Encouraging Health Games Adoption among Elderly: A Depiction of the Elderly Health Game Experience

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Abstract

Creating a healthy ageing society is taking priority in recent years. It is important to encourage health games adoption among elderly to fulfil this mission. This paper investigates the elements that contribute to the elderly's positive experience when playing health games, also known as the *elderly health game experience (EHGE)*. Findings from phenomenological studies of 5 elderlies playing health games revealed 3 factors that contribute to the EHGE: *familiarity, health values and human interactions*. These 3 factors are then mapped onto the interaction between the elderly player, the health game and a game companion to better understand how they enhance the interaction process between elderly and health game, and how might a game companion enhance this interaction. *Familiarity, health values* and *human interactions* are promising as new avenues of improvement for forging better health game experiences among the elderly population.

Keywords: elderly, health game, game experience, familiarity

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I.   Introduction

Research Motivation

With the rise of games' popularity among the elderly [1], serious games for health are gaining research interest [2] so that it can be utilized to shape a healthy aging society. However, adoption of health games are not as popular as mainstream games that are designed for entertainment. although health games' benefits are well proven, health games market are still at an early stage with relatively low investments, especially when compared to the commercial games market [3]. This is because health games, as "benefit delivery systems [4]", tend to have more stringent requirements. They are generally still limited to offering short-term engagement through extrinsic rewards [5], in contrast to the rich, vast and variety of experiences the commercial game industry can offer.

Low adoption of health games holds true even among elderly where they are perceived to be most impactful. Health games among elderly, despite gaining popularity in research, is still nowhere near as widespread as mainstream games. Research papers on health games for elderly generally still portray health games as "promising and beneficial" for elderly health; less of them propose concrete next steps to push health games beyond its confinements in the research lab.

Researchers have suggested that design and development of health games should learn from the commercial games industry to improve health game adoption, stating that *"if the user is sufficiently entertained to regard the process as a game rather than a rehabilitative program, then the chances of continued engagement are increased"* [6, p. 7]. In line with existing suggestions [6], there is much to learn from the commercial games industry to achieve a comparable success in the field of health games, which can in turn help encourage the need for a healthy ageing population.

Research Problem: Depicting the Elderly Health Game Experience

This paper sets out to promote health game adoption among elderly by presenting a depiction of the *elderly health game experience (EHGE)*. Commercial video games are valued in terms of the positive experience they create for the player [7], hence many prior studies uncovered several factors that cause positive game experiences (e.g. flow, immersion, affect [8]). Similarly, it is important to understand what the unique components of the game experience are when the players are the elderly and the games being played are serious health games. Preliminary analysis on the *EHGE* is conducted by dividing it into two parts: The Health Game Experience, and the Elderly Game Experience.

From the background above, health games are understood as dual-purposed games [9] that aim to provide health benefits and entertainment at the same time. Since health games pose such an interesting duality in the values they bring, it is fair to imply that the resulting game experience, termed as the health game experience, to share the same duality. The hedonic aspects of a health game experience is described in literature with the term *enjoyment* [10] [11], while the utilitarian aspects of a health game experience could be interpreted as *health benefits* [12]. This view of health game experiences' duality were also described as "serious experiences on top of fun, positive experiences [13] [14]" in prior research.

With the term *health game experience* covered, we now look into the *elderly game experience*, starting from how the elderly perceive digital health games. From the report titled "2019 Essential Facts About the Computer and Video Game Industry" [15], the elderly are observed to prefer games that are more relaxed (e.g. puzzles, board games) when compared to other age groups' preferences that are more action-packed (e.g. racing, shooters). On the other hand, gaming motivators (e.g. attitude, flow, satisfaction, perceived enjoyment, perceived playfulness) for the

general population [16] are mostly based on the Technology Acceptance Model [17], the Theory of Reasoned Action / Theory of Planned Behaviour [18], or dimensions in the Game Experience Questionnaire [8]. While the general population's gaming motivations are still relevant to the elderly, the elderly's specialized needs due to their age are still deemed to be more relevant when motivating them to play. Age-related factors include physical degeneration, psychological needs (e.g. loneliness, inferiority, menopause) and cognitive aging/impairment [19]. These limitations often form the "digital barriers" that keep the elderly away from health-benefitting technologies such as health games.

In this paper, a phenomenology study on the *EHGE* is presented. Participants recount their health game experience, as well as the elements that they value as part of their gameplay experience. These elements of the elderlies' health game experience are then discussed using an interaction diagram between the elderly, the health game and the game companion. With a better understanding towards how various EHGE elements work on improving different parts of elderlies' interaction with health games, more work can be done to validate these elements across different types of health games and elderly demographics.

