products without considering the place and external environment, can enter into the user's daily exercise life; Suitable for the users, strong durability and reliability, the hand exercise product designed to have the structure and size for the user, and the product should have high durability and reliability; Use fun, try to ensure the training effect without losing joy.

### 2.3. Developed Elderly Toy

#### 2.3.1. Overall Trend of the Industry

Currently, China's toy market mainly targets children, completely ignoring the elderly consumer groups. From the current market structure perspective, the variety of toys for older people is small, there are almost no toys for older people, and foreign toys for older people are more diverse. 40% of the toy products in the United States are designed for older people. The concept of toys for older

people is relatively backward, and the toy market for older people is relatively blank with the arrival of an aging society. With more and more older adults, the elderly toy market's potential demand is significant, and the industry development prospect is good.

Overall, China's elderly toy market demand is significant, the industry development prospect is good, the variety of toys for older people is few, and the cooperation with other industries is not strong (or traditional toys account for the majority).

### 2.3.2. Traditional Toys for the Elderly

According to the characteristics of older people, there are two main categories of suitable toys:

Table 2: Traditional large toys for the elderly.

name	diabolo	Jump ball	billiards	Kong Ming lock
product form	Offline single game	Single player play	Offline entertainment for two or more people	offline
Whether intelligent	deny	deny	deny	deny
market positioning	Sports and exercise toys for older people.	Balance your toys to strengthen your balance.	Sports type of entertainment projects can exercise the body of older people.	Folk toys develop the brain and spatial imagination ability.
state-of-the-art	It is more prevalent in the elderly market, but its use requires learning.	More popular and limited to the use of the population.	In recent years, it has been popular among the elderly group and is more attractive.	Children and older people are the primary audiences, which makes it more attractive.
trend in development	The market development is relatively general, with less innovation.	Offline development, less innovation.	Billiard development is getting better and better, and the penetration rate is getting higher and higher.	Traditional culture is becoming increasingly popular, and classic wood art is welcomed and loved.

In Table 2, some of the commonly used elderly toys in the Chinese market are active in thinking, while others are active and physically strong. Overall, innovative and exciting game interactions need for a particular market, and the audience's user experience will improve.

One is the lonely toys, such as puzzle toys, game toys, such as toys, game toys interactive toys; the other is to help the elderly wrist, and waist legs, to achieve physical fitness, such as model toys, cloth toys, and various light exercise toys [8]. In these traditional games, the activity itself has a

particular risk, such as sports fitness toys, the operation the time is easy to hurt themselves or others accidentally.

Several design opportunities are in these previous cases:

1) The portability and ease of use of toys should be high. The exercise products can be integrated into the daily life of older people so that the products will not impact users in the normal use process. They can also enable them to exercise independently.

2) The durability and reliability of the product should be vital to ensure that users can not consider the place and external environment when using the product and ensure that the product is safe during the use process and will not cause harm to users or others.

3) the cost performance should be high, low price product strategy can relatively cater to the psychological needs and consumption habits of older people but also should pay attention to the quality of products, improve the cost performance.

## 2.4. Analysis of Hand Acupoints

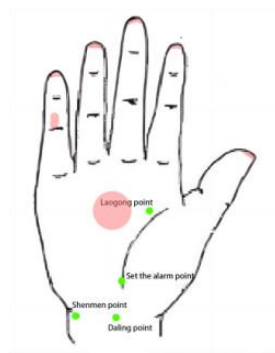


Figure 1: Corresponding hand acupoints in patients with mild cognitive impairment.

Figure 1 shows that massage stimulation can apply to the acupoints. Pressing the red part of the figure can also effectively prevent the incidence of Alzheimer’s disease in patients with mild cognitive impairment. If a long-term hand massage can stimulate the acupoints, it will have a good effect on alleviating the condition [8].

In the later design, the pressure acupoint point of the hand exercise is divided into two parts: the part of the finger and the part of the palm.

Of course, it is also necessary to consider significant changes in the hands of older people, as their muscles and ligaments are not as strong as before. The number of muscle fibers in the bones decreases, the muscle volume of the entire palm decreases, grip strength decreases sharply, and the interphalangeal joints proliferate, deform, and become enlarged, with reduced flexibility and other external objective factors [9].

## 2.5. Latent Demand

Table 3: Potential demand analysis (emotional demand).

Demand level	Elderly people with cognitive impairment
Instinct layer	The physiological feelings and reactions of older people’s own vision, hearing, smell, touch, and other aspects (by mobilizing the intuitive feelings of older people’s senses, triggering the instinctive emotional reaction of older people, which is beneficial to the training of older people’s daily life ability).

Table 3: (continued).

