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Participant Observation in Cognitive Gameplay as a Rehabilitation Tool for Living Alone Elderly with Dementia in Hong Kong: A Pilot Study

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Abstract:

In Hong Kong, the population is incontestably expected to remain on an ageing trend. Longer life expectancy has resulted in a rapid increase in aging population. In 2014, more than 70,000 aged 70 and above were diagnosed as dementia patient, expecting to have a substantial increase to 250,000 in 2036. This paper discusses the role of researcher as a participant observer in conducting social research with living alone elderly with dementia who were invited to participate in four existing gameplays in a natural setting, followed by semi-structured interviews. The qualitative research revealed that most of the existing cognitive gameplay in one of the targeted day care centres were lack of awareness of universal design that may affect the effectiveness of itself. Failure in fulfilling universal design may lead up to deviation in making judgement of the patients and heighten the risk for cognitive impairment.

Keywords: dementia, elderly living alone, participant observation, qualitative research, universal design

1. Introduction

Owing to the life expectancy rises while the fertility continues to decline, ageing population will occur continuously throughout the world. The proportion of population above aged 60 will rise gradually, comprising 12 percent of the global population. By 2050, most of the major countries will have nearly a quarter or more of their populations aged 60 or over, which is the fastest growing area (United Nations, 2015). The United Nations report revealed that, by 2030, the number of older persons is projected to be 1.4 billion among the countries of the world, expecting to be 2.1 billion and 3.2 billion by 2050 and 2100 respectively, constituting pressure on existing health care and social

protection system (United Nations, 2015). The proportion of populations over 60 years of age will grow progressively to reflect 12% of the global population. According to the United Nations (UN), the number of older persons in all countries is projected to reach 1.4 billion by 2030 – a number that may double by 2100. This gigantic figure places significant pressure on current social protection and health care systems (United Nations, 2015). The ageing situation is even worse in Hong Kong than in other Asian countries. In 2024, Hong Kong was home to 397,000 people over the age of 80, 24.8% higher than the figure recorded in 2014 (Census and Statistics Department, 2016). Between 1961 and 2011, the average annual growth rate of older persons increased at a rate of 4.8%, from 87,918 to 941,312. An ongoing ageing trend is projected for the coming decades due to the ‘baby boomers’, who were born from 1946 to 1964. As the number of elderly increase, so will the assistance they require to manage daily activities. Among the elderly population in Hong Kong in 2011, 24.9% were aged 65-69, 46.3% were aged 70-79 and 28.8% were aged 80 and above. Comparatively, in 2006 (2001), the percentages for the same age ranges were 28.2% (33.3%), 47.8% (47.1%) and 23.9% (19.6%), respectively (Census and Statistics Department, 2011).

2. Problem Statement

Hong Kong’s population exhibits an ongoing ageing trend. The elderly population (aged 65 years and over) is expected to increase from 1,065,900 in 2014 to 2,582,300 in 2064 – 15% and 33% of the total population, respectively. This change in the structure of the ageing population will require an effective housing policy and health care system to tackle the resultant social problems. According to the United Nations (2015), the percentage of the population of people aged 60 and over in Asian countries is expected to shift from 12% to 25% by 2050. In Hong Kong, the percentage of the elderly population aged 80 or over is 15% – nearly double the figures projected in the United States (8.3%) and Norway (8.8%). In 2012, the life expectancy at birth for males was 80.7 years in Hong Kong, even higher than the results obtained in Japan (79.9 years). The Aging, Demographics and Memory Study (ADAMS) conducted in the United States reported that 13.9% of people aged 71 and over had been living with dementia (Plassman et al., 2007). There is no doubt that the prevalence of dementia will continue to accelerate alongside the world’s ageing population. Thus, strategies are needed to develop dementia-friendly residential homes and product designs. A research report conducted by the World Health Organization (2012) revealed that 35.6 million people around the world were suffering from dementia – a number that is expected to double by 2030 and triple by 2050. The prevalence of dementia among Asian countries is increasing even more quickly than in the West due to the rapid growth of their ageing populations. A review of a prevalence study conducted in China during the late 1990s revealed that 1.26% of those aged 60 and over had Alzheimer’s disease (AD), and 0.74% had vascular dementia (VD), indicating that a lot of people were suffering from some form of cognitive impairment.