II. Phenomenological Study of the Elderly Health Game Experience

The interpretative phenomenological study presented in this chapter attempts to answer "*how do elderlies with reduced ability to interact with digital technology experience health games?*"

A. Participants Selection

Five elderly Parkinson's Disease (PD) patients are recruited for the study. The Pumpkin Garden health game for PD early detection and rehabilitation [20] [21] is used in this study. Participants

are selected through homogeneous purposive sampling to stay relevant with the game's health values. This sampling method is also in line with interpretative phenomenological study procedures [22]. The match between the selected health game and participant demographics allows us to conduct the study on more personally relevant grounds and generate a richer set of experiences to be studied. Table 1 shows the demographics of the recruited participants.

Table 1. Demographics of the 5 Elderly PD Participants

S/N	Age	Gender	Years since diagnosed with PD
1.	64	F	8
2.	69	M	20
3.	69	M	6
4.	73	F	30
5.	78	F	10

B.   Study Procedure

The game's health values are conveyed by introducing the Pumpkin Garden game as it is: a non-intrusive PD detection and rehabilitation tool. Our participants were told that they can expect to train their coordination and motor skills while at the same time, contribute their valuable gameplay data for researchers to make better PD rehabilitation games.

Participants in the study are required to play through different minigames in the Pumpkin Garden health game. The gameplay session is designed in a way that allow participants to use tools with varying levels of *familiarity* and experience varying amounts of challenge. Participants are first required to play 3 iterations of the water wheel minigame using 3 different tools in the listed order: their fingers, the Microsoft Arc Mouse, and the Apple Pencil. Each water wheel minigame consists of 6 rounds, and participants are required to switch hands between rounds. After the 3 water wheel

minigames, participants will be required to play 1 iteration of the weed-clearing minigame with their fingers, which consists of 5 rounds of static gameplay (participants clear weeds spanning 1 screen) and 1 final round of real-time challenge gameplay (participants are challenged to clear weeds as they grow in real-time). The minigames for each game session is presented below in Figure 1.
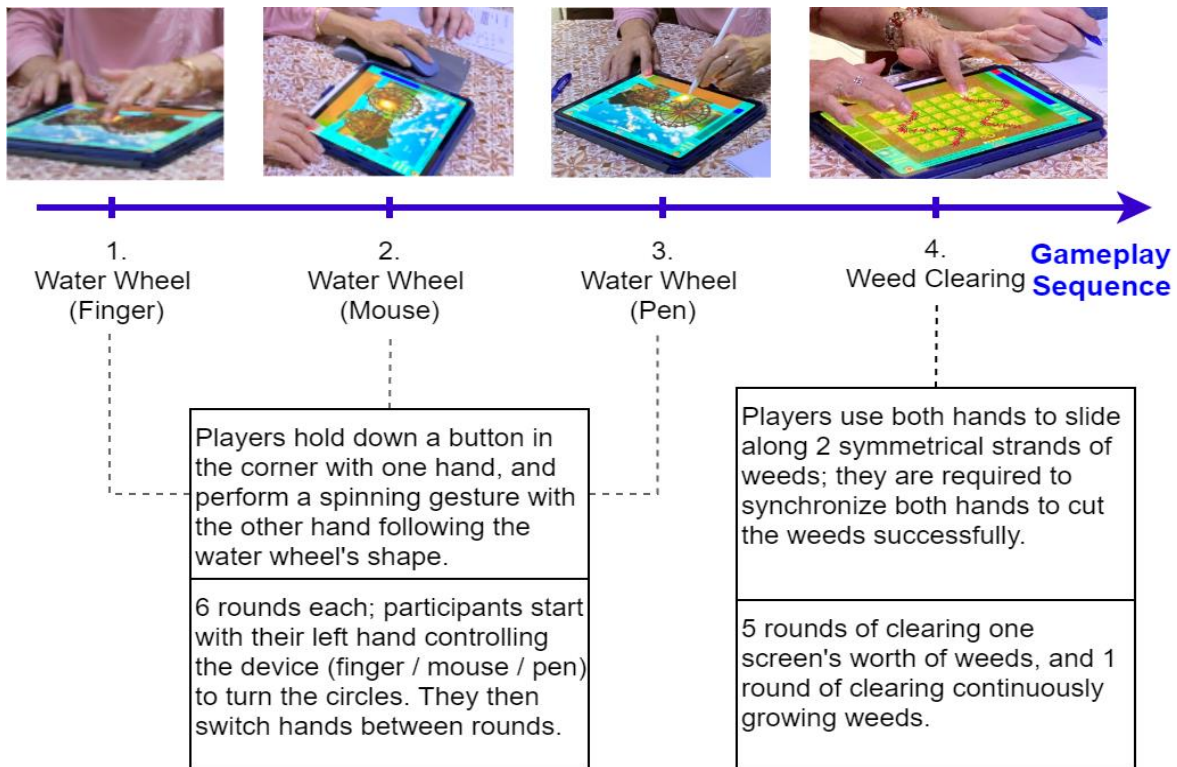

