Adv Health Behav, 2019, 2(2): 90-95
DOI: 10.25082/AHB.2019.02.004

RESEARCH ARTICLE

Financially-rich game: A stress reliever that behaves intelligently based on the performance and health condition of player

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Abstract: Health is affected by the financial, environmental and work conditions. In this paper, we have proposed an algorithm to be used in a game so that it could behave intelligently for stress relieving and health care rather than in a traditional leisure. Our study explores the efficacy of intelligent games to keep the interest of a user in computer usage that helps in the reduction of stress. The games keep track of a user's actions and decide intelligently which best next level should be provoked to the user for keeping his/her interest in the game. In several experiments it has been observed that after playing stress relief game, users become less distracted by rejection, help releasing their stress and anxiety.

Keywords: computer, mobile, game, environment, finance, health, algorithm

1 Introduction

Every human being depends upon own and companies financial conditions, and more or less becomes a victim of stress at any stage of his/her life. Millions of people consult doctors to help in curing stress-related issues whereas others try to participate in social gatherings to get them cured. Stress and anxiety lead to traumatic effects and is exposed substantially in low and middle-income countries[1]. Various researches of stress found that different games help people release stress. Computer games also achieved importance helping in the reduction of stress in users. According to a study in 2007, a stress relief game reduced cortical (stress hormone) levels by 17 percent in people who played the game five minutes a day[2].

Electronic games like Computer, Mobile or Video Games which became popular among teens during 1980s had not only been a source of entertainment but acted as a stress reliever of various factors like over work, depression or anxiety[3]. While designing any program, social needs are needed to be assessed[4]. American Psychological Survey conducted in 2009, concluded that the main causes of stress are a workplace, family relationship matters and social responsibilities especially in the family[5]. Stress can be released by sharing emotions with someone or diverting the thoughts to some relaxing modes like games.

The intelligence in the game is being used by researchers as the realistic/intelligent behavior of game characters. Previous studies show that computer games can provide an active, motivational way for depressed people to access the situation and decide accordingly in a positive way[6]. Game development is becoming more and more challenging because of current exponential growth in software development industries.

Hence, we have proposed a framework of the intelligent game to soothe down the stress conditions of a person based on his/her psychological and mental conditions. The proposed algorithm intelligently determines the difficulty level (Intelligence Level Determination) on getting two inputs, one through Psychological Stress Calculator, and other through the performance of the user on the game.

The game will be functioned on following dynamics to behave intelligently:

1. Adjust the difficulty level to be presented next to the user.
2. Record users capability to play/control the moves.
3. Adjust the game's prototype according to the user's

Received: August 27, 2019; **Accepted:** October 20, 2019; **Published:** October 30, 2019

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Citation: Ahmed IH, Khan KN, Jonathan T, *et al*. Financially-rich game: A stress reliever that behaves intelligently based on the performance and health condition of player. *Adv Health Behav*, 2019, **2**(2): 90-95.

mental stress or condition.

The stress relief game can be played on different platforms like single user, multi-users, over the internet and on hand held devices. The game will help the user in relieving stress/depression to some extent.

2 Related work

Game intelligence has been introduced in games using AI techniques. Intelligence can be defined in several ways depending upon the game.

The individual sport games like car racing *etc.*, where the environmental factors are considered, the game near to nature has been considered as intelligent *i.e.* behavior of the car according to the environment, *e.g.* on a bumpy or slippery road, is it functioning like a car in reality, what is the effect of cold, snow, clean, hot weather *etc.*; and what happens in case of accidents. How this car being affected by other cars passing near it. How the noise of other objects affects this one. If all these factors are considered while developing the game and the effects are as similar as in real life, then the game is considered to be an intelligent game.

Similarly in strategy games like a case of a fighting video game, if a bullet hits a person on arm or leg, he should not be considered as dead, but behave in a natural way, either he should continue to fight or try to escape from the scene[7]. Effects of a blast near a person should be as like as natural. The behavior of enemies, like their movements, sounds, words should make the game character behaving accordingly in a natural manner. In the aspect of corporate social responsibility, the direction is becoming cultural for social network games[8].

