The Gamer Types of Seniors and Gamification Strategies Toward Physical Activity

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Abstract. Gamification strategies were utilized as persuasive designs for promoting physical activities in recent years. However, the "one-size-fits-all" design approach cannot be employed effectively to convince all users to engage in targeted behaviors. Consequently, personalized gamified interactions which require an adaptation of gameful experiences to the user's preferences were applied to drive users more effectively. The aim of this study was to investigate the gamer types among the seniors, and which gamification strategies are affected by the same gamer types, thereby engaging in more physical activities. We conducted an online questionnaire to investigate the gamer types of seniors. Based on the results, seniors can be divided into three categories of gamers: Easygoing, Socializer and Achiever. For the Easygoing, they showed little preference for gamification strategies and were more difficult to drive by specific strategies. The Socializer tends to be driven by socially oriented gamification strategies, but disliked punishment in games. Furthermore, the Achiever preferred to pursue personal achievements rather than interacting with others in games. The findings of this study contribute to HCI Community with the preliminary investigations on the gamer types of seniors, arriving at a better understanding of how persuasive technology can be designed to meet the needs of seniors.

Keywords: Gamification strategy · Senior · Gamer type · Physical activity

1 Introduction

Previous research has revealed that aging is associated with physical and psychological changes, including the decline in cognitive abilities [1, 2], the loss of long-term partners and social support, etc. [3]. These changes in life increase the prevalence of depression and chronic diseases [3, 4]. Nevertheless, many preventive strategies have been demonstrated to help seniors facing life changes. Past research suggested that the types and amounts of physical activities relevant to slow down the aging process, which were also associated with lower risks of cognitive decline [5–7] and chronic diseases such as cardiovascular diseases, diabetes, hypertension, obesity, etc. [8]. In addition, physical activities are factors that help to relax and relieve stress, promote the quality of life and increase sense of happiness [9].

On the other hand, as the advancement of technology and the popularity of mobile devices, there have been many studies on how to use technology to persuade people to engage in more physical activities in recent years. The method of using designed technologies to change attitudes or behaviors of the users are so-called "Persuasive Technology" [10]. Gamification is a persuasive technology that attempts to influence user's behaviors by activating individual motives via game-design elements [11]. However, not all game-design elements can drive users to engage in targeted behaviors. The differences in personality traits, personality, gamer type, and age between users affect their perception and preference, and in turn affect their execution motivation for targeted behaviors [12–15]. Therefore, specific gamification strategies have to be applied for users with different personality traits to persuade them to engage in targeted behaviors. However, past researches made were mostly focusing on the applications of gamification for the young communities, rarely made on the gamer types of seniors, and preferences regarding technologies that motivate them for more targeted behaviors. Thus this paper conducted a questionnaire to investigate the gamer types of seniors and classify those who could be driven via similar gamification strategies into different "gamer types", and investigate the characteristics of each gamer types.

2   Literature Review

2.1   Persuasive Technology and Gamification

Persuasive Technology. Persuasive Technology has been proposed by Fogg [10], which was defined as a technology that was designed to change attitudes or behaviors of the users through persuasion and social influence rather than coercion. Increased popularity of smartphones made technology become vital to our daily life. Smartphones storage various visual information and the data from users' everyday-life scenarios could be collected by connecting with a variety of sensors for analyses [17, 18]. We could conduct experiments and collect data that are closer to reality easily with the assistance of such technologies. Likewise technologies such as internet, wearable devices, environmental sensors, and virtual reality have also become good tools for interacting and persuading people.

Gamification. The concept of Gamification is often adopted in the field of persuasive technology to enhance the motives of the targeted groups, and which in turn achieve behavior changes. Gamification is defined based on two perspectives, (1) the use of game elements in non-gaming system contexts [19]; (2) the use of game thinking and game mechanics to encourage for further activities and problem solving [20]. Some behaviors can bring benefits and have a significant influence to people's health in everyday life, such as healthy diets, physical activities, etc. Nevertheless, people may require amount of efforts and easily get bored for these positive behaviors. Therefore, studies were focused on gamification for persuading people by more enjoyable way to drive low-motivation behaviors.

