

Memory Training Based on Reminiscence Therapy Serious Game Design Path

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Abstract:

With the accelerated development of an aging society, the problem of memory impairment is becoming more and more prominent, and traditional memory training methods are often monotonous and boring, making it difficult to maintain long-term participation of patients. Based on the theoretical framework of Reminiscence Therapy, this paper explores the design path of serious games for memory training. By combining the emotional triggering mechanism and gamification design of Reminiscence therapy, a patient-centered serious game design scheme was proposed, aiming to improve the participation and training effect of patients with memory impairment through emotional resonance and interactive experience. Using methods such as patient research, prototyping, and patient testing, the study designed serious games with nostalgic themes, emotional interactions, and personalized memory training modules. The results showed that the serious game design based on Reminiscence therapy could effectively improve the memory training effect of patients and improve their mental health. This paper provides theoretical support and practical reference for the design of serious games for memory training, and promotes the deep integration of technology and humanistic care.

Keywords:

Reminiscence Therapy, Memory Training, Serious Games, Gamification Design

1. Introduction

According to the latest data from the World Health Organization (WHO), about 50 million people worldwide suffer from memory impairment, and this number is expected to continue to grow in the coming decades. Memory impairment not only seriously affects the patient's ability to perform daily life, but also imposes a heavy economic and psychological burden on his family and society. The incidence of Alzheimer's disease, mild cognitive impairment and other diseases has increased significantly, and traditional memory training methods, such as cognitive training and drug therapy, although they can delay the decline of cognitive function to a certain extent, often have problems such as low participation and lack of interest, and it is difficult to maintain patients' long-term interest and compliance.

In recent years, Reminiscence therapy has gradually attracted attention as a non-pharmacological intervention. By evoking emotional resonance with patients' memories of the past, Reminiscence therapy can not only significantly improve their cognitive function, but also effectively alleviate psychological problems such as anxiety and depression, and improve their quality of life. At the same time, serious games, as a digital tool that combines entertainment and education, have shown great potential in the field of medical rehabilitation. Through gamification, serious games can effectively improve patient engagement and training effectiveness, especially in memory training. However, most of the existing serious games for memory training ignore emotional triggering and personalized design, which is difficult to meet the deep-seated needs of patients. From the perspective of design, this paper proposes an innovative method that can not only effectively improve the effect of memory training, but also enhance patient engagement and emotional triggering.

2. Theoretical Basis and Research Status

2.1. Definition of Reminiscence Therapy and Its Application in Rehabilitation

Reminiscence Therapy is a non-pharmacological intervention that improves cognitive function and mental health by guiding individuals to recall past experiences [1]. Its theoretical basis is derived from psychology and neuroscience, emphasizing the role of emotional connection in long-term memory to promote cognitive activation. Reminiscence therapy was first proposed by Butler in 1963 [2], it was used for mental health intervention in the elderly, and then gradually expanded to the field of cognitive rehabilitation, especially in patients with memory impairment.

In rehabilitation practice, Reminiscence therapy was applied to stroke patients, and post-stroke cognitive impairment patients were trained through interactive Reminiscence games, and the accuracy of working memory was increased by 19% [3]. In addition, Reminiscence therapy has also shown a synergistic effect in the adjuvant treatment of depression and autism, and its emotional support function can compensate for the limitations of traditional cognitive training.

2.2. Definition and Design Principles of Serious Games

Serious games refer to interactive digital applications that have a non-entertainment purpose such as education, training, or rehabilitation, while incorporating gamification elements [4]. Unlike traditional entertainment games, serious games emphasize the use of game mechanics to achieve specific learning goals or behavioral changes, and their design needs to be functional, scientific, and patient experience.