3. People Living with Dementia

Dementia is a biomedical disease characterised by the degeneration and loss of abilities over time. The hallmark deterioration in cognitive function is not considered to be part of normal ageing. These cognitive impairments are often preceded by a decline in emotional control, motivation and social behaviour. Dementia may occur when the brain is affected by specific diseases, including AD or a series of strokes that cause confusion, speech problems and progressive memory and cognition loss (Alzheimer’s Society, 2016). This gradual decline in function eventually creates the need for extra support in daily life. People living with dementia can experience mood changes that may be affected

by their surroundings. The most common types of dementia include AD [Earlier, dementia is defined as a disease with Alzheimer's listed as a contributing factor, whereas here Alzheimer's is defined as a type of dementia. Please clarify.], VD, dementia with Lewy bodies and frontotemporal dementia. A person having subtle problems with reasoning, planning and memory may be classified as suffering from mild cognitive impairment (MCI). Normally, about 10-15% of people gradually develop dementia each year, but the rate of cognitive decline varies from person to person. Those who have had strokes, heart disease and/or diabetes are more likely to experience rapid deterioration

4. Universal Design

Universal design is characterised by building at little or no extra cost while maintaining an attractive and functional style that satisfies all people, regardless of ability or disability (Mace, 1985). Universal design addresses the full scope of functionality by making all spaces and elements accessible to the greatest extent through thorough planning and design at all project stages. It also requires a deeper consideration and understanding of an extensive range of human abilities throughout one's lifespan (Mace, 1990). Universal design plays a key role in enhancing the potential to develop a better quality of life for a wide range of individuals (Russell, 1999). It shapes products, places and systems that reduce the need for special accommodations and many expensive assistive devices, improving users' overall well-being. It also reduces stigma by putting people with physical disabilities on an equal playing field with the able-bodied population, benefiting society as a whole (Danford and Maurer, 2005). Universal design supports people's efforts to be self-reliant and socially engaged. It lowers the economic burden created by services and products that must be specially designed to assist individuals, and helps solve social problems in which usability, health and social participation play a major role in design response. It is a concept that emphasises accessibility, adaptability, aesthetics and affordability (Behar, 1991). The successful integration of universally usable features into products and environments has the potential to render the elderly indistinguishable from their younger counterparts (Story, 1998). Universal design is less about style and more a method of design that focuses on different ages, sizes and mental and physical abilities. Seeking universal design solutions to health issues is becoming both a social responsibility and a financial necessity due to the burgeoning cost of healthcare. The seven principles of universal design adopted during the design process in the later stages of research are as follows:

1. Equitable Use;
2. Flexibility in use;
3. Simple and Intuitive Use;
4. Perceptible Information;
5. Tolerance for Error;
6. Low Physical Effort;
7. Size and Space for Approach and Use.

5. Living Alone Elderly

There have been significant changes in social structures over the past few decades as the number of older people who are living alone has increased. Government reports in Hong Kong have shown that the proportion of elderly living alone increased from 11.3% in 2001 to 12.7% in 2011 (Census and Statistics Department, 2011). Living alone is one of the major causes of loneliness among the elderly. It lowers their accessibility to regular social connections and integration, mutual support and

communication with different people (Weiss, 1973). It has reached the point where loneliness seems unavoidable among China's elderly population due to social development (Goodwin, Cook and Yung, 2001).

6. Data Collection. Participant Observation

The present study is an ethnographic study of the elderly living alone with dementia in Hong Kong. An interpretive approach is used as a research paradigm to understand the meanings humans attach to their experiences (Schutt, 2006). Ethnography is a mixture of art and science used to describe, record and analyse a group of people/culture/society. The research paradigm involves an empathetic understanding of participants' daily lives, routines and problematic events in a natural setting. An inductive reasoning approach is used to observe the behaviour of people living alone with dementia in Hong Kong. The research occurs under a cross-sectional rather than longitudinal timeframe that supports simultaneous comparisons of different variables. In this study, a local visual communication design agency commissioned the redevelopment and proposal of a new design direction to enhance the current cognitive game sets for local dementia patients at the Christian Family Service Centre (CFSC) in Hong Kong. This involved purposive sampling, as the participants were referred by the CFSC, which had been participating in the training centre for more than one month.

