Selecting Effective Strategies for Tailoring Persuasive Health Games to Gamer Types

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ABSTRACT
Persuasive games can be effective tools for motivating healthy behaviors and/or attitudes, and so recent years have witnessed an increasing number of persuasive games. However, most games adopt a one-size-fits-all approach to persuasion in their design. Studies on gameplay and player motivation have shown that treating gamers as a monolithic group is a bad design approach because a motivational approach that works for one individual may actually demotivate the desired behavior in others. To correct this problem, we conducted a large-scale study on 1108 gamers, which examined the persuasiveness of ten Persuasive Technology (PT) strategies, and the receptiveness of seven gamer types identified by BrianHex to the strategies most commonly used in PT design. We developed models showing the receptiveness of the gamer types to the ten strategies and created persuasive profiles, which are lists of strategies that can be employed to motivate behavior for each gamer type. Although we studied and created our models using ten strategies, in this paper, we report results of five strategies.

Keywords
Persuasive game; gamer types; persuasive strategies; health; model, personalization; tailoring, healthy eating, BrainHex.

1. INTRODUCTION
Games have attracted attention as a novel approach for promoting healthy behavior change because of their motivational pull. Persuasive games are interventions with the primary purpose of changing a user's behavior or attitude [8] using various PT strategies. In the last decade, several persuasive games aimed at modifying users' behaviors in various domains, including physical activity and healthy eating, have been developed [4,19]. Among all these domains, games for promoting healthy eating behavior have attracted special attention [11,17,18,19]. Unhealthy eating behavior is a major factor contributing to the onset of several diseases and health conditions (e.g., obesity). Therefore, in this paper, we use healthy eating as a case study for investigating the persuasiveness of various strategies to motivate healthy behavior.

Despite this growing interest in game-based interventions for behavior change, current persuasive games suffer a major limitation: they generally take a one-size-fits-all approach, rather than tailoring their contents and strategies to individual users or user groups. Several researchers have pointed to the limitations and risks of the *one-size-fits-all* approach to persuasive intervention design, especially when aimed at motivating health behavior. For example, Kaptein et al. [12], in their comparative study of the effect of tailored and contra-tailored strategies discovered that the contra-tailored strategies (inappropriate strategies) led to strong adverse reactions that tended to increase the adoption of the unhealthy behavior that the intervention had intended to decrease. Thus, they concluded that the most important use of tailoring is to prevent the use of badly chosen influence strategies which can be counterproductive or backfire [12]. Similarly, Orji et al. [17] contradicted the one-size-fits-all approach for the theoretical determinants of health, suggesting individual differences depending on gamer type.

In this work, we develop models showing the persuasiveness of ten commonly used strategies, and propose design guidelines – based on our models – for tailoring PT interventions to various gamer personalities commonly referred to as gamer type. Our design guidelines are based on a quantitative study of 1108 gamers, where we studied the persuasiveness of the PT strategies (*simulation, reward, comparison, competition, cooperation, praise, customization, self-monitoring,suggestion,*and *simulation*) identified by Oinas-Kukkonen [16] and Fogg [8] on gamers of seven types (*achiever, conqueror, daredevil, mastermind, seeker, socializer, and survivor*) identified by the BrainHex model [2]. Our models reveal several differences and some similarities in the persuasiveness of various PT strategies with respect to their influence on the gamer types. Based on the results of our models, we highlight the best and the worst strategies for designing persuasive games that target each gamer type. Although we modelled using ten strategies, in this paper, we report results from five strategies due to space limitation.

2. RESEARCH BACKGROUND
In this section, we present a brief review of PT strategies. This is followed by an overview of game-based interventions for health and PT strategies employed. We conclude by presenting an overview of the BrainHex gamer type model.

2.1 Persuasive Strategies
Persuasive strategies are techniques that can be employed in PT to motivate behavior and/or attitude change. Over 20 years of research, a number of persuasive strategies have been developed (for a comprehensive review see [16]). Some of these strategies are commonly employed in the design of persuasive games.

In this section, we summarize the five strategies (from Fogg [8] and Oinas-Kukkonen [16]) reported in this paper. *Simulation* provides the means for a user to observe the cause-and-effect linkage of their behavior. It provides users with an opportunity to observe and experience the world (or some aspect of it) in a simulated environment. *Reward* offers virtual rewards to users for performing the target behavior. *Competition* allows the user to compete with others. *Comparison* provides means for the user to view and compare his/her performance with the performance of other user(s). *Cooperation* requires users to cooperate (work together) to achieve a shared objective and rewards them for achieving their goals collectively.