Figure 1. Pumpkin Garden Gameplay Sequence

Throughout the game session, the researcher as the gameplay companion for the elderly players that helps them complete the required rounds. This is because literature commonly attributes guidance as an important element when encouraging elderly to learn to use digital applications [23]. Encouragements were provided throughout, especially in challenging segments. Help was also provided in the form of step-by-step guidance towards solving the current problem on hand. Alternatively, the researcher also adjusted the game goal for elderly players with lower abilities by allowing them to skip sections that they find too hard, which helped preserve the positive

experience for other minigames that are more suitable for them. After completing the required rounds in the game session, the researcher interviews the player to obtain better depth of understanding towards the game experience they just had.

For the post-game one-on-one semi-structured interview, questions were designed to explore overall processes of health game experience. The questions revolved around two themes: their health game experience from the gameplay session and their opinion towards health games in general. The following few questions are used as a starting point for each participant:

- How do you feel after playing the Pumpkin Garden game? Would you like to share your game experience?

- What do you think about this Pumpkin Garden game? Have you heard of other health games?

- Do you recall encountering challenges when you played just now? What do you think enabled you to finish the game?

The guided game session contains desirable traits that has successfully supported the elderly's needs. Through using phenomenology as the study methodology, the researcher is allowed to freely pen down unique aspects of the EHGE that are yet to be formalized in literature.

C.   Interpreting the Data Using Phenomenology

Interpretivists believe there are endless number of realities, and the act of writing descriptions is an interpretive process. Interpretative phenomenology recommends interpreting the meanings found in relation to phenomena. Understanding towards the meaning of experience is obtained by engaging with data interpretively and less on finding out the essences. The approach allows and even encourages room for interpretation when performing the analysis of, for example, text. This

type of phenomenology does not to formalise an analytical method so that the context of a phenomenon can determine how the data is analysed [24]. Smith articulated an optimal approach to be "rigorous and systematic" and at the same time "exploratory and creative" [22].

In context of this study, the researcher goes through the voice recording of the participants to recount the health game experiences that participants have shared. The recordings were transcribed, and common themes were picked out from various quotes. The themes are presented as descriptions with quotes from participants to establish a traceable line of thought of how the researcher arrived at deeming the theme as significant. These themes are then discussed as part of the interaction process between the game companion, the elderly player and the health game. By interpreting the themes of these experiences as different parts of this 3-way interaction, links can be drawn between how different themes of the game experience affect different parts of the elderly's interaction with the health game. This model of interaction is promising in helping researchers derive better ways that can enhance the elderlies' health game experiences through the role of a game companion.

D.   Findings: Obtaining Real-World Context for Elements of the EHGE

1.   Familiarity

The 3-dimensions familiarity model [25] consists of *cultural familiarity, symbolic familiarty and actionable familiarity*. In our case study, these are relevant aspects of how the elderly players related themselves to different parts of the gameplay. The pumpkin garden gameplay resonated well with our participants in terms of familiarity, and observations were categorized based on the 3 familiarity dimensions.

Symbolic Familiarity

For P2, the in-game tasks of tending to a farm has encouraged him to share about his past doing farming activities for a living.

> *"My early life was in kampung. I did farming. Life was difficult, I tried very*
> *hard to survive. (There was) like no food, not even rice."*
> *(P2, Male, 69 years old)*

The visuals of a farmland and the farming activities he performed in-game invoked a symbolic familiarity of him in his youth days, which reminded him of the accompanying hardship as well as the coping attitude described as a "try again spirit".

> *"In the beginning, I thought of stopping it, I can't focus anymore, very*
> *difficult. I say, I will try it, try it one more round until I finish."*
> *"You not only finished it, you did well, very well!"*
> *"Very good game to stimulate the mind. I tried very hard."*
> *(P2, Male, 69 years old)*

With that he was able to have a memorable game experience when he was able to re-apply it into the challenging gameplay.