The first subject, Lung-Yum (LY), aged 82, retired in 1996 and had been living alone in Hong Kong since his family moved to the United States years ago. According to Danny, the CFSC's manager, LY's Mini-Mental State Exam (MMSE) score was 23, significantly below normal cognitive function (between 27 and 30). First, LY was asked to match geometrical graphics printed on paper with multi-coloured plastic pieces. The task was a typical thin tangram puzzle designed to test visual and spatial reasoning and attention span. On his first attempt, LY tried and failed to grasp a single piece, but there was room for improvement. For example, the material's thickness appeared to make it difficult for LY to manipulate. After a few tries, he switched to other methods, navigating the targeted piece to the edge of the long table using his right middle finger or sweeping with two fingers to his left palm and attempting to match it again with the outline printed on a piece of paper. His hands shook gently sometimes. It took LY a few minutes to grasp two tangram pieces while the research team recorded each of his gestures and movements. Turning a single triangular tangram piece was particularly difficult for LY, and became a major barrier for him in playing the game, even when he was assisted by a facilitator. Unfortunately, he could not complete the game on his own within the time given (Figure 1). He chose the correct colour quite frequently, but still struggled with the direction to match the appropriate location. The facilitator introduced the guidelines at the beginning of the game, and then verbally encouraged LY to try different directions, ultimately

physically guiding his hand to finish the task after a few failed attempts.



Figure 1. Participant observation with a facilitator, the designer and the principal investigator

The second game in which LY participated, called 'Putting Things Back Where They Belong', was recommended by the centre manager, who had been caring for LY for more than a month and who proposed the most effective and appropriate games to train each patient. Putting Things Back Where They Belong was designed to let players locate daily objects such as cooking oil, utensils and kitchenware and return them to their corresponding areas in a logical fashion. The main objective of the game is to test the participant's speech and ability to identify objects. The game, while relatively straightforward for a person with normal cognitive ability, required plenty of effort for LY to complete. He was asked to select a photo of an object (printed on a thick piece of A3-sized paper and laminated) and put it on top of another similarly prepared photo of the environment in landscape format. Each laminated photo was approximately half the thickness of a typical business card. Unfortunately, the flat surfaces of the photos proved difficult for him to pick up, and it took him two and sometimes three attempts to complete each match (Figure 2). The readability of the environment photo was also poor due to the reflection of the lamination obscuring visibility. Attempts to navigate using a finger on top of the photos were unsuccessful, as the photos were predominantly designed to be fixed with four round coin-shaped magnets arranged at the four corners. LY reported that he could not recognise a few of the photos due to their low resolution and unrealistic size. More importantly, the inconsistencies in the perspectives used in both of the photo groups complicated the gameplay. LY struggled to match the exact locations, and the design did not provide him with a clear explanation. It was clearly not a suitable play set for elderly dementia patients living alone. Gameplay should be well defined and speak for itself. Due to the improper

visual presentation, LY put the photo of the 'cooking pan' on the correct environment, but incorrectly placed the 'kettle' right below the 'cooking pan'. Direct observation did not reveal whether LY intended to put the paper 'kettle' back on the kitchen cupboard, or whether the placement was the result of the cooking area shown in the photo being fully 'occupied'.



Figure 2. LY engaged in the cognitive game set 'Putting Things Back Where They Belong' facilitated by a CFSC staff member

Lai Heung (LH), an 86-year-old woman with dementia living alone, was usually visited by her daughter two to three times a week after work. The facilitator tried to engage LH through a game set based on the hierarchy of the animal kingdom, e.g., 'Lion' killed 'Tiger', 'Tiger' killed 'Leopard' and 'Leopard' killed 'Cat'. The game was designed to train the memory and language skills of dementia patients. First, the facilitator spent a few minutes explaining the game repeatedly to LH, including the two levels of play. She admitted to the facilitator that she only partially understood the rules. The facilitator began the first level of play by telling a story about a local zoo in Hong Kong to build rapport (Figure 3). He then selected a picture of a 'lion' with the Chinese title in the upper right corner and asked LH to choose a picture from the pool that matched it. LH noted that the pictures were quite similar, and she was able to correctly identify matches only because she understood the Chinese titles in the upper right corners of the pictures. To LH, the animals' colours and sizes were similar because the printed graphics were not to scale. The next animal card chosen by the facilitator

was a 'cat', and LH successfully found a match because she was familiar with the animal. The third animal was a 'leopard', which LH had never seen before; thus, she did not understand or recognise the Chinese title. The facilitator tried to describe the animal's size and even the sound it made, but LY could not find a match. During the second level of play, LH was told to place the animals in sequence, assisted by the facilitator, based on size (e.g., 'Rat', 'Cat', 'Fox' and 'Lion'). Before LY made her choice, the facilitator deliberately distracted her with conversation. Unfortunately, LH failed to complete the game independently, and instead had to rely on the facilitator's verbal cues as he described the animals in detail to help her complete her selection.