Behavioral layer	In the process of behavior and actual operation of products, older people are awakened from memory, eliminate sensitivity and anxiety, mobilize enthusiasm, give play to subjective initiative (learning, thinking, active communication and expression, participation in social activities, etc.), and obtain optimistic attitude, confidence, and sense of achievement.
Reflect on the layer	The old people will have “unforgettable memories” of their experience. Through the designed hand exercise products, they can constantly record, remind and guide the reactions of older people to these memories, reflect the self-value of older people, meet the emotional needs of older people, and play a positive role in guiding older people.

Table 4: Analysis of chance points.

Demand level	Elderly people with cognitive impairment
Instinct layer	To train cognitive function through sensory stimulation.
Behavioral layer	Cognitive training is conducted by exercising hand muscles and stimulating hand acupoints. Combined with active music therapy, mobilize the enthusiasm of older people, less damaging psychology, give full play to the subjective initiative of older people, and use the products.
Reflect on the layer	Combine the “unforgettable memories” of the experience of older people, constantly record and remind them, trigger their reaction to these memories, improve cognitive functions, help them realize self-value, and meet their emotional needs.

From Table 3, it can conclude that in the subsequent product design, the product needs to provide more tolerance [10], which can continuously trigger older people to recall the past and guide them to have a positive emotional experience. The analysis of opportunity points in Table 4 found that this product mainly triggers older people’s memory of past times through sensory stimuli. It is achieved by exercising hand muscles and stimulating hand degrees.

### 3. Product Design

#### 3.1. Product Function Positioning

The hand exercise mode system for elderly aMCI patients divides into finger exercise and palm massage. It is mainly for the patients to use the product daily to achieve the intervention’s effect.

##### 3.1.1. Physical Product Function Positioning

Exercise the hand, stimulate the hand acupoints, and music/recall to boost the memory to achieve the effect of preventing/improving the cognitive impairment.

Implementation: 1) multimodal training + music therapy; 2) hand exercise (exercise therapy), supplemented by music therapy, etc.; 3) hand exercise device + elderly toys + instrument/recall stimulation (recall narrative).

### 3.1.2. Architecture Process

Imagine: “Smart walnut.”

Functional positioning: 1) Exercise the hands and stimulate the hand acupoints to achieve the effect of preventing/improving cognitive impairment. 2) Record the memory of older people through sound recording and remind and recall when needed.

How to achieve: hand exercise device + toys for older people + musical instrument/sound stimulation (memory narrative).

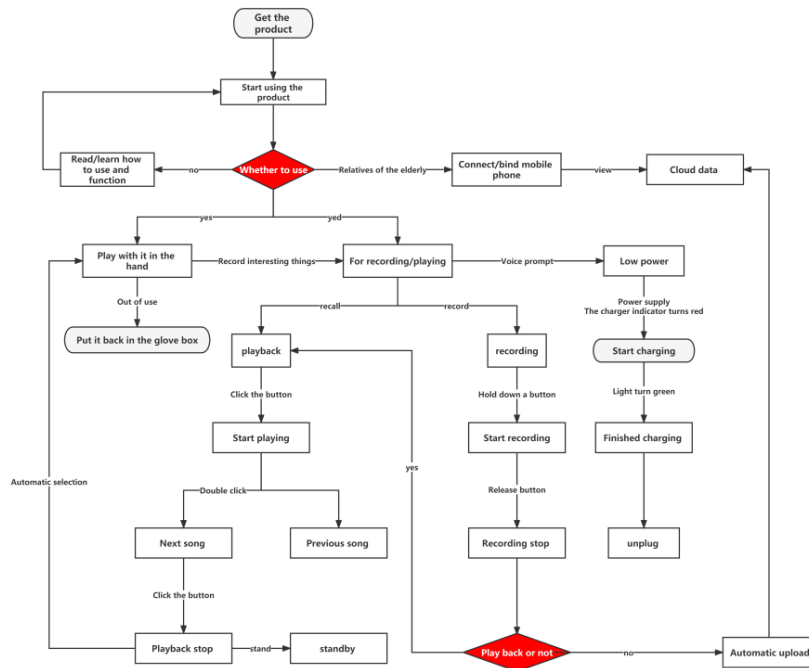


Figure 2: Flow chart planning of “walnut” use.

The usage flowchart of this product shows in Figure 2, which includes the process planning of three steps: obtaining the product, uploading it to the cloud, playing with the disc in hand, and performing recording and playback. The entire basic process style needs to be more detailed, but it does not explain the usage process, interaction process, and so on.

### 3.2. Design Discipline

#### 1) Learnability

The choice of operation mode should be more suitable for the cognitive characteristics of elderly MCI patients because there is basically no need to carry out other complex and deep operations, and users can easily and quickly choose different functional categories in the middle level.