Core Drives of Gamification. Hamari et al. [21] reviewed 24 studies on gamification and compiled ten "Motivational Affordances" that can drive users to engage in targeted behavior; Sailer et al. classified 7 "Gamification Elements" by reviewing research literature on gamification mechanisms; Orji, Nacke and Di Marco [23] have co-compiled the induction of Fogg [10] and Oinas-Kukkonen et al. [24], attributing into 10 "Persuasive Strategies" that can be applied to the gamification system. Furthermore, Chou [11] indicated his point on gamification in academic works "Actionable Gamification", suggesting "human-oriented design" to provide users with motivation rather than the "functionalities-oriented design" during the gamification design process. Chou deemed it important to investigate how the Gamification Elements drive the users to change their behaviors thus he has concluded 8 "Gamification Core Drives" via gamified theory examples in daily life, and named as "Octalysis":

- **Epic meaning and calling:** This Core Drive is in play when a person believes he or she is doing something meaningful, or has come up with sense of adventure or competency.
- **Development and Accomplishment:** This Core Drive is to make players focus on growth, making efforts for achieving mastery, and obtain the sense of achievement during the process.
- **Empowerment of Creativity & Feedback:** It emphasizes on allowing players to exert their creativity and see the results immediately. Because the creativity of each game is different, the result of the game is different too, so that the users are deeply attracted and not bored.
- **Ownership & Possession:** The players may feel themselves running certain types of things according to their own thoughts, such as a foster type of game, or a collection of virtual currency or virtual items.
- **Social influence and relatedness:** They are originated from people's desires for social contacts. In order to be integrated into social groups, people would comply to the commonly-recognized behaviors to avoid social rejection. This core drive has been applied in games, and the what we can see frequently are cooperation, competition, etc.
- **Scarcity and impatience:** Scarcity is resulted when the demand of something is greater than the supply. The cherished things may make users amazed that they won't hesitate to pay money and time to obtain them.
- **Unpredictability and curiosity:** People are usually curious upon things unpredictable, and this core drive is to drive the players by utilizing curiosity.
- **Loss and avoidance:** This core drive is from the fear of losing some things. The players would regret much if they losing some things in the games after spending all the time and efforts, thus they would prevent such loss from happening.

In spite of the discrepancy for above-mentioned terms of "Motivational Affordance", "Gamification Element", "Persuasive Strategy" or "Core Drives", these concepts have applied gamified elements to strategically drive the targeted gamers' groups, and the definitions are also similar. We consolidated these theories and summarize them into 12 gamification design frameworks as shown in the table below:

Table 1. Gamification design strategies and descriptions

Core drives [11]	Gamification design strategies			Naming and description	
	Persuasive strategy [23]	Motivation [21]	Gamification elements [22]		
Epic meaning and calling	Simulation			Simulation	By means of simulation, let users know the meaning and benefits of engaging in the targeted behaviors
Development and accomplishment		Points, Badges, Levels	Points, Badges	Point/Level/Badge	Driving and motivating users to engage in targeted behaviors by points, badges, and levels
	Self-monitoring and Feedback	Progress	Performance Graphs	Performance Graphs	Providing information about the users' performance compared to their preceding performance during a game.
	Goal-setting and Suggestion	Clear goals, Feedback		Goal-setting	Users set their own goals and provide appropriate advice
Empowerment of creativity and feedback	Customization			Customization	Users create their own ideas in the game
Ownership and possession			Avatars	Avatar	Offering users virtual avatars on behalf of themselves
Social influence and relatedness	Competition	Leaderboard	Leaderboards	Leaderboard	Competing with others, the scores of the competition will be presented in the rankings
	Cooperation		Teammates	Cooperation	Co-working with others to get more rewards in the games
Scarcity and impatience		Reward		Scarce Reward	Using rare and precious rewards to entice users to engage in targeted behaviors
Unpredictability and curiously		Story/Theme	Meaningful stories	Narrative Story	Creating a relevant story and attracting users about the follow-up
		Reward		Unpredictable Reward	Using a variable mechanism to earn the rewards randomly
Loss and avoidance	Punishment			Punishment	Conduct punishment to take away the belongings of gamers

2.2   Gamer Types and Gamification

Most gamification designs were developed as a one-size-fits-all approach which was used to explore whether the gamification strategies can drive targeted groups to engage in targeted behaviors. The concept of this design faces criticism as not considering the idiosyncratic needs of users. Hamari et al. [21] reviewed 24 studies on gamification and found that the application of gamification strategies can indeed provide users with additional motivations. However, part of the gamers showed negative attitudes toward the respective approaches, indicating the "one-size-fits-all" design cannot drive users efficiently and accurately. It was also revealed in the study by Orji et al. [25], which argued that individual differences need to be considered, and specific strategies are required to drive specific groups to engage in targeted behaviors. Orji et al. [25] investigated how persuasive game applications can be personalized by tailoring the