2.2 Game-based Interventions for Health

Over the years, several persuasive game for health have been developed. For example, *National Mindless Eating Challenge* (NMEC) is a mobile phone-based health game employing *reward* and *comparison* to promote healthy eating behavior [11]. NMEC players are tasked with caring for a virtual pet. Players receive *reward*s based on their ability to accomplish the tasks that were assigned to them at the beginning of the game. They can also compare their performances with the performances of others – *comparison*. Similarly, *LunchTime* is a slow-casual game for motivating healthy eating [18]. *LunchTime* employs *reward, competition,* and *comparison* strategies. Players play the role of a restaurant visitor, and the goal is to choose the healthiest option from a list of food choices. Players are awarded points – *reward* – and each player is allowed to view and compare their points with that of other players – *competition* and *comparison*. Finally, *RightWay Café* is a role playing game that employs *competition* and *simulation*, to promote healthy eating and physical activity [19]. Players are tasked with the role of managing the avatar's daily calorie consumption and physical activity to enable it to reach optimal weight. The player who best managed the avatar`s daily diet in a healthy way wins the game – *competition.* At the end of each week the game simulates the weight change based on the foods the player chooses – *simulation.*

2.3 Gamer Types

One way that players differ is in their preferred play styles. By tailoring games to a player's preferred style, games can be made relevant to the player and interesting to repeat. Research shows that gamer type moderates the influence of health determinants and hence, is an important characteristic for tailoring persuasive games [17]. The BrainHex model identifies 7 player types

Achievers are goal-oriented and motivated by the reward of achieving long-term goals [15]. Therefore, an achiever often gets satisfaction from completing tasks and collecting things (e.g., points). *Conquerors* are challenge-oriented. They enjoy struggling against impossibly difficult foes before eventually achieving victory and beating other players [21]. *Daredevils* are excited by the thrill of taking risks and enjoy playing on the edge. They enjoy rushing around at high speeds while still in control. *Masterminds* enjoy solving puzzles, devising strategies to overcome puzzles that defy several solutions, and making efficient decisions. *Seekers* enjoy exploring things and discovering new situations. They are curious, have sustained interest, and love sense-simulating activities. *Socializers* enjoy interacting with others. For instance, they like talking, helping, and hanging around with people they trust. *Survivors* love the experience associated with terrifying scenes and enjoy the excitement of escaping from terrifying situations. We adopt BrainHex model in this paper because although it is relatively a new model, it is based less on intuition, and more on neurobiological foundations; in addition, it has been validated with large numbers of participants and found to be reliable [15].

3. STUDY DESIGN AND METHODS

To collect data for our model, we followed the approach described by Halko and Kientz [10]. Specifically, we represented each persuasive strategy in a storyboard about a persuasive game for motivating healthy eating. The ten storyboards were drawn by an artist and were based on storyboard design guidelines by Truong et al. [20]. The storyboards show a character and his/her interactions with a persuasive application for promoting healthy eating. Figure 1 shows an example of one of the storyboards illustrating the competition strategy. To elicit feedback on the persuasiveness of the strategies, each storyboard was followed by a validated scale for measuring perceived persuasiveness, adapted from Drozd et al. [7]. The questions were measured using participant agreement with a 7-point Likert scale ranging from "1 = Strongly disagree" to "7 = Strongly agree". Prior to assessing the persuasiveness of the various strategies, we ensured that the participants understood the strategy depicted in each storyboard by asking them two comprehension questions – first, to identify the illustrated strategy from a list of ten different strategies; and second, to describe what is happening in the storyboard in their own words. To eliminate possible bias due to the ordering of the storyboards in the survey, we used latin square. Specifically, we created ten surveys that varied the position of the strategy and randomly assigned participants to one of the ten surveys.

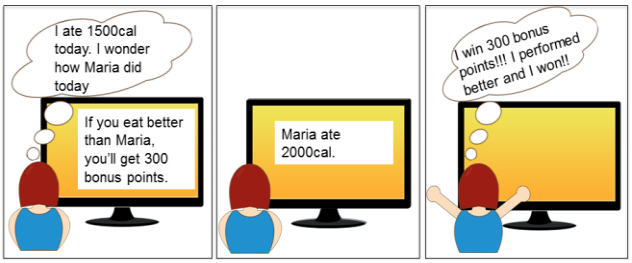

Figure 1 : Storyboard illustrating competition strategy

We recruited participants for this study using Amazon's Mechanical Turk (AMT). AMT has become an accepted method of gathering users' responses [14]. It allows access to a global audience at a relatively low cost, and ensures efficient survey distribution, and high quality results [5,14].