#### 2) Easy to operate

Due to the specific impairment of the cognitive ability of the aMCI elderly, it is difficult to remember the location and use the mode of various functional modules quickly and skillfully. Therefore, People should avoid the complex appearance design and deep hierarchical structure design, and the operation mode needs to be simplified as much as possible.



### 3.3. Physical Product Scheme Output

#### 3.3.1. Design the Sketch Scheme

The hand exercise product design for elderly aMCI users combines active music therapy and finger exercise, which is one section; the direction design for the whole palm massage is the second section, and the sketch output for these two directions, respectively. Some sketches show below.

“Intelligent walnut” sketch scheme

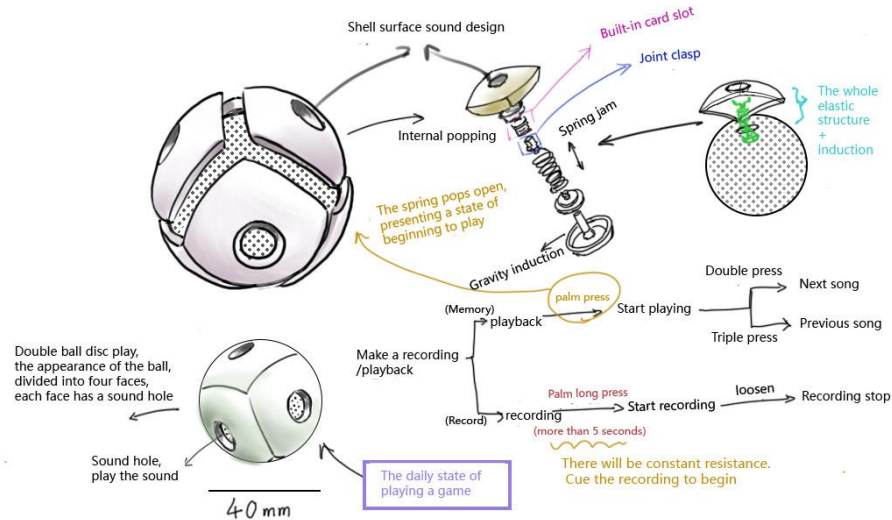


Figure 3: “Walnut” sketch.

Figure 3 shows the draft display of the entire product, with daily playing status. The recording and playback functions and forms are displayed through two different interactive methods of single press and long press with the hand, as well as the internal spring and playback structures inside.

#### 3.3.2. Render Effect Display



Figure 4: (a) Render of the “walnut” product, (b) Explosion analysis diagram.

Figure 4 (a) shows the appearance of this product, showing the product status during user play and playback recording. One is the closure of the entire opening and closing structure, and the other is the expansion and contraction. Figure 4 (b) shows the internal structure of this product, including an exploded view of the shell, spring structure, and audio system.



### 3.4. Design Description of the Product Use Method

Functional flow chart:

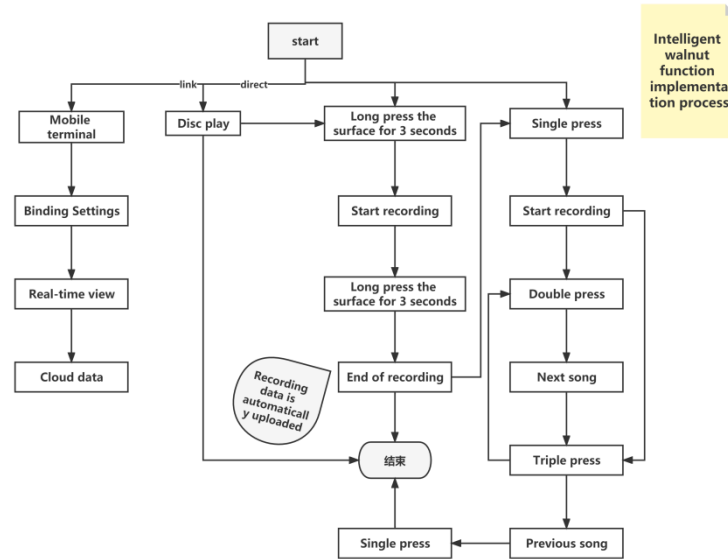


Figure 5: Flow chart of the “Walnut” function.

Figure 5 is the final function usage flowchart, which combines the product function display of user hand movements. There are long press surface start and end recordings, single press, double press, three press end playback, and the implementation process of the next and previous song.