persuasive strategies to various personality types. Therefore, studies on gamification relevant to gamers' motivation in recent year were focused on concerning the motivation of individuals. Ferro et al. [26] proposed the design of gamification elements by investigating possible relations among player types, personality traits, and game elements, suggesting a more practical design for gamification. The study of Orji et al. [16] investigated the perception of individual gamification strategies by different users with a "Healthy Diet Apps". The results revealed that different types of gamers showed significant differences for gamification strategies. For example, gamers of the "player" type are driven by gamification strategies such as competition, cooperation, and rewards. However, gamers of the "disruptors" type are not being driven by gamification strategies such as punishment, goal setting, simulation, and self-monitoring. Furthermore, Jia et al. [15] explored the relationship between the "Big Five" traits and gamified motivation preferences. It was found that different personality traits affect the perception of gamification strategies. This research also indicated that the age growth and emotional stability were negatively correlated with their preferences for all gamification strategy, suggesting that people are less likely to be driven by these gamification strategies along with the growth of the age. She concluded that the emotional stability will get better as aging, thus not easily affected by the sensory stimuli that gamification brings to the gamers. In Taiwan, numerous of seniors play mobile games, such as "Pokémon" and "Star Mahjong ", indicating a large potential market size of the game for senior players. We conducted a better understanding of how persuasive technology can be designed to meet the needs of the seniors in this paper.

3   Method

In this article, we conducted an online questionnaire to investigate the perception of gamification among seniors. Prior researches on gamification were reviewed to have a comprehensive understanding of gamification. This study summarized the core drives of "Octalysis" proposed by Chou [11] and the gamification motivates and strategies proposed by Sailer et al. [22], Orji et al. [23], Jia et al. [15] and conclude into 12 Gamification design strategies (See Table 1). Referring to the method proposed by Jia et al. [15], we demonstrated these gamification strategies with an online video in the online questionnaire to help the participants understand how the gamification strategies works.

3.1   Participants for the Online Questionnaire

The design of gamified applications targeting elderly people aged 55 to 65. Those over the age of 65 were excluded in the research for reasons given below: (1) Aging is a gradual process. It is meaningful for seniors to continue their habits of pursuing physical activities against aging before entering aged population. (2) Older adults over the age of 65 have less experiences with digital technologies. They may not be able to understand the gamification strategies through demonstration videos and use their own mobile phones and computers to complete the questionnaire. Finally 60 valid questionnaires have been collected for analysis in this study.

3.2   Questionnaire Design

The questionnaires were divided into two parts. In the first part, participants were asked to fill in their general information, physical activity habits, and frequency of playing mobile games. The second part was an aim to know how the participants perceive gamification. Participants fill in a five-point Likert scale questionnaire about their perceptions of gamification after viewing the demonstration video (See left picture of Fig. 1). The questions were designed to ask the answerers for their understanding of the gamification, whether the game can bring fun to them and help them to carry out physical activities, whether the game can drive them to engage in more physical activities, and whether the game has used simple rules and interfaces. In addition, the question design for level of understanding was to confirm whether participants fully understand the operation mode of the gamification presented in the film. If the participants who are not able to understand gamification, the collected information will be regarded as an invalid data. Other questions are referenced from the studies by Halko et al. [27] and by Jia et al. [15]. This questionnaire took about 15 or 20 min to complete.

Fig. 1. Online questionnaire design

4   Results

The participant's driving scores for each question were standardized in the beginning of analysis, and the SPSS software was used for cluster analysis. The groupings were based on the driving scores according to their attribute preferences from "fun scores", "driving scores", and "helpful scores". To determine how the participants can be identified into groups, a hierarchical cluster analysis was used to examine the decision tree in the report. According to the structure of the decision tree, a relevant conclusion has been made to divide into three groups. Furthermore, K-Means Cluster Analysis has been implemented to know about the grouping status of each participant.

The results of K-means cluster analysis showed the amount of the three groups were 40, 6, and 14, respectively, but it did not indicate whether there were any significant differences between each group. Therefore, we applied one way analysis of variance (ANOVA) to examine the differences between the three groups. We served the

numbers of groups as the independent variables, and the standardized values of "fun scores", "driving scores", and "helpful scores" as the dependent variables for comparing the differences between the groups. Based on the analysis results, we named the three groups as "Easygoing", "Socializer" and "Achiever", and the details were shown as follows.