Actionable Familiarity

When P4 tried to give up after encountering difficulties with the mouse gameplay, the pen is introduced as a play tool and she subsequently regained interest in the gameplay. She mentioned about her experience with writing.

> *"Until today I still write with the pen. I write to record or remember things,*
> *and sometimes I even write to learn something better."*
> *"Do you think being familiar with the pen helped you play the game?"*
> *"Yes, I think so. My past experience with the pen helped me play better."*
> *(P4, Female, 73 years old)*

The action of moving a pen along a surface has allowed her to enjoy the game segment and recover from the setback she experienced when playing with the mouse. Interestingly, actionable

familiarity could also be the reason why she dislikes using a mouse, as she recounted bad prior experience with it (i.e. environmental spoiling [26, p. 356]).

> *"I had a computer mouse before, but I found out that I can't really use it, so I gave it away. I have no interest towards the mouse, I played very badly when I use it. That is why I don't want to play with the mouse."*
> *(P4, Female, 73 years old)*

Cultural Familiarity

P1 experienced the game in a much more rational way, playing on when she learnt that the empirical data generated from the study can potentially help develop better healthcare tools. She was able to key into these medical facts and details due to her work culture in the past as a nurse. In her interview when asked about opinions towards health games, she highlighted their usefulness in capturing various metrics of the body or movement, giving detailed descriptions of the problems she faced and how she might overcome it.

> *"You must know which part of body is lacking, is it brain, fingers, or hand? Got to see what you are trying to measure. When this game measures finger movement, from there you can study where a person needs to develop… for me I try to (coordinate), but the fingers are not moving the way I want to go. The brain can think of wanting, but this hand is like, stuck. I think it is due to my degenerative Parkinson, and I think if I practice more, draw more circles and try harder, I think I'll still be able to do it.*
> *(P1, Female, 64 years old)*

As a retired nurse familiar to the culture in the field of healthcare, she was able to strongly associate the purpose of the gameplay process to a culturally familiar context, hence providing her with a meaningful and unique game experience in her own way.

From the observations above, familiarity is a dominant factor that affects how well the elderly can engage with in-game tasks. Despite that, it can be challenging to utilize familiar elements to guide the elderly due to very personalized requirements that vary greatly between individuals. While

familiarity is still a good measure of good health game experience, this study explores other personalization techniques that are more actionable and less dependent on the nuanced details of the individual's past.

2.   Health Values

When participants were asked to compare the fun and health values in the game they just played, the replies they gave generally reflected the cherish they have towards leading life with good health.

P2 and P4 indicated that health should come before fun. In P2's own words:

> *"Even if the game is not fun to play, I will still choose the health game. You know it is good for your health, so you play the game rather than for money or prizes. If you play it for health, you take it as a challenge… improving your mind and your wellness. Health value is the most important because without health, you go nowhere."*
> *(P2, Male, 69 years old)*

From his sharing, we gained a new perspective that the challenge provided by a game can stimulate continued usage of the game that ultimately encourages players to perform healthy activities. P4 expressed awe as it was her first time experiencing a game that helps people obtain better health, stating that better health is very important to her. If games can really bring about the good health she desired, she is willing to change her attitude towards digital games and would try more of them in the future. In health games' context, fun elements can help by encouraging players to utilize the health game to cultivate good healthy habits.

P3 and P1 puts a slightly different weightage towards the health or fun question. For them, both are equally important as they cover different aspects of the same problem. P1 was able to better articulate:

> *"Both (values) are important. Have to get people to be interested to play in the first place. Health values are important too, you must know which part of the body the person is lacking. From there, you can study where a person needs to develop."*
> *(P1, Female, 64 years old)*

The insight here is that health values and fun elements in a health game go hand in hand; while we ultimately depend on health values to provide players with the benefits, even PD patients who felt the need for good health every day would like to have fun too when playing a game to stay engaged.

> *It's interesting, enjoyable and somewhat challenging. Because I have to coordinate my brain and my hands. Having Parkinson's Disease has weakened my left hand. It did not listen to my brain, I felt like I have to keep practicing, be patient in order to complete the game. As I play, my skills get better and my coordination improved. And I feel very satisfied when I complete the game.*
> *(P1, Female, 64 years old)*

A health game that is perceived to be both fun and healthy can have positive real-world implications. For instance, the ability to maintain continued use of the health game through fun permits healthcare workers to obtain more regular and accurate logs of players. Despite the fun elements that makes a game enjoyable, health values could serve as great motivators that attract the elderly to play more health games. Regardless of being more important or on par with fun elements, health values are a defining element of health games and therefore should be considered as part of one's health game experience.