Social Network Games (SNG) are game applications made available through Social Networking Websites (SNSs), where users play the game with members of their social network, as articulated on the website[9]. These games often take advantage of the social features of SNSs, including access to a list of people interested in the same kind of games. SNGs are a type of networked game. Although computer games were traditionally considered a solitary medium that instigates unsocial behavior, networked games help form a new venture of social phenomenon. Social network games (SNGs) differ from traditional networked games because one could be able to play the game with the people having the same interests.

A limitation of common games is that players quickly learn the position and behavior of characters[10]. Software developers program these characteristics in such a way that after playing the game for a couple of times, the user learns exactly how the character will act in a specific situation. The game eventually bores, because the player needs only to execute a learned script to defeat the character and overcome all the hurdles he faces.

This pattern has sparked increasing interest in the usage of computational intelligence techniques to control the actions of computer characters, rather than relying on simple heuristics or rule-based systems. In particular computations, neural networks are being adopted to let software characters learn from their own experience and to predict what a player might do next by taking appropriate actions to meet their own challenges. In this way the game can remain continually novel, posing new tests for the player each time he plays[11].

Human interaction with robots and computers is important aspect of devising the algorithms[12]. Online games over the internet should behave like the human on the other side of the computer. The actual user should not judge either he is playing with a computer or a human. A chit chat could be in place with the game[13].

3 Proposed Work

3.1 The Stress Relief Intelligent Game:

The Game recognizes a player/user uniqueness through his/her profiles, that were being made during setup of the game. It will periodically update the performance of a user while he/she plays the game. The purpose to introduce the intelligent behavior was to keep the interest of the player in the game, not to let him bored quickly, like in ordinary games. In simple/ordinary games, the player either decides him/herself for the next level he/she wants to play or has been provided at a predefined level by the game controller itself. The player learns the strategy of the game by playing a couple of times and spends no time in winning the game levels. This leads towards the loss of interest in the game and user usually quits early. Also if a player could no succeed in winning a specific level, the game controller provides again and again at the same level and expects the user to clear it before playing any other level. This also results in loosing the interest in the game.

In our framework, an intelligent component of the game decides which best level to be presented to the user that makes it different from ordinary simple games. The decision of best next level to be presented will be based on the previous performance and psychological stress condition. Intelligence, flexibility and dynamic behavior will not only improve the interest of players but also keep their nerves soothe.

3.2 Design / Architecture of the game

Our framework will consist of five major components to constitute an Intelligent game to reduce the stress.

These five modules include:

1. Game Prototype
2. Stress Level Calculator
3. User Profile
4. Global Profile
5. Game Level Decision

In this paper, we discuss four of these five modules that will make the game unique and different from simple ordinary games. The designed framework has been tested on a simple game "Bubble Breaker" whose source code was available on the internet for free usage.

3.2.1 Tools and Techniques

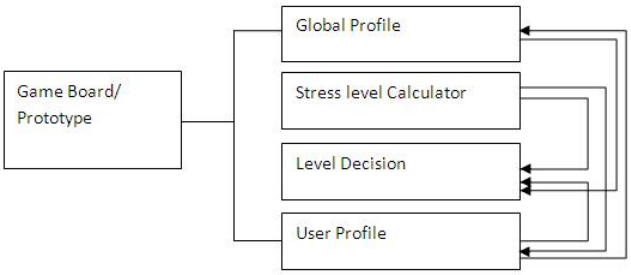

Figure 1. Design of five major components

3.2.2 Stress level

The stress level of the user will be measured with some predefined techniques using Blood Pressure, Anxiety Level, and Psychological Conditions before starting the game and will be tracked continuously during the game. Stress level will be stored in Users profile for future references. Stress calculation is not within the scope of this paper and will be covered in our next contribution.

If the user is new and playing for the first time, the first level that to be presented to the user will be based on his stress level (most probably first level) and if the user in not new and playing the game again then the level presented will be based on current stress condition and the last level user has played.

