

EFFECTIVENESS OF AN AI-POWERED LIGHT-SENSITIVE GAMING DEVICE IN MANAGING COGNITIVE AGILITY AND FINE MOTOR DEXTERITY AMONG CHINESE OLDER ADULTS

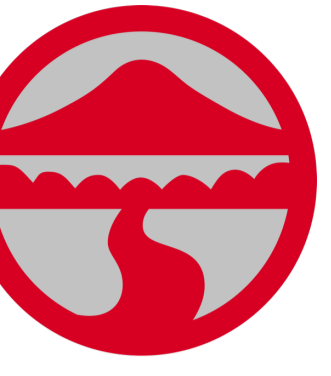
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INTRODUCTION

- It is no longer breaking news that Hong Kong's population is aging rapidly, creating pressing issues, one of which is cognitive decline, which presents significant challenges to healthcare systems. This has increased the demand for practical support for everyday cognitive and hand function, as cognitive agility and fine motor dexterity both contribute to daily independence.
- Conventional digital training may be difficult for some older adults, necessitating the exploration of tangible games that older adults can see, touch, and respond to physical cues.
- AI adaptation may help keep the activity challenging without making practice discouraging. Interventions to manage cognitive decline.



BACKGROUND AND THEORETICAL ALIGNMENT

- The correlation between cognitive (processing speed, attention) and motor (the ability to make precise movements with the hands and fingers) functions is significant, suggesting that both cognitive and motor interventions might yield more effective results than a single intervention.
- The design and evaluation of this light-sensitive toy using AI are based on embodied cognition and self-determination theory:
 - Embodied cognition assumes that cognitive function is very much embedded in the body's interactions with the environment.
 - Self-determination theory highlights the need for autonomy, competence, and relatedness

STUDY OBJECTIVES

- Assess the effect an AI-powered light-sensitive toy can have on cognitive agility (processing speed and attention) of older adults living in Hong Kong
- Assess acceptability and lived experience of using an AI-powered light-sensitive toy.
- Identify perceived benefits and improvement in processing speed, attention, finger dexterity, autonomy, and motivation.

METHODS

This project examined whether an AI-powered light-sensitive game could provide an acceptable, low-barrier way to support cognitive agility and fine motor dexterity among older adults. Twelve community-dwelling participants aged 65 years or older participated in an eight-week intervention and completed Cantonese interviews following supervised practice sessions.

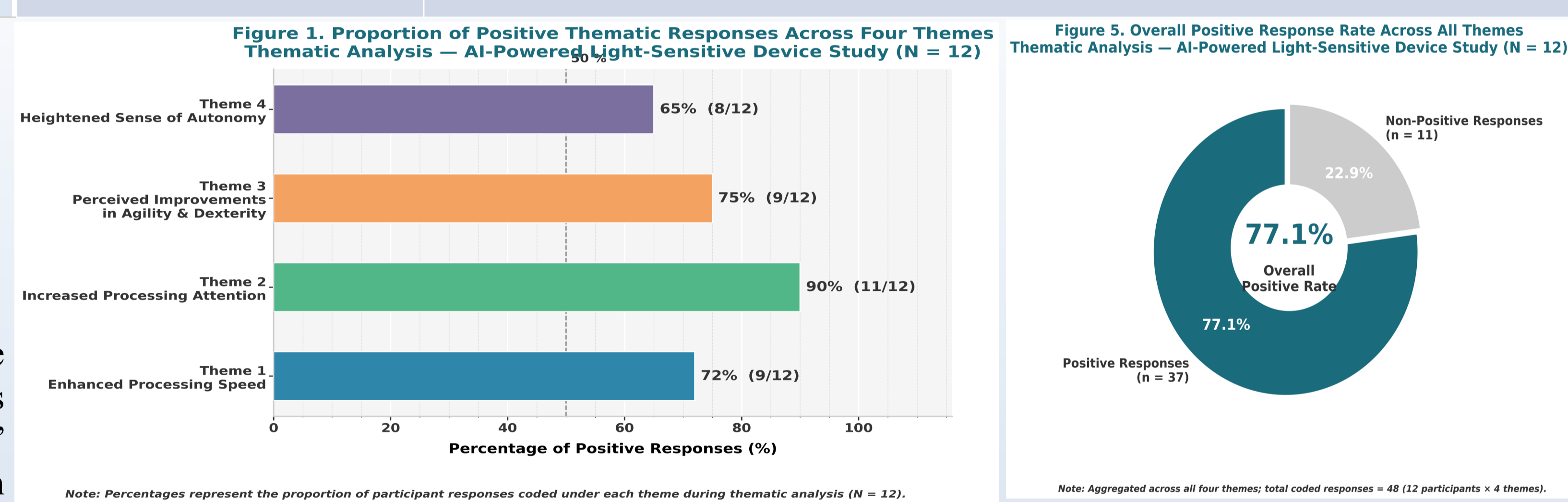
| DESIGN | |
|-----------------|---|
| SAMPLE | 12 older adults, aged ≥ 65 years |
| SAMPING METHOD | Stratified convenience sampling (age, sex, baseline function) |
| INTERVENTION | 30-minutes session, three times a week, 8 weeks |
| DATA COLLECTION | Semi-structured face-to-face interviews (post-intervention) |
| ANALYSIS | Thematic analysis (Verbatim transcription) |