Use flow chart:

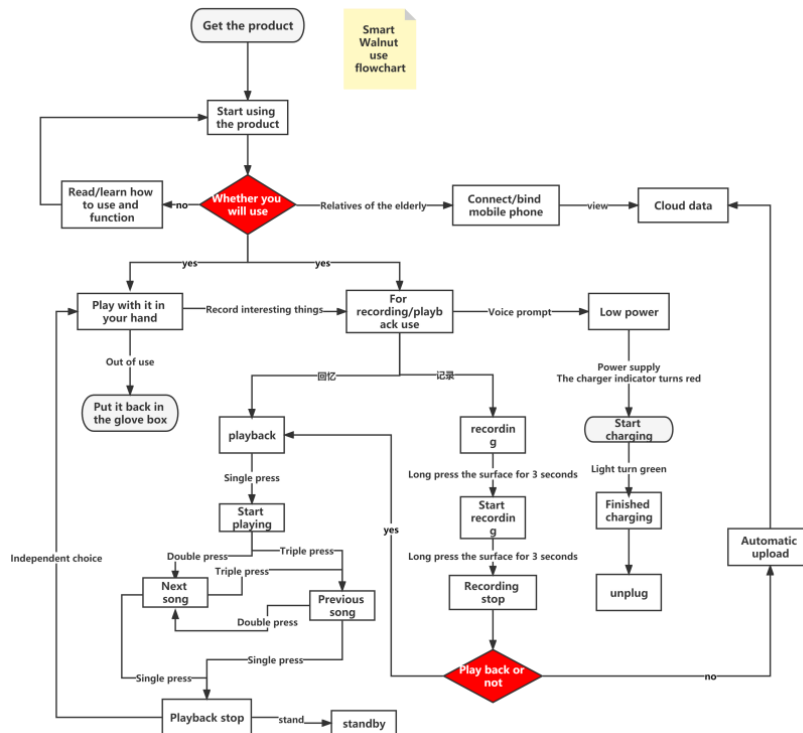


Figure 6: Flow chart of “walnut” use.

Figure 6 is the usage flowchart of the entire product, which includes all the behavioral habits, interaction methods, and simple cloud upload methods that users can use after receiving the product. Cloud view flow chart:

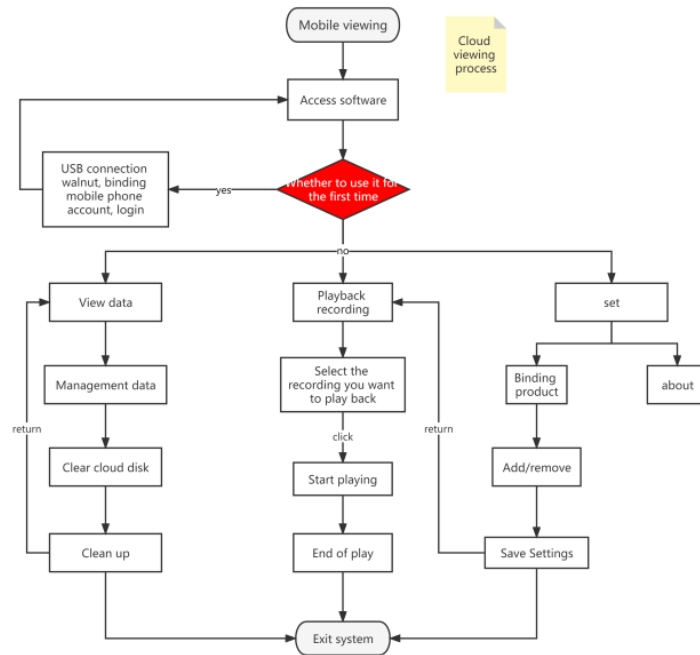


Figure 7: “Walnut” cloud view flow chart.

Figure 7 shows the flowchart of cloud viewing. As this is uploaded through the cloud and does not require an app, the entire flowchart involves relatively simple recording and playback of audio and managing audio data.

#### 4. Conclusion

By studying the feasibility of the effective intervention in hand exercises for mild cognitive impairment in older people, they are using biomimetic design and motion system construction methods, focusing on effective intervention in health and MCI, and exploring the creation of hand exercise equipment for older people and through market research, demand point analysis, ergonomics, and user experience process design, designing the hand mentioned above exercise products to customize products that are more suitable for elderly users. What’s more, promoting the transition from breakpoint passive movement to continuous active training, stimulating the recovery of memory in the brain of older adults through recording and playback of daily life stories, and combining traditional Chinese medicine’s hand acupoints to boost long-term treatment of mild cognitive impairment through pressing or playing with two behavioral habits, delaying the deterioration of memory in older adults due to the pathological effects of cognitive impairment, helping older adults prevent and slow the occurrence and development of mild cognitive impairment. Otherwise, providing targeted training to improve their quality of life, increase their happiness, and meet the differentiated needs of healthy aging for those with mild cognitive impairment. On the other hand, this product can also alleviate the burden of caring for their families.

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