3.2.3 User Profile

Above information will be used in determining the design of Game prototype when the user starts the game initially and at the time of the decision of the next level.

3.2.4 Global Profile

The global profile contains all the information already described in User Profile in addition to two more values i.e.

1. Winning Score: Average score, to be calculated using all the scores users have achieved so far.

2. Winning Time: Average winning time for a particular level.

The database will contain the aggregates, the overall game statistics. This helps in showing the trends of the players, the level of difficulty of games, and also in determining the forecast either a user with his proficiency will win a particular level in the first attempt or not. It also helps us in determining the user's interest in a particular level.

Table 1. User profile database contains information about a particular user in following sections

Sr. No	Section	Value
1	Game Info	**i.** Stress Level **ii.** Level Played
2	Performance (Level Wins)	Number of times a user has won a particular level. *e.g.* Win (L1) = 3 Win (L2) = 8 Win (L3) = 6 Win (Ln) = 4
2	Performance (Winning Probability)	Probability with which a user has won a particular level. *e.g.* P(W) L1 = 0.5 P(W) L2 = 0.4 P(W) L3 = 0.8 P(W) Ln = 0.3
3	Level Played	Number of times a user has played a particular level. *e.g.* Played L1 = 5 Played L2 = 3 Played L3 = 11 Played Ln = 8
4	Performance (Winning Probability with respect to Time)	Probability with which a user has won a particular level within specified time. *e.g.* Ptime(W)L1 = 0.5 Ptime(W)L2 = 0.6 Ptime(W)L3 = 0.8 Ptime(W)Ln = 0.3

3.2.5 Game Level Decision

To decide which level a user should play at the start of the game will be made on the stress conditions of a player if he/she is a new user and playing for the first time. The decision is a bit easy and if the stress level is high an easier level will be presented to the player. On the other hand, if the user is not new and playing the game again the decision will be made on stress condition and previous performance.

Again the decision about which level a user will play is on finishing a particular level and wants to start a new level.

Proposed algorithm for the decision of next level will be based on two factors.

1. Performance (Either a user wins a particular level or not – i.e. user achieved the score above the threshold set by the game itself).

2. Time (Either a user finishes a level in a specified time or not).

With reference to a player, two scenarios will be dis-

cussed for the decision of the next level to be presented to the player:

Scenario 1: If the user wins a particular level then what is the probability that the user will win the next level.

Scenario 2: If the user loses a particular level then what is the probability that the user can win the same level if he/she plays again.

Based on these we proposed the following algorithm in terms of time-barred and without time-barred.

4 Proposed algorithm

4.1 Scenario 1

Inputs:

1. Probability to win the games (levels) of a particular user.

2. The probability of Next Level Win. i.e. Probability already calculated and stored in the Global Profile database.

Output:

The probability of winning next level by this user.

If the probability of winning the next level is greater than 0.8 (the threshold in our case), the player is considered to be an expert and with his/her skills he would easily win the next level. In this case, it is assumed that a player will lose its interest in the game if presented the immediate next level, so instead of presenting him the next level, the same algorithm will be repeated for the next to next level. This time probability of win lies between 0.5 and 0.8. It shows that there are chances that the user can lose the game if he/she does not play with concentration; this is the most suitable level to be presented to the user. It will keep the user's interest in the game.

4.2 Scenario 2

The same algorithm described in the above section will be repeated but now instead of calculating the "Probability of Win for Next Level", the probability of win will be calculated for the same level. If the probability comes above the threshold the user will be presented with the same level again, otherwise, the same algorithm will be repeated with one level lower than the present one.

4.3 Use of Bayesian theorem

Bayesian theorem[11] has been used here to calculate the probability and has been described with the following example.

Inputs: 1. P(Winning Next level) = P(A)

2. P(Winning Current Level) = P(B)

3. P(Winning Previous Level) = P(C)

Output:

Theorem used is:

P(Winning Next Level) = $(P(A)\times P(B)\times P(C))\big/ (P(A)\times P(B)\times P(C)) + ((1-P(A))\times(1-P(B))\times(1-P(C)))$

It provides the probability of winning the next level.