KEY RESULTS

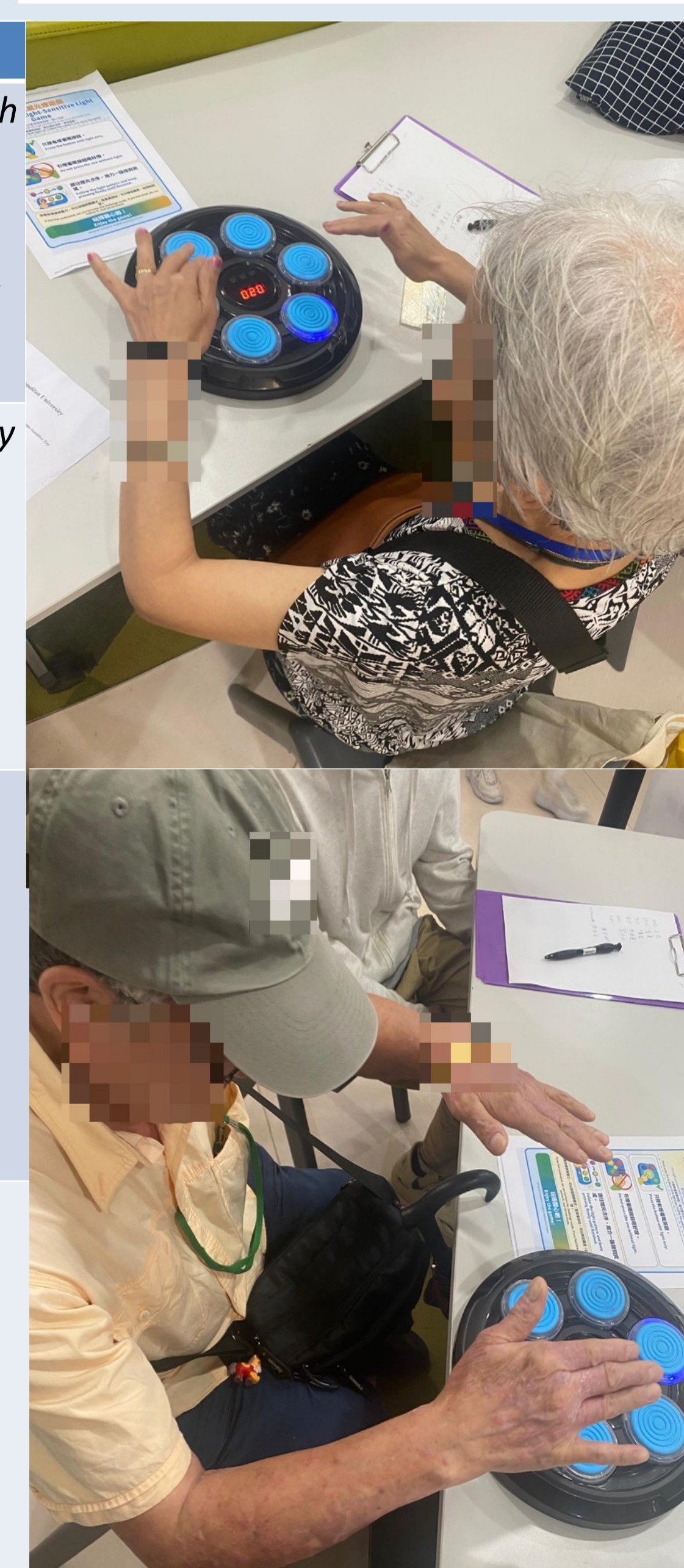
Thematic analysis of the 12 participants showed four themes:

- Theme 1:** 72% of responses showed faster and improved Reaction to Visual Signals
- Theme 2:** 90% of responses showed Improved Focus and Attention during play and ADLs
- Theme 3:** 75% of responses showed Better Hand Movement and Finger Control
- Theme 4:** 65% of responses showed Greater Confidence and Independence

The qualitative outcomes strongly support embodied cognition and self-determination theory. The sense of increased processing speed supports the notion that sensorimotor interaction boosts cognition. The interactive results showed that participants reported feeling "completely focused," indicating that AI personalization created a state of flow, which accords with SDT's focus on