4.1   Comparison of Three Groups

Table 2 showed the differences between three groups after ANOVA, and * the mark indicated the significant difference ($p \leq 0.05$). Italic was marked on the items with low driving scores, while bold was marked on the items with high driving scores. It was found that the "Easygoing" exhibited lower driving scores in the items "Point/Level/Badge" and "Performance Graph"; higher driving scores in the items "Unpredictable Reward" and "Punishment". In spite of higher driving scores in the items "Unpredictable Reward" and "Punishment", the driving scores were close to zero, revealing that the "Easygoing" group showed no particularly preference in these 2 gamified items. The seniors in the "Socializer" group preferred the socially oriented gamification strategies, showing higher driving scores in the items "Leaderboard" and "Cooperation", and lower driving scores in the items "Unpredictable Reward". They do not prefer the gamification strategies of Unpredictable Reward that the motivation scores were significantly lower than those of the other two groups. In addition, the Socializers extremely disliked the gamification of "Punishment" with the driving scores all below −2 in all three indicators. On the contrary, those in "Achiever" have shown less preference on the socially-oriented gamification strategies, especially the item "Leaderboard". They preferred a gamification strategy for personal achievement orientation, such as Point/Level/Badge and Performance Graph.

4.2   Comparing the Driving Scores Within a Group

This study investigated the role of gamer type among seniors, and which gamification strategies were affected by the same gamer types, thereby engaging in more physical activities. The driving scores of core drives for each group of 12 gamification strategies were also discussed in this article. Table 3 lists the top three driving scores and the bottom three cores of the core drives in each group.

Seniors in the "Easygoing" group preferred the gamified items "Leaderboard", "Customization", "Narrative Story" and "Unpredictable Reward", showing less preference in the items "Punishment", "Avatar" and "Scarce Reward". All the driving scores of core drives for "Easygoing" group were close to zero, suggesting that there's no specific gamification strategies for driving them in the games. Nevertheless, this conclusion requires further verification.

The top 2 preferences of core drives for the "Socializer" were "Cooperation" and "Leaderboard". Both of the 2 items used social influence to drive gamers to engage in targeted behaviors. In addition, the driving scores in the item "Progress Graph" are similar to "Leaderboard". Those of the "Socializer" disliked and concerned about the "Punishment" mechanism. It should be verified by further experiment whether them would lose their motives as "Punishment" mechanism was applied on them.

Table 2. Differences between three groups after ANOVA

Items	Group 1 (Easygoing)	Group 2 (Socializer)	Group 3 (Achiever)
Point/Level/Badge_Fun Scores	*0.02**	0.46	0.46
Point/Level/Badge_Driving Scores	−0.03	0.17	**0.66***
Point/Level/Badge_Helpful Scores	*−0.03**	0.42	0.49
Performance Graph_Fun Scores	*−0.01**	0.13*	**0.46***
Performance Graph_Driving Scores	*0.05**	0.67	0.58
Performance Graph_Helpful Scores	*0.02**	–	**0.35***
Leaderboard_Fun Scores	0.17*	**0.79***	*−0.69**
Leaderboard_Driving Scores	0.20	0.67	*−0.49**
Leaderboard_Helpful Scores	0.20*	**0.92***	*−0.65**
Cooperation_Fun Scores	−0.11	**1.13***	-0.33
Cooperation_Driving Scores	−0.10	**1.50***	-0.42
Cooperation_Helpful Scores	−0.05	**1.08***	−0.22
Unpredictable Reward_Fun Scores	**−0.01***	−0.87	−0.4
Unpredictable Reward_Driving Scores	**0.07***	*−0.67**	−0.35*
Unpredictable Reward_Helpful Scores	**0.17***	−0.75	−0.29
Punishment_Fun Scores	**−0.21***	*−2.37**	−0.97*
Punishment_Driving Scores	**−0.23***	*−2.34**	−1.06*
Punishment_Helpful Scores	**−0.15***	*−2.08**	−0.94*
Simulation_Helpful Scores	0.02	−0.25	**0.42***
Customization_Fun Scores	*0.14**	–	**0.53***
Total Amount	40	6	14

Table 3. The top three high driving scores and the last three low driving scores of the gamification strategy for each tree group

Rank		Group		
		Easygoing	Socializer	Achiever
Top	1	Leaderboard (0.2) Customization (0.2)	Cooperation (1.5)	Point/Level/Badge (0.66)
	2	Narrative Story (0.12)	Leaderboard (0.67)	Performance Graph (0.58)
	3	Unpredictable Reward (0.07)	Scarce Reward (0.33)	Goal-setting (0.39)
Last	1	Punishment (−0.23)	Punishment (−2.34)	Punishment (−1.06)
	2	Avatar (−0.18)	Unpredictable Reward (−0.67)	Leaderboard (−0.49)
	3	Scarce Reward (−0.13)	Goal-setting (−0.37)	Cooperation (−0.42)

As for those of the "Achiever", they preferred the core drives of "Point/Level/Badge", "Progress Graph" and "Goal-setting" which attributed to personal-achievement-oriented items in the gamification strategies. They like single-player games and got a sense of achievements from them, but showed no preference on cooperating and competing with others in games.