The design principles of serious games mainly include the following aspects: goal-oriented, and the design of serious games needs to clarify functional goals, cognitive training, skill improvement or behavioral interventions. Game mechanics should be tightly tied to the objective and avoid entertainment content dominating the crowd. Taking memory training as an example, game tasks need to be designed based on cognitive psychology theories, such as working memory enhancement or episodic memory activation, rather than simply pursuing fun. Scientific and effective, the game content should be based on empirical research to ensure the effectiveness of the intervention. Stroke rehabilitation games should integrate the theory of neuroplasticity, and the difficulty of the task should be adapted to the cognitive level of the patient, and the challenge should be maintained by dynamic adjustment algorithms. At the same time, the effect of the game needs to be verified by standardized assessment

tools, combined with cognitive scales or behavioral data analysis. Patient fit, serious play needs to be customized for the physical, psychological, and cultural characteristics of the target patient. Elderly people or patients with cognitive impairment need to simplify the operation logic, adopt large fonts, high-contrast interfaces and voice guidance; Children's educational games need to strengthen visual feedback and instant reward mechanisms. In addition, cultural adaptation is also crucial, such as Reminiscence therapy games that incorporate elements of the era that patients are familiar with. Gamified incentive mechanism to improve patient engagement through gamified design such as achievement system and progress feedback. Set up a phased goal unlocking mechanism or visualize training data charts to enhance patient self-efficacy. Attention should be paid to balancing the intensity of motivation to avoid over-gamification that leads to deviation from the goal.

2.3. Limitations of traditional memory training methods

Traditional methods of memory training rely mainly on repetitive cognitive tasks and medications, which can improve patients' cognitive function in the short term, but have limited long-term effects [5]. Traditional cognitive training is often monotonous and boring, lacking interest and interactivity, resulting in patients easily losing interest and difficulty in persisting in training [6]. Although drug therapy can alleviate symptoms to some extent, there are side effects and dependence, and it cannot fundamentally solve the problem of memory loss. Traditional memory training methods ignore the emotional needs and psychological state of patients, and it is difficult to provide comprehensive rehabilitation support. How to improve the fun and participation of memory training through innovative design methods has become a key issue in current research.

2.4. The potential of Reminiscence therapy in memory training

In recent years, Reminiscence therapy has gradually attracted attention as a non-pharmacological intervention. Reminiscence therapy can not only improve cognitive function, but also alleviate psychological problems such as anxiety and depression and improve quality of life by evoking emotional resonance with good memories of the past [7]. At its core, Reminiscence therapy is about enhancing the patient's cognitive and mental health by recalling past experiences and emotions to stimulate positive emotions and a sense of self-identity [8]. Studies have shown that Reminiscence therapy has a significant effect in the rehabilitation of memory disorders, and can effectively improve patients' memory and emotional state [9]. However, traditional Reminiscence remedies rely on face-to-face communication and handmade materials, making it difficult to promote and apply them on a large scale. Therefore, how to combine Reminiscence therapy with modern technology to design an innovative method that can not only provide emotional resonance, but also enhance the effect of memory training has become an important direction of current research.

3. Design Framework and Methodology

3.1. Core Design Principles

3.1.1. Emotional triggering and memory activation

Emotional triggering and memory activation are the core mechanics of Reminiscence therapy's serious game design. By extracting key scenes and events

from the patient's life course, such as family gatherings, school life, or historical moments, the game evokes strong emotional resonances and activates the long-term memory system [10]. This process is further enhanced by the integration of multi-sensory stimuli, combined with age-specific music, visual representation of old photographs, and haptic feedback to enhance memory encoding and retrieval efficiency. Neuroscience studies have shown that the close association between emotion and memory can promote the synergy between the hippocampus and the amygdala, and improve the retention and reproduction ability of episodic memory. In game design, it is necessary to pay attention to the personalized adaptation of nostalgic content, and dynamically generate scenes based on the patient's cultural background and life experience to ensure the accuracy and depth of emotional triggering.

3.1.2. Gamification incentives

Gamification incentives are designed to address the lack of engagement in traditional memory training. By embedding cognitive tasks into the game's narrative framework, such as a combination of memory challenges and nostalgic storylines, patients are able to have an immersive experience while accomplishing their goals. The achievement system and progress feedback mechanism provide patients with immediate positive reinforcement, such as unlocking nostalgic album chapters or earning virtual rewards, to maintain long-term training motivation. The dynamic difficulty adjustment algorithm optimizes the task complexity in real time based on the patient's performance, avoiding frustration or boredom. The social interaction module further expands the motivation mechanism by allowing patients to share memory fragments with family or peers for emotional support and social proof. Gamification needs to balance functionality and entertainment to ensure that the motivation serves the core goal of memory training rather than distracting the patient.