3.   Human Interactions

One of the defining features of this study is the presence of a human guide to accompany and assist

the elderly when they play. With proper guidance, players were able to quickly engage with the

in-game tasks.

> *"Do you feel nervous when you play the game?"*
> *"Not at all. I just follow your instructions. No need to think… I felt confident to tackle the game since I know you will help me if I face any difficulties."*
> *(P4, Female, 73 years old)*

P1 encountered difficulties when synchronizing her fingers in the weed clearing minigame. For

more than half a minute, she not making any progress; in their perspective the screen seemingly

did not react to their inputs which is a source of frustration. We then explained the step-by-step

process to her on how to synchronize the fingers and move upwards together, at the same time

providing real-time feedback by asking them to go back when her fingers have slid too far ahead

without registering progress. With specific instructions to break a problem down into

understandable goals, her performance improved, and she are able to complete the weed clearing

minigame. P1 later expressed appreciation towards the guidance provided throughout the game

session. When asked what helped her complete the challenges, she expressed that she found having

a helpful presence to be encouraging.

> *"You are very encouraging… I never thought of giving up."*
> *(P1, Female, 64 years old)*

The step-by-step guide is also well-received by P3 and P5.

> *"I like the step-by-step guide, the goals are clear."*
> *(P5, Female, 78 years old)*

> *"Does the process motivate you to play?"*
> *"Yes. It helps me stay focused to complete the game. I enjoy the game play experience."*
> *(P3, Male, 49 years old)*

On the other hand, P5 was very comfortable to voice out any doubts to us while playing and was able to enjoy the game session despite not having owned any smart devices.

> *"Am I playing ok? Did I mess up anything?"*
> *(P5, Female, 78 years old)*

She also displayed much friendliness towards a human subject, and felt happy to accommodate the researchers.

> *"Have you eaten? Do you need food? Coffee?"*
> *(P5, Female, 78 years old)*

In our study, the researcher as the game companion interacts with the elderly at key moments, especially when they are having difficulties with the game. The elderly attributed the companion to be "helpful". These moments reflected that human interactions help elderlies feel comfortable when facing doubts in a digital realm.

E.   Discussion: Mapping the Proposed Factors as a 3-way Interaction

The 3 proposed factors of the EHGE can be understood as 3 sets of the relationships between 3 entities: the elderly player, the health game and the researcher who acts as a game companion throughout. The sets of relationships are presented in the following diagram. The arrows in the diagram represents the flow of information, and each pair of arrows represent a relationship between a pair
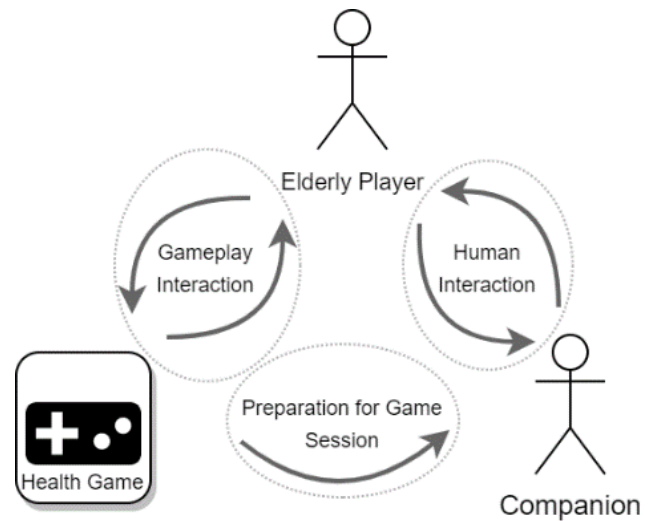
Figure 2. Understanding of relationships between Elderly, Health Game and Game Companion

of entities. Figure 2 is reconstructed using the themes of health values, familiarity and human interactions presented above.