A total of 1384 participants responded to our study. A total of 1108 valid responses were retained and included in the analysis. The eligibility criteria were that participants were game players – to ensure accurate classification and mapping to the gamer types – and at least 18 years old at the time of data collection. This is in compliance with the study ethics approval and to ensure that the participants were of legal age to make decisions independently (including decisions on what to eat). The demographic information of the participants is summarized in Table 1.

Table 1: Participants' demographic information

Total Participants = 1108	
Gender	Females (533, 48%), Males (575, 52%)
Age	18-25 (418, 38%), 26-35 (406, 37%), 36-45 (168, 15%), Over 45 (116, 10%).
Gamer Types	Achiever (176, 16%), Conqueror (131, 12%), Daredevil (114, 10%), Mastermind (331, 30%), Seeker (153, 14%), Socializer (101, 9%), Survivor (102, 9%).

4. DATA ANALYSIS

To analyze our data, we used several well-known analytical tools and procedures. To ensure that participants understood the intended persuasive strategy in each of the storyboards, we ran chi-squared tests on the participants' responses to the multiple-choice questions that required them to identify the represented persuasive strategy for each of the storyboards. The results for all the strategies were significant at $p<.001$. We determined the consistency of the scale using Cronbach's alpha (α). The α for all the strategies were all greater than 0.70 showing that the scales have good internal consistency. To determine the appropriate

number of factors in our data, we performed Exploratory Factor Analysis (EFA) which shows that competition and comparison loaded into one factor (reducing our reported factors from five to four). We then employed Partial Least Square (PLS) Structural Equation Modeling (SEM) to develop seven models showing the persuasiveness of the PT strategies for various gamer types. We employed the multi-group comparison approach in PLS-SEM to compare our model (for possible differences between the gamer types with respect to their perception of the strategies) and test for significant differences in effect size across the gamer types.

5. RESULTS

The structural models determine the perception of various strategies by modeling the relationship between the gamer types and the strategies. An important criterion to measure the strength of the relationship between variables in structural models is to calculate the level of the path coefficient (β) and the significance of the path coefficient (p) [9]. Path coefficients measure the influence of a variable on another. The individual path coefficients (β) and their corresponding level of significance (p) obtained from our models are summarized in Table 2.

Table 2: Standardized path coefficients (β). All displayed coefficients are significant at $p<.05$. whereas '-' represents non-significant coefficients. The negative coefficients are highlighted.

Strategies	COMP	COOP	SIML	REW
Achiever	-	.15	-	.10
Conqueror	.25	-	.14	-
Daredevil	-.10	-	.11	-
Mastermind	.12	-	.12	-
Seeker	.10	-	-	-
Socializer	.11	.17	-	-
Survivor	.17	-.20	-	-.14
COMP = competition&comparison, COOP = cooperation, SIML = simulation, REW = reward				

6. DISCUSSION

The results from our models show that the seven gamer types – achiever, conqueror, daredevil, mastermind, seeker, socializer, and survivor – differ with regards to the persuasiveness of the strategies, see Table 2. In this section, we discuss and compare the perceptions of strategies by the gamer types.

6.1 Competition and Comparison

Competition&comparison (Comp) are among commonly used strategies in persuasive games design specifically (for e.g., see [18]). This is based on the assumption that humans are competitive beings and have the natural drive to compete. In line with this assumption, the results from our models show that Comp is perceived positively by all gamer types except achiever and daredevil. As shown in Table 2, conqueror, mastermind, seeker, socializer, and survivor are significantly positively associated with Comp.

Comp showed no significant relationship with the achiever gamer type, while daredevil is the only type that perceives Comp as negative (β=-.10). The explanation to these results can be found in the characteristics of the gamer types. An achiever who is obsessed with completing a game may not be motivated to compete and compare with other players because it may interfere with her progress. Similarly, a daredevil is inclined to thrill seeking, while at the same time maintaining control. Comp has the tendency of confining people to their comfort zones and avoiding exploration and thrill seeking. This explains why daredevils perceive Comp as negative and might try to avoid any game based on this strategy – once competition is introduced, people tend to avoid trying new things for fear of losing. The result is in line with previous research that found that users were uncomfortable with using competition to motivate behavior in a health application, and may even become demotivated if they lose [3]. The tendency of Comp to demotivate behavior for some people is nicely summarized by Kohn [13]: "to say that an activity is structurally competitive is to say that it is characterized by what I will call mutually exclusive goal attainment. This means, very simply, that my success requires your failure."