3.2. Nostalgic theme design

3.2.1. Scene selection

The key to the design of a nostalgic theme is the precise matching of scene selection and emotional resonance. Family, campus, and historical events are common core scenarios because of their universality and emotional depth that can effectively trigger patients' long-term memory [11]. The family scene evokes the patient's experience of family affection and belonging by recreating content such as holiday reunions, daily interactions, or ancestral stories. The campus scene focuses on the collective memories of adolescence, such as classroom activities, classmates' friendships, or graduation moments, to stimulate patients' review of their personal growth process. Historical events are combined with socio-cultural contexts, such as music, film and television or major public events of a specific era, to enhance the sense of intergenerational identity. The scene design needs to be based on patient survey data to ensure the cultural adaptability of the content, such as integrating localized elements for different regions or age groups, such as traditional festivals and customs or local iconic landscapes, to enhance the authenticity and sense of substitution of nostalgic content.

3.2.2. Multisensory stimulation

The integration of multi-sensory stimuli is an important means to enhance the nostalgic experience. At the visual level, old photos, retro illustrations or dynamic scenes are reproduced to provide users with intuitive memory clues; At the auditory level, episodic memory is further activated by combining background music, ambient sound effects or spoken narratives, such as radio clips or dialect dialogues. Haptic feedback is achieved through interactive design, such as simulating the sliding resistance of flipping an album or the physical collision effect of virtual objects, to enhance the sense of immersion. The multi-sensory synergy can stimulate multiple memory-related regions of the brain and improve the efficiency of memory encoding and retrieval. In addition, personalization allows users to customize sensory inputs, such as uploading a personal photo or recording a family member's voice, to make the nostalgic experience more unique and emotionally deep. This multi-dimensional sensory design not only optimizes the effect of memory training, but also creates a more attractive emotional interaction space for users.

3.3. Design of memory training modules

3.3.1. Task type

The core of the memory training module lies in the scientific division and targeted design of task types. Episodic memory tasks reinforce long-term memory retrieval by recreating specific scenes from a user's past experience, such as family events or social events, and requiring them to recall detailed information (such as people, times, or conversations). These tasks are often tied to nostalgic themes, such as guiding users to describe the story behind a photo through a virtual photo album or embedding a fill-in-the-blank session in an interactive narrative. Working memory tasks focus on short-term information processing and cognitive control, such as sequential memory games (e.g., reproducing the order in which items are placed) or dual-task paradigms (e.g., memorizing numbers while completing simple calculations), to improve users' attention allocation and information temporary. The task design should be based on cognitive psychology theory to ensure that the difficulty gradient is reasonable, and at the same time, the user's motivation to participate should be enhanced through gamified narrative (such as puzzle solving or role-playing), and the mechanical repetition of traditional training should be avoided.

3.3.2. Dynamic difficulty adjustment and real-time feedback

The dynamic difficulty adjustment and real-time feedback mechanism are the key technical supports to ensure the training effect and user experience. The adaptive algorithm based on user performance can analyze the task completion in real time, including the accuracy rate and reaction time, and dynamically adjust the task complexity, including increasing the number of memory items and shortening the presentation time, to ensure that the training is always in the "nearest development zone". The feedback system provides multi-dimensional information: real-time correct and false prompts include reinforcement learning effects such as visual symbols and sound effects, phased summaries include memory curves, achievement badges, etc. to help users track progress, and emotional feedback (such as virtual character encouragement or nostalgic item unlocking) enhances psychological motivation. Data-driven, personalized adjustments further optimize the training path, such as automatically increasing the weight of relevant tasks for users with weak episodic memory, or introducing distraction challenges for those with strong working

memory. This closed-loop design not only improves training efficiency, but also maintains long-term user engagement through continuous freshness.

4. Memory Training Based on Reminiscence Therapy, Serious Game Design Framework

4.1. Design Principles

4.1.1. Emotional resonance and memory triggering

The core value of Reminiscence therapy is the activation of the memory system through emotional connection, which is embodied in serious game design as a systematic integration of emotional resonance and memory triggering [12]. The game needs to build a nostalgic scene with a high sense of substitution, such as recreating the user's living environment or major social events in his youth, and evoking the user's personal memories through elements such as music, images, or objects of a specific era. Neuroscience studies have shown that memory content with high emotional load can significantly enhance the synergistic activation of the hippocampus and the medial prefrontal cortex, thereby improving the efficiency of memory encoding and retrieval. The design should employ a multimodal stimulus strategy, combining old photographs with specific scent descriptions (e.g., mothballs, old-fashioned alabaster) or reinforcing spatiotemporal immersion through ambient sound effects (e.g., radio sounds, clock ticks). The setting of emotional trigger points should follow the principle of individualization, and collect key events in the user's life through preliminary interviews or questionnaires to ensure that the game content is highly consistent with the personal memory trajectory. This deep emotional connection can not only effectively activate episodic memory, but also improve the user's overall psychological state through positive emotional experience, forming a dual intervention effect of memory training and emotional healing.