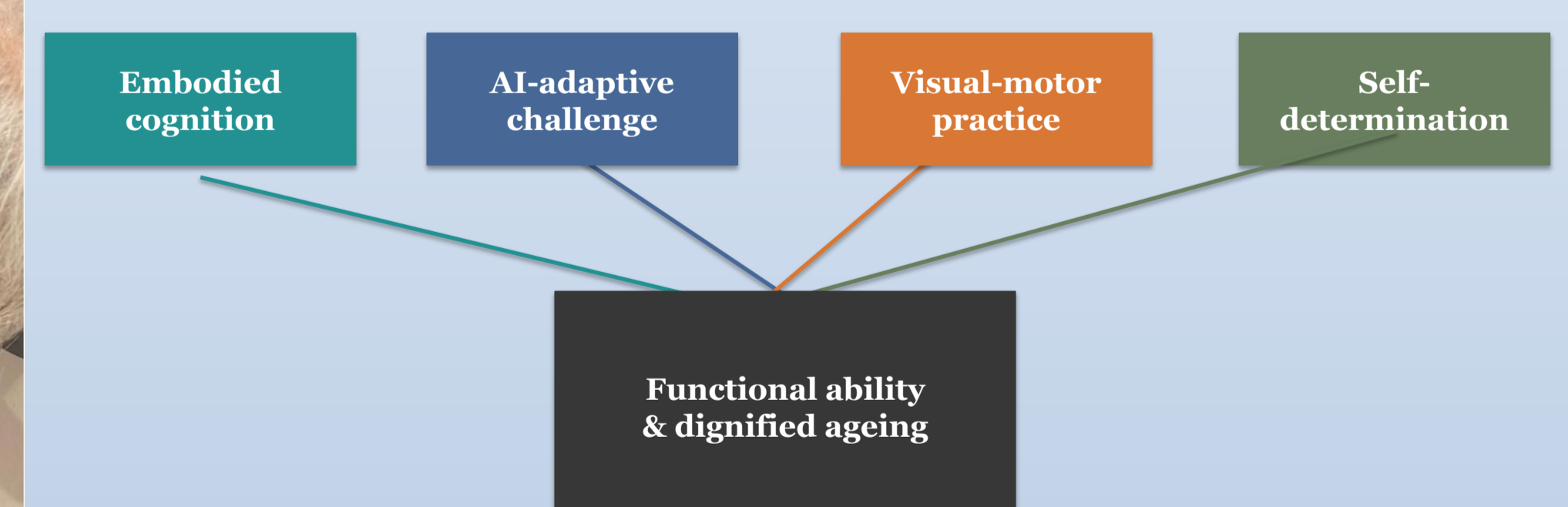


| Themes | Participants responses |
|--|---|
| Theme 1: Enhanced Processing Speed | "I react much faster now when the light flashes (72 years old JK). "I react much faster now when the light flashes (72, JK). "At first, my hands felt heavy and slow, but now I catch the signals almost instantly without having to think too hard about it" (68 Pf). "Although the fast mode was quite difficult at first, it encouraged me to become more alert and to respond more quickly each time" (80, Cd). |
| Theme 2: Increased Attention | "When I play with the toy, I am completely focused on the patterns. It trains my mind to block out background noise, and I find myself paying better attention to details even when I am just watching television or talking to my grandchildren" (74, Tf). "Playing the game also helped me follow the light sequence more carefully. My children have also noticed that I can remember things in a more orderly manner than before" (68, Pf). |
| Theme 3: Perceived Improvements in Agility and Dexterity | "My fingers feel much more flexible and steady" (68, Pf). "I used to struggle with buttoning my shirt and picking up small coins, but reaching for the lights repeatedly has made my hands feel younger and more coordinated" (77, Jb). "At the beginning, I felt some sharp pain in my thumbs when I played at home, but I still wanted to play again because the game was interesting. With consistent practice, my fingers no longer felt as stiff, and I could feel more movement and control in my thumb and index finger" (70, Yk). |
| Theme 4: Heightened Sense of autonomy | "Being able to control the game and see my own progress gives me a great sense of achievement" (68, Pf). "I do not need anyone to help me set it up, which makes me feel independent and capable of managing my own mind. I also felt very happy and motivated while playing the game. It brought back childhood memories and gave me a sense of enjoyment" (72, Jk). "I was pleased when I learned that I could have a personal one at home, which will make me feel more independent and willing to continue practising" (80, Cd). |



CONCLUSIONS & RECOMMENDATION

THEORY-TO-IMPACT MODEL



Overall, participants described the toy as engaging and usable. Four positive themes were identified. The findings suggest practical promise for community-based gerontechnology, while future multi-centre controlled studies are needed. The AI-powered light-sensitive toy was perceived as an engaging and acceptable way for older adults to practise reaction speed, attention, and finger dexterity. Recommended next steps are a larger multi-centre pilot, a control-group design, longer follow-up, and evaluation of home-practice support for caregivers and families.