Figure 3. LH, 86-year-old elderly living with dementia, engaged in the cognitive game set specializing in training memory and language ability with a facilitator

7. Semi-structured Interview

The present research was the first part of an ethnographic study of elderly living alone with dementia in Hong Kong. In-depth interviews with CSFC's manager and the participants who were not living with dementia were included in the second stage of research. Interviewer (I) adopts interpretive approach to understand the meaning that humans attach with any experience (Schutt 2006). Ethnography is a mixture of art and science to describe a group of people or culture. Paradigm involves empathetic understanding of participants' day-to-day experiences and to the routine and problematic events in a natural setting. The semi-structured interviews were conducted during breaks from the games, which lasted 20 minutes. Each interview was recorded and transcribed, supplemented by field notes.

I: Nice to meet you, Lung-Yum, how do you find the tangram game?

LY: Good... I feel good...a bit difficult...quite good...I'm tired.

I: Is it fun?

LY: Yes...um...

I: Do you still remember how to play the game "Putting Things Back Where They Belong"?

LY: Not sure...

I: Do you want to play again?

LY: Um...no...I am tired (he drinks water).

I: How old are you, Lung-Yum?

LY: I am 82...I worked in San Francisco...40 years ago...many years...do you know San Francisco? United States...San Francisco in United States...My family is living there... (right hand is shaking) San Francisco...I worked in San Francisco...in San Francisco...for years...do you want some water?

I: Will someone bring you home after training today?

LY: Yes... sometimes (I have seen a Filipino care taker sitting outside).

I: Thank you Lung-Yum, I will meet you again next month. Good day, Lai Heung?

LH: Yes, how are you, sir?

I: I'm good. Thank you. Do you enjoy playing the card game 'animal kingdom' with the centre staff?

LH: Yes! I like to play games! I like to play card games!

I: Will you play card games with your friends?

LH: No...they sometimes called me idiot...I feel sad. I am idiot! They are not kind! What time is it now?

I: 4:30pm. We are now having a tea break after playing the games. During the break, you are being interviewed by me.

LH: My daughter...my daughter will prepare a dinner with me tonight...it will be a late dinner. She is in Hong Kong now...

I: How often will your daughter come to see you?

LH: When she does not need to work overtime, she will come...she will call me.

I: How do you find "Animal Kingdom"? Is it easy to play and understand?

LH: I cannot read it clearly...I am useless...I am not educated...like an idiot!

I: You have just finished two games, one is 'Animal Kingdom', while the other is 'Matching Game'. Which one is better?

LH: They are all good! I want to play again! What time is it now?

I: We are about to finish and thank you for your time and see you next month.

8. Discussion

The findings of this study were recorded to discuss whether the principles of universal design should be applied to design consideration. First, there was a general lack of concern about minimal physical effort. LY repeatedly tried and failed to grasp the single triangular piece of tangram, and eventually chose another triangular piece next to it. This might have affected his preference, influencing the entire game set. After several attempts, he tried to guide the target piece with his right middle finger to the corner edge near himself and use his left hand to finish the task, taking additional time to finish a simple step. He ultimately became frustrated and lost the incentive to play with the facilitator. The principal investigator (PI) has suggested that the tangram pieces be made thicker to satisfy the ergonomic considerations, leaving the player free to experience the game in terms of cognitive focus thanks to the benefits of universal design. The combination of current designs in the training kit seemingly failed in this regard after nearly five years of use.

Second, the game sets did not satisfy the concept of ‘perceptible information’. Putting Things Back Where They Belong has substantial potential for redevelopment into a meaningful play set without the current drawbacks, such as the unrealistic sizes of the detachable pieces (e.g., a classic ‘kettle’ appears larger than two pieces of ‘watermelon’). LY also did not see the differences between a bottle of ‘oil’ and a one-litre bottle of ‘orange juice’. Such confusion seriously affected LY’s decisions when choosing and placing items. The game set was also made with inferior paper, so that creases were visible all over the surface. The glossy lamination created another hurdle in reading due to high reflection. Product designs that can achieve the concept of perceptible information should provide enough information correctly so that users can make effective and efficient use of the products. Even when the users have low sensory abilities, they should be able to understand and perform tasks according to their cognitive abilities.