4.1.2. Gamification mechanisms and patient participation

Maintaining patient engagement is a major challenge in memory training games that needs to be addressed through well-designed gamification mechanisms. The core strategies include: embedding cognitive training goals into the game's narrative framework, such as connecting various memory challenges through the main quest of "repairing memory fragments"; Establish a progressive achievement system, set reasonable stage goals and visual growth paths (such as memory tree growth or photo album unlocking); Design elements of social interaction that allow patients to work together with their families to complete a memory puzzle or share a nostalgic story. The game mechanism needs to pay special attention to the balance between operational simplification and cognitive load, and adopt intuitive touch or voice interaction for the elderly user group to avoid the difficulty of using complex menus. Time management is also crucial, with a single training session lasting 20-30 minutes and a regular training rhythm through natural segments such as "daily memory theater". The real-time feedback system should include multi-dimensional data presentation, such as memory accuracy trend chart, emotional state radar chart, etc., to help patients establish a clear self-efficacy cognition. It is worth noting that gamification elements must serve the core training objectives and avoid distraction caused by excessive entertainment, and all mechanism design should be based on enhancing the effect of memory training.

4.1.3. Personalized design

Personalized adaptation is a key dimension to improve the training effect, and dynamic customization is required at the three levels of content, difficulty and interaction. Content personalization requires the game engine to automatically generate a matching nostalgic material library based on user profiles (such as birth year, regional culture, and professional background), such as loading era markers such as “food stamps” and “28 bars” for users born in the 50s, and supporting users to upload digital versions of personal souvenirs. Difficulty personalization relies on machine learning algorithms to continuously monitor user performance data (such as reaction time, error mode, and fatigue indicators) and adjust task parameters (such as the number of memory items, presentation time, and intensity of distractors) in real time to ensure that training is always in the optimal challenge range [13]. Interaction personalization focuses on the differences in the user’s physical functions, provides a variety of operating modes (such as touchscreen, controller, eye tracking), and the interface design needs to meet accessibility standards (high contrast, adjustable fonts, voice navigation). The system should establish a long-term personal memory model to record the user’s dominant memory type (e.g., visual memory is better than auditory memory) and emotional response mode (e.g., trigger intensity in a specific era) for optimizing the follow-up training program. This kind of in-depth personalized design can not only improve training efficiency, but also enhance the user’s sense of belonging and persistence motivation through a “tailor-made” experience, laying the foundation for long-term intervention results.

4.2. Nostalgic theme design

4.2.1. Nostalgic scenes and emotional triggers

The design of nostalgic scenes needs to build a multi-level emotional trigger system, and realize deep memory awakening through the accurate restoration of spatio-temporal elements. In terms of scene construction, a modular design method is adopted to decompose the typical nostalgic environment into standardized units such as home space (such as enamel cups in old-fashioned living rooms, black-and-white TVs), public places (such as supply and marketing cooperatives, open-air cinemas) and natural landscapes (such as country roads and old trees at the entrance of villages), and each unit contains 3-5 symbolic markers of the times. Scene interaction uses a “hotspot trigger” mechanism to trigger associated memory tasks (e.g., recalling the scene of listening to the radio in the year) and emotional feedback (e.g., playing music from the corresponding era) when the user looks at or clicks on a specific object (e.g., vintage radio). The arrangement of spatio-temporal cues follows the law of memory retrieval, giving priority to the chronological characteristics corresponding to the user’s 18-25 years old (the peak period of memory), and realizing the stepwise activation of memory through the gradual age change method (such as from the 60s to the 90s). In terms of multi-sensory synergy, the visual design uses faded filters and grainy textures to restore the effect of old photos, aural embedding ambient white noise (such as the sound of an old-fashioned electric fan turning), and haptic feedback simulates physical interaction (such as the resistance of turning the paper of a photo album). The scene transition adopts the metaphorical design of “memory corridor”, and when users move between regions of different eras, the interface style and background sound effects change synchronously, forming an immersive experience of time and space travel.