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In prior literature, game experience is typically described as a subjective relationship between

player and game. When the average player plays a commercial game, they are usually able to interact with the game without issues and have fun from it. When put in context of elderly participants playing health games for improving health as the main benefit (instead of entertainment), the situation is
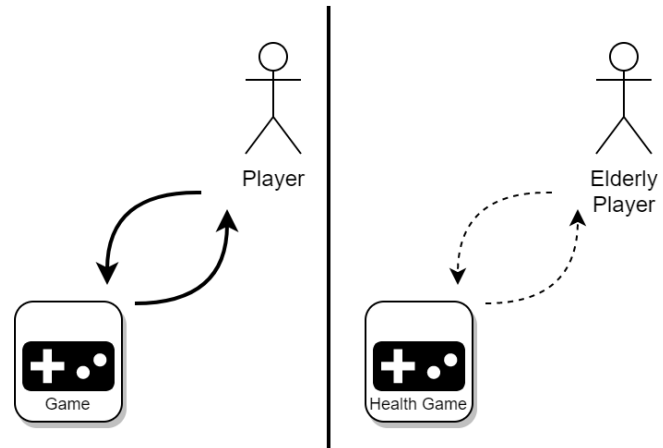
Figure 3. Elderlies' Diminished Interaction with Health Games

significantly different (see Figure 3). If left to their own devices, the elderly tends to find it difficult

to adapt to the technology products and has to spend extra effort to learn to interact with virtual

entities which they are not used to (represented in Figure 3 as dotted arrows).

However, with the presence of a human game companion, this situation could be alleviated. As

shown in the case studies, the researcher acts as the elderly's gameplay companion throughout the game session. The elderly player experiences the added company of a companion, and now there are 3 entities in the gameplay: the player, the health game and the added game companion (Figure 4).
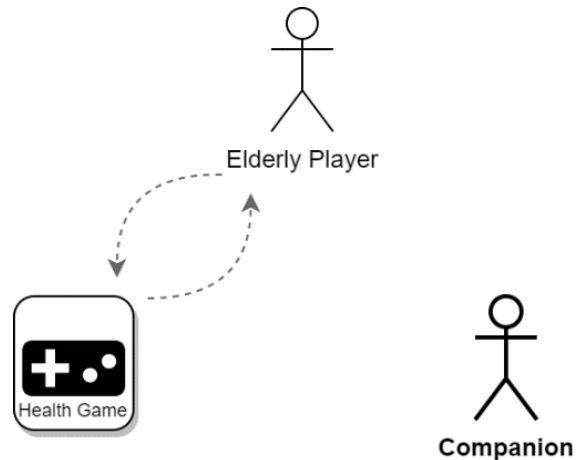
Figure 4. The Researcher as the Game Companion

Elderly participants have provided feedback that *Health Values* are important to them, hence we found it important to highlight the health values of health games to the players as they play. In this study, the game companion highlighted game-related health values to the elderly when introducing Pumpkin Garden to our PD patients. As a result, subsequent feedback that the health
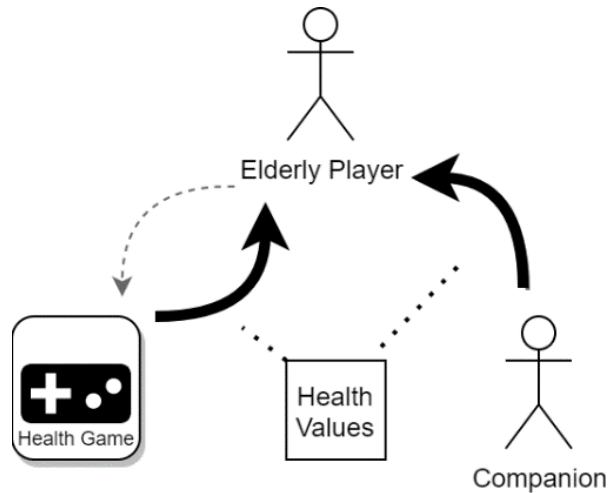

Figure 5. Health values

game provides to the player were much more relatable with the game companion helping the elderly understand the game's health values (Figure 5). With a better ability to relate to the game tasks' purpose, the elderly participants were able to enjoy the health game.