6.2 Cooperation

Cooperation is different from competition&comparison because achievement depends on group effort. The major assumption is that group members will encourage each other to perform better for mutual benefits like recognition and winning, which in turn leads to target behavior performance. The results from our study show however, that cooperation is only a significant motivator of behavior change for achievers and socializers. This is in line with the gaming style of socializers, who enjoy helping others. Achievers would also prefer to cooperate because they are inherently more altruistic. According to Bartle [1] "achievers do often co-operate with one another, usually to perform some difficult collective goal." These results are also in line with previous research that found that playing in teams increased members' motivation and behaviour performance as members shared vital information on how to reach their goals [3]**.** On the contrary, introducing cooperation demotivates survivors**.** This could be explained by the fact that in cooperative games, rewards are often based on collective performance – a player can succeed only if the others also succeed. As a result, survivors – who enjoy the thrill of escaping from scary situations – may be frustrated if they get pulled down after putting effort into the activity. This explains why survivors are not inclined to cooperation, which assumes that we primarily want to help or need help from others [13].

6.3 Simulation

According to Fogg [8] an application can persuade people to change their attitude or behavior if it provides a way for people to observe the immediate cause and effect linkage of their behaviors. Simulation is not among the frequently employed strategies in intervention design for health promotion; however, in our models, simulation emerged as one of the strategies that is not negatively associated with any gamer type, thus was included. Specifically, simulation shows some significant positive relationship with the conquerors, daredevils, and masterminds. This suggests that a persuasive game that is designed to show users the consequences of their behaviors could motivate them to change. This is particularly necessary for PT interventions aimed at motivating healthy behavior. Adopting healthy behavior is a lifestyle that requires effort over a lifetime and likely does not have immediately visible consequences. People tend to be demotivated from adopting a healthy behavior that has no observable immediate benefit or consequences. Simulating behavior can close this gap as it allows users to visualize and compare outcomes of alternative behaviors over a period of time. This suggests the need for applications designed to motivate health behavior to find ways of projecting and making observable the benefits and

consequences of a user's behaviour, thus reducing the abstraction that is often associated with the outcome of health behaviors.

6.4 Reward

Reward is one of the commonly used strategies in applications that motivate health behaviour (for example see, [3,11,18]). However, from our model reward emerged as the least significant of the eight strategies. Reward is positively associated with only achievers. This is in line with the playing style of achievers. Achievers are interested in completing tasks and collecting all possible rewards (e.g., points). On the other hand, introducing rewards could deter survivors who perceive rewards as negative (β=-.14). This is not surprising considering that reward has been a controversial strategy because of its focus on extrinsic motivation. It has been argued that using reward as an incentive to change behavior has the potential of redirecting the intention of a particular activity [6]. This suggests that rewarding may change the way people perceive the targeted behavior and the benefit they attribute to it. Therefore, persuasive game designers should apply caution when employing any form of reward to motivate healthy behavior. Our findings emphasize the need to tailor the rewards based on the user's susceptibility to and perception of reward.

6.5 Summary of Results

Our models revealed some differences in receptivity to various PT strategies between the seven gamer types. Based on our results, we present the best strategies to influence health behavior change and the worst strategies to avoid when designing for each gamer type in Table 3. These results suggest the need for persuasive game designers to take special care not only in deciding on the strategies to employ to motivate behavior performance for each gamer type, but also in deciding on the strategies to avoid in order not to deter users from performing the target behavior. The results from our model can serve as a guide for persuasive game designers to decide on the appropriate strategy to employ for each gamer type.

Table 3: Best and worst strategies to achieve high persuasive effect for each gamer type. Strategies presented in descending order of persuasive strength (underlined is highest)

Gamer Type	Best Strategy	Worst Strategy
Achiever	Cooperation, Reward	
Conqueror	Comp, Simulation	
Daredevil	Simulation	Comp
Mastermind	Comp, Simulation	
Seeker	Comp	
Socializer	Cooperation, Comp	
Survivor	Comp	Cooperation, Reward

7. LIMITATIONS AND FUTURE WORKS

There are some limitations and opportunities for future work.

Our work has benefited from the large-scale study of persuasiveness of the PT strategies with respect to eating behavior and we can claim applicability in other health behavior domains (due to the high level nature of the storyboard depicting the strategies). However, our model should be applied with caution to other health behavior domains (for example, encouraging physical activity). Future work should therefore, examine the applicability of our model in other health domain. Again, our study reports the persuasiveness of various PT strategies, however, the actual persuasiveness of the strategies may differ when implemented in a specific game. Therefore, future research will focus on examining the persuasiveness of the recommended strategies by applying our findings in persuasive game design and evaluating it.

We have taken a first step toward personalizing persuasive games for maximum efficacy or something.

8. CONCLUSION

Our work is the first attempt towards providing guidelines for tailoring strategies in persuasive game design using the players' personalities as described by gamer types. Through our study, we exposed the limitations of the current one-size-fits-all approaches to persuasive game design and provide guidelines for tailoring persuasive games to gamer type based on a large-scale study.

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