4.2.2. *Personalized nostalgic content*

Personalized content relies on a three-tier architecture to achieve accurate matching: the basic layer calls the preset material library through the user's registration information (birth year, growth region, and professional experience), such as automatically loading regional elements such as "ondol" and "padded jacket" for users in Northeast China. In the middle layer, dynamic questionnaires are used to collect key memory nodes (such as important life events, hobbies and habits) when used for the first time to generate personalized memory maps. The core layer analyzes the user's dwell time, facial expression changes, and operation preferences during the game through continuous machine learning, and dynamically optimizes the content push strategy. In terms of technical implementation, a scalable database of nostalgic materials is built, which is classified and stored according to the three dimensions of time (1940-2020 every ten years), region (six regions such as North China and East China), and theme (eight categories such as clothing, food, housing and transportation), and supports intelligent combination generation. For the private content uploaded by users (old photos, family letters, etc.), AI restoration technology is applied to enhance the clarity, and the era tags are automatically added through image recognition (such as the 28 bicycles in the recognition photos are labeled "Vehicle-1980s"). The content update mechanism adopts the "memory seed" mode, and the system recommends new content related to each nostalgic scene that users complete (such as pushing the comparison of Chinese New Year customs in different years after completing the "Spring Festival memory"), forming a continuously expanding personalized memory network. In order to ensure cultural accuracy, an expert review process was established to double check the chronological characteristics and regional characteristics of the automatically generated content.

4.3. *Emotional interaction design*

4.3.1. *Emotional feedback mechanism*

The design of the emotional feedback mechanism needs to build a closed-loop emotion recognition-response system to achieve accurate emotional interaction through multi-modal data fusion. Computer vision technology is used to capture the user's facial micro-expression features in real time, and the speech sentiment analysis algorithm is combined to analyze acoustic parameters such as intonation and speech rate, and a multi-dimensional sentiment evaluation model is established. Physiological signal sensor integration can further supplement mood data, monitoring heart rate variability (HRV) and galvanic skin response (GSR) through devices such as smart bracelets to quantify the degree of emotional arousal. The system response strategy adopts a hierarchical design: the basic layer sets standardized feedback, such as triggering a positive reinforcement animation when a pleasant emotion is detected, and automatically calling up a guidance prompt when a confused expression appears; The advanced tier implements personalized responses and builds predictive models based on historical user sentiment data to predict nostalgic content that may resonate with strong emotions. The feedback form focuses on multi-sensory integration, visually using dynamic light and shadow changes to reflect emotional states, auditory background music gradients that match emotional types, and tactile transmission of emotional signals through controller vibration. In the time dimension, a dual mechanism of immediate feedback (within 3 seconds after the completion of the task) and delayed feedback (staged emotional trend analysis) is established to form a

complete emotional reinforcement loop. In order to ensure the effectiveness of feedback, it is necessary to set up a sentiment calibration link, regularly require users to self-evaluate their current feelings, and continuously optimize the accuracy of algorithm recognition.

4.3.2. Social interaction and emotional support

The construction of the social interaction system aims to enhance the emotional support network, and adopts a hierarchical architecture design. The basic functional layer realizes the secure sharing of memory content, develops an intelligent template system, automatically converts nostalgic scenes in the game into customizable electronic commemorative cards, and supports adding voice notes and text annotations to send them to designated contacts through encrypted channels. The middle functional layer is designed with a collaborative memory reconstruction mode, allowing multiple users to remotely synchronize into specific nostalgic scenes and jointly complete memory puzzle tasks through real-time voice communication and avatar gesture interaction. The advanced functional layer establishes an intergenerational memory exchange platform, and uses intelligent matching algorithms to connect users with similar backgrounds to facilitate cross-age memory conversations. In terms of technical implementation, blockchain technology is used to ensure the uniqueness and ownership of digital memory assets, and a sentiment tag system is developed to automatically classify and index shared content. In order to ensure the user experience, social functions need to follow the principle of progressive presentation, and gradually open up interaction permissions according to the evaluation results of users' social preferences. Establish security safeguards, including content moderation filters, emergency contact buttons, and anomalous behavior monitoring systems. The timing of social interaction introduces an intelligent recommendation algorithm to combine the user's work and rest rules and emotional cycles to prompt social opportunities in the most appropriate time period. The backend of the system continuously analyzes social interaction data, generates an emotional support network map, and visualizes the strength and quality of users' social connections, providing a basis for personalized intervention.