Familiarity was found to be a great motivator for our elderly participants as they were able to be immersed in the game quickly if they pick up familiar elements in the game process (e.g. on-screen design, game mechanics). Thus, the game companion could utilize this piece of information to assess how much a player is enjoying a game (Figure 6). Through evaluating the match between elements presented by the game and player's preferences, the game
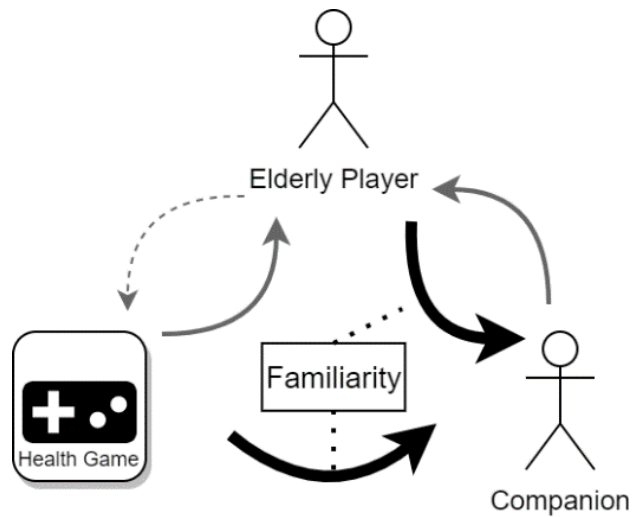

Figure 6. Familiarity

companion can obtain an accurate judgement of how much the player is enjoying the game. If the game companion can obtain sufficient understanding towards the player, it is possible to nudge the player into recalling some of their prior knowledge and reapplying it into the gameplay.

The elderly values human companionship when using digital products, hence it is not surprising when the guidance and assistance provided by the game companion helped them figure out what to do and interact better with the Pumpkin Garden health game (Figure 7). The elderly players subsequently expressed that the "human touch" helped them interact properly with the health game which improves their overall game experience.
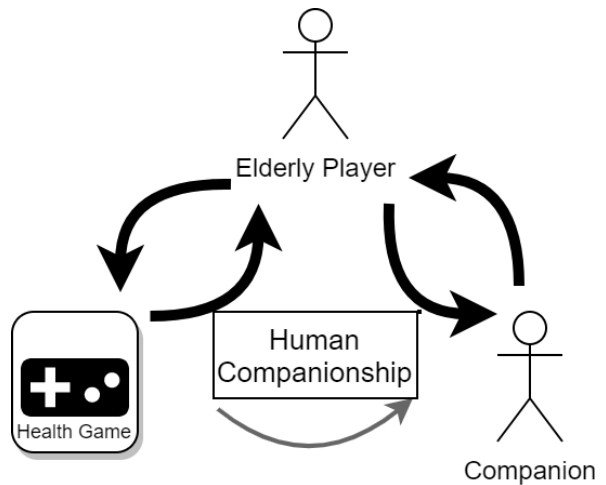

Figure 7. Human Interaction

With the presence of familiarity, health values and human interactions, the elderly's difficulties encountered when playing health games can be alleviated. As a result, they get to enjoy better game experience when playing health games.
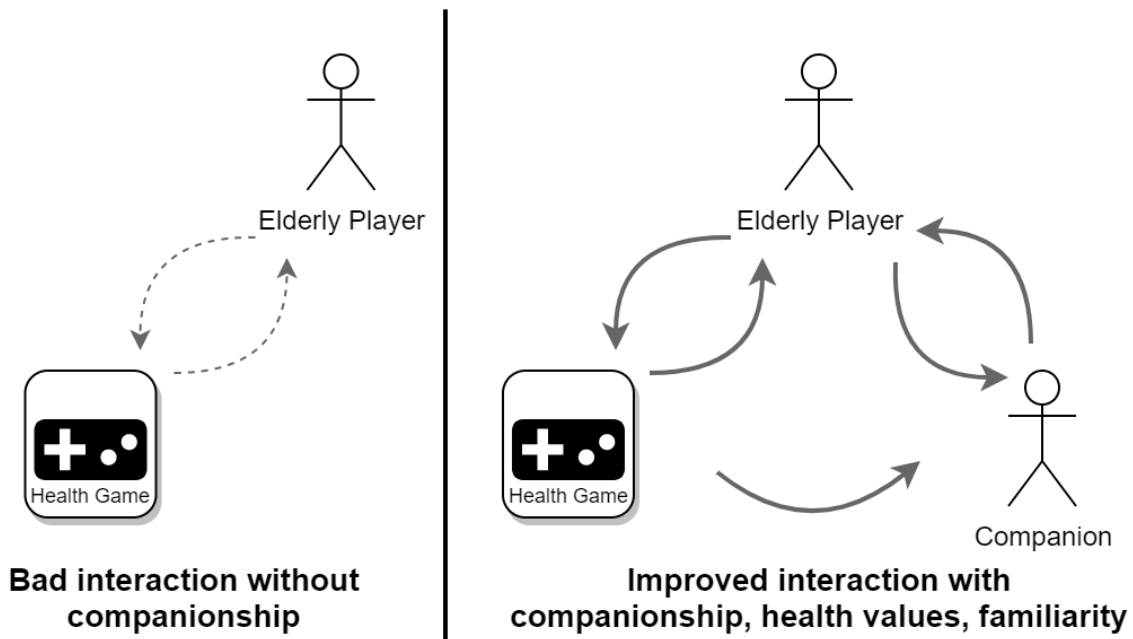