Finally, one of the game sets did not fulfil the requirement of ‘simple and intuitive use’. A game’s design should be easy to understand, regardless of the player’s education level, language skills or knowledge. Even if one has had no experience with the product, he or she should still be able to intuitively use it correctly. The Animal Kingdom game set failed to achieve this requirement because its rules violated common sense. Why does the ‘fox’ kill the ‘cat’ instead of the ‘dog’? What about the ‘elephant’? It is the biggest animal, but can be killed by the ‘lion’ – why? The facilitator did not provide a detailed explanation, and thus the game’s rules were vague, which might have damaged the level of cognition training appropriateness.

The game play should be revisited and facilitated by a trained staff to take initiative to participate with the people living with dementia. The design recommendation listed below will serve as a guideline for designers to pay attention to the areas that may lower the effectiveness of game sets if they are not being properly followed.

Recommendation	Explanation	In relation to the Principles of Universal Design
Encourage collaboration	Game sets should be designed to promote collaboration when possible between different players,	Equitable use – all parties among players and facilitator could participate on the same ground.

	and player with facilitator. This will motivate players to participate during the training	
Common interest	Seek games that developed based on common interest to generate topics for communication during the training. Understanding their day-to-day activities become crucial in developing new set of gameplay. For example, to order dim sum with Chinese tea in the morning.	Simple and intuitive to use – understand user behaviours in daily activity could enhance the validity and reliabilities of each player. Let users express without any language barrier.
Adjustable difficulty levels	During the game play the level of cognitive impairment of each group may be varied, adjustable difficulty levels could provide appropriateness for different group of players.	Flexibility in use – this can provide different levels of game recommended for each patient by centre manager, as players are usually having different difficulties in cognition.
Use of recognisable images	Every chosen image should be clear and recognisable, without any distortion or misinterpretation. This will deeply affect the effectiveness of training if the fundamental visuals are not well presented.	Perceptible information – photos and visuals should not be altered and distorted so that players may confuse with your images and hurt the effectiveness significantly.
Offer additional information	Giving a cue to player by the facilitator could encourage them to	Perceptible information – even if the players are having cognitive impairment, we can still offer useful cue to stimulate different ways of

	continue when facing difficulty in making a choice. Audible cue and dialogue could be beneficial for memory recall.	their sensibilities.
Keep going to play until all finished	Even if a winner existed, the facilitator should give support to other players to have a chance to become second and third winners but not closing the game immediately	Tolerance for error – users might choose the incorrect ones and are encouraged to pick another they believe they are correct. Low physical effort – benefits when the game played in a certain long period.
Employ positive feedback all the time	If the player does not familiar with the game and participate in a wrong way, do show enthusiasm in supporting through verbal expression	Tolerance for error – obviously, people with dementia may need several attempts when playing card games in the training.

The participatory design approach in the process of revamping existing game sets in the latter contribute significantly design development through iteration. By inviting physiotherapist, social worker, centre staff, carer and designer to take part in design process in a typical dementia centre. Designing with the end users offers a holistic approach to let all stakeholders work altogether as a team with one goal, focusing on the process and procedure but not simply modifying the style of design. Not only can speed up the process of generating ideas and evaluate the dirty models, but also let researcher explore users' cultural background, emotional response and practical needs of the proposed designs.

9. Conclusion

This study revealed that many of the game sets used in a traditional elderly day-care dementia centre in Hong Kong did not satisfy the foundation meaning of cognitive training due to lack of universal design consideration. The gameplay should be well developed and facilitated by a trained staff member. Simple, clear explanations of the games could help elderly persons with dementia play individually in the early stages of cognitive impairment. As the study was conducted in one elderly centre with a dementia focus, its findings may not be representative of other elderly centres. Therefore, both participant observation and semi-structured interviews were used as research methods to enhance the credibility when receiving trustworthy information. Further semi-structured interviews were conducted with the CSFC's manager, Danny, and one caretaker named Leo to reveal

concerns about the daily activities of elderly persons with dementia. The findings will appear in a future paper. It is necessary to raise awareness of the importance of applying universal design principles to cognitive gameplay as a rehabilitation tool for elderly persons with dementia. The findings of this research will help to improve participation in gameplay among elderly persons living with dementia by improving the designs of current play tools. The timing for reviewing cognitive play tools is relevant in that the PI intends to promote dementia-friendly products and environments that enhance the meaningfulness of daily life.

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