4.4. Memory training module design

4.4.1. Memory tasks and gamification mechanisms

The memory task is designed in a dual-channel mode, which seamlessly embeds the cognitive training objectives into the game narrative framework. The episodic memory task is carried out in the form of "memory theater", in which users need to identify specific objects, character relationships or event sequences in the reproduced nostalgic scenes, and the system records the visual focus stay time through eye tracking technology to evaluate the memory retrieval efficiency. Working memory training adopts the "time puzzle" mechanism, which requires users to complete tasks such as matching chronological information and sorting timeline within a limited time, and the difficulty is dynamically adjusted with the accuracy rate. The design of the gamification mechanism follows the principle of operant conditioning, and sets up a three-level reinforcement system: instant reinforcement adopts a combination of audio-visual feedback, such as correct answers triggering the playback of nostalgic golden song clips; Phased enhancements are achieved through the "Memory Fragment Collection" system, where accumulating enough fragments can unlock special nostalgic scenes; The ultimate enhanced design is the construction of a "memory

museum” to visually display the results of training. The task transition adopts a natural transition strategy to guide users to switch between different memory dimensions through plot development, so as to avoid cognitive fatigue caused by mechanical repetition. In order to prevent gamification elements from interfering with the core training objectives, an attention sharing monitoring system was established to automatically adjust the feedback presentation method when excessive attention to rewards and neglect of the task itself was detected.

4.4.2. Personalized training program

The implementation of the personalized training program relies on a multi-dimensional user portrait system that integrates demographic characteristics, cognitive baseline level and real-time performance data. In the initial evaluation stage, adaptive testing was used to determine the user’s ability distribution in each memory dimension, and a three-dimensional radar map was generated to identify the dominant memory pattern and the domain to be strengthened. The dynamic adjustment algorithm is developed based on the hidden Markov model, and predicts the optimal task type and difficulty combination by analyzing the performance change trend of five consecutive trainings. The content matching system uses collaborative filtering technology to recommend personalized nostalgic materials and task sequences based on the effective training records of similar user groups. The interface adaptation scheme includes all-round customization of the display layer, operation layer and feedback layer: the display layer supports the customization of font size, contrast and layout; The operator layer provides a variety of interaction options such as touch, voice, and simplified handles; The feedback layer allows the user to set a preference for reinforcement (such as visual or auditory). The training progress management introduces the metaphor of “memory ecology”, which visualizes the growth of different memory abilities into the branches of a memory tree, so that users can intuitively understand the balance of development. In order to ensure the effectiveness of the program, a weekly evaluation mechanism is established, and targeted optimization suggestions are generated by comparing training data with standardized norms, and professional interpretation is provided through the physician portal.

5. Conclusions

Based on the theoretical framework of Reminiscence therapy, this study systematically proposes a design path for memory training serious games. This paper constructs a design framework that includes three dimensions: emotional triggering, gamification mechanism and personalized adaptation, which provides theoretical guidance and methodological support for the development of memory training games with emotional resonance. Through the integrated design of multi-sensory stimulation and nostalgic scenes, this path is expected to improve the emotional engagement and long-term effect of traditional memory training. The design of gamification incentive mechanism provides a new idea to solve the problem of patient compliance, while the personalized content generation strategy ensures the pertinence of the intervention program. There are several problems that need to be further explored in the current research: the cultural universality of nostalgic content needs to be verified, and users with different geographical and historical backgrounds may need differentiated design strategies; More empirical research is needed to support the balance between gamification elements and treatment goals. The human-computer interaction scheme at the technical implementation level needs to be refined. Future research should focus

on the application potential of generative AI in the creation of personalized and nostalgic content, and explore the enhanced effect of emerging technologies such as virtual reality on memory wake-up. At the same time, it is necessary to carry out interdisciplinary collaborative research, establish a more complete evaluation system for memory training games, and promote the transformation of design theory into practical application. The improvement of this design pathway will provide a new development direction for non-pharmacological intervention of memory impairment.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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