4.4 Software process

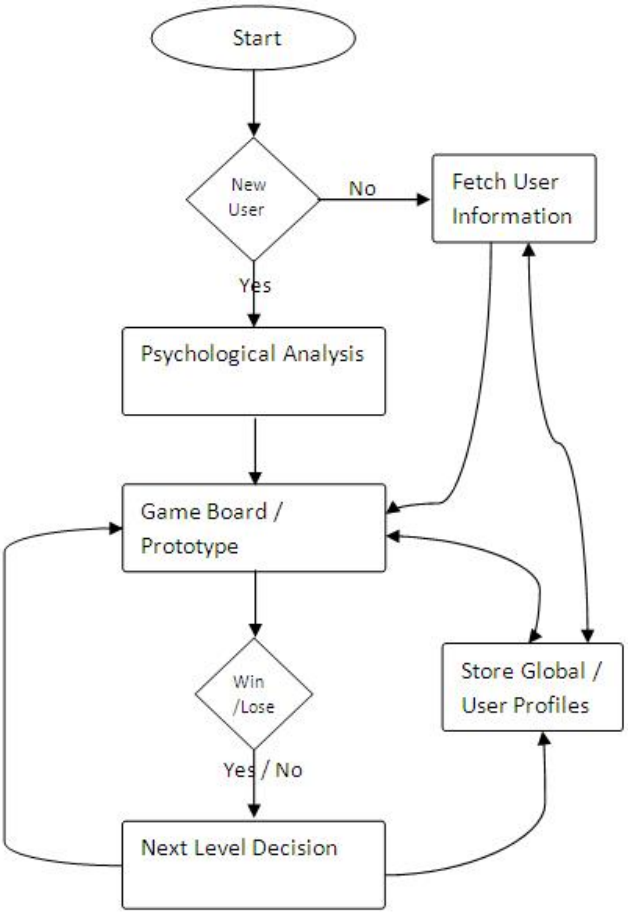

Figure 2. Software process

From the figure above software architecture is as follows[12,13]:

1. The user will start the game, If he/she is a new user it will have to go through a psychological analysis that will determine the stress level of the user.

2. After determining the stress level the appropriate level will be presented to the user. If it was not a new user and an existing user plays again, its information will be fetched and an appropriate level will be presented to the user.

3. When the user plays and either wins or loses, the information will be stored both in Global and User profiles; along with next level to be played by the user will be decided.

5 Discussion and conclusion

Cross cultural management is mandatory for effective social interaction[14]. Ethically, the assessment of human factor in any computer or technical development is necessary.[15] Games are of different kinds - ranging from single user games to multiple user games. Social Networking Games could be more effective, as a user can interact with a person of his/her own choice or habits and can share the problems/thoughts with each other[16]. For further advancement, at first phase, we have implemented our theme to a simple single user game i.e. Bubble Breaker to check the working and outcome in terms of the intelligent behavior of the game while deciding the next best level to be presented to the user[17]. In the next phase, we developed a complete Psychological Stress Relief Game using Artificial Intelligence having almost all the features of stress relief[18] which could also be used for commercial stress relieving therapy[19]. The entrepreneurs of computer or mobiles games, aiming the better health of users must keep the aspect of corporate social responsibility in their plans[20]. The corporate social responsibility is keystone for the success of business[21] helping in video game therapy for good health[22]. We mainly focused on those people who live in far-flung areas where facilities of schools and hospitals are not enough and significant in terms of a number of inhabitants having depression due to social and environmental factors. Companies can stabilize the financial procedures by controlling health factors in the ways of controlling user's health and environment.

The framework acts on the user's psychological state as his/her stress level will continuously be measured during and before he starts to play, using the Psychological Stress Calculator. This framework is supposed to soothe the stress level of the user. The prototype and difficulty level of the game will be determined dynamically based on the user's performance and feedback.

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