Figure 8. Elderlies enjoy Improved Health Game Interactions with the 3 Presented Elements

In summary, the themes are presented as the interaction between the 3 entities: the player, the game and the companion. Thus, the emergent diagram on the 3-way relationship between the 3 entities represents our holistic view of the EHGE.
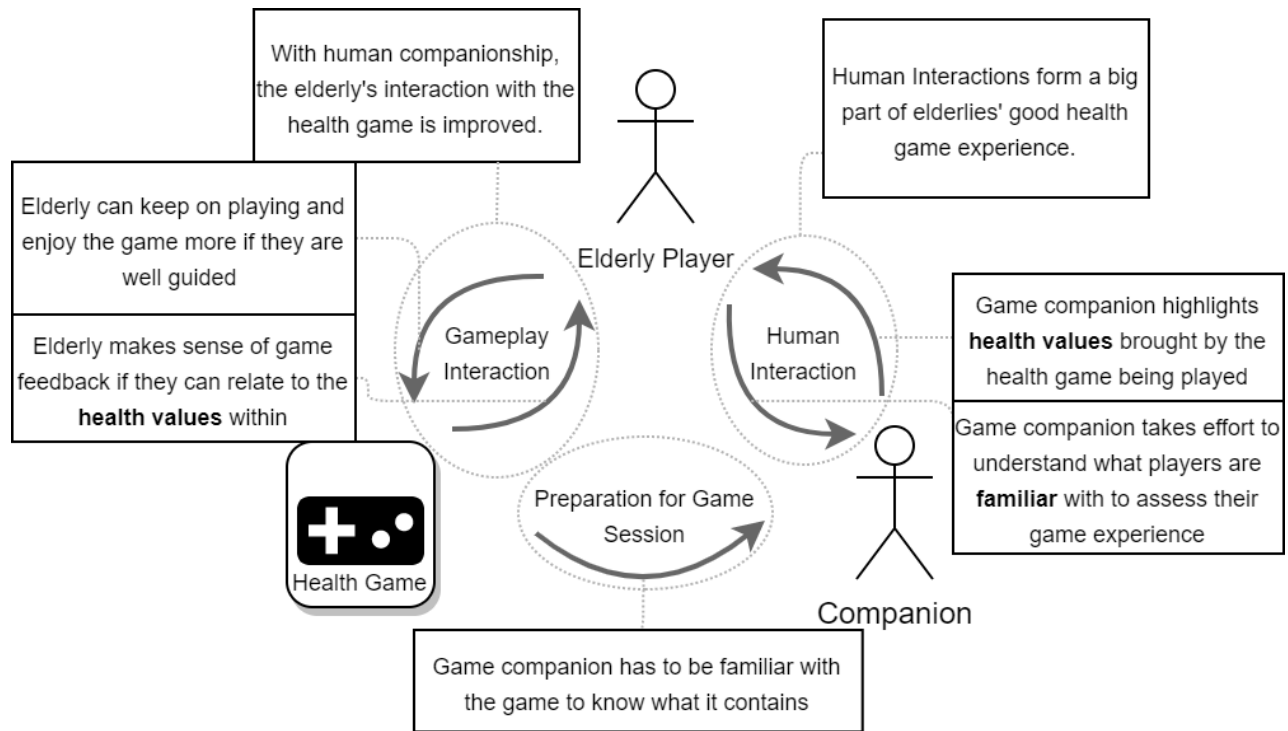

Figure 9. Holistic View of EHGE with Familiarity, Health Values and Human Interactions

III. Conclusion

Learning from commercial games' success, the game experience of elderly when they play health games is believed to be an important motivator for increasing adoption. This paper presents a phenomenological study that uncovers 3 key aspects of the *EHGE*: familiarity, health values and human interactions. These aspects contributed to an overall positive game experience among elderly PD patients recruited for the study.

The 3 elements are then explained as different parts of the 3-way interactions between the elderly player, the health game and the researcher who acts as the game companion to guide the elderly. The interaction model paves the way for new avenues to improve health games that can encourage

adoption among the elderly population, either for general wellness or rehabilitation programs. Further research can be done to validate this interaction model using empirical methods.

Acknowledgements

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