Furthermore, the lowest driving scores showed in the three groups were "Punishment". It was suggested that "Punishment" was a core drive with "Black Hat Gamification Design" defined by Chou [11]. This type of gamification design make gamers feel urgent, stressful or uncomfortable that gamers tend to engage in targeted behaviors to eliminate such negative feelings. However, the cost of engaging in physical activities may be greater than the incentives provided by the games, causing the gamers to give up physical activities directly as they get punished in the games.

5   Discussion

Previous studies indicated that there are different preferences of gamification strategies between different gamer types. Thus specific gamification strategies are required to effectively drive the specific gamer groups [15, 23]. In this study, it is found that different gamer groups showed different preferences in the gamification strategies too. Based on the analysis of the questionnaire, we divided the gamer types of the seniors into three categories. The characteristics of three types of gamer were discussed as follows:

Easygoing. The "Easygoing" type of gamers predominate the overall samples, with 40 out of 60 ones belonging to this type. All the driving scores of the core drives for "Easygoing" group were close to zero, the highest driving scores were shown on the "Driving Score" and "Helpful Score" of the "Leaderboard", but just 0.2, suggesting that there's no specific preference of gamification strategies for driving them into the games. Compared to the other 2 groups of gamers, the "Easygoing" exhibited less preference for the two gamification items of "Point/Level/Badge" and "Performance Graph". In addition, the gamers in the "Easygoing" group showed less aversion for the item "Punishment" than the "Socializer" and "Achiever" even though the driving scores have shown negative values. Most of the gamification strategies can be applied for the "Easygoing" type gamers, and so can the "Black Hat" Types games.

Socializer. The "Socializer" type of gamers have accounted for the least percentage, with only 6 persons in our samples that we guess it could be attributing to the cultural difference. For the seniors in the "Socializer" group, their preferences of gamification strategy were focused on two items related to social impact: Leaderboard and Cooperation. Compared to other 2 groups, the "Socializer" scores significantly higher on the items "Leaderboard" & "Cooperation" than other groups. Furthermore, the "Socializer" gamers cannot be driven by the core drives of "Punishment" and "Unpredictable Reward". The best way to drive the "Socializer" gamer is using socially-oriented gamification strategies and avoid the "Punishment" and "Unpredictable" mechanisms.

Achiever. The "Achiever" gamers preferred achievement-oriented gamification strategies, such as "Point/Level/Badge" and "Performance Graph", which got higher "fun scores" of "Performance Graph" than the other 2 groups. To the Contrary with the "Socializer" gamers, the "Achiever" gamers showed no preference for socially-oriented gamification strategies, especially for the item of "Leaderboard". Their driving scores for "Leaderboard" were much lower than that of "Cooperation", indicating that "Achiever" gamers tend to pursue the self-breakthrough pleasure in the games, and showed no preference for having social intervention or competing with others. For the gamer type of "Achiever", the design of the games should focus on the characteristics of self-breakthrough and self-growth, and avoid the use of socially-oriented gamification strategies. The "Cooperation" way of design should be applied in case social-oriented of strategy was a must.

6   Conclusion

In this research, prior studies of gamification were collected and summarized into 12 strategies for promoting physical activities. We conducted an online questionnaire to investigate the gamer types of seniors aged 50–65 by applying these 12 gamification strategies. Based on the scores of the questionnaire items, seniors can be grouped into three categories of gamers in accordance to their preferences eventually: "Easygoing", "Socializer" and "Achiever". Seniors in the "Easygoing" group showed no particular preference for the gamified items, and they did not dislike black-hat gamification design of the item "Punishment" much either. The "Socializer" gamers interested in the socially-oriented gamification items, and extremely disgusted with the "Punishment" mechanism. As to the"Achiever" gamers, they preferred personal-achievement-oriented gamification strategies, but could not be driven by socially-oriented items for physical activities.

In conclusion, past researches have been studied mostly on the applications of gamification for the young communities. Since more and more seniors have experiences in using digital technologies thus it does worth it to persuade seniors with such technologies. The findings of the study contribute to HCI Community with the preliminary investigation on the gamer types of seniors, and future research should be further focused on practical experiments to verify the conclusions of the self-reports.

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